The purpose of Education?
Exploring the contradiction of inclusion through attainment grouping in Norwegian mathematics teaching

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Sammendrag

Det norske utdanningssystemet er sterkt forankret i humanistisk tradisjon der formålet med opplæringen er å legge til rette for elevenes læring og utvikling av kunnskap, ferdigheter, holdninger og verdier som er nødvendige for å ta del i et demokratisk samfunn. Et sentralt prinsipp i norsk skole er inkluderende undervisning i sammenholdte klasser. Dette er også regulert gjennom norsk lov, som sier at elever «til vanlig» ikke skal organiseres i grupper etter kjønn, etnisitet eller faglig nivå. Inkluderende undervisning kommer også til syne gjennom prinsippet om Tilpasset opplæring som anerkjenner alle elevers rett til likeverdige muligheter til læring og utvikling, uavhengig av deres forutsetninger. Det er den enkelte lærers ansvar å tilrettelegge for Tilpasset opplæring i klasserommet for å møte elevenes ulike behov. Til tross for Norges lange tradisjon med tydelige verdier om inkluderende opplæring, har nivådelt undervisning blitt en stadig mer utbredt måte å organisere undervisningen på, spesielt i matematikk. Dette skjer til tross for internasjonal forskning som stiller seg kritisk til nivådelt undervisning. Nivågruppering i matematikk kan ses i sammenheng med en økt bekymring for Norges prestasjoner på internasjonale undersøkelser som PISA og TIMMS. Undervisning i nivådelte grupper har blitt foreslått som et tiltak for å forbedre elevers resultater, og spesielt resultatene til høyt-presterende elever. Fokus på elevprestasjoner, framfor vekt på utvikling av hele barnet, har bidratt til en smalere forståelse av begrepet Tilpasset opplæring.

Denne studien tar utgangspunkt i det økte fokus på elevers prestasjoner, og mer bruk av nivådeling i matematikkundervisningen. Gjennom klasseromsobservasjon og intervju av tre matematikklærere som jobber ved en skole der matematikkundervisningen er organisert i nivådelte grupper, studeres lærernes undervisningspraksis og deres refleksjoner rundt egen praksis, sett ut ifra konteksten de står i. Forankret i Gees (2014) teori om «language-in-use» og «big D Discourse» presenteres tre ulike, men sammenkoblede problemstillinger som fokuserer på lærernes undervisningspraksis i nivådelte grupper, hvordan lærerne forklarer og teoretiserer sin undervisningspraksis, og hvilken rolle politiske, sosiale og kulturelle diskurser betyr for lærernes undervisningspraksis. «Situatedness», eller kontekstualisering står sentralt i Gees teori. Dette gir et viktig perspektiv til å se lærerne i konteksten av den lokale skolekulturen, men også den bredere konteksten av norsk utdanningskultur med inkluderende undervisning og Tilpasset opplæring for alle elever. Gjennom kritisk diskursanalyse åpnes det også for et bredere perspektiv som inkluderer betydningen av sosiale krefter og maktforhold og hvordan dette påvirker læreres matematikkundervisning. Analysen av de tre lærernes undervisningspraksis og teoretisering, «Enactment of Discourses», avdekker betydningen av

omsorg i lærernes undervisningspraksis. Det kommer fram hvordan tradisjonelle norske humanistiske verdier som omsorg for hele barnet har en spesiell rolle, men også hvordan dette veves inn i en kultur preget av elevprestasjoner og fokus på resultater.

Abstract

The Norwegian education system has deep roots in humanist traditions in which the purpose of education is enable all students to develop the knowledge, skills and attitudes they need to participate in a democratic society. As such, it emphasises inclusive mainstream schooling in which teaching in whole class mixed groups is a central tenet. This practice is protected by the law, which stipulates that students should 'not normally' be organised in groups according to gender, ethnicity or ability. These traditions are also visible in the policy of Tilpasset opplæring (TPO) – formally translated in curriculum documents as differentiated instruction – which recognises the right to equal opportunities for learning and development through variations and adaptations which suit students' needs. It is the individual teacher's responsibility to use their professional judgement to facilitate TPO in the classroom. However, in apparent contradiction to these strong statements in Norwegian educational ideology, and despite international evidence which casts doubt on its usefulness, a significant number of Norwegian schools have introduced attainment grouping as a means of organising TPO, particularly in mathematics. This shift appears to be largely driven by concerns over Norway's underperformance in international tests: grouping is seen as a means of raising students' marks in general, and is argued to benefit under-performing higher attainers in particular. This new focus on performance over and above an emphasis on developing the whole child has thus become influential in narrowing interpretations of TPO.

Recognising the impact of a new emphasis on performativity in Norwegian schooling, this thesis uses classroom observation and interview to explore the practices and reflections of three mathematics teachers at a school where attainment grouping has been introduced. Using Gee's theory of language-in-use and "big D" Discourse (Gee, 2014) to support analysis of each teacher's narrative of self, it addresses three research questions focusing on their enactment of mathematics teaching in attainment groups, the ways in which they explain and theorise their practice and the role of policy, social and cultural discourses in their enactment. Situatedness is important in Gee's theory, offering a lens for exploring the role of the local school culture in addition to the broader Norwegian education culture of inclusive teaching and its policy of TPO for all students. As a critical discourse analysis, it also enables a broader view into the role of social forces and power in a world where there are contested ideas about what mathematics teaching should look like. Contrasting the three teachers' Discourses of being a mathematics teacher, the thesis reveals the particular role of care in their enactments,

highlighting how traditional Norwegian humanistic values of care of the whole child interact with a culture of performativity.

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Chapter 1. Introduction

In Norway, the education system has deep roots in the humanistic tradition, which emphasises inclusion of all students in comprehensive schooling, both at school and classroom level - teaching students together in mixed groups is part of this tradition. However, despite this deeply embedded ideology, in recent years, a significant number of schools in Norway have introduced attainment grouping, and particularly in mathematics (Sjurgård, 2022; Vibe, 2012). This shift might be expected to indicate a conflict between inclusive traditions and current practice, but in fact many schools support attainment grouping as a means of delivering inclusive principles rather than undermining them. This thesis explores the complexities of this situation and the tensions which it generates, focusing on the practice and narratives of three Norwegian lower secondary mathematics teachers working in a school which has taken up the practice of attainment grouping. In this chapter, I first explain the role of humanistic values in the Norwegian education system and the recent history of their interpretation in inclusive practices with particular reference to mathematics teaching. I then present my own background and interest in these issues as a teacher educator and former mathematics teacher. Finally, I introduce the structure of the thesis chapter by chapter.

1.1 The purpose of education: shifting values in the Norwegian education context

In this section I explore the recent history of Norwegian education in terms of a gradual shift in values in the general movement towards New Public Management, neo-liberalism and performativity. In particular, I explain the nature and role of the pedagogical principle of *Tilpasset opplæring* (TPO), a fundamental tenet in Norwegian aims of inclusion.

Humanistic values and inclusion

Norway has a long tradition of state schooling, with compulsory education from 1st (age 6) to 10th grade (age 16). All students also have the right to further upper secondary schooling in grades 11 to 13. Deeply rooted in the humanistic tradition, the stated purpose of education in the Norwegian system of Unitary education is to enable all students to develop the knowledge, skills and attitudes they need to participate in a democratic society, as clearly stated in the objectives clause in the Education Act (Opplæringslova):

> *Education and training must be based on fundamental values in Christian and humanist heritage and traditions, such as respect for human dignity and nature, on intellectual freedom, charity, forgiveness, equality and solidarity, values that also*

appear in different religions and beliefs and are rooted in human rights. (…) Education and training must provide insight into cultural diversity and show respect for the individual's convictions. They are to promote democracy, equality and scientific thinking. The pupils and apprentices must develop knowledge, skills and attitudes so that they can master their lives and can take part in working life and society (Education Act, 1998, § 1-1 official English translation).

This emphasis on humanistic values becomes even clearer in references to the objectives clause in the core curriculum[1] opening comments on 'the purpose of education'. Human dignity and the values that support it are the foundation of student learning and schooling itself:

> *The objectives clause expresses values that unite the Norwegian society. These values, the foundation of our democracy, shall help us to live, learn and work together in a complex world and with an uncertain future. (…) These values are the foundation of the activities in school. They must be used actively and have importance for each pupil in the school environment through the imparting of knowledge and development of attitudes and competence.* (Ministry of Education and Research, 2017, pp. 4, official English translation).

The core curriculum goes on to emphasise the role of the school in ensuring recognition that "all people are equal regardless of what makes us different" (p. 4). There are multiple references to human rights and equal rights, the need to consider diversity and the need for all pupils to feel a sense of belonging and identity. Emphasising critical thinking and ethical awareness and respect for nature and the environment, the core curriculum states that pupils must learn through creativity and exploration, and schools must "promote belief in democratic values and in democracy as a form of government" (p. 9). Consequently, "teaching in school shall develop the all-round person and give each pupil the opportunity to learn and develop their skills and abilities" (p. 10). This emphasis on the whole child leads to a clear statement that education is more than subject learning:

> *A pupil's identity and self-image, opinions and attitudes grow in interaction with others. Social learning takes place in both the teaching, training and in all the other*

[1] The core curriculum is that part of the curriculum which talks about education in general. It describes values and principles for primary and secondary education and training. In addition to the core curriculum there are individual curricula for the different subjects. Together the two parts of the curriculum form the basis of what is described as the double social responsibility for schools, both education and bildung [danning].

activities at school. Learning subject matter cannot be isolated from social learning. Bearing this in mind, in the day-to-day work, the pupils' academic and social learning and development are interconnected. (p. 11)

Listening and dialogue are priorities, and collaboration is a key feature in both subject learning and the three interdisciplinary topics of health and life skills, democracy and citizenship and sustainable development. Hence it is the duty of a school to develop an inclusive learning environment in which “diversity must be acknowledged as a resource” and where “pupils shall learn to respect uniqueness and understand that everyone has a place in the school community” (p. 18).

Inclusive mainstream schooling is emphasised in this context. The core curriculum recognises, however, that “In spite of their personal efforts and use of learning strategies some pupils will have learning challenges” (p. 14), while “pupils come to school with different experiences, prior knowledge, attitudes and needs” (p.18). The curriculum thus turns to a discussion of *Tilpasset opplæring* (TPO), which is formally translated as “differentiated instruction”, although the term is more frequently translated in the research literature as “adapted education”. Presented in the core curriculum as one of the central principles of school practice, TPO recognises each student’s right to equal opportunities for learning and development through variations and adaptations which suit their needs: “School must give all pupils equal opportunities to learn and develop, regardless [of] their background and aptitudes” (p. 18). Addressing this issue is a holistic pursuit:

Good classroom management is based on insight into the needs of the pupils, warm relations and professional judgment. To create motivation and the joy of learning in the teaching situation, a broad repertoire of learning activities and resources within a predictable framework is needed. (pp. 18-19)

The core curriculum emphasises the role of teachers’ professional judgment in assessing individual pupils so that they might cater for their future development through TPO. The central aim is ‘good classroom management’ using a variety of approaches to meet pupils’ needs within ‘ordinary teaching’:

Differentiated instruction means that the school adapts the teaching so that all pupils have the best possible learning outcome from the ordinary teaching. (…) Differentiated instruction applies to all pupils and shall for the most part take place through variation and adaptation to the diversity in the pupil group ***within the***

> ***learning community***. (Ministry of Education and Research, 2017, pp. 19-20, official English translation, my emphasis).

This description of TPO in the core curriculum shows its position within the strong statements of inclusive teaching and humanistic values. Although there is no explicit statement about the organisation of classrooms, the emphasis on the learning community suggests that teaching in whole class mixed groups is a given, and indeed it is protected by law: the Education Act states that “Pupils must not normally be organised according to their level of ability, gender or ethnic affiliation” (Education Act, 1998, § 8-2 official English translation). The principle of TPO is thus strongly linked to students’ wellbeing, learning and the principles of inclusive education and all-round development.

Narrowed interpretations of TPO within the context of accountability and New Public Management

Despite this extensive description of TPO and its strong connection to the purpose of education, the exact nature of TPO is unspecified and open to interpretation. Consequently, what is seen as the main focus of TPO has shifted across successive curricula and policy documents. Such shifts can be seen as reflections of the politics of different governments, moving between an emphasis on TPO within learning communities to more of a focus on individual learning (Jenssen & Lillejord, 2009). In this sense, rather than seeing TPO as a pedagogical principle, it is more rightly understood as a policy concept. At the same time, although shifting interpretations align with shifts of government, research also finds a tendency towards a gradual narrowing of interpretations of TPO through successive curricula, regardless of government. Specifically, there has been a movement from a collective understanding of education to a more individual-centred ideology focusing on performance, closely related to neo-liberal ideology (Fasting, 2013; Jenssen & Lillejord, 2009) and a major trend towards New Public Management (NPM) across education reforms in Norway which is not specific to individual governments’ education policies (Solhaug, 2011).

Mapping different interpretations of TPO policy from its very beginning in 1975 when it was introduced by law, Jenssen and Lillejord (2009) identify four different eras: TPO as integration (an equal society is fostered by heterogeneity and acceptance of difference), as inclusion (community is prioritised over the individual), as individualisation (adaptation is to individual learner needs and characteristics – learners are equal but different), and as learning communities and teaching quality (education as a tool for social equality). Initially introduced as an initiative to end separate special needs schools, TPO was mostly understood in the context of integration of special needs students into mainstream comprehensive schooling. From the beginning of the 1990's, a shift towards inclusive learning communities for all students coincided with a 'global wave of inclusion' associated with the Salamanca declaration (Jenssen & Lillejord, 2009, p. 6). The interpretation of TPO in these two first periods, connects closely to the humanistic values of teaching in mixed groups. However, from the end of the 1990's, a new focus on the individual influenced education policy. TPO was interpreted in terms of individual student needs, placing the student at the centre while the idea of TPO in a community was backgrounded. One example of this focus on individual students was the use of individual working plans (arbeidsplaner) for all students beginning in 2000 (Klette, 2007). In this third era, the influence of neo-liberal ideas is more evident: students' rights to TPO are emphasised and strengthened alongside a focus on teaching of theory and basic skills in order to suit both 'theory-thirsty' and 'theory-tired' students. TPO was interpreted as a matter of meeting individual students' needs as a starting point, with classroom organisation following on; consequently, TPO was not necessarily delivered within students' original class groups and adaptation in relation to the whole of school activity was backgrounded in favour of a focus on providing measurable learning outcomes (Jenssen & Lillejord, 2009, p. 9).

However, around 2005 there was a further shift in interpretation. Having been criticized for being too focused on the individual, TPO was again interpreted in the context of learning communities. As Jenssen and Lillejord (2009) point out, it was finally acknowledged politically that putting TPO into operation was difficult (p. 10), and that TPO should be organised within the community of the class in a way which was manageable for teachers. One result of this was an end of the use of individual working plans (arbeidsplaner). At the same time, TPO in this period is also characterised by a focus on quality of teaching; while the government held back from declaring a "recipe for adapted education" (p. 11), the ability to realise it was seen as indicative of the competent teacher as portrayed in a White Paper (Ministry of Education and Research, 2008-2009):

> *They follow the students' learning closely, and tell, ask, check, repeat, sanction, vary and adapt the teaching to students and subjects. Flexibility and creativity are among the qualities that are particularly highlighted as important for adapting and varying the teaching* (pp. 13, my translation)

Once teaching quality was introduced as a policy aim, school managers were seen as responsible for school and pupil outcomes and for reducing inequality; measuring results became important, together with a focus on increasing student achievement as part of a general expectation of competence in all subjects (Jenssen & Lillejord, 2009). This was particularly evident in the new curriculum in 2006, Knowledge Promotion, (K06) which was organised according to achievement aims in all subjects (The Norwegian Directorate for Education and Training, 2006). Part of this new focus on results and achievement was the introduction of attainment levels (Kjennetegn på måloppnåelse). This was particularly evident at the end of the 2000's when schools themselves were held responsible for the defining the content of the different competence aims and their sublevels, so that they could carry out ongoing evaluation of students' achievement (Aasen et al., 2015). National tests of basic skills in English, arithmetic, and Norwegian were introduced for 5$^{\text{th}}$, 8$^{\text{th,}}$ and 9$^{\text{th}}$ grade students within the same period. Although the tests were not primarily intended as assessment of students' achievement but as an information tool for teachers, schools were obliged to report results to the municipality which also were made public in statistic presentations (Larsen et al., 2022).

This focus of measurement and achievement levels was reflected in the interpretation of TPO and how this was played out in classrooms, particularly through teachers' use of tasks, teaching material and textbooks which were organised according to different achievement levels (Kristensen, 2008). This period also opened the way for teaching particular groups of students together for a restricted period of time on the basis of need for extra support (Jenssen & Lillejord, 2009). More generally, this can also be seen as an opportunity for delivering TPO in different groups as part of a skills and competency agenda which narrow interpretations of content, with teachers being held more clearly responsible for facilitating and carry out teaching for TPO within a new culture of accountability and performativity (Jenssen & Lillejord, 2009). Regardless of policy and government disagreements, there has been agreement within a New Public Management (NPM) discourse on approaches to education reform and an accountability system of "testing as a means of quality improvements in school" (Solhaug, 2011, p. 272). Welle-Strand and Tjeldvoll (2002) argue that this gradual integration of NPM into Norwegian education policy led to questioning of the relevance and quality of the Norwegian Unitary school model, and a move towards discourses of individualism, with limited space for humanistic values. Seeing this movement in connection with the gradual narrowing of interpretations of TPO, Fasting (2013) claims that through the influence of neo-liberalism, “the principle [of inclusion] seems to have partly vanished in the name of providing efficient education” (p. 273).

Parallel to this gradual shift of education policy towards a narrowed interpretation of TPO was a growing concern about Norway’s underperformance in the PISA and TIMMS international tests (see, IEA, 2022; OECD, 2022), particularly in science and mathematics (Kjærnsli & Olsen, 2013). This issue first arose with the PISA results of 2000 (OECD, 2000). Although establishing Norwegian students as average, it was presented by the government and media at that time as “PISA-sjokket” [PISA-shock] based on an expectation of better results for Norwegian students (Kjærnsli & Olsen, 2013). However, subsequent test results showed a slight decline in mathematics scores, and the negative trend led to an intense response regarding Norwegian students’ performance in mathematics. Another concern pointed to the small proportion of Norwegian students scoring at the highest level and the high proportion scoring on the lowest level compared to other countries. Figure 1.1 shows one example of these results from the TIMMS study in 2011 (Grønmo et al., 2011).

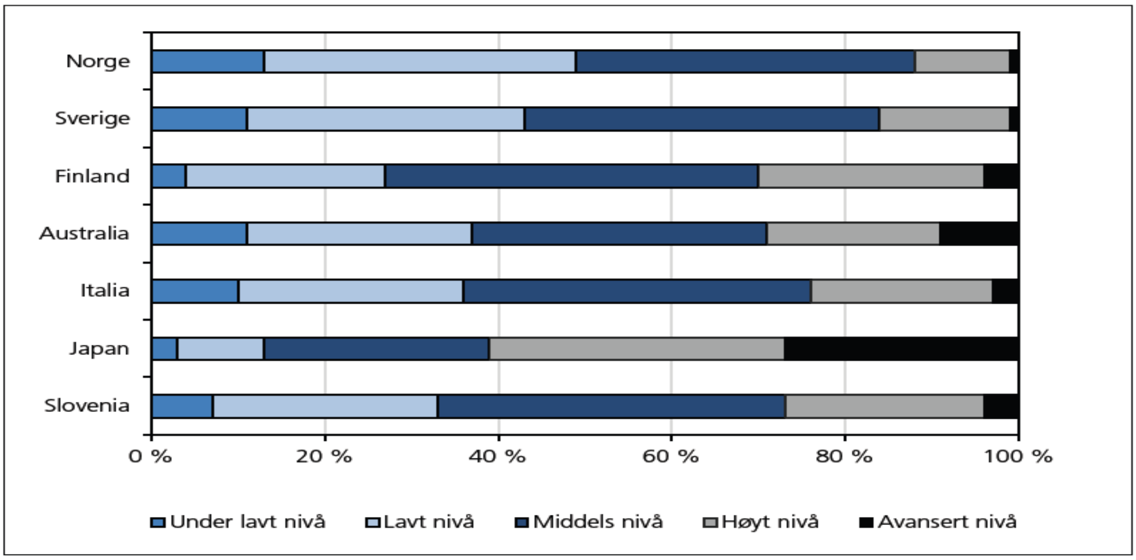


Figure 1.1. Proportion (percentage) of Grade 8 students scoring on different competence levels in mathematics in the TIMMS 2011 tests. The different categories represent five different benchmarks: below the low level, low level, intermediate level, high level, advanced level. (Grønmo et al., 2011, p. 33)

One particular response to this result was an emphasis on high attaining students, aiming to increase the numbers achieving on the highest level. *More to Gain*, reporting on the findings of the state-appointed committee for high achieving students to the Ministry of Education, aimed to “assess and propose recommendations relating to how a varied and differentiated teaching programme for high achieving students can be provided within the regular schooling" (NOU 2016:14, 2016, p. 7). The report held back from advocating attainment grouping, but did not rule it out either:

> *The social interaction and the social composition of students in a group is the decisive factor for students with higher learning potential to perform well. (…) The research summary therefore points out the importance of group differentiation as a measure supporting learning. Social interaction may influence how the students work best, and it is important to consider the students' need for cooperation, both with likeminded students and others" (NOU 2016:14, 2016, p. 70).*

A suggestion that attainment grouping was a solution for increasing high attaining students' performance was more clearly presented in the report of another expert group who claimed that: "High-attaining students can benefit greatly from a stimulating learning community with equals (...) initiatives should therefore be established which not only give students the opportunity to meet with other high attaining students, but especially high attaining students of the same age" (National Centre for Science Education, 2015, pp. 75, my translation). We can see how the narrowed interpretation of TPO was strongly influenced and supported by the impact of international test results alongside the increased focus on measurement and accountability in New Public Management. The interpretation of TPO is now dominated by a focus on particular students' results rather than their place in learning communities for all students.

Exploring the issue of mathematics teaching in attainment grouping

This recent history of humanistic values in Norwegian education and the link with TPO illustrates how the increased use of attainment grouping in mathematics in Norway is reliant on the gradual narrowing of the interpretation of TPO. TPO can be seen as moving from a broad understanding emphasising collective ideological aspects of education, to a narrower understanding which focuses on individual students' performance of skills and competencies in line with subject curricula goals and trends in education policy (Bachmann & Haug, 2006). This shift forces the original purpose of education in the Norwegian education tradition - the development of the participatory citizen - into the background. Teaching for TPO can instead be seen as something to be achieved in a tick-box system of organising teaching in levels with an eye on individual students' achievement. TPO thus interpreted opens the way for attainment grouping, clearly influenced by a neo-liberal stance on education which by-passes the original humanistic and inclusive values of education in Norway and the role of TPO in it.

Compared to the initial broad description of TPO, support for attainment grouping as a means of realising TPO reflects a clear shift in how it is understood and played out.

Nevertheless, as Jenssen and Lillejord (2009) note, delivering TPO is difficult. Norwegian teachers describe teaching for TPO in mixed groups as not only difficult but often impossible, and some describe attainment grouping as a deeply unsatisfactory but more manageable way of meeting student needs (Eriksen et al., 2022). Humanist concerns for student identity and development remain but are difficult to meet within the current context. This thesis aims to understand this situation, exploring how three teachers in one Norwegian lower secondary school manage demands for performance and TPO in mathematics and the contradictions between attainment grouping and humanist concerns for inclusion.

1.2 My part in this thesis

My motivation for exploring the issue of attainment grouping in mathematics teaching in Norway lies in my background as a mathematics teacher for twenty years. For all these years I taught at the same primary/lower secondary school which takes students from grade 1 through to grade 10. Like most teachers in Norway, I sometimes travelled with my students as they moved up through the grades, and so I have taught in all grades, my first ten years of teaching at primary school level and the last ten years at lower secondary. Also like most teachers in Norway, I trained as a generalist and have taught all subjects, not just mathematics. However, in the last three years of teaching, I was the lead mathematics teacher at the whole school, covering grades 1-10, with responsibility for focusing with other teachers on how we taught mathematics.

I took a special interest in mathematics throughout my teaching career, focusing on teaching structures and connections within mathematics, aiming for students' understanding. Strongly influenced by the explorative approach to mathematics teaching I had met in my teacher education, fostering classroom talk and student discussion was a priority. I was also influenced by Norwegian humanistic values and the idea of inclusive teaching in mixed groups, which I believe enables better opportunities for dynamic learning communities where all students can benefit from working together and learning from each other. My ideal for mathematics teaching is therefore that it involves whole class discussions in mixed groups, with differentiated instruction (TPO) which enables productive exploration for all students.

However, I have experienced the challenges of being the teacher I wanted to be. Although I aimed for explorative teaching, I have experienced the difficulties of holding on to this approach when a traditional teaching approach was more familiar to students, parents, and other teachers. I have also experienced the difficulty of managing to include all students in the teaching, making sure to teach for TPO for all. I often felt that I didn't have enough time to help all the students.

My teaching experiences are mainly from teaching in mixed groups but attainment grouping was tried out at my school, in grade 8-10. The motivation for attainment grouping at that time was our sense of the difficulty of meeting all students' needs in mixed groups, but we also aimed to deliver TPO to increase the students' learning and raise their marks. My view of mathematics teaching led me to be critical of grouping, because I was concerned that students would have unequal access to mathematics as a result of teaching by levels. I was particularly concerned about low attainers who often appeared to have only restricted access to mathematics content. I also worried that selection and grading of "appropriate content" for different groups would detract from a more integrated understanding.

Although I found attainment grouping problematic, having decided on this teaching practice at school, I wanted to be loyal to the common agreement. I also wanted to be trustworthy in my teaching to the students and I therefore felt I had to somehow invest in it. I tried to be open, but I also had my doubts. However, I found that my doubts were strengthened by the students' response to being taught in attainment groups. One particular example of this is a statement from a 10th grade student who was placed in the lowest attainment group, which I taught. After some weeks of teaching in this group he came to me just before a lesson and said: "I can't stay in this group. I need other students around me who are motivated to get motivated myself". This statement confirmed my doubts about attainment grouping, particularly for the low attainers. I had myself reflected on this "missing engine" in the group - there was no one there to motivate the boy to work. In this thesis I revisit some similar situations of difficulty and doubt.

1.3 This thesis

This thesis addresses the following research questions:

- How do Norwegian teachers enact mathematics teaching within a context of attainment grouping?
- How do teachers explain and theorise their practice?
- What is the role of policy, social and cultural discourses in teachers' enactment of mathematics teaching?

The following chapters build up to and address these questions as follows:

Chapter 2 Literature review

Chapter 2 reviews the literature which makes the case for my study. As this chapter has shown, the introduction of attainment grouping in Norway is related to the culture of performativity, and the first part of the literature review focuses on the role of measurement and performance in education and its impact on the purpose of education. The second part of this chapter focuses on attainment grouping in mathematics, focusing in particular on the impact on pedagogy and what teachers say about attainment grouping as a teaching practice. This literature review builds towards my research questions and their focus on the context as central to understanding how Norwegian teachers manage the tensions between attainment grouping and their professional aims of inclusion.

Chapter 3 Theoretical framework: How can we understand situated meaning?

In chapter 3, I present and discuss the theory which guides my research and the analysis of my data, Gee's theory of critical discourse analysis. Gee's critical discourse analysis is both theory and method, so both are intertwined in this chapter, but the aim is to focus on the theoretical perspective. The chapter begins with a grounding of Gee's theory of critical discourse analysis and situated meaning. In the second section it focuses on the role of identity and Gee's foregrounding of identity in his theory as 'big D' Discourse. Throughout the chapter I illustrate the theory by drawing on one of Gee's own examples of his approach to critical discourse analysis.

Chapter 4 Methodology

Chapter 4 describes the methodology of my study including methods and analysis. In the first part of the chapter, I present the methodological development of my study, eventually arriving at a critical discourse analysis approach. I discuss the epistemological implications of this approach with particular reference to the issue of Gee's 'frame problem'. The second part of the chapter presents the analytic framework and my operationalisation of Gee's theory. At the end of the chapter I discuss issues of validity, trustworthiness and ethics.

Chapters 5-7 Lena – the competent teacher; Julie – the "good" mathematics teacher; Jon – the old timer mathematics teacher

In Chapters 5, 6 and 7, I present the analysis of the three teachers, Lena, Julie and Jon, in turn. All the teachers are presented in the context of their enactment of 'big D' Discourses as mathematics teachers at Berg school. In each case I combine classroom observation and interview data to identify and explore underlying figured worlds and their relationship with particular Discourses. I identify Lena as enacting the competent mathematics teacher, Julie as enacting the ‘good’ mathematics teacher, and Jon as enacting the old timer mathematics teacher.

Chapter 8 Discussion

Chapter 8 addresses each of the research questions of this thesis, placing the data analysis in the context of the literature review and Gee’s theory of critical discourse analysis. I emphasise the joint role of saying, doing and being in my understanding of each teachers’ enactment of mathematics teaching, combining the teachers’ classroom practices with their reflections on teaching, situated in the context of Berg school. Considering the wider Norwegian education context, the discussion focuses on the role of the Norwegian ideology of humanistic values in the teachers’ enactments, where care for the whole child and relationships to students emerge as particularly important.

Chapter 9 Conclusion – revisiting the purpose of education

In chapter 9 I offer some final reflections about the contribution of this thesis. I relate this contribution strongly to my methodological approach and my use of Gee’s critical discourse analysis, focusing the role of situatedness and context. I reflect further on how this shift in the field of view leads to new understanding about the policy of TPO in the humanistic education context in Norway. I end the chapter by discussing implications for further research as well as implications for education policy. I argue that there is a need for debate about the role of attainment grouping in the context of the humanistic values and emphasis on inclusive teaching through TPO in Norway, and I conclude that there is a need to revisit the purpose of education.

Chapter 2. Literature review

As described in Chapter 1, Norway, like many other countries, has an increased focus on measurement in education as a result of international comparison studies such as PISA and TIMMS. In Norway, PISA results in 2000 led to what is known as “PISA-sjokket” (PISA-shock), an intense response to results which were perceived as less good than they should have been (Kjærnsli & Olsen, 2013). At the same time, policy moves towards New Public Management (Solhaug, 2011) heightened the role of data in schools’ local accountability. Norway’s resulting increased focus on measurement highlights how the emerging practice of attainment grouping has a political dimension in terms of its association not only with a narrow interpretation of TPO but also with a desire to raise student marks, especially in the area of high attainment (see NOU 2016:14). In this chapter I review the literature on the impact of this focus on measurement and performance on education in general, and more particularly on mathematics teaching and learning and the role of attainment grouping in it. In the first section, I focus on the international literature on the impact of performativity on values in education and on teachers’ understanding of their work. I pay particular attention to the role of context, culture and ideology in teachers’ responses to performativity. In the second section I first consider the impact of performativity on mathematics teaching and learning before turning to explore the literature on attainment grouping and its relationship to performativity and the discursive positioning of students.

What emerges from this review of the literature is the close relationship between attainment grouping and performativity and how this impacts on teachers’ work within potentially constraining discourses. It draws attention to the importance of how teachers see themselves as mathematics teachers and how they explain their aims and justify their practice. At the end of the chapter, I present the research questions for this study and introduce the theoretical framework needed to capture both teachers’ practice and their narratives of mathematics teaching.

2.1 The impact of testing on education

This section focuses on how the culture of performativity not only affects educational values but also teachers’ subjectivity and sense of who they are as professionals. The literature spans some twenty years, and tells a story of teachers’ de-professionalisation and loss of identity and autonomy. While earlier work argues that the culture of performativity leads to insurmountable constraints, later research aims to understand how teachers work within these constraints, manoeuvring in ways which enable them to gain some agency. Most recently, studies have observed that some teachers operate in a "post-performative" culture where their agency rests on the normalisation of performativity.

Values in education

The increased focus on measurement and test results in education raises a fundamental question about the purpose of education. Commenting on the impact of the PISA (Programme for International Student Assessment), (OECD, 2022) and TIMSS (Trends in International mathematics and Science Study), (IEA, 2022) studies, and their emphasis on international comparisons and league tables, Biesta (2008) argues that the focus on measurement has resulted in a narrowing of what is seen as a relevant outcome in education. The perception of measurement as factual data, and the "abundance of information about educational outcomes" (p. 35) gives the impression that decisions about education policy and practice can be solely based on this data. However, this overlooks the crucial role of values in education, and raises the question about what is actually measured. Biesta argues that this is not just a question of technical validity which concerns what is intended to be measured, but, rather, normative validity in terms of whether we are actually measuring what we value, or whether we are "just measuring what we can easily measure and thus end up valuing what we (can) measure" (Biesta, 2008, p. 35). Teaching in such a system is governed by "ticking boxes", and normative validity is replaced by technical validity. Hence, Biesta (2008) argues, education has turned to 'learnification' in which 'learning' is an 'individualistic concept' (p. 38) which omits to recognise the relationship with the educator and their purpose, focusing on process rather than 'content and direction' (p. 39).

Similarly, Hardy and Lewis (2017) argue that measurement through numeric representation is often seen as "inherently 'objective'", but that numbers are "deeply complicit in how the phenomena to which they relate are known and understood" (p. 673). They argue that the focus on demonstrating evidence of students' achievement leads to prescriptive and technical teaching, controlled by standardised exams and performance-based teacher evaluation. Teaching which is geared towards ensuring the production of positive data-focused performance results in a disproportional focus on those particular areas of the curriculum to be assessed while others are skipped, with teaching to the test and fewer opportunities for deep learning (Hardy & Lewis, 2017). Ball (2003) also argues that the technology of performativity is misleading in its appearance of objectivity through measurement. Defining performativity as: "… a technology, a culture and a mode of regulation that employs judgements, comparisons and displays as means of incentive, control, attrition and change - based on rewards and sanctions (both material and symbolic)" (Ball, 2003, p. 216), Ball points out that performances serve as a measure of productivity and output which represent the quality or the value of an individual or organisation in a field of judgement. Education reforms took a new direction, being "embedded in three interrelated policy technologies; the market, managerialism and performativity" (Ball, 2003, p. 215), resulting in a commodification and a de-socialisation of knowledge. Teachers are required to do 'what works', without any clear rationale for teaching and with less care for students.

Culture and ideology

Shifts in education values within the culture of performativity play out differently in different cultural contexts as illustrated by a number of international studies. For example, Hordern and Tatto (2018) compare the impact of PISA test performance on education policy and concepts of knowledge and teaching in Germany and England. Referring to 'good teaching' as involving three complementary conceptions of teaching - as craft (built on situated understanding), as the application of technical protocols (technical know-how), and as professional endeavour (critical reflection) - they argue that educational policy and reforms concerned with teacher performance prioritise restricted technical or craft-based conceptions of teaching. Putting classical professional models of teaching under pressure, this shift causes disciplinary educational knowledge to suffer (Hordern & Tatto, 2018).

However, the relationship between conceptions of teaching and notions of educational knowledge not only depends on different models of teaching but also on national contexts. Hordern and Tatto describe Germany's educational system as deeply rooted in strong traditions of teacher professionalism and critical thinking within the context of *bildung*[2]. Poor performance in PISA tests in 2006 led to criticism and the introduction of educational reforms and standards against which teacher performance would be evaluated. Hordern and Tatto (2018) argue that these reforms led to an emphasis on teaching as technical practice. However, the German national context meant that extreme moves towards a technical/instrumental conception of teaching were not likely and teachers were able to sustain a certain level of professional autonomy (Hordern & Tatto, 2018). In comparison, they argue, teaching is dominated by a craft concept in the English school context where a "conception of teaching as 'professional endeavour' has never been firmly established" (p.

[2] A German stance on the philosophy of education which prioritises the development of independence and humanity in the whole child. Traditional Norwegian education ideology is close to this idea of bildung.

696), and educational knowledge may be more fragmented. In this national context more instrumentalist forms of educational knowledge may be more valued or accepted. As a result, teachers have less autonomy with regard to their professional status in the context of educational reforms (Hordern & Tatto, 2018).

These contrasts raise questions regarding the Norwegian context and its foundation in the social democratic welfare model and a teaching tradition in line with the German *bildung.* As in Germany, "PISA-sjokket" resulted in a rising trend of measurement in education and a growing focus on raising students' marks (Fasting, 2013; Larsen et al., 2022). Larsen et al. (2022) explore this issue in their study of Norwegian education policy documents in the wake of the major national educational reform represented by the 2006 curriculum, Knowledge Promotion (K06), (The Norwegian Directorate for Education and Training, 2006). This curriculum reflected an increased focus on outputs (national tests at grades 5, 8 and 9 were introduced in 2007 following piloting in 2004), and emphasised the development of skills and competencies. Larsen et al. (2022) argue that while an instrumental approach to education is now dominant in Norway, there is clearly a tension between social democratic values and those of a performative culture which is not resolved. Policy documents continue to emphasise professional learning and education for democracy such that Norway is not overwhelmed by the emphasis on measurement.

The differential impact of a culture of performativity on conceptions of educational knowledge in different national contexts is also discussed by McGarr and Emstad (2020). Their comparative discourse analysis of teacher education documents in Norway and Ireland focused particularly on the treatment of reflective practices. While there are similarities between the two countries in terms of population size and how they relate to European educational policy trends, differences in their national contexts – Norway's social democratic welfare model versus Ireland's location in the Anglo-American tradition – were reflected in the analysis. Although both countries presented reflective practice as a tool for teachers to evaluate and improve teaching, the Norwegian documents appeared to take a wider perspective by also focusing on its role in teachers' contribution to development of the school community. The Irish policy documents, on the other hand, appeared to focus more on individual teacher development and personal endeavour. At the same time, neither country made reference to more personal and critical dimensions of reflective practice. Reflective practices were thus reduced to a key skill and as an activity to help the development of teacher and school, seen as a framework for teachers' self-improvement. They conclude that a strong neoliberal context leads to greater impact of performativity compared to countries such as Norway which has a different knowledge tradition.

Teachers and teaching

The relationship between performativity and educational values also plays out in teachers' professional lives and teaching practice. Here, the literature focuses on issues of professional autonomy, teachers' sense of self, and the conflicts engendered by performativity in what it means to be a 'good teacher'.

De-professionalisation, a changing subjectivity and loss of autonomy

For Whitty (2000), the progressive development of performativity in England led to teacher de-professionalisation, in contrast to the "golden age of teacher control" (Whitty, 2000, p. 283) when education policy mainly focused on the welfare state and students' access to school, and teachers had autonomy over both curriculum and teaching. The shift to performativity and neoliberal education policy within a post-welfare market society led to a loss of teachers' authority and autonomy as teachers were not just told what to teach but also how it should be taught, controlled by testing and league tables. Writing in the same period, Ball (2003) further claims that the reforms in education in England produced a new kind of teacher subject. Famously referring to the "terrors of performativity", he argues that performativity changes teacher identity, creating a "struggle over the teacher's soul" (p. 217) which was experienced very personally: performativity challenged teachers' values, beliefs, commitment and emotional well-being. Constantly judged through the mechanisms of monitoring systems and the production of data, teachers become insecure about their teaching in terms of whether they were doing enough or doing the right thing, and were always working to improve. Ball (2003) argues that this constant judging and reshaping led to de-professionalisation and loss of agency such that the rationale for what is taught is strongly controlled by what is measured.

The cost is a potential splitting between a teacher's own judgement of what is 'good practice' and the "rigours of performance" (p. 221). Ball argues that, in the culture of performativity, teachers either consciously "play the game" of enacting "the teacher the inspectors want to see" (p. 222), or they become the 'other' teacher who is controlled by accountability rather than making their own professional judgements. These "other ways" of self-presentation in terms of what is valued in the performative context are what Ball calls *fabrications,* the enactment of the teacher who is "hailed and rewarded by educational reform and 'school improvement'" (Ball, 2003, p. 222). Fabrications are thus versions of a person (teacher) who does not exist, but who is “produced purposefully in order to be accountable” (Ball, 2003, p. 224); they lead to a changed subjectivity as teachers describe themselves as ‘the other teacher’ and not ‘who they are’. Teachers’ beliefs about teaching or their rationale for own practice have no place in this teacher identity, and concern over relationships with and care of students is not encouraged. Instead, a new kind of teacher identity is required which focuses on outputs and ‘what works’, valuing teachers for their productivity.

Similar points about the impact of performativity on teachers as a result of school inspection regimes in England are made by Perryman (2006). Focusing on one school which was put under ‘special measures’ – a disciplinary mechanism for raising standards, she introduces the term “panoptic performativity” to capture teachers’ responses to the constant threat of inspections, and the need to perform in readiness for any kind of inspection. Analysing data drawn from the same school around the time of inspection, Perryman (2009) observes that both teachers and management staff ‘played the game’ in order to present the school to meet inspection requirements, with detrimental effect: "teachers fabricated the situation in order to meet OfSTED requirements, but this fabrication led to inspection of the performance, not the reality and a sense of alienation and cynicism about the result" (p. 611). Again focusing on the impact of school inspection, in a study of four schools, Perryman et al. (2018) argue that self-regulation had become so entrenched that such practices had become normalised in a form of governmentality in a ‘post-panoptic’ school in which “the veneers of success to demonstrate to the inspectors are likely to be present all the time, and teachers will be rehearsed, trained and inculcated in Ofsted-friendly ‘effectiveness’ in a permanent way” (p. 158). Teachers ensure that they “tick boxes” in their teaching, with constant awareness of how the criteria might be modified.

The theme of fabrication appears in other research too. Studying accountability practices in an Australian primary school, Hardy and Lewis (2017) also report that teachers produce favourable representations or *fabrications* of their practice, rather than what they see as meaningful and more educative teacher practices. In response to pressure to produce performance data, teachers focus on the “‘performance’ of performance” (p. 681) to produce visible evidence of student learning. Again in Australia, Appel (2020) reviews the research on teacher professionalism in the culture of performativity and identifies three significant issues: lack of autonomy, stifled creativity and lack of trust. She argues that these issues resonate strongly with Australian teachers as a result of top-down leadership and regulation of the teacher’s work, leading to de-professionalisation, with lack of trust in particular relating to fabrications as "made-up responses to performativity requirements" (p. 308). Priestley et al. (2015) also write about fabrication as *strategic compliance* in their study of teachers in Scotland and Cyprus dealing with a new curriculum policy, in which teachers described intense pressure which meant that they needed to be sure to "tick all the boxes" (p. 195).

Other writers have commented further on the impact of performative neo-liberal policy on teacher autonomy. Writing from a personal point of view as a teacher in England, Fox (2021) argues that "if performative culture subsumes and dictates [professional] goals then our teachers become willing performers who are unaware of the autonomy or identities they might have had" (p. 48). Furthermore, even though teachers might not recognise the impact of performativity, their lack of autonomy leaves them 'unfulfilled' and likely to leave the profession. In the Norwegian context, where teachers have traditionally experienced a high degree of autonomy, Larsen et al. (2022) note that despite decentralisation and the increased school-level local autonomy which resulted from the 2006 curriculum reforms, the focus on monitoring of school performance and public accountability ultimately results in restricted teacher autonomy, and "little attention is given to professionalism as a deliberative activity" (p.120). Aasen et al. (2015) find similar results in their analysis of K06 curriculum policy documents and interviews with school leaders on both local and national levels. They also conclude that despite a clear shift towards local autonomy at school level, pressure from an increased focus on school performance and results undermined teacher autonomy. The complexity of these shifts in teacher autonomy are mapped by Mausethagen and Mølstad (2015), who note that the 2006 curriculum forced a move from traditional individual teacher autonomy in the classroom to collective teacher deliberation and decision-making. While apparently increasing autonomy in terms of teachers' professional work as curriculum developers, Mausethagen and Mølstad (2015) report that teachers resisted such a move and held on to their individual pedagogical freedom in the classroom with the result that "teachers have been positioned and have positioned themselves as curriculum deliverers rather than developers" (p. 38), exposing them to further reduction of their autonomy by the state.

Conflicts in being a 'good teacher'

These pressures lead to an emerging struggle for teachers of how to reconcile the two competing agendas: the performative agenda and the professional agenda and what each mean in the context of being a 'good teacher'. This becomes evident in a study by Sullivan et al. (2021) of early career teachers' understanding of teacher quality and their self-assessment within a 'quality' framework in Australia, where concern with 'falling standards' led to increased accountability targets, benchmarks and performance milestones which identify ‘good’ or ‘quality’ teachers (p. 390). Sullivan et al. (2021) report that although teachers’ understandings of being a quality teacher illustrated a commitment to more general ideas of good teaching, they were strongly influenced by the pressures of performativity when assessing their own performance, illustrating that they “‘governed’ themselves using the regulations and discourses related to ‘the quality teacher’” (p.393). They ‘internalised’ the ‘logics of “improvement”’ (p. 395), valuing continual monitoring and feedback on their performance as part of their commitment to becoming a quality teacher. Nevertheless, they also had internal professional agendas to become “the teachers they wanted to be” (p. 397), being committed to teaching and their students, and “the importance of liking the students, having a passion for the job and wanting to ‘make a difference’”(Sullivan et al., 2021, p. 398). Despite these desires to go beyond a teaching standards checklist, the power of “common sense” leadership practices such as giving feedback on teaching led them to “‘fall into line’ with prevailing educational orthodoxies (Sullivan et al., 2021, pp. 394-395).

Ward and Quennerstedt (2019) also understand performativity as played out through self-governance by both teachers and pupils in their study of mathematics lessons in an English primary school. They describe how surveillance and the metrics of performativity in the form of testing and inspection led teachers to become “evidence hunters” (p. 273) in their quest to ensure that pupils followed designated procedures and produced correct answers, while pupils supported this subjectivity through their own enactment as “confessant and unafraid producers of evidence” (p. 273). However, teachers were also found to attempt a balance between surveillance and emotional care, and so “soften the direction and mechanism of the governance” (p. 274), suggesting that it was OK to give wrong answers sometimes, or praising students’ answers even when they were not those expected.

Gray and Seiki (2020) find the same struggle to navigate the pressures of institutional performativity, in their study of two first-year elementary teachers in a US school context. The teachers described how they felt obliged to abandon their own perception of good and effective teaching practice in order to meet the demands of the school norms. One of the teachers describes her struggle between the institutional performativity pressure of content pacing and student assessment, compared to her own professional pedagogic agenda and understanding of student needs. Given her aim for students’ growth, she struggled to see herself as a successful teacher when they improved their test scores. Nevertheless, Gray and Seiki argue that both teachers “remain hopeful in spite of the constraints placed upon them”

(p. 8), but, like Sullivan et al.'s (2021) teachers, not producing expected outcomes was risky, and the systematic pressure of performativity "thwarted their goals to be the best teachers they could be" (Gray & Seiki, 2020, p. 8).

Teachers navigating performativity

Despite these findings of struggle and constraints on teachers working in a culture of performativity, some researchers find teachers who challenge the culture of performativity, and also teachers who manage to manoeuvre in the constraints. For example, Priestley et al. (2015) report that teachers in Scotland and Cyprus are able to achieve agency in similar situations of conflicting demands about their role in curriculum development. In contrast to Sullivan et al.'s (2021) early career teachers' struggle in the culture of performativity, Priestley et al. (2015) found that experienced teachers had greater agency, particularly those with variety and breadth of experience. Priestley et al. (2015) point out that agency is not purely about individual teacher capacity but is also dependent on their confidence to engage in the particular situation, that is, "the interplay between what the teachers 'bring' to the situation and what the situation 'brings' to the teachers" (p. 198). They argue that simply having autonomy does not guarantee the achievement of agency, and that agency needs to be "shaped and enhanced by policy that specifies goals and processes, enhancing the capability of teachers to manoeuvre between repertoires, make decisions and frame future actions" (Priestley et al., 2015, p. 198).

Hardy and Lewis (2017) also find teachers who manage to manoeuvre their teaching in a culture of performativity in an Australian primary school where students' performance data dominates the field of practice in a situation of "contradictory and contested logics of deifying, delivering and denying data" (p. 671). They report that teachers strongly advocated the practice of data collection while simultaneously rejecting it in a process of 'doublethink'. On the one side, teachers deified the practice of gathering performance data, and "allocated extensive time and effort to preparing for the data stories, stories that constituted representations of student learning," (p. 680). They described this as helpful to understanding and developing their own practice, and necessary for the delivery of performance data which would present the value of their work and improvement as teachers. However, teachers were also critical of the data stories, questioning their validity and arguing that the focus on performance data was detrimental to student learning. Hence, in the context of this 'doublethink', teachers both denied and deified the practice, delivering the required performance data but also questioning the benefits. Hardy and Lewis suggest that the teachers' concerns about the data stories and their impact on their teaching present "a cause for optimism" (p. 682), but conclude that "given the terrors of performativity to which these teachers were subjected, they arguably had little choice" (p. 683).

A more optimistic account of teacher navigation of performativity can be seen in a study by Ro (2021) which examines secondary school teachers' perceptions of teaching in Singapore, where performativity is also a normalised structure and teachers' primary responsibility is exam-oriented teaching. However, teachers criticised such performative teaching as limiting students' opportunities for learning, describing a broader conception of teaching for deep learning "beyond the exam" (Ro, 2021, p. 10) which also focused on care and relationships with students. However, despite the teachers' concern about performative teaching, they were not completely critical of it. Rather, they "embraced exam preparation as one important dimension of teaching instead of being entirely critical about it and simultaneously called for the significance of teaching beyond the exam that encompasses meaningful subject teaching and emotional labour" (p. 13). Ro (2021) argues that the Singaporean context is not solely a question of performativity metrics, but is also characterised "by a rooted social belief that academic performance determines one's future" (p. 13). Thus, teachers agreed that "exam preparation was a must, but teaching should be and do more than that" (p. 13). Hence, Ro (2021) argues, their views were not incompatible with the norm. Instead, teachers expected to teach both to and beyond the exam, although this was difficult "because of the supremacy of performativity in schools" (p. 13). As Ro suggests, this situation suggests features of Western post-performativity as described in the following section, but she argues that "what teachers think and do could be more diverse and complex depending on the system's own establishment of performativity" (p. 14).

Post-performance teachers

As Ro (2021) points out, the culture of performativity may affect teachers differently in a context where performativity is culturally normalised. A similar situation is evident in recent Anglo-American studies where many years of the dominance of performativity culture has led to normalisation. In such a 'post-performative' culture, teaching to meet the criteria of the education reforms may be perceived differently.

Holloway and Brass (2018) argue that there has been a "paradigmatic shift in the construction of teachers' professional knowledge and subjectivity" (p. 362), in that policy reforms produce "new teacher subjects who no longer see the system as 'out there' but as constitutive of their professional knowledge and subjectivity" (p. 378). Comparing two different qualitative studies investigating the implementation of accountability shifts in US which took place ten years apart, they find that teachers expressed very different responses to accountability. Whereas teachers in the first study described accountability mechanisms as “unnecessary and reductive impositions on teaching that undermined autonomy, profession and practice” (Holloway & Brass, 2018, p. 378), teachers in the later study saw them as ways to enhance and ensure quality in their teaching and as “constitutive of their professional knowledge and subjectivity” (p. 378). The opposition between the teachers and the accountability system in the first study has been dissolved as the teachers has been disciplined as performative teachers. Citing Ball’s (2003) warning of “this inevitability” (p. 378), they note the speed of this transformation towards performative culture as supporting inner knowledge for the teachers that structured their thought and actions such that “teachers are disciplined, and discipline themselves, as (…) performative teachers” (Holloway & Brass, 2018, p. 378). The ‘good teacher’ had become reconstituted in line with performative standards.

Post-performativity in a humanistic professional context

As Frostenson and Englund (2020) point out, “in a ‘post-performative’ era, professional teachers no longer conceive of performativity as threatening or de-professionalising, but rather as a largely normalised and naturalised part of what it means to be a professional teacher” (p. 696). Performative techniques, initially developed for managerial purposes, have reshaped professional work and workers, both teaching and teachers. Culture makes a difference, however, and Frostenson and Englund (2020) explore the issue of post-performative teachers working within the Swedish culture of humanistic professional values. As in Norway, teaching is required to be organised according to humanistic or ‘student-centred’ values and ideals, emphasising the importance of developing students as citizens, engaging in dialogue and democratic participation, thus leading to a situation of ambiguity for teachers working in what is also a regime of performativity. Their findings from a study conducted in a Swedish private school show a general positive attitude towards performative techniques; the mechanisms of performativity were not just managerial but were also embraced and justified by the teachers. However, it is important to note that performative techniques and professional ideals were not seen as separate. Instead, teachers saw performative techniques as accommodating professional values. This interplay allowed for “a reinterpretation or reconstitution of professional values in light of the performative techniques” (p. 707). In their expression of both performative and humanistic ideals, teachers described building good relationships with students, seeing the whole student, motivating them and creating mutual respect to build confidence so that they could help students to raise their marks. Students' performance reflected on teachers' performance too. Frostenson and Englund (2020) argue that their study "partly solves the paradox of how it is possible to combine performative techniques with professional values usually understood as being in stark opposition to the logic of performativity that underpins the techniques" (p. 708). In this sense, "humanistic ideals converge with the ideology of performativity" (p. 708).

2.2 The impact of performativity on mathematics education

Performativity clearly has a strong influence on both what is taught and who teachers are. Given the clear role played in the widespread policy focus on measurement and performance by international mathematics tests such as PISA and TIMSS, there are reasons to argue that the culture of performativity may be of particular influence in mathematics education.

The shift toward only valuing what we can measure is strongly compatible with a discourse of mathematics as an individual activity in which problems which have only one correct means of solution, producing only one right answer (Schoenfeld, 1992, p. 359). This also underpins a conception of mathematics teaching as delivery of procedural knowledge characterised by fast pace in a teacher-led presentation of mathematics as a discrete and compartmentalised body of knowledge. An alternative approach to mathematics teaching, however, is the reform-oriented inquiry-based approach which is strongly connected to a conceptual view of knowledge (Hiebert & Lefevre, 1986) and advocates student exploration and participation in the community of mathematics. Students have greater agency and more opportunity for deep learning in comparison to the procedural approach where they merely "receive" knowledge rather than co-construct it. Learning processes are more valued in such an approach, but crucially this involves mathematical knowledge which is less measurable than procedural knowledge. Although Hiebert and Lefevre (1986) wrote about this division in mathematics almost forty years ago, this issue remains in later debates about mathematics teaching (Heyd-Metzuyanim & Shabtay, 2019; Munter et al., 2015; Sfard, 2008), and is still part of ongoing debates focusing on 'what works' in mathematics teaching and learning.

Conflicting values in mathematics teaching

Wake and Burkhardt (2013) focus on the gap between advocacy of inquiry learning and teachers' actual practice in their exploration of the impact of a European education policy promoting inquiry-based learning (PRIMAS) in the context of global neoliberal policy and a market orientation in education. Their analysis of policy intentions and outcomes in the participating nations points to a “misalignment in what policy defines in terms of input to learning, what is measured and valued in terms of outcome, and what is desired in the teaching process” (Wake & Burkhardt, 2013, p. 851). They point to the influence of PISA on the redesign of teaching which aims to improve performance on the tests and consequently, may not always be in line with an inquiry-based approach. Thus there is a move to “specifying input [and] measuring output [in] an increasing trend towards centrally defined learning aims, objectives and subject content throughout the curriculum” (p.859). Content is clearly organised around PISA subdomains, with corresponding influence on teachers' prioritising of particular knowledge and skills. Assessment and measurement of output leads to reduced complexity in what is measured, and has a “major and narrowing impact on teachers' classroom practice and, consequently, on students' experiences of learning” (Wake & Burkhardt, 2013). They conclude that if global policy initiatives promoting inquiry-based learning are to have impact, “we need to measure **and value** more than merely attainment using tests as currently constituted and designed” (p. 859).

The mismatch which Wake and Burkhardt (2013) identify between the intended inquiry-based approach to mathematics and teachers' practice is explored by a number of other researchers. In Canada, Nolan (2008) comments on the fact that trainee teachers often abandon university-endorsed inquiry once they are in placement due to instrumental practices in host schools. She argues that, in addition to the dominance of accountability in schools which makes it difficult for trainee teachers to pursue more inquiry-led teaching, a procedural educational habitus generated from their own experience of schooling is resistant to change. Similarly, Barnes et al. (2013) report that trainee teachers in England found it hard to resist pressure from placement schools to focus on test results and were forced to compromise: although the way they wanted to teach was not unwelcome, they found it difficult to work comfortably alongside their mentors. In a Norwegian study of pre-service teachers' placement experiences, Bjerke et al. (2013a, 2013b) report that mentors were not necessarily against reform approaches, and even expressed stronger pro-reform ideas than their mentees, but did not enact reform approaches in practice. In the same study, Solomon et al. (2017) found that the pressure on schools to achieve good results in mathematics led to anxiety among mentors who felt a need to control their mentees' teaching. The authors conclude that “while university teacher education about mathematics frequently attempts to challenge [pre-service teachers'] beliefs, the impact of school placement can often act in the opposite direction, forcing a return to earlier embedded ideas, particularly when assessment, testing and accountability are high on the agenda" (Bjerke et al. 2013a p. 20).

Performativity thus exposes conflicting values in mathematics education. Williams (2012) notes the tensions between views of mathematics as a question of practical competence versus passing tests, as enjoyment versus social/economic advancement, as a collaborative and cooperative pursuit versus as an opportunity for competition, as right/wrong or debatable, and as a matter of procedural learning versus understanding (pp. 57-8). These binaries of 'use' versus 'exchange' often create conflict for both learners and teachers, tensions that arise from the culture of performativity and the role of education in its production, particularly mathematics. Williams (2012) points to how mathematics as exchange-value has led to a dominance of procedural and transmission teaching which has become the norm. Such teaching is perpetuated at the expense of students' understanding of the mathematics while providing a "ticket to the future", enabling students with the qualification and the grades they need. Thus Williams concludes that "what emerges for us is a dual but contradictory value of mathematics education in the re-production of labour power -as an exchange-value of capital in the education field **and** as a use value of the mathematics in the development of mind" (p. 70). Exchange value in the culture of performativity is dominant, however, as illustrated by Wake's (2013) analysis of why a new mathematics qualification aiming at widening participation through an emphasis on use of mathematics and greater student understanding ultimately failed due to 'doublethink'. While initially embraced as inclusive by further education institutions in England, the obvious use value of the qualification was undermined by the need to obtain qualifications which were more excluding of students but had greater exchange value in the university entrance market.

Issues in attainment grouping in mathematics

It appears that mathematics teaching may be more influenced by, and play more of a role in, performativity than other subjects. Mathematics also appears more likely to be associated with attainment grouping than other subjects (Sjurgård, 2022; Taylor et al., 2022), given that an emphasis on procedural teaching with its support for a focus on student outcomes and their associated 'levels' lends itself to the idea of attainment grouping as a 'common-sense' solution to concerns about performance.

Impact on performance

In fact, research on the impact of attainment grouping on student outcomes generally finds that it has little effect (Ireson et al., 2005; Kutnick et al., 2005; Slavin, 1990; Steenbergen-Hu et al., 2016; Zevenbergen, 2003, 2005), but the picture is a complex one, covering a range of school ages and organisational and pedagogical patterns. Focusing on the impact on particular attainment groups reveals that while grouping can have a positive effect on high attaining students, it has a negative effect on students placed in middle or low attaining groups, or students from poorer socio-economic backgrounds (Francis, Archer, et al., 2017; Higgins et al., 2016; Ireson et al., 2005; Nunes et al., 2009; Parsons & Hallam, 2014). Parsons and Hallam (2014) argue that low attaining students benefit from working with more advanced students, an opportunity which is removed by attainment grouping, and Steenbergen-Hu et al.'s (2016) second-order meta-analysis concludes that although attainment grouping is not beneficial, within-class grouping is. These points coincide with Kutnick et al's (2005) conclusions from this review of the literature that "A focus on type of ability grouping as an organisational strategy may divert consideration from what is happening in relation to teaching, learning and attitudes within pupil groups in classrooms" (p. 47). Furthermore, they find a "general lack of correspondence between seating/grouping and assignment of work/learning tasks" (p. 47). Taken together, these results suggest that it may not necessarily be which kind of group the students are placed into which is crucial but, rather, what happens in classroom level practice.

Teaching practices and cultures of grouping

Research focusing on classroom level practices also presents a complex picture. Several accounts indicate differences between low and high attainment groups, with less demanding content in lower groups which is cause for complaint from students in some cases (Beswick, 2007; Boaler et al., 2000; Francis et al., 2019; Hallam & Ireson, 2003; Kaur & Ghani, 2011; Solomon, 2007). There are also differences in pedagogic practice: in England, Boaler et al. (2000), Francis, Archer, et al. (2017) and Francis et al. (2019), and Kaur and Ghani (2011) in Singapore report that teaching in lower attainment groups tends to correlate with a more traditional approach of teacher-led instruction and routine and repetitive tasks. In this transmission pedagogy, there is little use of open ended questions and few opportunities for the students to reflect critically on their way of thinking (Boaler et al., 2000; Kaur & Ghani, 2011).

Teaching in high attainment groups may make mathematics more available to students as in Solomon's (2007) study where secondary school students reported that higher attainment groups had greater access to problem solving tasks, investigations and creative work. Students in low attainment groups reported more ritual work and less productive relationships with teachers. Other studies have also reported a different quality of pedagogy in higher attainment groups, largely commenting on pace and challenge (Boaler et al., 2000; Francis et al., 2019; Ireson et al., 2005; Mazenod et al., 2019; Wiliam & Bartholomew, 2004). Solomon points out, however, that the contrasts between groups are not as straightforward as they may seem, since not all students in her study experienced higher attainment groups positively; girls in particular reported being stressed by the fast pace in high attainment groups, an observation also made by Hallam and Ireson (2013), who report that girls were more likely to ask to be moved down a set (see also, Boaler, 1997; Boaler et al., 2000; Hallam & Ireson, 2003). More generally, there appears to be a relationship between attainment group placement and student self-confidence, with students in lower groups expressing lower self-concepts (Ireson & Hallam, 2009), to the extent that group allocation becomes a 'self-fulfilling prophecy' (Francis, Connolly, et al., 2017; Zevenbergen, 2003, 2005).

Research which focuses on comparisons of teaching in attainment groups versus in mixed groups reports that the latter are less restrictive and more investigative (Boaler et al., 2000; Francome & Hewitt, 2018). This is not necessarily due to differences in teacher styles, since the same teacher may tend to take a more investigative approach with mixed groups than when teaching in groups organized according to attainment (Boaler et al., 2000). Francome and Hewitt (2018) compared mathematics teaching in a mixed-ability school and a school using attainment groups, finding that there was more teacher-centred transmission teaching in the "attainment school", while the "mixed school" used more collaborative work. Research also finds differences between group types in terms of teacher experience and quality. Less experienced teachers are more likely to teach in attainment groups compared to mixed groups (McGillicuddy & Devine, 2018), and experienced and well-qualified teachers are more often allocated to high attainment groups (Francis et al., 2019; Kelly, 2004; Wiliam & Bartholomew, 2004).

Grouping as a dominant discourse in mathematics teaching

Given the research outcomes presented here, Francis, Archer, et al. (2017) question its lack of impact on policy and practice. They argue that the English government's advocacy of attainment grouping as effective than mixed groups for meeting the needs of all students 'stretching the brightest' has led to the dominance attainment groups in a context in which the practice has become "a signifier for 'academic high standards'" (p. 7). As "a manifestation of various longstanding narratives in English culture" (Francis, Archer, et al., 2017, p. 8), attainment grouping is part of a discourse of 'natural order' of 'hierarchy and segregation' (p.9), for which there is no need for further evidence, and research arguments about the lack of effect of attainment grouping are not enough to go against this long tradition. Furthermore, middle-class parental investment in their children's futures and the power of parental choice means that "institutions may be deterred from pursuing mixed-attainment grouping by perceptions of middle-class parental preferences (real or imagined)" (p. 9). At the same time, Francis, Archer, et al. (2017) argue, the complexity and inconclusiveness of research findings mean that the research base is insufficient to counteract the role of attainment grouping in sustaining "discourses of standards, natural order, and aspiration" (p. 11).

Similar issues are addressed by Taylor et al. (2017) in their investigation of English schools' reluctance to join a study exploring mixed attainment teaching, focusing on teachers' perceptions of mixed attainment practice as problematic. They report that mixed attainment teaching is perceived as a risk because it is "difficult, and unconventional" (p. 341). Performativity regimes made them particularly risk-averse, given the high stakes nature of student learning outcomes. The idea of mixed attainment teaching evokes a range of fears for teachers which are connected to three main issues: concerns about stakeholder opinions (colleagues, parents, students, school leaders, governors), workload (time, training needs), and the pedagogy (differentiation, pace, student needs) (p. 337). Few teachers had experience of teaching in mixed attainment groups, and few models among their colleagues. They argued that teaching in mixed attainment groups was more time consuming due to the need to prepare multiple activities to meet all students' needs, particularly low attainers. Ultimately, Taylor et al. (2017) argue, student outcomes suffer because "a vicious circle exists, operating to perpetuate the inhibition of mixed attainment teaching in English schools" (p. 341). Similarly, McGillicuddy and Devine (2018) argue that teachers' perspectives on the use of attainment grouping must be viewed in the wider context of educational policy and practice, where teaching is shaped both by internal and external factors. Studying attainment grouping in an Irish school, McGillicuddy and Devine (2018) find that teachers felt pressured to teach in attainment groups because teaching in homogeneous groups was perceived as effective and 'best practice' both by practitioners and policy makers.

Student positioning in attainment grouping and performativity

A range of research shows that teachers' perceptions of mathematics teaching and their expectations of students differ for different attainment groups. Hence the practice of attainment grouping as a mechanism of performativity has important consequences for student positioning in terms of perceived needs and discourses of ability.

Attainment grouping, expectation and fixed ability discourses

Francome and Hewitt (2018) report that teachers at both their attainment grouping and mixed teaching schools professed a similar connectionist belief about mathematics teaching and similar views about a 'growth mindset' in mathematics learning but teaching practices at the two schools differed. Teachers in the "attainment school" showed traces of a fixed-mindset view in their descriptions of students in the different attainment groups, whereas the teachers in the 'mixed school' strongly disagreed with such a view and held strong growth mindset opinions. In line with these findings, Wiliam and Bartholomew (2004) followed students' mathematics achievement at six London secondary schools in over a period of four years from grades 8 to 11. All students were taught in mixed groups in grade 7 but shifted to attainment groups in grade 8 or grade 10 according to which school they attended. Wiliam and Bartholomew (2004) report that teachers teaching in mixed groups varied their teaching to meet individual differences, whereas the same teachers treated attainment groups as homogenous. In attainment group teaching, teachers' expectations tended to overestimate students in top sets and underestimate those in lower sets. Wiliam and Bartholomew (2004) thus argue that attainment grouping benefits high attaining students at the expense of lower attainers.

Marks (2014) arrives at a similar conclusion in her study of attainment grouping in an English primary school. She recounts how Government pressure on schools to maximise numbers of students achieving the Grade 6 targets, led the school to operate an 'educational triage' by directing available resources towards students with greater perceived chances of crossing the target threshold. However, Marks (2014) points out that this practice also led to 'unintended consequences' in terms of its impact on low attainment students. Although the number of students meeting targets increased, the distribution of resources led to reduced learning experiences for the low attainment students, who experienced a narrower curriculum content and limited access to quality teachers. Marks (2014) points to the powerful influence of policy pressures which gave teachers little choice "but to play the accountability game" (p. 50). Importantly, their actions rested on their beliefs about student ability, echoing the discourses which Francis, Archer, et al. (2017) note about 'natural order'. Marks (2014) comments that "these decisions are grounded in shared meaning making – in this case meanings related to ability (…) – developed within the Discourse Communities that teachers inhabit" (p. 50).

Research thus finds that teachers' practice in different attainment groups frequently reflects their expectations of students as homogeneous groups, communicating a labelling of students based on fixed ability discourses (Francis, Connolly, et al., 2017) and fixed mindsets (Boaler, 2013). Beswick (2017) explored Australian teachers' expectations and beliefs about "poor" and "good" students in low and high attainment groups, finding that they held fixed ability views in which basic computation was considered important for low attaining students but not mentioned for high attainers who were described in terms of their mathematical proficiency, skills and knowledge. "Poor" students were characterised in terms a lack of understanding and ability to explain, and were given more restricted tasks in comparison to challenging and open-ended tasks for the "good" students. Beswick concludes that "teachers may also believe that mathematical proficiency is the province only of 'good' mathematics students rather than something that should and can be taught to all students" (p. 104).

In their study of Irish primary school teachers' perspectives on the use of attainment grouping in reading and mathematics teaching, McGillicuddy and Devine (2018) found that teachers who were working with low attainment students argued that attainment grouping was the best way to adapt instruction and pace. Implicit in these findings were the teachers' assumptions about students' learning capacity and readiness in the context of a fixed ability view. This became evident in their hierarchical descriptions of low attainers as lacking skills of an effective learner and "turned off" versus high attainers who were "ready to fly" (McGillicuddy & Devine, 2018, p. 93). This contrast between the groups was also evident in the teachers' perception that the lower attainers would hold higher attainers back if they were placed in the same group. Thus McGillicuddy and Devine (2018) argue that "ability grouping 'bounds' the children's learning in a complex interaction between teacher perception (of who learners are and should be) and the structuring of pupil experience through the demarcation of learning spaces" in attainment groups (McGillicuddy & Devine, 2018, p. 93).

A fixed ability view is also crucial in a study by Fitzgerald et al. (2021) who explore teachers' responses to a major shift in practice in New Zealand from traditional attainment grouping to mixed grouping. The authors comment on the role of teachers' persistent beliefs about students' fixed ability as a barrier to change in practice. Although they might express a change in views to suggest that all students were capable of learning mathematics at high levels, teachers had a tendency to fall back on fixed ability language. They also described mathematics as a subject which could only be taught effectively through attainment groups which accommodated different abilities, and they held on to categorising students in terms of levels. Fitzgerald et al. (2021) conclude that for change to take place, assessment practices and school policies need to change to remove narrow definitions of success.

In an account of change in the opposite direction, Forgasz (2010) reports on a study of post-primary teachers in the state of Victoria, Australia, where educational tradition and guidelines had for some years argued that attainment grouping was unacceptable on grounds of equity. Despite the previous tradition of mixed attainment teaching, and a clear statement in national guidelines that while teaching ‘gifted’ students in small ability groups made sense, grouping across a whole school was inequitable and undesirable, it had become apparent by 2008 that there had been an increase in attainment grouping for all students, justified by selective interpretation of the guidelines (Forgasz, 2010, p. 61). Forgasz reports on teachers’ reasoning about their grouping practices, finding that the most frequent responses in support of grouping focused on the need to meet students’ different abilities. Describing the students as falling into homogenous groups, teachers saw high attainers as needing “to move ahead and not become bored with classroom activities” whereas low attainers needed to “learn at a pace more suitable for their needs” (Forgasz, 2010, p. 74). When teachers disagreed with grouping, they provided limited reasons for their views, and overall teachers tended to concentrate more on their concerns about challenging high attainers in their support for grouping. Although the survey did not ask specifically about equity, Forgasz notes that teachers did not identify equity issues as disadvantages of grouping. Overall, teachers’ responses, whether for or against grouping, focused on perceived fixed ability.

The issue of equity also arises in Hallam and Ireson’s (2003), study of English secondary school teachers’ beliefs about teaching in attainment groups. Like other studies, they find that teachers felt that teaching in structured attainment groups made it easier to meet the needs of all students, and mathematics was singled out as requiring grouping. At the same time, teachers were concerned about the self-esteem of low attainers when placed in groups, and they saw mixed groups as benefiting all children socially. However, Hallam and Ireson report that teachers showed “little overall agreement (…) of the relative equity of the different systems” (p. 354).

One potential resolution for teachers concerned about students’ well-being is an association of fixed ability beliefs with a perceived need for nurturance. As we have seen, teachers’ perceptions and expectations of student ability according to attainment group allocation strongly influences their access to mathematics in terms of both pedagogy and content. Teachers have lower expectations of students in low attainment groups based on beliefs that they should not be ‘over-challenged’. This leads to an “over supportive” pedagogy which limits development in the context of a nurturing approach (Francis et al., 2019; Mazenod et al., 2019). Drawing on data from a large study of secondary school English and mathematics teachers in England, Mazenod et al. (2019) report similar findings to many other studies that teachers adopt different teaching approaches depending on which attainment group they teach in. More importantly though, their accounts reflected fixed ability views which were couched in a language of nurturing learning which Mazenod et al. (2019) argue can instead encourage dependency and lack of opportunity for development. Teachers described altering their pace, lesson content and general approach in accordance with expectations of more in depth learning for high attainers compared to a need for more repetitive teaching for the low attainers to give them more time to consolidate. They saw high attainers as more capable of independent work, while low attainers were seen as in need of more scaffolding and structure. They also described 'all' low attainers as lacking confidence or resilience and in need of management to 'keep them on task'. Consequently teachers saw such students as in need of one to one support by teacher and a strong relationships with teachers in order to build confidence. The teachers were significantly concerned about 'over-stretching' the low attainers in terms which "were often expressed in protective or nurturing terms and on emotional or moral grounds" (p. 61). Mazenod et al. (2019) argue that "discourses of dependency were intertwined in the teacher narratives of nurture and support" and that such narratives "raise concerns about the extent to which teachers' expectations may be capping opportunities for students (…) to develop their independent learning skills and to enable them to become less dependent on their teachers" (p. 64).

Teacher challenge to cultures of attainment grouping

Despite the emphasis in the majority of the literature on teacher support for attainment grouping, some studies find that teachers are critical, but change in practice relies on making direct challenges to the idea of fixed ability. Bradbury (2019) addresses the issue of apparently inevitable links between fixed ability beliefs and teachers' experience and practice of attainment grouping, reporting on early years/early primary teachers in England. She finds that many teachers understood 'ability' to be fixed in line with a common-sense 'orthodoxy' (p. 45) which is rarely questioned. Some of these teachers expressed concerns about the impact on students feeling of being ranked, but Bradbury argues that these concerns were largely based on the perceived problem of making differences *visible* rather than that the problem lay in ordering children by 'ability' in the first place (p. 46). However some teachers "found space to question this and, in some rare cases, to disrupt its use and dismantle the apparatus of grouping" (p.42). These teachers directly challenged the idea of fixed ability itself, emphasising “fluidity and variability” in student learning, arguing that they could “change over time” (p. 45). Teachers were often unable to act on their views since they were limited by accountability pressures and school policies, leading to a situation of “doing without believing” (Bradbury, 2019, p. 48) but a few were able to employ their “professional capital” (p. 49) to actively disrupt and redirect school practices.

Returning to Fitzgerald et al.’s (2021) study of transition in New Zealand discussed above, they report that while many teachers struggled to change their fixed ability views and associated practices, some teachers did describe a significant shift away from attainment groups. As in Bradbury’s study, what characterised these teachers was a strong move away from fixed ability beliefs to personal beliefs that ‘everyone can learn mathematics’, aligned with a principle of using heterogenous groups and an inquiry approach to teaching. These teachers were also critical of their school’s assessment practices which were tied to a discourse of ‘levels’ and ‘stages’ and the demand that teachers record student achievement accordingly. They criticised the tools of assessment as promoting labelling which they were aware led to limitations in teachers’ perceptions of students’ mathematics knowledge.

Writing about the same intervention, Hunter et al. (2020) map the shift from teachers’ views of attainment grouping as normal practice based on expectations about who could or could not do mathematics. Mathematics was seen as a discrete body of knowledge and mathematics teaching as an individual activity. The study finds that the inevitable tensions arising between the teachers’ beliefs and the more equitable practice they engaged in while working in heterogenous groups as part of the intervention provided opportunities to reflect. Hunter et al. (2020) report some re-construction of teachers’ values and beliefs: “although student achievement remained an important end goal, the teachers no longer relied upon comparisons, and dividing and comparing (…) as a yardstick measure of success” (p 53). The study concludes that a change of practice requires not just a change in organisational structures, but also opportunities to try out tasks which enable students to engage with mathematics in ways which challenge teacher expectations, along with time to reflect.

2.3 Exploring attainment grouping in a Norwegian school

This literature review has explored the impact of a culture of performativity on what we see as the purpose of education in terms of a shift from a view of teaching which encourages teachers to reflect on their rationale as an educator, to a technical practice which is controlled by external requirements for the measurement of students’ learning. Relations of care for the whole child and an emphasis on deep learning for citizenship appear to have little room in teachers' lives such that they also end up only "valuing what we measure" (Biesta, 2008, p. 35). As Ball (2003) points out, performativity has led to a lack of autonomy for teachers, research underlines how teachers struggle to exercise agency. More recently, research describes how teachers who have been socialised into a performativity culture and accept it as normalised, channelling professional humanistic values through the mechanisms of performativity.

This review also shows how performativity may have a particular impact on mathematics education. Focus from PISA and other international tests alongside national tests which are developed in order to service public accountability demands, leaves mathematics teachers under pressure to raise students' marks and prioritise procedural teaching to the test. Research in many countries shows that, although attainment grouping is a strongly contested issue, it is widespread and feeds into common sense discourses of how we might raise attainment in mathematics. Attainment grouping impacts on how teachers perceive the mathematics teaching and learning and what they need to do in order to be a good mathematics teacher. In addition, the literature also points to the importance of how teachers perceive students and their needs. This becomes particularly evident in research on fixed ability views which feed, and are fed by, attainment grouping discourses and practices and their impact on students, especially low attainers.

As described in Chapter 1, attainment grouping is relatively new in Norway and not very widespread. It is correspondingly under-researched. It is also clear how it runs against the humanistic tradition of education in Norway with its focus on inclusive teaching and TPO for all students. However, despite the apparent contradictions involved, attainment grouping has become a way of both organising for TPO and a perceived means of raising students' marks. As an important policy driver in its own right as laid down in the Education Act emphasis on inclusion, TPO has over the last decade or so become associated with performance measures and related teacher accountability and is now seen to be delivered via teaching in attainment groups. Nevertheless, as Hordern and Tatto (2018) find about the role of *bildung* in Germany or McGarr and Emstad (2020) find about differences between the influence of performativity on education in Norway and Ireland, culture is important. In this study, my aim is to look closely at a Norwegian school which has embraced attainment grouping and explore this new context of a focus on performance and the role of TPO in it. This thesis focuses on three mathematics teachers in such a school, exploring their enactment of their practice and the mathematics teachers they present themselves to be and aspire to be. I address the following research questions:

- How do Norwegian teachers enact mathematics teaching within a context of attainment grouping?
- How do teachers explain and theorise their practice?
- What is the role of policy, social and cultural discourses in teachers' enactment of mathematics teaching?

In order to answer these research questions, I draw on Gee's (2014) theory and method of critical discourse analysis, described in the following chapter.

Chapter 3. Theoretical framework: How can we understand situated meaning?

In this chapter I present and discuss the theory which frames my research findings and analysis, Gee’s theory of language-in-use (Gee, 2014). This theory offers an opportunity for exploring teachers’ enactment of the potentially structuring policies and systems of attainment grouping and TPO in terms of how these are played out in teachers’ practice, and their relation to teacher identity. Although mathematics teachers operate within a “common” practice of mathematics teaching, their enactment of TPO as a pedagogic principle varies. Gee’s theory offers a lens for understanding how teachers operate in a world where there are contested ideas about what teaching should look like.

As a theory of *critical* discourse analysis, Gee’s theory focuses on how saying-doing-being gains its meaning from the practice it is part of and enacts (Gee, 2014, p. 11) but it also provides insights into the role of social forces in the Norwegian mathematics classroom. Teaching in attainment grouping is situated within multiple, conflicting discourses, and understanding teachers’ practice requires analysis of the different discourses that they draw on. Gee’s critical approach to discourse analysis enables us to highlight the role of TPO as a policy framework and the exercise of power and position in the ongoing debate about attainment grouping in mathematics teaching.

As Gee himself points out (Gee, 2014, p. 11), his theory of discourse analysis is in fact both theory and method intertwined. Hence a presentation of his theory cannot go without including a commentary on method as well, and this chapter reflects this close relationship. This chapter therefore includes that part of Gee’s method which is intrinsically connected to his theoretical position, largely with respect to identity. In the following methodology chapter, I focus on how I have applied Gee’s methods and my operationalisation of this theory in the data analysis.

This chapter is structured around two main sections: the first begins with a grounding of Gee’s theory as critical discourse analysis, before moving on to explain his theory of situated meaning and some of its methodological consequences. The second section focuses on the role of identity in language-in-use and Gee’s foregrounding of identity in his theory as ‘big D’ Discourse. Throughout the chapter I will draw on one of Gee’s own examples as an illustration of his approach to critical discourse analysis.

3.1 Gee's critical discourse analysis

For Gee a theory/method of discourse analysis must 'have a point'. It needs to go beyond description to:

> *a) illuminate and provide us with evidence for our theory of the domain, a theory that helps to explain how and why language works the way it does when it is put into action; and b) contribute, in terms of understanding and intervention, to important issues and problems in some area that interests and motivates us as global citizens* (Gee, 2014, p. 12)

Furthermore, a *critical* approach to discourse analysis includes recognition of the role of power in social practices and its relation to the reproduction of social inequities:

> *Critical approaches [of discourse analysis], however, go further and treat social practices, not just in terms of social relationships, but, also, in terms of their implications for things like status, solidarity, the distribution of social goods, and power.* (Gee, 2014, p. 87)

For Gee, use of language in a practice involves a distribution of social goods: distribution of status, power or acceptance in the practice. Gee illustrates this as taking part in a game, where we use the rules of the game to win those social goods at stake. For example, in a school practice, social goods may be about being accepted as a good student, and thus, students in this game use the rules, or the language, to win the game, aiming to be accepted as good students.

Taking Gee's perspective that use of language involves social goods, and seeing distribution of social goods as politics, then all language is political, and thus, according to Gee, all discourse analysis also should be critical. Thus in a 2004 interview, Gee claimed that "…language has an inherent property that it must always communicate stuff about social relationships that are also political" (Rogers, 2004, p. 6). In order to understand how power and positioning works through language, a *critical* discourse analysis is therefore not only needed but essential:

> *In fact, critical discourse analysis argues that language-in-use is always part or parcel of, and partially constitutive of, specific social practices, and that social practices always have implications for inherently political things*

> *like status, solidarity, the distribution of social goods, and power* (Gee, 2014, p. 87)

Gee argues that critical discourse analysis goes beyond the actual setting between a speaker and a listener into value-laden positions where use of language must be seen as a part of an ongoing dialogue or debate - a widening of the actual context. We need to take the context into account in order to understand the situated meaning - how language takes up its meaning in the actual context in which it is used (Gee, 2014, p. 82).

Gee's theory is perhaps best understood when illustrated by one of his own examples, and I draw throughout this chapter on the example of 'the oral history project', in which he illustrates how critical discourse analysis can be used to uncover situated meanings and explore contestation and positionality. This example seems particularly apt for this thesis because both concern teachers, focusing on positioning within institutions, power relations and how teachers identify in their particular contexts. I introduce this example next.

Example: The oral history project

Gee's example (Gee, 2014, pp. 198-212) concerns a university-led oral history project working with two middle schools in a small American town which he calls 'Middleview'. The project was initiated by a history professor at the local 'Woodson' university named Sara, who wanted to work with middle school teachers on local black oral history and had invited the two schools to take part. It is important to Gee to make the point that the university is an old small elite university, while Middleview is a largely working-class industrial town. The two schools involved are both public (ie state-owned), with teachers who are mostly local and from working-class backgrounds. Gee also notes that there are historic tensions between the university and the town, particularly between people working at the university – who are mostly not local citizens - and at the public schools.

The example is set in two meetings of the project group, one being the very first meeting, chaired by a representative of the group which funded the history project. The other persons attending the meeting are the history professor, Sara, two of her research assistants, four teachers from the two schools, one of whom is named Karen, the curriculum coordinators at the two schools, the one at Karen's school being named Mary, and a few other people. As an important context to the first meeting, Gee tells us that Sara had contacted Mary, the curriculum coordinator at Karen's school, to ask for help with her project and get access to the schools. Prior to this first meeting there had also been a "Summer Institute", a workshop on research collaboration between university educators and school teachers, arranged by the university. The funder of the history project had hoped the professor and the teachers could meet at this workshop.

Karen, the teacher, had been asked by the chair of the meeting to give everyone in the group some background on what had happened in the project prior to the meeting. Gee picks out as his starting data Karen's account of this incident[3]:

1. *Last year, Mary Washington, who is our curriculum coordinator here, had a call from Sara at Woodson*
2. *And called me and said:*
3. *"We have a person from Woodson who's in the History Department*
4. *And she's interested in doing some research into Black history in Middleview*
5. *And she would like to get involved with the school*
6. *And here's her number*
7. *Give her a call"*
8. *And I DID call her*
9. *And we BOTH expected to be around for the Summer Institute at Woodson*
10. *I DID participate in it*
11. *But SARA wasn't able to do THAT* (Gee, 2014, p. 199)

This excerpt could be taken at face value as a mere description of what had happened prior to the meeting, but Gee goes on to point out how this speech is loaded with meaning which becomes more apparent when we explore the situation and what Karen says. Based on an initial analysis of this small piece of data, Gee formulates a hypothesis that the role of the teachers in the oral history project is something of an issue. He bases his argument on Karen's emphasis on particular words in line 9-11, which she uses to draw a contrast between herself and Sara. Karen seems annoyed that Sara did not turn up to the Summer Institute. Gee also points out other examples from the excerpt which support the hypothesis: Karen seems a bit annoyed by the way she was ordered to make the call to Sara and how she makes the point that although she was "ordered" to take part in the project she was reliable and did what was expected, but the professor did not. Gee analyses how Karen positions herself and others in the group through her speech.

[3] Gee divides and presents his data in lines and stanzas where lines represent one idea unit, and a stanza constitutes one topic or a theme. This extract of 11 lines constitutes one stanza. Details such as pausing and hesitation are left out here, but words which were said with particular emphasis are capitalised.

Gee makes it clear that formulating hypotheses is also based on the context of the data. Karen's positioning may indicate conflicting interests between the teachers as a group and the leaders of the project. This can also be grounded in the wider context of tensions between people working at the university and those who work at the public schools. Gee emphasises that this opening extract only offers hints about what is going on and that there is thus a need for confirmation of his interpretation of this first piece of data through analysis of more data. The more talk is analysed, the more will be revealed about the meaning of the speech.

In the example Gee goes on to build on this first hypothesis by exploring other data from the project, including a later meeting in the group where it becomes visible that Karen and the other teachers were bothered by the fact that Sara had contacted the school through the curriculum coordinator and not directly through the teachers themselves. Gee argues that this new data corroborates his hypothesis about the role of the teachers in the oral history project and how they see themselves positioned in the project. It also highlights an issue concerning how much control the teachers have in the project. The new data can also be seen as related to the context of historic tensions between people working at the university and at the public schools.

Using various of 'tools of inquiry', Gee illustrates how he builds an 'evidenced' final analysis across multiple data points. He points out that the analysis of the new data not only enables a better understanding of the first piece of data, but also may give a deeper insight into the issues of power and position in the situation, providing us with a better understanding of events and the various actors' roles and identities.

Throughout this chapter, I will draw on various extracts from this example in order to illustrate Gee's theory/method. I first move to what Gee says about situated meaning.

"Language has meaning only in and through social practices"

Gee's stance in critical discourse analysis involves understanding language as part of a social practice. As a linguist Gee thus goes beyond an understanding of meaning in language based on grammatical structures alone, and takes a broader view which includes the specific meaning language takes in an actual context of use; this is the situated meaning of language, and emphasises the role of practice - "…language has meaning only in and through social practices" (Gee, 2014, p. 12).

In taking this view, Gee argues that we use and interpret language differently in different practices, based on the specific "rules" or conventions for the particular practices we participate in. The rules about how to participate in a committee meeting are different from the rules for taking part in a casual chat. This not only concerns what kind of words we use (lexicon/register) but also how we formulate and express ourselves in our use of language in the context of a particular practice. In the history project example this is evident from a later episode. At the very end of the example, Gee presents a smaller piece of data from an informal chat which takes place after the second project meeting has ended, when only Sara, Karen, Jane and Joe (the other curriculum coordinator) remain (Gee, 2014, p. 211). Gee notes that all are all local Middleview citizens, apart from Sara. Although they still talked about local history in this chat, this talk was very different from the talk in the project meeting; Gee argues that this is because the participants take up different roles in the group on the basis of their local affiliation. Gee makes the point that Sara, the professor, participates in this talk on different terms from the others, because she is unable to switch and participate in the discussion as an everyday citizen. This is also evident from the observation that Sara grew uncomfortable in the situation and left, while the three others remained to talk further about local history. Gee points out that in this part of the talk the tensions between the different groups in the meeting had evaporated because of their common local affiliation.

This example illustrates how language is used differently in the project meeting compared to the informal chat after the meeting, although both concerned local history. This is especially evident because the premises for participating in the chat after the meeting were based on the participants' local affiliation and the possibility of switching to these "rules", but Sara was not able to do this. This was not merely about local knowledge; rather, it concerned the fact that Sara could not cast off her powerful professor identity. When Karen, Jane and Joe started to talk based on their identity as Middleview everyday citizens about local everyday stories, Sara could only continue to participate as the academic historian.

Gee argues that situated meaning is "assembled 'on the spot' as we communicate in a given context, based on our construal of the context" (Gee, 2014, p. 122). In a dialogue between two people the speaker picks their words based on who the recipient is, but what is said also reflects what happens in the context. The speaker relies on the listener to use the context to fill in meanings that are left unsaid. Going back to the example of the history project, Sara clearly was not able to draw on the context of the chat. In one way we can say that Sara did not have knowledge about the "rules" which guided participation in the local chat practice, and she ended up struggling in comparison to her participation in the meeting context. Although Sara had knowledge of local history, not knowing the rules of the practice and its use of local everyday stories excluded her from taking part in it. Thus, this change of "rules" also affected the positionality and distribution of power in the situation. In contrast to her position as the leader of the project meeting, Sara ended up disempowered in the chat, unable to participate. At the same time, she was still the one with more power in the overall situation.

When we understand contexts in terms of social practices, we also need to include elements of the context beyond the language, for instance the physical setting of a situation and everything in it. Contexts can also concern shared knowledge between those involved in the particular situation or what has been previously said. All aspects of context will potentially be used to interpret the situation and the language both by the speaker and the listener. However, Gee argues that we do not use all context available to interpret meaning, but only the parts that are relevant to figuring out what the speaker is saying. Of course, this is not given, and what is considered as relevant depends on the person who is interpreting the context and how the context is understood. Thus Sara, the university professor, interprets the context of the chat after the project meeting differently from Karen, Jane and Joe as local citizens. Sara does not have access to what is relevant context of the chat according to the others.

As we can see, the role of context in the use of language therefore entails a reflexivity between context and language. We use language based on how we interpret context, but at the same time we interpret context in accordance with how language is used. Language therefore simultaneously reflects context, and constructs or construes it to be of a certain kind (Gee, 2014, p. 120). Going back to the example of the chat after the project meeting, Gee points out that Sara grew uncomfortable in the chat and eventually left the meeting. She was unable to construe the context as Karen, Jane and Joe did, as local citizens, sharing local knowledge. Their use of language both reflected this local context and constructed it in that direction. Gee also points out that although Joe was one of the curriculum coordinators, the tensions between the groups apparent in the project meeting was not an issue in the chat between Karen, Jane and Joe where all three participated on the same premisses. This situation shows the implications for distribution of power in this situation, which is now being in the hands of the local citizens in contrast to the situation in the project meeting where the power was held by Sara and the group leaders. This example clearly illustrates how language takes up specific meaning in the actual context of use, and thus that how we understand and use the context has implications for how we understand language and situated meanings.

Gee's theory shows how situated meaning is dependent on or generated through context and practice. At the same time, because meaning is situated, we need to know where to draw the line in extending our incorporation of wider contexts in our interpretation. As researchers trying to understand situated meaning, how far do we extend our inclusion of context? How much of the context is relevant to interpreting meaning? Do we focus only on the immediate context, or do we also take the wider context into account? Going back to the oral history project example, how far should we take Middleview's history into account and how far do we take people's personal experiences into account?

These questions raise what Gee calls the 'frame problem' - the question of how we can claim validity in critical discourse analysis (Gee, 2014, p. 85). Gee sets out to develop a method of discourse analysis which can settle these questions.

The frame problem – Where should we make the cut in a consideration of context?

Gee describes the frame problem as presenting a dilemma for the researcher: "Any aspect of context can affect the meaning of an utterance. Context, however, is indefinitely large (…) Where do we cut off consideration of context?" (Gee, 2014, p. 85). No matter how much of the context we have considered in offering an interpretation of an utterance there are always other and new aspects of the context to consider which may also change our interpretation. The problem is, therefore, how can we know our interpretation is right? In other words, how can we ensure validity in our interpretations? Gee's theory/method explores how far we can go in our interpretations, how far we should take in new (wider, or more distant) aspects of the context to look at and explain situated meanings, while still ensuring validity.

Gee points out that the Frame problem is therefore both a problem and a tool. The problem occurs because our discourse analytic interpretations are always at risk of changing in any widening of the context and the deeper interpretation it may bring with it. The new extended interpretation then raises the question of where we stop if our aim is to assert the truth of our causal arguments. However, the frame problem is also a tool in enabling us to think about how a widening of contexts enables access to new information and values which are not given in what is initially known about an event.

An illustration of such a widening of context is evident in Gee's example of how critical discourse analysis can be used to understand events in the oral history project. His analysis of the first eleven lines of data suggests that there is some sort of issue about the teachers' role in the history project, about how much control they have. Widening the context with further data alongside this first account of events from Karen, Gee illustrates how this new data helps the researcher to understand more about the teachers' situation in the project. The example also shows that a widened context does not undermine the explanatory value of the first context, but merely leads to a richer interpretation of the claim suggested in the first context. The first context is embedded in this wider picture.

Gee argues that we need a structure and a "grammar" which will ensure validity and a robust analysis of situated meanings. To understand this approach, we need to recognise his roots in linguistics where discourse analysis relies on concrete and "scientific" arguments based on a clear structure and the grammar of the language. Using similar techniques, Gee therefore aims to assert the critical discourse analysis of situated meanings as "scientific" through a methodologically robust approach. He argues that a discourse analysis needs to be *critical* because language in use, and situated meanings, are always part of, and partially constitutive of, social practices. A discourse analysis therefore needs to include how language functions politically in social interactions (Gee, 2014, p. 87).

To do this, Gee's theory/method of critical discourse analysis presents a structural grammar of situated meanings. Seven 'building tasks' constitute the structure or the grammar of how we use language to build meanings, and these can be analysed by six 'tools of inquiry'. As I have already noted, Gee makes it clear in the introduction to his book that his framework incorporates both theory and method (Gee, 2014, p. 11), although he argues that this perspective is not specific to his approach - any research method invokes a theory, and investigation of any domain requires both a method and a theory of what that domain is. For Gee, the domain is language-in-use, that is, "saying-doing-being [which] gains its meaning from the "game" or practice it is part of and enacts" (Gee, 2014, p. 11). In his method Gee offers various of tools of inquiry and strategies to be adapted and applied which support what the researcher takes to exist and to be important in the domain. In addition to providing an analytical perspective on how we construct and construe situated meanings, the tools are necessarily unpinned by a theoretical perspective on the nature of situated meanings. Thus theory and method are intertwined in a crossover which becomes most evident in the tools of inquiry. I elaborate on this issue in the section of this chapter on Gee's treatment of identity which invokes two major tools of inquiry, 'big D' Discourse and figured worlds. First, I present the building tasks and discuss their role in Gee's approach to critical discourse analysis.

Making meaning with building tasks

Gee presents seven different building tasks in his theory of situated meaning: significance, practices, identities, relationships, politics, connections and sign systems and knowledge. These building tasks constitute the structural grammar of situated meanings, the structure of how we use and construct language to build meanings. I present each in detail below, but first, to understand the role of the building tasks in Gee's theory/method, these need to be seen in the context of his roots in linguistics and his focus on structure and grammar of the language.

Although it is clear that we use language to make meaning, Gee argues that it is not clear what "making meaning" means: "In the broadest sense, we make meaning by using language to say things that, in actual contexts of use, amount, too, to doing things and being things" (Gee, 2014, p. 31). Gee gives the example of what it means for a musician to "make music", and how this involves responding to cultural conventions about how to make music, but also involves bringing in something unique and new related to the style of the musician. The same is true in use of language. We use language to fit the conventions in the grammar, but we also bring in something unique in what we say and how we say it (Gee, 2014, p. 31). In this context, Gee thus asks for a structure or grammar for how we "make meaning", the conventions for "making meaning".

The building tasks in Gee's theory/method offer such a structure and grammar. According to Gee, when we use language to make meaning we simultaneously build with the seven building tasks, and we also use them to understand and interpret meaning. When the speaker or writer constructs meaning with the building tasks, the recipient similarly uses the building tasks to construe and make meaning of the language. Building meaning with language is therefore a mutual process in that we use the building tasks both to construct and construe meaning and where the speaker and the recipient together "build significance, enact practices and identities, and relationships, make connections, engage in politics (…), and privilege or deprivilege various sign systems and ways of knowing the world" (Gee, 2014, p. 122). Gee argues that when we use language to make meaning we therefore build things in the world.

Since the building tasks constitute the structure of situated meanings, or what we use to make meaning with language, they also become the key structure for the researcher in analysing situated meanings. For Gee, this structure also contributes to ensuring validity and a robust critical discourse analysis of situated meanings. To analyse a piece of data, the researcher can thus ask seven different questions about it, one each in relation to the building tasks, in order to analyse situated meanings. Gee illustrates this in the example from the oral history project.

Starting with the first piece of data, the eleven lines presented above, he works systematically through the building tasks and asks questions related to each in order to better understand how language is used to make meaning in this particular piece of data (Gee, 2014, pp. 38-42). He asks how language is used to make certain things significant, and what practices and identities are enacted through this language, in addition to other questions about relationships, politics, connections and sign systems and knowledge. Gee shows how the hypothesis about the conflict of interest between the teachers and the project leaders is generated through this questioning based on the building tasks. I next present the seven building tasks and with illustrations from the oral history project example.

Significance

When we use language, one of the things we need to indicate to make meaning is s*ignificance*. We use language to signal what is significant, but also what is less significant. This is apparent in what we speak about, or what we emphasise in our use of language. Turning to the example of the history project, Gee points out that although Sara's absence from the Summer Institute could be treated as unimportant in the situation, Karen makes it significant, and she does so in how she uses language to draw contrasts between herself and Sara. These contrasts appear not only in how Karen emphasises particular single words ('DID', 'SARA', 'THAT'), but also how she describes herself as responsible, taking part in the Summer Institute, using the word "but" to underline that Sara did not participate *as expected*. We make things significant therefore in both *what* we say, and *how* we say particular words.

Practices

Gee describes the building task *Practices* as "a socially recognized and institutionally or culturally supported endeavour that usually involves sequencing or combining actions in certain specified ways" (Gee, 2014, p. 32). We use language differently in different practices, and we thus use language in order to be recognised as a participant in a particular practice. For example, Sara uses language to be recognised as the university professor in the project meetings but fails when she continues this use of language in the informal chat after the meeting. Gee points out that there is a reflexivity between use of language and practice. When Sara uses language to be recognised as the professor in the project meeting, we can say that the language enacts the practice of the project meeting. At the same time, the practice of the meeting gives meaning to her use of language.

In asking about what practices Karen is enacting in, focusing on the first piece of data, Gee suggests that she is engaging in “telling the ‘origins story’ of the project” (Gee, 2014, p. 38). Gee makes the point that Karen positions herself and others by engaging in this practice. She tells the story in terms of a certain hierarchy of the people in the practice, but she also tries to undo this hierarchy in how she uses language and refers to Sara as the professor. Thus, asking these questions about practices as a building task here leads to a hypothesis about contested power relations between the teachers and the administrators of the project and how much control the teachers had in the project.

Identity

The third building task is *Identity*. Besides enacting specific practices in the use of language, we also use language to be recognised as a certain kind of person, with a certain identity. We use language to build identity here and now (Gee, 2014, p. 33). In the project meeting Sara uses language to gain recognition as the university professor who is leading the project. When Karen speaks in the meeting, she uses language to be recognised as a proactive and responsible doer and teacher in the project. At the same time, Karen, Jane and Joe use language in the chat after the second meeting to be recognised as everyday Middleview citizens. By speaking and acting in different ways we thus take on different identities, but we must take them on at the right time and in the right place to make it work. Although Sara has the role as the university professor, she has to enact this identity in the meeting to be so recognised. Gee points out that when we enact certain identities, we may also attribute certain identities to others as well. For example, when Karen enacts an identity of being responsible, she also attributes an identity to Sara of being less responsible. Karen thus builds an attributed identity for Sara and in so doing builds an identity for herself.

Identity is central in Gee’s theory of language-in-use, not just as one of the building tasks. It is also closely connected to ‘big D’ Discourse as one of the inquiry tools, and I return to the concept of identity in the next section of this chapter.

Relationships

The next building task is *Relationships*. Gee argues that we use language to signal and build relationships: these include relationships with other people, listeners, readers or institutions we are communicating with. We therefore use language differently according to who we see our recipients to be, and we also position our recipients in our use of language (Gee, 2014, p. 21). One thing which signals or builds relationships is use of names or titles when we talk to somebody. Using a title signals a more formal relationship compared to using a person’s first name. When Gee explores the enactment of relationships in the history project, he sees that Karen enacts a distanced relationship with Sara in how she refers to her just as “a person from Woodson”. Karen’s contrasting of herself and Sara, in her self-positioning as a responsible person and her use of Sara’s first name, does not signal a deferential relationship. Gee points out that Karen’s enactment of her relationship to Sara also may have consequences for what kind of relationship she attempts to have with the rest of the group: Karen appears to talk on behalf of the group of teachers in the project, potentially signalling a distanced relationship between the groups.

Politics

Politics is a crucial building task in taking a critical approach to discourse analysis, since it focuses on perspectives on the distribution of social goods, and status, power and acceptance. Gee argues that social goods are potentially always at stake when we speak and write in a way that implies what is “adequate”, “normal”, “good” or “acceptable” for some group in society. (Gee, 2014, p. 34). Gee defines this distribution of social goods as politics, and thus all use of language is political. So, when we use language, what are the implications for the distribution of social goods in our use of language? In the example from the history project, this concerns status and power in the project, and who has rights to school the children. In the first piece of data this is just formulated as a hypothesis based on how Karen uses language to contrast herself and Sara. This hypothesis is confirmed through the later data from the second meeting in the group when it becomes clear that the teachers were bothered by the fact that Sara had contacted the school through the curriculum coordinator and not directly through the teachers themselves. This further relates to the issue of how the teachers see their positioning in the project and how much control they have.

Connections

Connections, as the sixth of the building tasks, concerns how we use language to make connections between certain things and indicate their relevance. At the same time, building connections also includes the opposite, in that what we say makes it clear when we see things as *not* connected. Connections are not always obvious, and we may therefore use language to make these connections clear. In the oral history project example, this occurs when Karen connects her attendance on the Summer Institute and Sara’s lack of attendance, underlined in her emphasis on particular words (…we BOTH expected, I DID, but SARA wasn’t able to do THAT). Karen’s use of language here also potentially connects this issue of attendance at the

Summer Institute with the issue of the teachers' position in the project, and may thus imply that Sara's absence broke assumed connections.

Sign Systems and Knowledge

The last of the building tasks is *Sign Systems and Knowledge*. *Sign Systems* includes different kinds of languages, varieties of language, languages of special groups of people such as mathematicians or musicians, but also other systems of communication, for instance diagrams. *Knowledge* concerns how we build meanings by using different forms of knowledge, for example knowledge rooted in research on education, or related to experiences of teaching. When we use language, different forms of knowledge will thus communicate different things. Gee argues that we make knowledge and beliefs claims within these systems, and that we can use language to privilege one sign system or knowledge over another (Gee, 2014, p. 35). The oral history example illustrates differences in privilege between teacher knowledge versus university-professor knowledge, and this connects to the role of status and power differences between the teachers and the project administrators. The teachers obviously felt less included in the project and were bothered that Sara had gained access to the students through the curriculum coordinator rather than through the teachers. When Jane, one of the teachers, speaks up for the teachers she thus argues about the importance of teacher knowledge for teaching history, saying that the teachers "own the kids" (Gee, 2014, p. 201). One of the curriculum coordinators replies to Jane with the argument that special knowledge is needed to lead such a project, since it is "complicated" and "murky" (Gee, 2014, p. 202). Gee argues that the curriculum coordinator uses these words in a bid to privilege this knowledge over the teachers' knowledge.

Another example of different sign systems is evident in the chat after the meeting. As natives of Middleview, Karen, Jane and Joe use their everyday language in this talk, while Sara, the professor, uses her academic language. In addition to not having local knowledge, her lack of a local everyday language repertoire makes it difficult for Sara to participate in the chat. This example also illustrates how use of the different types of language and knowledge leads to different positions for the participants compared to the project meeting. Sara's participation in the chat is limited in comparison to the other three. The contrasts between the different groups in the meeting are no longer apparent, and Karen, Jane and Joe can thus take a different role in this chat.

Mutually supportive building tasks

It is clear that the seven building tasks are integrally linked in our use and construction of language to build meaning. Karen's participation in the *practice* in the first meeting in which she tells the "origins story" of the project supports how she performs the *identity* of proactive teacher. Her use of these building tasks connect to the *sign systems* and different forms of language she chooses to use from her repertoire. She clearly conveys meaning about the role and importance of the teachers' position in the project. This situated meaning is also enhanced in the way she builds *relationships* between the teachers as a group but also how she contrasts the teachers with others in the group. What Karen makes *significant* and how she makes *connections* in her use of language also supports her building of meaning around the *politics* of the situation in terms of status and power of the different roles in the project. These connections illustrate how the building tasks mutually support each other in meaning making, constituting the structural grammar of situated meaning, and thus also how it can provide a structure for critical discourse analysis. Gee shows this in his illustration of how questions related to each of the building tasks mutually support the hypothesis first formulated in response to the first eleven lines of data (Gee, 2014, p. 42).

It also appears that all the various building tasks tend to be underpinned by or related to the role of identity. This is of course obvious for *identity* as one of the building tasks, but Gee's example illustrates how the other building tasks relate to this as well. Enacting the identity of proactive teacher, the *practice* Karen participates in also underpins this identity in how she chooses to tell the original story and what she emphasises in the story. In the building task *relationships*, identity is evident in the way in which Karen contrasts herself to Sara as the professor while connecting herself to the group of teachers. What Karen makes *significant*, how she makes *connections* and her use of *sign systems* and *knowledge* also underpin this identity. Identity is also apparent in *politics* in terms of status and power relations between the different groups in the meeting. Identity thus emerges as a major concept in all the building tasks; together, the building tasks refer to an extended and multiple understanding of identity in relation to context. Identity thus plays an important role in Gee's work. In the next section I focus on the role of identity in Gee's theory, and its connection to two key tools of inquiry, 'big D' Discourse, and figured worlds.

3.2 Gee's writing on identity: introducing key tools of inquiry

Gee's background in the field of linguistics means that he is clearly interested in words, but he takes a broad view which incorporates the social and cultural aspects of language such that all meaning must be understood in its specific context and practice and must acknowledge social power and the political nature of language. Identity thus emerges as an important concept in a theory of situated meaning: Gee argues that saying things “never goes without also doing things and being things” (Gee, 2014, p. 3). When we are saying things, we also engage in practices or activities and thus *do* things. Language allows us to take on different socially situated identities and *be* things. Going back to the example of the local history project, Karen engages in the practice of telling the origins of the story, as well as taking on the identity of a proactive and responsible doer and teacher in the project. She simultaneously says something, does something and is something. Thus when we use language, we use it as a particular kind of person. To understand situated meanings and language in use, Gee argues that we therefore need to understand both *who* is saying what and what the person is trying to *do* (Gee, 2014, p. 47).

The importance of recognition

Gee has for many years been interested in identity and the role of identity as an analytic tool for research, particularly in the field of education. To better understand the role of identity in Gee’s theory of situated meanings I turn to one of his earlier works (Gee, 2001) in which he develops what he describes as a specific perspective on identity. For Gee, identity relates not just to action and interaction but also recognition; identity is defined as “being recognized as a certain “kind of person” in a given context” (Gee, 2001, p. 99). Identity is closely connected to performance, but this requires others to recognise someone as “a certain kind of person”. Gee thus takes a dynamic approach to identity, since what “kind of person” someone is recognised as will vary in relation to change of context, time and place. He argues that all people therefore have multiple identities related to different performances in society.

Four labels of identity

Gee builds his understanding of identity around four different identity perspectives that he labels Nature-identity, Institution-identity, Discourse-identity and Affinity-identity (Gee, 2001). What distinguishes the different perspectives relates to the particular situations and practices in which they are generated, leading to different identities in the sense of “what makes you like this?”. N-identity describes a person’s identity as a state controlled by nature. For instance, a student could be described as ‘naturally good’ at mathematics because of her genes or the “nature of the child”, rather than in relation to societal forces, for instance. Describing a person from an I-identity perspective is to describe them primarily in terms of positions occupied in society, “positions authorized by authorities in institutions” (Gee, 2001,

p. 100). Taking the example of a student who is seen as good at mathematics, this can also be recognised as an I-identity based on her position in a high performing group for mathematics in a school which organises classes by attainment. Being a member of this group can be all that is needed for her to have this I-identity.

D-identity differs from the two previous labels, in that it concerns identity seen as an individual trait, recognised in discourse and dialogue. Being recognised as a certain kind of person is thus related to individual accomplishments. Returning to the example of the student who is seen as good at mathematics, a D-identity perspective recognises her as good at mathematics because she works fast on mathematics tasks. This is a discursively built label which operates according to the assumption that being good at mathematics is indicated by speed. This label is attached to the student regardless of whether she is placed in any particular attainment group. It may relate to the N-, and I-identity of being good at mathematics, but as a D-identity it is a discursive positioning underpinned by recognition of the importance of speed in a common discourse of school mathematics. The fourth identity perspective, A-identity, relates to an individual's experiences of distinctive practices or "affinity groups" (Gee, 2001, p. 101), and thus denotes an identity shared with others in such a group. Being 'one of the students who are good at mathematics' can then be also seen as an A-identity. Our example student who is part of a high attainment group shares the experience of being good at mathematics with the others in the group, taking masterclasses, for instance, or being asked to help other students. This identity is recognised in relation to the context of the affinity group, and is not related to "nature", institutions or discourse as such.

Gee argues that the four perspectives have been differently foregrounded in different societies and historical periods; in the context of educational research in Western society, perceptions of identity have moved from first understanding identity as a matter of nature (N-identity), to a focus on institutional positionality and power (I-identity), followed by identity as a matter of discursive positioning based on individual traits (D-identity), and most recently in relation to being a member of an affinity group (A-identity) (Gee, 2001). There has thus been a shift from seeing identity as a matter of "we are what we are", decided or positioned by forces outside of our control, to a view that individuals themselves choose and form their own identities.

However, while different perspectives predominated in different periods and societies, Gee is clear that the four perspectives are not separate but interrelate in complex ways, and that all perspectives coexist. These connections also become visible in the examples of the different perspectives on an identity of being good at mathematics. The different perspectives can thus be seen as four different ways in which identities are formed and sustained, or four different ways to ask questions about identities to understand different people in different contexts. Emphasising multiple identities, all the four perspectives may therefore be present and woven together as a person acts within a context, but with one perspective predominating.

The way in which the perspectives interleave and work together becomes very clear if we consider what is relevant about the four types of identity with relation to Gee's example of the history project (Gee, 2014). Focusing on I-identity, Sara has a professor identity based on her position at the university. On the other hand, the teachers can be seen as having an I-identity in their position as persons responsible for the students. D-identities can be seen in terms of being a good teacher or a caring teacher as a discursively given label in the Middleview schools. Another example may be Jane as the 'responsible' teacher recognised as a particular trait relating to Jane in how her talk about herself as doing what she is asked for. This D-identity is recognised in that she is asked to attend the Summer Institute by the curriculum coordinator. This example of Jane shows how D-identity may also connect to an I-identity in terms of Jane's role or position in the institution. Focusing on the perspective of an A-identity in the history project, Sara has membership of the group of academics and is also recognised in terms of a D-identity in terms of her enactment of academic practices. The teachers, based on their local affiliation as citizens of Middleview, have A-identities as teachers at Middleview schools but also as local citizens of Middleview.

Seeing ourselves through others' eyes

As we can see, these different identity perspectives are closely interlinked; they coexist in any individual. Although particular identity perspectives may be foregrounded, Gee emphasises the multiplicity of identity. This interlinking means that discourse operates through all the perspectives, so that identity is in general sustained and underpinned by discursive practices. For example, an I-identity (for example that of a student in the "high ability" mathematics group) is also a discursive identity and a social construct ("ability" is recognised as a meaningful trait which can be attached to a student which in this context draws on a discourse or dialogue about fixed ability). Identity therefore concerns how people are discursively positioned and recognised as a certain type of person. Although someone might have some agency or control over what is foregrounded, recognition by others is key:

> *Thus, people can accept, contest, and negotiate identities in terms of whether they will be seen primarily (or in the foregrounded way) as N-, I-,*

> *D-, or A-identities. What is at issue, though, is always how and by whom a particular identity is to be recognise* (Gee, 2001, p. 109).

Identity is thus a matter of seeing ourselves through other's eyes, and the performance of multiple identities which depend on recognition by others. Gee describes this performance in terms of *combinations,* which involve choices of

> *(a) speaking (or writing) in a certain way; (b) acting and interacting in a certain way; (c) using ones face and body in a certain way; (d) dressing in a certain way; (e) feeling, believing, and valuing in a certain way; and (f) using object, tools, or technologies ("things") in a certain way* (Gee, 2001, p. 109)

In performing identity and engaging in such combinations, individuals may consciously bid to be recognised in a certain way, or they may act less consciously (Gee, 2001). At the same time, since people may not all recognise behaviour and actions in the same way, combinations may also be recognised in different ways. Being recognised as a certain kind of person requires others to recognise a combination in a certain way.

Gee develops the concept of Discourse with a capital D in order to distinguish it from the more general idea of discourse. It describes any act of combination which is recognised as being a "certain kind of person" - Discourse involves "ways of being certain kind of people" (Gee, 2001, p. 110). Hence, Discourse emphasises that we see ourselves through others' eyes, performing within a set of expectations of what behaviour is expected within a particular kind of context. This performance and enactment of identity takes place through engagement in combinations, including speaking, acting, interacting, use of face and body, feeling, believing, valuing and using object and tools in a certain way. Parallel to his emphasis on performance of multiple identities in the context of Discourse, Gee also argues that people have a sense of self, a *core identity* (Gee, 2001). People have a unique trajectory through *Discourse space*: "This trajectory and the person's own narrativization of it are what constitute his or her 'core identity'" (Gee, 2001, p. 111). *Core identity* captures a person's unique memories and history, a sense of an ongoing identity, which is narrativised. People tell the story of who they are, a certain kind of person. Gee emphasises that this story, as an ongoing identity, will never be complete, and is "never fully formed" (Gee, 2001, p. 111). So, Discourse is social and historical, existing independently outside the person, but the trajectory through Discourses, the person's narrativisation of it, is individual.

Thus Gee (2001) develops his understanding of identity in terms of multiple identities which reflect the four perspectives of identity. However, since all identity perspectives rely on discursive practices, D-identity emerges as important, and with it the concept of ‘big D’ Discourse to describe identity performance. ‘Big D’ Discourse reappears in his later theory of situated meanings and language in use, where it also acts as a major tool of inquiry.

‘Big D’ Discourse - “characteristic ways of saying, doing and being”

The concept of ‘big D’ Discourse makes it clear that the enactment of identity includes more than just words in a dialogue or discourse: it also includes ways of interaction, deeds, values, use of objects and tools – what Gee calls “other stuff”. ‘Big D’ Discourse is “an interactive identity-based communication, including both language and everything else at human disposal” (Gee, 2014, p. 24). Discourse thus concerns the enactment of socially-situated identities and different “kinds of people”; Discourses are “ways of combining and integrating language, actions, interactions, ways of thinking, believing, valuing, and using various symbols, tools, and objects, to enact a particular sort of socially recognisable identity” (Gee, 2014, p. 46). However, as we have seen, the key to Discourse and to being a particular kind of person is recognition of enactment. We need to “believe and value the right things and wear the right things at the right time and right places. Identity is a performance” (Gee, 2014, p. 24). Being recognised as a particular “kind of person”, for example a university professor, a middle school teacher or a local Middleview everyday citizen, requires speaking in the right way, acting and dressing the right way, engaging in the right ways of thinking, acting, valuing, feeling, and using tools and objects at the right time and in the right place. It is about being recognised as being able to both “talk the talk” and “walk the walk” (Gee, 2014, p. 222).

Discourse thus connects identity and practice. In their use of language, people enact a certain kind of person, but this identity takes place in the context of a certain kind of practice. Discourse is therefore both about communicating a “who”, a socially-situated identity, but also a “what”, a socially situated practice (Gee, 2014, p. 47). Enactment of an identity will always be connected to a practice; the “whos” and “whats” are not separable, and are integrated into a “multiple or ‘heteroglossic’ who-doing-what” (Gee, 2014, p. 48). This integration of identity and practice in Discourse also emphasises the idea of identity as performance. Performing an identity, a particular “kind of person”, will always be in the context of engaging in a particular practice as well. For example, Karen in the history project performs the identity of a proactive and responsible doer and teacher in the context of “telling the “origins story” of the project” in the project meeting. The identity Karen enacts is thus integrated into the practice she engages in.

However, Discourse is not simply local; for Gee, Discourses are long-running, they existed before us and will continue to exist – they are “bigger than us” (Gee, 2014, p. 52). Hence a Discourse must be seen as a general idea which is historical and cultural. When two people engage in a Discourse, they may therefore be seen as being carrier of the Discourse, interacting in the context of the Discourse. We may thus imagine that it is not just the people, but also the Discourses which are interacting. Taking the example of the local history project, the teachers participate in the meeting within the Middleview teacher Discourse, and the professor within the academic historian Discourse. The conversation focuses on the teachers' role in the project, but if we see it as a conversation “among Discourses”, it also reflects historical tensions between people working at the university and those working in the public schools. The “local” conversation reflects the big ideas of the Discourses, how the Discourses interact. The teachers and the professor are carriers of the historical Discourses and tensions between the different groups. This is not to say that Discourses cannot change, however: although the Discourses predate this conversation, by acting them out in this meeting the participants may also gradually transform what counts as being the Discourse of a Middleview teacher and the academic historian Discourse (Gee, 2014, p. 210).

Because Discourses relate to different situations and settings, and people enact different Discourses, conflicting Discourses may arise in some situations. When Karen is recognised in the Discourse of a proactive doer and teacher, this may be in conflict with the Discourse she enacts as an everyday Middleview citizen. When she engages in the practice of using small talk, Karen no longer enacts her specialist identity and the professional Discourse. She enacts the identity of an “everyday” person, speaking and valuing in a way which is typical of a Middleview Discourse. However, when Sara tries to engage in the chat, she does not manage to enact a different Discourse. Rather, she tries to mix the academic historian Discourse together with the Middleview everyday Discourse, although since she does not “talk the talk” and “walk the walk” of the Middleview everyday Discourse she is not recognised in it.

Seen as long-running macro structures, Discourses are embedded in a medley of social institutions and involve various props such as different tools, technologies or other relevant objects. To “pull off a Discourse”, we engage in a “dance”:

> *In the end a Discourse is a “dance” that exists in the abstract as a coordinated pattern of words, deeds, values, beliefs, symbols, tools, objects, times, and places and*

in the here and now as a performance that is recognizable as just a coordination. Like a dance, the performance here and now is never exactly the same. It all comes down, often, to what the "masters of the dance" (the people who inhabit the Discourse) will allow to be recognized or will be forced to recognize as a possible instantiation of the dance (Gee, 2014, pp. 53-54).

Discourse is thus about the "performance, negotiation and recognition work that goes into creating, sustaining, and transforming Discourses" (Gee, 2014, p. 55). Hence, Discourses are not consistent and have no clear boundaries. Discourses may change, new Discourses may emerge, and old ones may die. Discourses may be big or small. There are thus innumerable Discourses in society, all characterised by recognition of identity and practice. Since Discourses in society betoken certain identities and associated practices, they are material realities at the same time that they function as mental maps by which we understand society: "Discourses, then, are social practices and mental entities, as well as material realities" (Gee, 2014, p. 57).

Figured Worlds mediate Discourses

Alongside Discourse, figured worlds represent people's expectations about the world, about "how things should be" and also how they should be in it. As they engage in a Discourse, people act out figured worlds, and hence a figured world can be seen as the context in which Discourse is acted out. Over the years, Gee has used different terms to talk about what he now calls figured worlds. Originally, in the first edition of his book, Gee used the term 'cultural models' to convey the idea of expectations about the world, changing to 'Discourse model' in the second edition. In the latest version of his theory/method, he uses the concept *figured worlds,* a term he borrows from Holland et al. (1998), who describe a figured world as:

A socially and culturally constructed realm of interpretation in which particular characters and actors are recognized, significance is assigned to certain acts, and particular outcomes are valued over others. Each is a simplified world populated by a set of agents who engage in a limited range of meaningful acts or changes of state as moved by a specific set of forces (Holland et al., 1998, p. 52)

Building on this definition Gee gives his own description of figured worlds, which is rather close to Holland et al.'s definition:

… a theory, story, model, or image of a simplified world that captures what is taken to be typical or normal about people, practices, things, or interactions. (…) A figured

world is a socially and culturally constructed way of recognizing particular characters and actors and actions and assigning them significance and value (Gee, 2014, p. 226).

Gee thus emphasises figured worlds as socially and culturally constructed theories which capture what people expect to be normal. He explains his choice of the term:

> *…it has the advantage of stressing that what we are talking about is ways in which people picture or construe aspects of the world in their heads, ways they have of looking at aspects of the world. We humans store these figured worlds in our heads in terms of stories, ideas, and images. We build little worlds, models, simulations – whatever term we want use – in our heads in terms of which we seek to understand and act in the real world* (Gee, 2014, p. 95).

Figured worlds thus become guides for acting in the world and engaging in Discourse. Hence, to fully understand Discourse and use it as a tool of inquiry in which we aim to identify the multiple Discourses at play in a communication, we also need to understand figured worlds.

Local taken-for-granted theories

Figured worlds are theories or stories about the world, and about what is normal. This includes the perceived typical participants, activities or objects in a figured world which we build up through our experience of particular contexts. In entering a figured world, for instance the figured world of academia, someone becomes a part of that figured world, learning to recognise and share in what is valued and what is significant. However, this learning is not necessary conscious, and thus figured worlds are often unconscious theories and stories about how things are or should be. Hence, they are often "taken-for-granted" theories or stories about the world. In acting out figured worlds people act on these "first thoughts" and assumptions of what appears to be normal to guide their actions in the real world. However, what is typical or normal differs according to context. Typical participants, activities or objects of one figured world may not be typical for others. Figured worlds are therefore guided, shaped and normed in different social and cultural groups.

Figured worlds are never clearly articulated by a person. However, based on what is communicated in context, situated meanings can guide us to make hypotheses about what figured worlds people operate on (Gee, 2014). Turning to the example of the oral history project, Gee argues that Jane (who says that the teachers feel excluded in the project) operates on a figured world about the informal practices at Middleview. In this figured world, teachers are the people who control access to the students in the classroom, and this gives them special responsibilities and rights (Gee, 2014, p. 207). So, Jane acts out this figured world, either consciously or as a “taken-for-granted” theory, commenting on the teachers’ role in the project, based on what she expects to be the normal.

Since figured worlds are theories about what counts as normal, this affects what is seen as marginal and non-typical in a setting. Figured worlds thus both include and exclude people and actions on the basis of what is “normal”. In Jane’s figured world of the informal practices at Middleview, at the same time that it is normal that the teachers are the people who have access to the students in the classroom, the project administrators are excluded from this access - figured worlds are not neutral, and certain aspects are foregrounded while others are backgrounded. When the project administrators are arguing about the organisation of the oral history project, they operate on a figured world in which management of a teaching project is controlled by the school administrators while teachers have a more peripheral role.

Interactions between figured worlds

Because figured worlds are local theories based on experiences in different social and cultural groups, people will have different figured worlds for different settings (Gee, 2014). On the other hand, different people may bring different figured worlds to the same setting. Jane and the project administrators clearly operate on different figured worlds in the project meeting. Hence, there is no “right” or “wrong” figured world. Figured worlds can be big or small, and they link to other figured worlds in complex ways. Smaller figured worlds can be inside bigger figured worlds, or one figured world may incorporate another. Jane may have other figured worlds at different levels about the organising of teaching which may link to her figured world of informal practices. At the same time, although figured worlds are local theories, figured worlds can also concern large and important aspects for particular groups of people, seen as a ‘master figured world’. One example could be that Jane’s figured world of the informal practices of the Middleview schools is part of a master figured world about school organisation in general.

Since people have many different figured worlds, they may also have allegiance to competing and conflicting figured worlds. For example, Joe is one of the curriculum coordinators but also a local Middleview citizen. Being one of the project administrators he may act out the figured world where the project administrators control management of the teaching project leading to a more peripheral role for the local Middleview teachers in the project. At the same time, taking part of the informal chat after the meeting as a local Middleview citizen, Joe may act out a figured world about local citizens sharing local stories about everyday life in Middleview. In this situation the teachers are included due to their local affiliation. This simultaneous exclusion and inclusion of the teachers on the basis of these figured worlds suggests that there may thus be conflicting figured worlds for Joe.

Gee argues that figured worlds “need not be complete, fully formed or consistent” (Gee, 2014, p. 111). Being socially and cultural located, theories and stories will continuously be revised and developed through experiences and interactions, and the characteristics of a figured world may change through time. Figured worlds are therefore not static theories. People learn figured worlds from experiences, but people may also gain experiences variously from texts, media and other people’s stories. Hence, although figured worlds appear to be stored in people’s minds, it is the case that parts of these stories also exist in books, media and knowledge gained from what other people say and do, and in what we can infer from various social practices around us (Gee, 2014). Sharing the local stories from Middleview, people gain these from experiences in local groups, but they may also access this knowledge from books about local Middleview history.

Figured worlds and Discourse

For Gee, people engage in Discourses by acting out different figured worlds, and hence different identities. In order to understand the relationship between Discourse and figured world, we can consider the relationship between classroom Discourse and the figured world of a classroom. Figured worlds are local theories (how the classrooms in this school are organised), whereas Discourses are culturally general ideas and macro-structures about how to enact socially-situated identities (how teachers take responsibility for student learning). Hence, Discourses are “bigger” than figured worlds, where figured worlds are local simplifications of Discourses. To illustrate this with an example from the history project, when Jane takes part in the project meeting, she engages within the historical Discourse of being a Middleview teacher, but in the meeting, she acts out her local figured world of informal practices of Middleview schools. In enacting a Discourse, acting-interacting-thinking-valuing, figured worlds thus mediate between the local expectations and the macro level patterns of Discourse. We can therefore say that figured worlds are simplifications which enable us to enact a role within a Discourse, and enacting a Discourse hence requires a figured world in order to act.

Discourse and Figured Worlds: tools of inquiry which bridge between theory and method

Discourse and figured worlds represent two of the tools of inquiry in Gee's theory of situated meaning and language in use. However, as we can see, the ideas of Discourse and figured worlds are also theoretical devices and a crucial part of the structure of Gee's theory of situated meaning and language in use, particularly when it comes to understanding identity. Referring to the crossover between theory and method, Gee is clear about this role of the tools as more than tools for analysis; they are "our ways as theoreticians and analysts of talking about and, thus, constructing and construing the world" (Gee, 2014, p. 91).

In addition to Discourse and figured worlds, five other tools of inquiry remain: social language, Conversations, intertextuality, form-function correlations, and situated meanings. These tools are more obviously to do with method and hence I discuss them in the next chapter, where I will also return to a discussion of Discourse and figured worlds as members of the set of tools of inquiry in Gee's theory/method.

I started this chapter by asking the question, how can we understand situated meaning. Gee's theory/method. As I have shown, central concepts in the theory are situated meanings, identity, Discourse and figured world, but these must be seen in the context of critical discourse analysis, the frame problem, and the crossover between theory and method. In the next chapter, I explore the methodological implications of Gee's work further, focusing on the contribution of a critical discourse analysis to my study and my operationalisation of Gee's framework.

Chapter 4. Methodology

In this chapter I describe the methodological development of my study, and its methods and analysis. I focus on the epistemological implications of taking a critical discourse analysis approach, and the operationalisation of Gee's theoretical framework. I also discuss issues of validity and trustworthiness, with particular reference to Gee's frame problem. Working with schools and teachers raises ethical issues and I discuss how I deal with these as part of a critical discourse analysis approach.

4.1 Addressing the research questions: moving towards critical discourse analysis

The original starting point of this thesis was an exploration of the situation laid out in Chapter 1: an increase in attainment grouping as a response to the policy requirement to deliver TPO and to raise student performance on the international stage. There was very little research in Norway focusing on attainment grouping, and the legal and ideological background of inclusive teaching raised questions about the nature of mathematics teaching in Norwegian schools which were taking up grouping. It seemed reasonable to ask whether the patterns in the international literature would be repeated, or whether the introduction of grouping into traditions of mixed group teaching might have different outcomes. Thus, the initial aim of my study was to find out more about mathematics teaching in attainment groups in Norway, by means of a largely observational comparative study. Influenced by the literature which suggests that mixed class teaching might be more inclusive, or that different 'ability' groups might receive more or less explorative teaching with differential access to mathematical meaning-making, I aimed to focus on teachers' orchestration of classroom talk. I was particularly interested to look at potential differences in students' access to mathematics according to their placement in different attainment groups. My early research aims therefore focused on comparisons, and my research design involved observation of mathematics teaching in different types of groups, focusing on turn-taking in classroom talk. Hence, I observed mathematics teaching at two different schools, one teaching mathematics in attainment groups, and one teaching in mixed groups. As a support to the main observation data, I also gathered interview data from the teachers, focusing on how they conceptualised mathematics teaching. However, my main unit of analysis at this stage was a lesson-level analysis of classroom interaction in the different groups. To this end, I chose to use Schoenfeld's (2018) Teaching for Robust Understanding (TRU) framework for observing whole class mathematics teaching and talk sequences, prioritising issues of student authority, agency and inclusion. This framework and its assumptions about mathematics teaching for understanding reflected my own views as both a teacher and a teacher educator.

These initial ideas about the nature and purpose of my study were based on a number of epistemological assumptions which further reflection on the literature and the implications of a critical discourse analysis approach call into question. My focus moved from "what" to "why", with major implications for how I was to understand my data.

Shifting to questions about why

As chapter 2 showed, the research on the nature of pedagogy in different attainment groups is inconsistent, with some researchers reporting higher rates of investigative learning and student participation in higher attainment groups compared to lower attainment groups, while others found that, on the contrary, higher attainment groups emphasised pace and procedural learning. Yet others reported that mixed attainment groups were the most collaborative. Juxtaposing this literature with that on cultures of performativity highlighted the links between attainment grouping and a focus on student marks and their importance in education policy and local school cultures. This situation challenged my earlier assumptions that there would be observable patterns linking group types and pedagogic practice. The clear impact of policy contexts highlighted the need to recognise the role of situatedness in my research. My focus began to shift towards a need to understand not only how teachers worked with attainment groups, but also why their practice followed particular patterns as part of the wider context of performativity. This recognition of the role of situatedness and context in understanding classroom processes highlighted the need to move towards a critical discourse analysis in which what happens in a classroom needs to be understood as socially, culturally and politically influenced.

Alongside this recognition of the situated nature of classroom interaction, my initial focus on TRU (Schoenfeld, 2018) as a straightforward means of comparison was also called into question. As described by Schoenfeld (2013), the development of TRU is underpinned by a complex theoretical and methodological process which makes no claims to objectivity or timelessness. As Schoenfeld says, "All I have at this point, ... is an intuitive sense that the dimensions highlighted in the scheme have the potential to be necessary and sufficient for the analysis of effective classroom instruction" (p. 618), *but*, "Getting at 'what counts' requires multiple lenses, methods, and perspectives" (p. 619). Robust implementation of TRU's three scoring levels (see Schoenfeld, 2014) relies on developing inter-rater reliability across a research community, but using the tool itself also raises the question about how to score a lesson, as a whole unit or as a sequence of episodes, and if the latter, then how to aggregate scores. It also relies on observer judgement on how to reconcile scores for individual actions which do not match scores for the overall task. It raises questions then about how consistent scores need to be within a lesson, and indeed the number of times that a teacher should be observed in order to arrive at a reliable evaluation. Although we can argue that by observing a teacher during a whole week of teaching we might find some patterns of teaching, there is a deeper question of whether quantification is appropriate in the first place, and whether this imposes a relatively positivist explanation when in fact an interpretive narrative is required, in *"a different logic of research procedure"* (Bryman, 2016, p. 26). While Schoenfeld's intuition is that the framework covers the "necessary and sufficient" qualities of effective teaching, he acknowledges that "the teacher's knowledge, goals, and orientations are 'backgrounded' in this context, as class-room activity structures are highlighted" (Schoenfeld, 2013, p. 619). For Schoenfeld, these background factors are only important if the goal is professional development, but they are also necessary once we recognise the fundamentally situated nature of classroom mathematics. This became clear in my initial readings of the interview data, leading to a shift in my understanding of the role of these data in the study, and what they showed about important differences between individual teachers despite similarities in how their classroom practice would be scored according to the TRU framework.

These initial readings showed how teachers related differently to the practice of attainment grouping, presenting different explanations and justifications of their teaching and different mathematics teacher identities within the school. These various considerations caused me to shift focus from a comparison of pedagogy in different groups - the *what* of teaching in attainment groups - to development of a more detailed story about the *why* of teaching in attainment groups. This also indicated a shift in my research design away from a comparison of pedagogy in two differently organised schools towards an in-depth analysis of teacher narratives in a single school using attainment grouping, so I no longer needed the mixed group school which I had recruited to the study. Epistemologically, I now looked for interpretive understanding of what I saw in the classroom through teachers' narratives of self, including their intentions, theories and professional histories. Taken together, these various shifts led me to discourse analysis, and particularly critical discourse analysis, as the right approach for my study.

Saying and doing – arriving at Gee's critical discourse analysis

Critical discourse analysis has been used as a way to make sense of meaning-making in educational contexts, and to explore questions about relationships between language and context by combining analysis of the microstructures of classroom interactions with analysis of macro structures in the social world. Rogers (2011) sees critical discourse analysis in education research as growing from a work in sociolinguistics, narrative research, linguistic anthropology and ethnography of communication such that 'Schools, classrooms, and educational practices became sites for studying not only the micro-dimensions of classroom talk but also the ways in which social structures are reproduced at macro-levels' (p. 3). For Rogers, the *critical* aspect of critical discourse analysis brings a focus on power, and its effects and outcomes, and how it impacts on people (p. 3). *Discourse* concerns meaning-making through presentational systems, of which language is but one form, but most important is that "Meanings are always embedded within social, historical, political, and ideological contexts. And, meanings are motivated." (p.5). *Analysis* underlines the fact that theories of critical discourse analysis are closely aligned to method: "What is important is that analyses are connected to a theory of the social world and a theory of language that is coherent. Beyond that, procedures and methods vary" (p. 10). Although critical discourse analysis includes a number of researchers, Kress and Hodge (1979), Fairclough (1995, 2010) and Gee (2011, 2014) are key proponents.

Having decided on critical discourse analysis and a focus on teacher narratives, the question arose as to the role of the observation data in my study. As Schoenfeld (2013) notes, teachers frequently do not do what they say they believe in, while many other researchers have commented on the fact that they do not put into practice what they are taught in professional development (Solomon et al., 2017; Wake & Burkhardt, 2013). Nevertheless, I assumed that a relationship existed between teachers' saying and doing which was important to explore – while teacher narratives were clearly important, I could not ignore teachers' practice. The decision to explore this relationship led me to Gee's (2014) 'big D' Discourse as the combination of saying, doing and being. It enabled a focus on the teachers' enactment of Discourses as the performance of a mathematics teacher identity which incorporates theorisation of local contexts with actions in that context, understanding what they say as part of their performance, rather than as distinct from it.

Gee's theory required a radically different way of looking at the observation data alongside the interview data. My unit of analysis had now shifted to focus on the teachers' stories as not only providing insights into their lessons but linked to them as part of their overall performance of being mathematics teachers rather than as merely contradictions to or confirmation of what they did in the classroom. Gee's (2011) emphasis on his theory/method as *critical* discourse analysis played a part in this in terms of its demand that the wider policy interest in attainment grouping and its role in interpreting TPO could not be ignored if I was to understand the relationship between saying and doing. In tune with Gee's (2011) argument that …

> *critical discourse analysis argues that language-in-use is always part and parcel of, and partially constitutive of, specific social practices, and that social practices always have implications for inherently political things like status, solidarity, the distribution of social goods, and power (p.28)*

… I could not ignore the political and social context of performativity, particularly its impact on interpretations of TPO. Combining the interview and observation data was not a question of looking for mismatches between saying and doing which lead to a deficit view of teachers; rather, it assumed an integrity of saying, doing and being, interpreted through the lens of performativity.

Gee's work was thus particularly useful in making sense of how teachers were working in the political and social context of attainment grouping and performativity. It meant that I did not ignore their practice, and it enabled me to explore the complexity of the relationship between their saying and doing. Hence, from my start point of a somewhat positivist approach based on quantifiable observations and an assumption of direct connections between group types and pedagogy, I had arrived at an interpretive understanding of the dynamics of policy and practice.

4.2 Research design and methods

In order to explore mathematics teachers' enactment of teaching in the context of attainment grouping with Gee's critical discourse analysis as my theoretical framework, I needed a research design which captured teachers in their situated practice, both individually and collectively, recognising the role of co-constructions in the collective. As I have explained, observation data alone was not enough to capture this - I also needed to know about their intentions, theories and histories and how these related to the wider context outside the classroom.

The school and its organisation

Since attainment grouping is most frequently used in lower secondary schools in Norway, I aimed to recruit a lower secondary school where this was the normal practice. I wanted to ensure that I was observing teaching in an everyday situation where the students and teacher were known to each other and students were familiar with the regular practice of the classroom, so I chose 9th grade: in 8th grade students are new to the school and their teacher, and in 10th grade teaching may be influenced by the upcoming transition to upper secondary school and national testing. This study focuses on three teachers from Berg school, a lower secondary school serving a mixed socio-economic status community in a rural area in the east of Norway. The school has three or four parallel classes in each grade, with four in the 9th grade. Recruitment to the study involved contacting the head teacher with a request to carry out research on attainment grouping in mathematics classes. She welcomed my approach and put me in contact with one of the 9th grade mathematics teachers who was the lead mathematics teacher at the school. This teacher organised a meeting between myself and the group of four 9th grade mathematics teachers where I informed the teachers about the study details. I explained my intention to interview them and observe their teaching, and told them that I was particularly interested in classroom talk in addition to focusing on teaching in attainment groups. All the four agreed to participate. However, as a result of one of the teachers going on long-term sick leave, I ended up focussing on just three of the teachers. I explain this situation further below.

Beginning as a teacher initiative, Berg school had organised mathematics teaching mainly in attainment groups for the last five years. This was largely supported by the school leaders, although they had also questioned the practice. According to the mathematics lead, this questioning was based on some research that the school leaders had read. However, due to the strength of the teacher initiative and their motivation for this way of organising teaching, the school leaders ultimately supported their decision. As noted in Chapter 2, this type of teacher autonomy in decision making is not unusual in Norway (Eriksen et al., 2022), as is the existence of a variety of grouping practices. Over the previous five years, partly as a result of an experimental use of resources, Berg school had organised attainment groups in a varying number of groups and types of groups. This practice was publicly (including to the students) called “mestringsgrupper” [“mastery classes”] although in their conversation with me, the teachers also referred to it as “nivågrupper” [“level groups”]. These had included groups organised just for high attaining students and/or low attaining students, and individual high attaining students had also been offered accelerated learning by attending mathematics classes at a higher grade.

In the year of this study, in the 9th grade, mathematics teaching was partially organised by attainment groups. In two of the three mathematics lessons in each week, students were reorganised into four different attainment groups. In the third lesson of the week, they were taught in their original whole class mixed group. Teaching in attainment groups was planned for most of the school year, starting after the autumn break in October and running through to the end of the year, but because one of the teachers went on long-term sick leave in March, attainment grouping was stopped and teaching returned to whole class mixed groups for the rest of the school year. However, the organisation in attainment groups lasted throughout my whole period of data collection.

The organisation of attainment groups in only two of the three mathematics lessons a week was explained as being due to limitations in timetabling: the school leaders had not managed to arrange for all three mathematics lessons for all the four classes to take place in parallel. The attainment group lessons were scheduled on Mondays and Thursdays, but three of the four classes had their whole class mixed group lesson on Wednesdays, while the other class, 9B, had their mixed group lesson on Mondays. This also meant that 9B's mixed group lesson was scheduled just before one of the attainment group lessons, as shown in Table 4.1.

Period	Monday	Tuesday	Wednesday	Thursday	Friday
Lesson 1			9A and 9D		
Lesson 2			9C		
Lesson 3	9B				
Lesson 4	Attainment groups			Attainment groups	
Lesson 5					

Table 4.1 The timetable for 9th grade mathematics teaching at Berg school

This uneven scheduling of the mixed group lessons had the potential to lead to problems with planning teaching content in the different groups and lessons. One such situation is reported in Chapter 6, the analysis of Julie, the teacher in 9B.

Because there were four classes, the teachers had initially asked the school leaders for the resources to organise five different attainment groups, aiming for smaller groups of students. However, since this would require one more teacher, the leaders said that this was not possible due to limited resources. Having agreed to accept organisation into just four groups, the teachers prioritised the needs of the lowest attainment group, Group 1, for greater teacher support, and decided to place fewer students in Group 1 than the other groups.

Allocation of the students to groups had been decided by the 9th grade mathematics teachers on the basis of results in the 8th grade end of year test and the 9th grade national test in mathematics which had taken place early in the school year. Some exceptions were made on the grounds of specific social issues for some students. The curriculum content in the different groups was geared towards the expected end of year test content as planned by the teachers. While Groups 2-4 followed the same content, there was a common agreement among the teachers that Group 1 should receive reduced teaching content which focused on the four arithmetical operations and basic proficiency.

Each of the four 9th grade teachers taught mathematics in one attainment group as well as one of the four whole class mixed groups. Jon taught Group 1, the lowest attainment group, and class 9A. Julie taught in Group 2 and class 9B, Daniel taught in Group 3 and class 9C, and Lena taught in Group 4, the highest attainment group, and in class 9D, as shown in Table 4.2. This arrangement had been agreed between the four teachers.

Jon	Julie	~~Daniel~~	Lena
Group 1	Group 2	~~Group 3~~	Group 4
9A	9B	~~9C~~	9D

Table 4.2 The teachers and their classes. All names are pseudonyms. Daniel is not included in the study due to long-term sick leave

The teachers

Lena was also the lead mathematics teacher at Berg school. She is the youngest of the three teachers, being in her late twenties. Having started her teacher education directly after completing upper secondary school, she qualified as a lower secondary school teacher in mathematics, science and religion. She went straight on to work at Berg school, where she had taught for five years.

Julie came to teaching late, having had a previous career in a different sector. Hence, although in her thirties, she is an early career teacher and a newcomer at Berg school, where she has worked for two years as her first teaching job. After her basic teacher training she had also taken a master’s degree in mathematics education, with a dissertation on exploratory mathematics teaching in algebra.

Jon had taken a bachelor's degree in social work as a student, extending his education by taking further studies in mathematics education to graduate as a teacher. His first (and only) teaching job was at Berg school, nearly twenty years ago, so of the three mathematics teachers he had been longest at the school.

Disruption to the data collection

Unfortunately, Daniel's sickness prevented me from carrying out my classroom observations of his teaching at our pre-arranged time. This situation happened at the beginning of March 2020, just as the Covid-19 pandemic began. A national lockdown began on March 12th 2020 in Norway and schools were closed for several weeks, until May 11th in lower secondary schools. When they opened, students attended school on alternate days until the end of the school year in order to enable social distancing in classrooms, and the nature of classroom interaction was substantially different from pre-pandemic conditions. Schools were also reluctant to receive visitors and in any case like many researchers I was not willing to impose extra stress by requesting to visit in the remaining school year. Consequently, I was unable to collect further observation data and complete my study of Daniel that year. There was also considerable uncertainty about the likelihood of teaching in attainment groups in the following school year because resources were not guaranteed. This meant that my data collection was incomplete and, given the long-term lockdown situation, I needed to decide how to proceed with my study. I had complete data from the three other teachers. I also had data covering teaching of the range from low and high of the attainment groups having observed teaching in Groups 1, 2 and 4. I decided that the data I had collected was good enough to address my research aims and that I could continue my study meaningfully with the three teachers Jon, Lena and Julie.

Data collection

Interview and observation methodologies

I employed pre- and post-lesson interviews and classroom observations to gather the data for this study. In the pre-lesson interview, I wanted to explore the teachers' accounts of their teaching practice, their aims as mathematics teachers and their thinking about teaching in attainment groups and how this related to TPO policy. In the post-lesson interview, the aim was to give them an opportunity to theorise in the context of specific lessons and to stimulate further reflections about their practice. Planning for in-depth interviews, I chose semi-structured interviews as a flexible form with a prepared interview guide which is also open for follow up on interviewees' replies (Bryman, 2016).

My interest in what the teachers had to say as strongly situated in the wider social, cultural and political context meant that the interviews needed to yield data which would lend itself to my research questions. Roulston (2010) argues that seeing the interview as a co-construction in the moment between the actors involved enables a situated account of the research topic. Understanding teacher narratives as part of a co-construction provides insights into their enactment of mathematics teachers as they explain, describe and justify their practice in dialogue with me and the person they take me to be. Understanding talk as a way of performing actions (Roulston, 2010) means that the interview provides insight into teachers' performance of teacher identity, as Gee (2014) also notes with respect to Discourses. Similarly, Braathe and Solomon (2015) argue that interviews enable us to "witness the emergence of identity through the enactment of agency" (p. 155) in the co-construction between interviewer and interviewee. What comes out in the interview is thus strongly influenced by what happens in the moment between the interviewer and the interviewee. Hence a major issue in this study was the relationship between myself and my participants, and how they saw me. Roulston (2010) argues that an interview aiming for dialogic interaction and critical reflections between the participants of the interview requires less asymmetry in the talk than is often the case. In my interviews, my position as a teacher educator with a fairly predictable pro-inquiry/dialogic view of mathematics teaching was potentially problematic due to an asymmetry generated by the teachers telling me what they thought I wanted to hear. At the same time, my background as a mathematics teacher created potential for establishing a more open relationship with them, in the context of being "colleagues" who could share reflections. What the teachers would tell me in the interviews were therefore strongly dependent on how we built our relationship and how I managed to prepare for a potential dialogue which would gain 'honest' stories. I tried to establish these channels in the pre-lesson interview, and to capitalise on a more open conversation in the post-lesson interview.

The aim of the classroom observations was to understand more about mathematics teaching in different attainment groups. Again, recognising my own position and placement in the classroom observations was important. Just by being present in the classroom as the observer, I would inevitably influence the setting (Blikstad-Balas, 2017), and my position as a teacher educator would have further impact, potentially eliciting an 'ideal teacher' performance, or a particular focus on classroom talk because of my special interest in this. This influence on the teacher was unavoidable, and insights from Gee (2014) and from the literature on co-

construction in interviewing suggest that rather than attempt to minimise the inevitable impact of my presence, it was better to acknowledge it and build it into my understanding and interpretation of the data. This is most easily seen in my analysis of Jon (Chapter 7), who clearly 'performed' for my benefit in both his interview and the lesson. For the students' part, my presence could lead to a different participation or behaviour compared to a 'normal' situation or 'normal' lesson. However, this was more straightforwardly addressed by trying to interrupt as little as possible, not engaging or taking part in any decisions about the lessons, and not participating in the lessons. I therefore took the role as a non-participant observer (Bryman, 2016).

Aiming to capture rich data and to observe as much as possible of the teaching situation, I wanted to have open eyes while observing. At the same time, since I was influenced by own theoretical and professional lenses and focus of research, a totally open-ended observation is impossible (Punch & Oancea, 2014). My own positionality as a teacher educator and researcher, and also my background as a former teacher would influence what I would see. At the time of my observations, I was assuming that I would use the TRU framework for analysis, and what I saw was therefore partly influenced by my interpretation of the five dimensions of the framework.

To ensure that I collected observation data which captured the whole of the teaching in addition to the details that I noticed at the time, I video recorded all the lessons. A video recording provides opportunities for examining the complexity of classroom interactions (Klette, 2009) but also for decomposing the data into smaller entities (Blikstad-Balas, 2017). However, more importantly in my study, using video recording enabled me to access the observation data in retrospect, with the opportunity to go back to the data several times to look again, but also to search for new and different actions and events compared to what I noticed in the real-time observations (Blikstad-Balas, 2017; Klette, 2009; Klette & Blikstad-Balas, 2017). I was aware that the presence of a video recorder could influence the students and the teacher, and I placed the equipment carefully as detailed below. Despite the negative consequences of using video recording, I assessed the gains of using it as higher.

As a support to the video observations, I made field notes, aiming to better capture what was happening in the moment of observation. Although I could return to the video recording, the details that I noticed in the moment of observation would not necessarily be easily recalled when relooking the video data. Detailed fieldnotes including recording the timing of particular moments from the classroom observation was therefore an important support to my video data. At the same time, when observing and noticing, we choose where our eyes are focused. Hence, attention is drawn to some things, and other things are ignored in how. I thus needed to be aware of my way of observing as a classroom researcher. This also included my choice of where to place the video cameras (Jacobs et al., 2007; Klette, 2009).

Another issue in capturing rich observation data is the question about how much data is needed. It is difficult to decide this in advance, however (Bryman, 2016). What happens in the classroom is influenced by multiple factors and also by the wider context but equally observations will always be just snapshots of particular moments. Seeing this in the context of Gee's (2014) frame problem, increasing the number of observed lessons would lead to new data and new information from the classroom, but we also need to consider how far these extra data can take the analysis and maintain validity. At the same time, the practicalities of carrying out a study in a feasible amount of time mean that there is a need for a planned timeframe for collecting observation data. Hence, a limited amount of observation data can also be useful, but it is important to treat it in its right context, as snapshots from the whole classroom setting. As with interview data, treating these data as indicative of teachers' performance of Discourses which are underpinned by particular figured worlds and understandings of my own role provides insights which are more robust than decontextualised judgements of them as teachers.

The pre-lesson interviews

The pre-lesson interviews were my first meetings with the teachers, and took place with each teacher individually in a meeting room at Berg school where we had the opportunity to talk undisturbed. The time frame of the interview was about 45 minutes. All interviews were audio recorded and transcribed in full. Since I collected my data before my shift towards critical discourse analysis, the questions for the interview were based on my aim of focusing on the *what* of attainment grouping, including teachers' use of classroom talk and students' access to mathematics. However, because I also was interested to explore teachers' accounts of their practice and their aims in mathematics teaching in general, my questions were quite open.

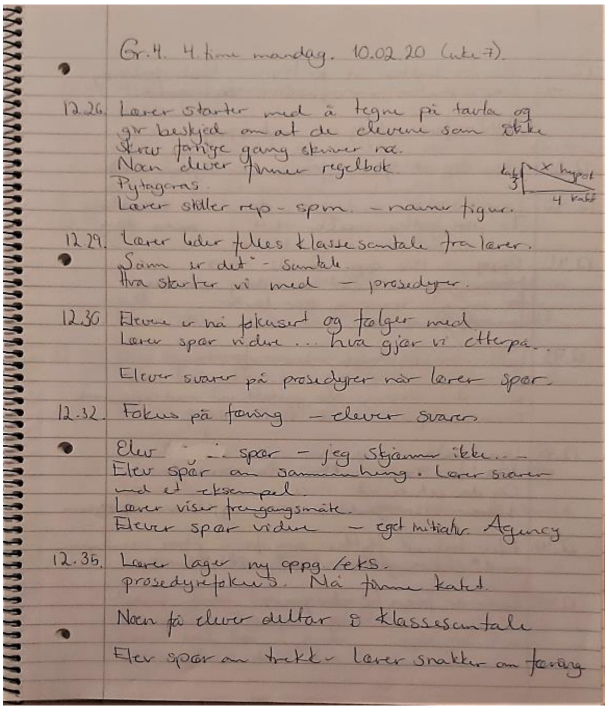
The interview guide was organised into five main questions with potential follow-up questions for each. The first question focused on the organisation of mathematics teaching and attainment grouping, while the second asked about TPO and how this related to attainment grouping. Question three asked the teachers to describe their mathematics teaching, followed by question four focusing on their understanding of students' learning. The teachers were asked to give examples from their own teaching practice. Finally, question five focused on use of classroom talk in mathematics teaching and learning. The full interview guide is reproduced in Appendix 1 and 2. Although I had prepared potential follow up questions for each of the main questions, I could not know in advance what the teachers would focus on in their responses. I therefore needed to be prepared to adjust my questions and to prioritise encouraging the stories the teachers wanted to tell me. Thus I frequently asked “can you tell me more about that?”, in order to elicit further elaboration. In the course of the interviews I also gathered information on their histories as mathematics teachers, the ways in which they talked about relationships with the students and how they positioned themselves as teachers at Berg school. It was important to treat the teachers with respect and ensure that they felt comfortable and safe in the interview situation. I had informed the teachers in advance about the main theme of the interview and I had been clear about that I was not interested in “right answers” and that I wanted to hear their stories.

The classroom observations

I undertook classroom observations of each of the teachers corresponding to one week of teaching in each class/group, totalling three weeks of classroom observations in all. I had made it clear to the teachers that I wanted to observe ordinary mathematics, and that I did not want to participate in the lesson or take part in planning, including giving any kind of input or support during the lessons. I sat at the very back of the classroom.

I used two video cameras. The first was placed at the back of the classroom, aimed at the teacher and the board at the front of the classroom with a microphone attached to the teacher. The other camera was placed at the front of the classroom, aiming at the students sitting at their desks, with a microphone attached to the camera. This placement enabled an overview of the talk going on in the classroom and social interactions from both the students’ angle and the teacher’s angle. Students who had not consented to being video recorded were placed outside the camera angle.

I also took field notes in which I tried to capture particular events and notice what was happening in the moment of the observation. It was not possible to notice everything, but I tried to write down as much as possible. Since my focus at that time was on classroom talk, I was particularly alert to this. At this point, I was also aiming to use the TRU framework for the analysis and consequently I therefore also noted down observations which I felt were particularly connected to the five different dimensions, for instance Student Agency. I noted the time at which events happened, to make it easier go back to the video recording later in the analysis work. For instance, I noted one occasion where the teacher was talking to some students and the particular instructional moves she made as illustrated in Figure 4.1.



Gr.4. 4 time mandag. 10.02.20 (uke 7)

12.26. Lærer starter med å tegne på tavla og gir beskjed om at de elevene som ikke skrev forrige gang skriver nå.
Noen elever finner regelbok.
Pytagoras.
Lærer stiller rep-spm. – navner figur.

12.29. Lærer leder felles klassesamtale fra lærer.
"Sånn er det" - samtale
Hva starter vi med – prosedyrer.

12.30 Elevene er nå fokusert og følger med
Lærer spør videre ... hva gjør vi etterpå...
Elever svarer på prosedyrer når lærer spør.

12.32. Fokus på føring – elever svarer
Elev ... spør – jeg skjønner ikke...
Elev spør om sammenheng. Lærer svarer med et eksempel.
Lærer viser fremgangsmåte.
Elever spør videre – egt initiativ Agency

12.35. Lærer lager ny oppg/eks.
prosedyrefokus. Nå finne katet.
Noen få elever deltar i klassesamtale
Elev spør om trekk – lærer snakker om føring

Gr 4 Lesson 4 Monday 20.02.10 (week number 7)

12.26	The teacher starts to draw on the board and gives the message that those students who didn't made notes in the last lesson have to make notes now. Some students find their rule book. Pythagoras Teacher asks rep. questions. – names the figure.
12.29	Teacher leads a whole class discussion. That's the way it is-talk What do we start with - procedures
12.30	Now the students are focused and pay attention Teacher asks further… what do we do then… Students respond with the procedures when the teacher asks.
12.32	Focus on notation – students answer. Student asks – I don't understand… Student asks about connections. Teacher answers by giving an example. Teacher shows how to do it. Student continues to ask – unprompted. Agency
12.35	Teacher starts a new task/example. Focus on procedure. Now to find the side. Some students take part in the classroom talk Student asks about move – teacher talks about notation.

Figure 4.1 Example of fieldnotes made in Lena's class, with English translation to the right

As a part of my field notes, I also made an audio-recorded log of my own reflections after each of the lesson observation. This was helpful in capturing my immediate reactions to the lesson while it still was fresh in memory. This was also an important support in data analysis.

The post-lesson interviews

The post-lesson interviews took place after the classroom observations. Since these were based on the observed lessons, I tried to arrange them as close to the last classroom observation of each teacher as possible, aiming to have the lessons fresh in mind. The post-lesson interview was also planned as a semi-structured interview, but with even fewer and more open questions, to make ensure that there was enough space for the teachers' own views and reflections (Bryman, 2016). I started by asking the teachers to sum up the lessons in terms of their aims and lesson plans, and then I asked about their own evaluation of the lessons. As a later question, I asked the teachers to reflect especially on TPO and the use of classroom talk in the lessons. The full interview guide is reproduced in Appendix 1 and 2.

The post-lesson interviews took place in the same meeting room as the pre-lesson interviews with a duration of around 30 minutes. All interviews were audio recorded and transcribed in full. I also made an audio recorded log after this interview as a summary of my own reflections after both the interview and the observation as a whole. Like the pre-lesson interviews, these post-lesson interviews generated important data on how the teachers theorised their practice, how they talked about the students, and how they positioned themselves as mathematics teachers.

4.3 Data analysis

As discussed in Chapter 3, Gee's theory of situated meanings seeks to describe and analyse the enactment of socially situated identities in ways which recognise cultural perspectives, power differentials and the political implications of language use. Exploring teachers' Discourses of teaching in attainment grouping involves not only looking at their enactment of teaching but also how they operate in their context within the school, the school organisation and the policy requirements of TPO. Hence, Gee's theory enables inclusion of the context of attainment grouping through its concerns with policy and the constraints and contradictions/conflicts which it generates, and relationships within a school, all filtered through personal histories and narratives. It also recognises the impact of, and interplay between, discourses and theories of teaching and learning mathematics. This approach recognises the power of context and interrelationships together with individual histories and stories, and hence enables an analysis which goes beyond a critique of individual teachers.

As already discussed in Chapter 3, Gee explains the structure of situated meanings in terms of the various building tasks (significance, practices, identities, relationships, politics, connections, and sign systems and knowledge), together with the important theoretical concepts of Discourse and figured world. At the same time, because of the crossover between theory and method discussed in Chapter 3, these two concepts - Discourse and figured world - also constitute major tools of inquiry in Gee's *method* of discourse analysis. In addition, Gee offers four other inquiry tools for analysing situated meanings which are more closely aligned to traditional linguistic analysis: social language, Conversation, intertextuality and situated meanings. This section focuses on my use of the inquiry tools in this thesis. I will first elaborate on the different tools, before illustrating their operationalisation. I draw once again on the oral history project in order to illustrate the tools.

Tools of inquiry

We make ourselves and build situated meanings through the seven building tasks. Gee offers six tools of inquiry for the analysis of these processes, each of which involves asking questions aiming to understand different aspects of situated meanings.

Discourse as a tool of inquiry concerns enactment of socially situated identity in a socially situated practice. Gee's stance emphasises that we have multiple identities, so Discourse as a tool of inquiry involves identifying the multiple Discourses that are at play in a communication. In the case of the oral history project these might be how Jane enacts both the Discourse of being a Middleview teacher as well as the Middleview 'everyday person' Discourse. Since people enact Discourses both through language and "other stuff", using Discourse as a tool of inquiry involves asking questions about ways of acting, interacting, valuing, knowing, believing, and the use of artefacts at specific times and places, in order to uncover the workings of a Discourse or multiple Discourses: What Discourses are involved? And "How is 'stuff' other than language relevant in indicating socially situated identities and practices" (Gee, 2014, p. 78) in this piece of data? So, for instance, we can use Discourse to understand the role of the chat after the project meeting in the oral history project, where everybody except Sara was speaking out of their Discourse of being a Middleview citizen. This did not just involve their use of language, but also interaction, thinking and valuing in relation to their Middleview Discourse.

Applying *Figured world* as an inquiry tool involves asking questions about what theories of the world and typical stories a communication may assume. This also involves asking questions about participants, activities, forms of language, objects, environment and values in a figured world. For example, the figured world of an elementary school classroom includes typical participants like one teacher and a group of students of the same age, who are most likely sitting in rows while the teacher leads different activities, asking the students to answer different questions. However, since a figured world is not necessarily articulated clearly or explicitly, its analysis often involves hypothesising what theories an individual may be operating on, based on what is communicated in context. In the oral history project example, Gee hypothesises that Jane operates on a figured world which maintains that it is the teachers at Middleview who control access to students in the classroom. This becomes evident in how Jane emphasises the teachers' role in the history project in terms of the 'structure' of the Middleview school, which means that the norm is to ask the teachers about classroom involvement; she also talks about how the teachers "own the kids" (Gee, 2014, p. 206).

There are three different types of figured worlds – espoused worlds, evaluative worlds, and worlds-in-(inter)action. We can distinguish between them according to how a particular figured world is put to use, and the effect it has (Gee, 2014, p. 109). An espoused world is one which we consciously take up; it describes what we explicitly say or think we believe. We may assume that Jane's figured world of the informal practices at Middleview school is an espoused world since she clearly articulates and seems conscious of this figured world. An evaluative world involves theories and stories we use consciously or unconsciously to judge ourselves or others. This may be the case when Karen in the first project meeting tells the "origins story" of the project, and through this position may judge Sara and the project leaders for not being sufficiently involved in the project. The last type of figured world, worlds-in-(inter)action, are those theories and stories which, consciously or unconsciously, and regardless of what we say or think we believe, guide people's actual actions and interactions in the world. For example, when Joe and the other local Middleview citizens take part in the chat after the meeting they may operate on such a world-in-(inter)action which guides them perhaps unconsciously in sharing the local stories about everyday life history of Middleview.

In a discourse analysis, using figured world as a tool of inquiry is not just a question of asking what figured worlds are being invoked, but also what types of figured worlds are relevant in the actual setting. In addition, we need to ask about differences between figured worlds, how consistent the figured worlds are, and if there are conflicting or competing figured worlds. In the case of conflicting figured worlds, we can ask whose interest a figured world represents. One example of this is Joe, one of the curriculum coordinators, who seemingly acts out two conflicting figured worlds. First, in the project meeting he operates on a figured world where the project administrators control management of the teaching project which leads to a peripheral role for the local Middleview teachers. Later in the chat he acts out a figured world about local citizens sharing local stories about everyday life history of Middleview, and where everyone in the chat is equal.

People use *social language* to build and enact identity and engage in a practice. Social language as an inquiry tool thus concerns asking questions to explore how socially situated identities are enacted through use of language. In the history project, Karen uses a different social language when she joins in the chat after the meeting, using different and more informal words, compared to the social language she uses in the meeting itself. We can see how this change of social language supports her enactment of the two different Discourses, the Middleview "everyday" Discourse and her teacher Discourse. However, Sara, the professor, tries to engage in the conversation while enacting the academic Discourse. At the same time, her use of her academic social language does not support her attempt to take part in the chat. We can also argue that Cynthia, one of the curriculum consultants, also uses a social language when she uses 'curriculum development' as a particular concept to explain the processes of the history project, enabling her to enact the identity of project leader.

Conversations (with a big C) are those public debates, arguments or themes which are widely known and shared in society or in a social group. However, in a discourse analysis, the key aim of using Conversations as a tool of inquiry is to analyse according to the different "sides" in a Conversation. Hence, we need to identify what Conversations in a particular context are relevant to understanding enactment of socially situated identities and situated meanings, and then ask how the different "sides" will affect what is communicated. At the same time, analysing data with Conversation as an inquiry tool provides an opportunity to take a different perspective and ask what Conversation a communication contributes to. For example, Gee identifies a Conversation in the history project which concerns whose knowledge – that of teachers or that of university people - is to be privileged in regard to school and schooling (Gee, 2014, p. 209). Identifying this Conversation is important to understanding the teachers' enactment of their socially situated identities in terms of how they participate in the meeting and what they say. At the same time, it is clear how the communication between the teachers and the university people maintains this Conversation.

Intertextuality concerns borrowing or using others' words, and how a text, spoken or written, makes references to other texts and sources. Intertextuality can be a question of directly or indirectly quoting other texts, but it can also involve quoting and expecting people to understand this *as words borrowed from others*. In a discourse analysis, using intertextuality as an inquiry tool involves noticing in what ways a communication quotes or borrows words from other sources, and what these references indicate about the communication in terms of identity and situated meanings.

Moving to the inquiry tool *form-function correlations*, Gee distinguishes between utterance-type level and utterance-token meanings (Gee, 2014). The utterance-type level represents the meaning range of a form or structure of any word of phrase. However, in taking a social cultural perspective in his discourse analysis, Gee emphasises utterance-token meanings which concern the correlations between form and function in language in use. This focuses on the situation-specific forms of language used in specific contexts, and what potential any given form has for taking on much more specific meanings in contexts of actual use. This type of meaning is what Gee calls *situated meanings*. Hence, *situated meanings* as a tool of inquiry highlights how particular language forms take on specific or situated meanings in different contexts of use. This can be specific meanings of key words, families of key words, or other words which are important to understand the language. Using *situated meanings* as an inquiry tool involves looking for key words or phrases which we assume are important in understanding a communication and asking questions which enable the researcher to understand the importance and function of these words and phrases in their context. An example is the word ‘own’ in Jane’s talk about the students, when she says “In a sense we own the kids” (Gee, 2014, p. 201). We can see how this word has a special meaning in the context, and also in the figured world that Jane operates in of the informal practice at Middleview. Analysing situated meanings may therefore also guide us to a recognition of a figured world.

The connection between situated meanings and figured worlds is one example of how all the different tools of inquiry are closely connected and corroborate each other in a discourse analysis. Another example of connected inquiry tools is how figured worlds may help to reproduce, transform, or create Discourses and Conversations. The figured world of informal practice in the Middleview schools may reproduce the Discourse of a Middleview teacher, reflecting the historical tensions between the local teachers and the academics, and also the Conversation about status of teachers and academics in terms of whose knowledge is privileged. Using the inquiry tools in a discourse analysis is thus not only about asking the questions related to the different tools, but also how results emerging from these questions can be confirmed in how the different tools are connected.

Revisiting the building tasks

Beside the inquiry tools, Gee’s method of discourse analysis also involves the seven building tasks introduced in the previous chapter. While the building tasks are primarily seen as supporting the structure of situated meanings and the means by which we make meaning of ourselves, they also have a role in the method of discourse analysis when they are used to ask questions of a piece of data. Gee gives an example where he analyses an extract from the first meeting in the oral history project, using the building tasks. He goes through all the seven building tasks asking about significance, practices, identities, relationships, politics, connections, and sign systems and knowledge for this piece of data. Based on his answers to these questions, Gee forms a hypothesis about the data, about the teachers’ role in the project (Gee, 2014). It is also clear how the different building tasks in this example are integrally linked and often mutually supported by the same words and phrases in an analysis.

In addition to being integrally linked, building tasks also link to some of the inquiry tools. For example, Discourse concerns enactment of the building tasks identity and practice, and social language as an inquiry tool involves the building task sign systems and knowledge. This connection between the building tasks and the inquiry tools lays the ground for what questions we might ask in a discourse analysis. In analysing a piece of data, we can thus ask about all seven building tasks, but also, for each of the building task we can ask about the six different inquiry tools as well. Hence, the building tasks and inquiry tools together generate six times seven, i.e., 42 different questions to ask in a discourse analysis. Asking all these 42 questions can be seen as the general method or an "ideal" discourse analysis (Gee, 2014, p. 140). In my analysis I could have gone through all the 42 questions. However, what is important is not to ask all these questions, but those questions which are relevant for the communication in the actual context of use.

In this thesis, the aim is to understand teachers' accounts of teaching in attainment grouping in the context of TPO as a policy requirement. It thus focuses on a socially, culturally and politically contested area where people may argue about how we should teach mathematics, and where power relations (within the group of mathematics teachers, between the school leadership and the teachers as a group, and between school and municipality for instance) may be in action. My interest was in the teachers' enactment of socially situated identities through Discourses, use of social language and figured worlds. I needed to go beyond an analysis focusing on building tasks, which are more concerned with analysis of linguistic facts, to ask questions which would enable analysis of what lay behind what the teachers said. This was mainly a question of employing the inquiry tools. For example, I needed to analyse how teachers used the social language (inquiry tool) of mathematics, rather than focusing on what sign systems and knowledge (building tasks) were used. So, in analysing social language I asked why the teachers used particular words, focusing on the significance of these words and how they fitted with other things a person might try to do.

Hence, in my analysis, the inquiry tools become more relevant than the building tasks, and I therefore did not work with all the 42 questions. At the same time, since some of the building tasks interact with various inquiry tools, building tasks are still included in my analysis (practices and identities are part of Discourse and sign systems and knowledge in social languages). However, two of the building tasks, *significance* and *relationships*, were more directly involved in what questions I asked in my analysis. At the very beginning of the process of looking at the data, before formulating hypotheses, I looked for *significance* in the data in terms of particular words and phrases. *Relationships* is of relevance in the context of exploring a group of three teachers; analysing their positions in the group meant that relationships were important. The questions for the analysis were thus mainly generated by the inquiry tools. However, asking all these questions derived from the different inquiry tools and building tasks, looking for converging answers, also ensured validity of my interpretations in analysing. Referring to the *frame problem* discussed in Chapter 3 about how far I could go in interpreting my data by asking all these questions, I looked for corroborating evidence across the whole dataset for each teacher in support of my hypotheses. In the next section I will explain more in detail how I used the inquiry tools in my analysis and how I operationalised Gee's method of discourse analysis.

How I carried out the analysis

In order to explore teachers' accounts of teaching in attainment grouping, capturing their enactment of socially situated identities and practices, I needed to analyse both pre- and post-lesson interview data and classroom observations and integrate them in a way which enabled connections to emerge. I describe the iterative nature of this process in this section.

The structure of the analysis

Analysis of the first interview focused on how the teachers described themselves as mathematics teachers and their teaching of mathematics within TPO and attainment groups. I built on this analysis through my exploration of the classroom observations, looking particularly for episodes related to significant issues identified in the interviews and how these related to the overall enactment of Discourses as saying, doing and being. Building on the emergent findings from these analyses, further analysis through inspection of the post-lesson interview focused on juxtaposing each teacher's reflections on the lessons with my earlier understanding of significant aspects of their Discourse(s). This iterative synthesis of the various data sources generated a holistic picture which incorporated hypotheses about figured worlds, Discourses and significance for each teacher. By looking back and across all the data I tested and verified the hypotheses by analysing the data from multiple angles, asking about Discourses, figured worlds, situated meanings, intertextuality, social languages, Conversations, significance and relationship. I looked for matches between bits of data from the different areas, looking for convergence between answers to the different questions. I also checked for connections to relevant building tasks and linguistic details to confirm the interpretation of the analysis. Taking this multiple view, looking across all the data in the analysis, I also ensured validity of my interpretations.

Operationalising the theoretical framework: Analysing the interview data

The analysis of the pre-lesson interviews began with my choices of how and what to transcribe. I chose to transcribe all the interviews in full in the original Norwegian, organised in my questions as the interviewer followed by the teachers' answers. The transcripts were structured in macro-lines, sentences of speech (Gee, 2014). Emphasised words and utterances were written in capital letters, and words and phrases with particular meanings were written with quote marks. Words and series of words which were difficult to catch were written as three question marks in parenthesis (???). The process of transcribing the interview gave me a first impression of this data.

I read through each transcript a couple of times in order to get more into the context of the interview. This reading gave me an overview of what topics and themes the teachers picked up on, how they interpreted my questions, what they chose to focus on, but also what they appeared to avoid talking about. In this reading I also began to notice patterns and word use in the teachers' speeches. I needed to have some initial interpretation of their talk before I could go on to formulate hypotheses and analyse the data using the various tools of inquiry. I started to identify repeated words, phrases and details which stood out in the text, and which I assumed were relevant to the context. An example is Lena's frequent use of the word 'control' when she talked about her own teaching and described herself as a mathematics teacher. For instance, she explained that she did not practice whole class classroom talk to avoid losing 'control', and that teaching TPO in attainment groups was a good thing for the teachers to have 'control' in teaching. The word 'control' turned out to be of significance for her enactment of the Discourse of the competent teacher. Overall, key words identified in this way from the initial phase of the analysis were in general closely linked to significance as one of the building tasks.

Based on this initial interpretation of the interview, identifying issues of potential significance, I started to formulate initial hypotheses about the data, about what the different teachers thought about mathematics teaching, what they valued in mathematics teaching and how the saw themselves as mathematics teachers. Noticing how the keywords connected to the building task *Significance* was helpful in forming the hypotheses. In the example of Lena, I formed an initial hypothesis about a need for control in her teaching.

Moving to the next phase of the analysis, I looked for corroborating evidence in the data to support and confirm the hypotheses I had made. I started to use the inquiry tools asking questions about Discourse and figured worlds, together with social languages, Conversations, situated meanings, intertextuality and relationships. For instance, I recognised Discourses in how the teachers described themselves as mathematics teachers and followed up by asking about what figured worlds this may indicate for the teachers. As an example, recognising that Lena position herself within the Discourse of being a competent teacher, her descriptions of her teaching also indicated that she held a figured world in which student learning was determined by fixed ability. However, Discourses and figured worlds could also be separately identified, and with a figured world recognised before recognising a Discourse. An example of this is Lena's figured world about learning mathematics through practice and "mass-training" which first became evident in how she explained her own experience of mathematics teaching in the interview. Using the inquiry tools for analysis was thus a cyclic process in which I moved back and forth between the different tools, looking for converging answers, but also for apparent contradictions emerging in the narrative. These connections between the different inquiry tools were therefore important to ensure a robust analysis of the data in that they provided coinciding interpretations taken from different viewpoints. As Gee points out, the frame problem means that there was always a question about how far away from the words and their face value meaning I could go in my interpretations. Using the different inquiry tools to search for support for my hypotheses, I looked for corroborating evidence in the data and checked out connections to relevant building tasks, looking across the whole interview.

Table 4.3 shows how I operationalised and used the different inquiry tools and two of the building tasks offered in Gee's theory in the interview analysis.

Concept	Operationalisation
Inquiry tools	
Discourse	Gee describes *Discourses* as socially situated identities enacted in a socially situated practice. Discourse is thus about being recognised as a particular type of person engaged in a particular type of practice. (Gee, 2014, p. 47). Engaging in a Discourse is both about using language and "other stuff"; ways of combining and integrating language, actions and interactions like thinking, valuing and use of tools. Discourse can therefore be seen as situated claims about identity. In this way, a Discourse denotes what somebody wants to be and how they enact that Discourse in context.

	In analysing Discourses, I identified references to what kind of teachers the participants want to be in their particular context in the school, and how they put that into practice. Also, what kind of teachers they described themselves as or wanted to be. One example is when Julie talks about aiming to be an explorative teacher or when Lena describes how she is the right mathematics teacher for the high attainment students because her way of learning mathematics is similar to the students in Group 4.
Figured worlds	Gee defines *figured worlds* as simplified, often unconscious theories about the world (Gee, 2014, p. 95). Engaging in a Discourse, people act out these theories or figured worlds. Figured worlds are often about values. One example can be viewing teaching in terms of traditional teacher-centred teaching. I have identified figured worlds in teachers' references to "how things are" in teaching and learning, with particular sensitivity to descriptions involving values, for example, references to fixed ability or relationships with students. I also looked for references not just to related figured worlds, but also competing or conflicting figured worlds; for example, when Lena talks about her teaching, her talk briefly indicated a figured world of students learning from each other through talk regardless of their 'level' as well as a far more consistent figured world of fixed ability.
Espoused world	*Espoused world* is a figured world people consciously say or think they believe (Gee, 2014, p. 109). I identified references to espoused worlds when the teachers gave reflective descriptions of their own teaching approaches in terms of different models of teaching and learning. For example, Julie appears to have an espoused world of exploratory mathematics as an ideal way of teaching; she also refers to having written her master thesis about this.
Social language	Gee describes *social language* as any variety of style of languages associated with socially situated identity. This can involve use of special words and phrases or styles of language (Gee, 2014, p. 45). I identified references to social language in words and phrases which

	indicate a certain style or form of language in the teachers' descriptions. This can for instance be references to theory and use of technical terms in describing teaching and learning. Another example is how Jon talks to the students in his enactment of the 'Socratic' old-timer teacher.
Conversation	Gee refers to *Conversations* as ongoing themes, debates and motifs, well known in a field or in a social/cultural group (Gee, 2014). When people belonging to a particular group talk, they may allude to these debates, which may also indicate different values relevant to various sides of a Conversation. One Conversation relevant for my data is the debate about how to put TPO into operation and the use of attainment grouping as one way of organising TPO. I identify references to this Conversation in the teachers' comments about organising teaching for TPO, and their comments about teaching and learning in attainment grouping. One example is when Lena argues about attainment groups as a good way to teach TPO because "everyone gets something on their own level".
Intertextuality	*Intertextuality* concerns incorporating or "borrowing" words from a different text, spoken or written, in use of language (Gee, 2014). In the analysis I identify intertextuality by noticing when teachers refer to, quote or directly borrow another's words. One example is when Jon refers to Pólya when he describes his own mathematics teaching or when Lena refers to some of Jon's statements about teaching mathematics.
Situated meanings	Gee defines *situated meanings* as a tool of inquiry as the special meanings that words and phrases take on in particular contexts (Gee, 2014, p. 233). I identify situated meanings of words and phrases out of the particular context of the word. One example is the situated meaning of the word 'control' out of Lena's context and making the teaching manageable for herself.

Building tasks	
Significance	Gee talks about how we use language to render *significance* to particular things (Gee, 2014, p. 32). I identify significance in repeated words and phrases which stand out and appear to have significance for the teachers' Discourses. One example is how 'maybe' is of significance for Julie as a mathematics teacher.
Relationships	Gee refers to *relationships* as how we use language to build social relationships (Gee, 2014, p. 34). I identify relationships in how the teachers position themselves in the group of mathematics teachers in this thesis, and at Berg school in general; I also identify relationships in how the teachers are positioned by each other. One example is how Lena positions Jon as the best teacher for Group 1 and through this also positions herself as the teacher for the high attainers in Group 4.

Table 4.3 Operationalisation of the inquiry tools used and two building tasks to analyse the interview data

Analysis of the observation data: operationalising the theoretical framework

The analysis of the classroom observations focused on being and doing in the teachers' enactment of Discourses, recognised through their sequencing and combining of actions in certain specified ways.

I began the analysis by transcribing all the video observations in the original Norwegian. I wrote down everything that I could capture from what was said during the lessons. This included what the teachers said, the students' replies to the teacher's questions, the students' questions and other comments. I also described the teacher's and students' movements in the classroom, together with their body language and significant events in the lesson. In these transcripts I tried to give as faithful an account of the lessons as possible. However, this account was of course filtered through my own lens as the observer in the classroom, what I noticed and what drew my attention. All the video recordings I made were based on choices I had made from my perspective, for instance recording some of students' movements but not those of others. Some choices were made as soon as I chose the positioning of the video cameras in the classroom. My lesson transcripts were also influenced by the key issues which emerged in my analysis of each teacher's first interview. One example was my transcribing Lena's classroom observations, where my awareness of the issue of 'control' which had emerged in the interview influenced my choices of what to write down. Following the initial transcription, I watched the observation videos once more and filled in missing comments and observations.

I then began to look for episodes of significance in the observation data relevant to the issues that I had identified in the first interview. For instance, having identified the issue of ‘control’ in Lena’s teaching, I looked to see how this was evident in my observations of her teaching. I also looked for how or if the teachers acted out the Discourses identified in the interview analysis. One example is Julie’s talk about teaching explorative mathematics in the interview, which led me to expect that she would act out the Discourse of an explorative mathematics teacher in her lessons. Based on hypotheses formulated as a result of my analysis of the interview data I therefore looked for converging evidence in my analysis of the observation data.

I analysed the observation data with particular reference to the teachers’ mathematics teaching practice by identifying passages in which they enacted teacher Discourses as “saying, doing and being” in terms of their sequencing and combining of actions. I noticed the distribution of power in the classroom and teachers' relationships with students, their positioning and use of social language. I also noticed actions such as explaining, funnelling (providing hints so that students supply the desired answer, as noted by Wood (1998)), and the pace of teaching. While I analysed these particular episodes more closely, I also developed an overall impression about what was going on in the classroom. The analysis of the observation data thus became a cyclic process which moved between a general understanding of what happened in the lesson and particular episodes which related to particular Discourses. Referring to the frame problem, this cyclic process also ensured the validity of my analysis as I looked for converging evidence across the interview and observation data. Table 4.4 describes how I operationalised Discourse in my analysis of the observation data.

Discourse	Discourse is the enactment of socially situated identities in associated practices where saying things "never goes without also doing things and being things (Gee, 2014, p. 3). I understand teachers' enactment of Discourse to involve speaking and listening, acting in teaching, valuing in teaching, using objects, tools and technologies in teaching and also uses of times and places. I have analysed the teachers' actions in terms of enactment of their individual teacher Discourses. I looked for use of questions and discussions, use of tasks, use of explanations, and how the teachers position and are positioned in the teaching. For example, I looked for Julie's use of discussion in relation to enacting the Discourse of an explorative mathematics teacher. Another example is that I looked for how Lena positioned the students in enacting the Discourse of the caring teacher.

Table 4.4 Operationalisation of Discourse in the observation analysis

Analysis of the post-lesson interview

I began the analysis of the post-lesson interviews by transcribing the original Norwegian in full and structured in macro-lines as with the pre-lesson interviews (Gee, 2014). Emphasised words and utterances were written in capital letters, words and phrases with particular meanings were written with quote marks, and words difficult to catch were written as three question marks in parentheses (???). The teachers' reflections tended to turn out as small speeches with just a few interruptions from me as I asked follow-up questions. The transcription process was followed by a first reading which highlighted which episodes from the classroom observations the teachers chose to focus on, but also how they talked about issues raised in the first interview in this post-lesson interview, or if they appeared to avoid talking about some issues.

Analysis of the pre-interview and observation provided the starting point for the analysis. I looked for connections between the hypotheses and arguments formulated in the previous analyses, and the teachers' reflections on the lessons and their own teaching. For example, in analysing the post-lesson interview with Julie, I looked for references to exploratory mathematics teaching in her lessons. Having identified connections, but also disconnections to the analyses of the first interview and the classroom observations, I started to ask questions about Discourse, figured worlds, social languages, Conversations, situated meanings, intertextuality and relationships. I used the inquiry tools as described in the operationalisation in Table 4.3. For instance, asking about Discourses, I identified references to how the teachers described themselves in the classroom settings. By using the inquiry tools and looking for apparent connections between the different parts of the data, moving back and forth between analysing the interviews and the observation data, I also ensured validity of my interpretations, testing my hypotheses and looking for converging evidence.

Presentation of the data in this thesis

I transcribed all of the data in the original Norwegian prior to analysis. All data which appears in this thesis is translated into English. I worked myself on the original translations into English, which I then checked with my supervisor, who is a native English speaker. In all instances I have aimed for translation which captures my understanding of the speaker's original meaning, rather than literal translation which can of course be very misleading. Translation is not straightforward, and as a researcher I often needed to make assumptions about speaker intentions. I aimed to make this as robust a process as possible and discussion with my supervisor would often be quite extensive and would involve understanding particular phrases in the context of larger episodes. In the data analysis chapters I have aimed to ensure validity by including the original Norwegian in footnotes for all interview extracts. Observation extracts are lengthy, so they appear only in English in the main text but are presented in the original Norwegian in the appendices (see Appendix 3).

4.4 Ethical issues

Ethical issues in social science concern how we should treat those who are the subjects of our research (Bryman, 2016). For me as a researcher this is primarily about my responsibility to the students and teachers in my research and the need to show respect for human dignity and the participants' autonomy and integrity. Additionally, it concerns intellectual integrity and the need to ensure the trustworthiness and validity of my research.

In undertaking this research I followed the ethical guidelines of The Norwegian National Committees for Research Ethics (2016), and reported my study to Norsk senter for forskningsdata (NSD) for approval of my data processing and privacy protection plans, including safe data storage and deletion of data after my work was finished. To ensure voluntary consent to participation from the students and teachers I provided full information about the aim of the study as an investigation of mathematics teaching in attainment groups, and what participation entailed, including being video recorded. I made it clear that confidentiality and anonymity was assured, especially when it came to video recording (Bryman, 2016; Pring, 2004). All participants were informed of their right to withdraw from the study (Bryman, 2016; The Norwegian National Committees for Research Ethics, 2016). See Appendix 4, 5, and 6 for the participant information sheet, consent form and other information relating to the ethics approval process.

In this study, with its focus on teachers, the key aim is to treat teachers with respect. The teachers had welcomed me into their classrooms and were happy to talk to me about their teaching. Despite my position as a researcher with special knowledge in the field, I was still a visitor in the school, an outsider from the context in which they worked and belonged. For both ethical and theoretical reasons, I was not interested in pointing out emerging mismatches between the teachers' practices and how they described them. I was committed to avoiding a deficit view of teaching. Instead, I wanted to understand more about apparent contradictions, and to make sense of these within the teachers' own understandings of their context.

Throughout this study, this importance of context for a better understanding of the teachers' enactment of mathematics teaching emerged as essential. This was both central to and supported by my choice of critical discourse analysis where the role of context is evident through the impact of different social, cultural and political discourses. I recognised that including the contexts of classroom, school and Norwegian education culture and policy in my analysis was essential to understanding not only how these individual teachers were positioned but also the ongoing impact of a global culture of performativity. A critical discourse analysis makes the assumption that every individual has "good reasons" and makes "deep sense": "within their Discourses, people move to sense" (Gee, 2014, p. 115).

Any study involving people as participants needs to consider carefully how the informants will be involved, and to what degree. This required me to think carefully through what data I needed to collect and what methods to use, so as to avoid this being unnecessarily burdensome and intrusive for participants (Bryman, 2016). Unfortunately, the theoretical development of my study meant that data collected from the mixed group school was not used, but this was not something I could have known in advance.

Using video recording creates some extra ethical issues to consider, and this also forced me to think through what special data I would gain from this. Video recording from classroom observations would provide me with detailed data from interactions in the classroom which I considered to be useful. I also valued the video data for its importance in ensuring a proper treatment of the observation data in my data analysis, since it provided the opportunity to go back and look again at the data. I therefore decided to use video recording. At the same time, video recording interrupts students' daily lives and their teaching and could affect their learning. I therefore had to limit its use and decide to what degree video was required. I did not turn the video camara on until just before the teacher started the lesson and I also stopped the recording as soon as the lesson has ended so as to avoid recording students' and teachers' informal and potentially private talk. I informed the students and teachers about my video recording plans and how I would treat the data. Those students who did not want to be video recorded were placed outside the camera angle during the recording of lessons.

Finally, ethics in research also concerns intellectual integrity. In my case, I needed to be conscious of how my background as a teacher and a teacher educator might affect my research. As a teacher I had my own views about mathematics teaching and attainment grouping, and this could easily influence me as a researcher in how I conducted the research and interpreted data and findings (Bryman, 2016). I guarded against this by being conscious of my researcher identity and trying to put aside my teacher identity. Gee's (2014) critical discourse analysis theory and method was very important in this effort to ensure the rigour of my analysis, based as it was on asking questions generated by the building tasks and inquiry tools of Gee's method rather than on my personal views and experiences. At the same time, it is difficult to stay neutral and therefore, to ensure trustworthiness, I have made my background transparent and strived to be conscious of this issue in doing this research.

Building up validity through the methodology

These considerations also concern the validity of this research. Gee's (2014) theory and method of critical discourse analysis has clear methodological implications which contribute to the validity of the study. Throughout this chapter I have emphasised how Gee's method recognises power and position, and the impact of cultural and political discourses. The issue of validity becomes particularly evident in Gee's treatment of the frame problem which I have discussed in Chapter 3, but also in his method of analysis through hypothesising. Generating hypotheses about the data and using different inquiry tools and building tasks in successive visits to the data creates opportunities to assess how a hypothesis can be seen to be supported by multiple elements of the data, where the answers to questions converge to support the analysis. In this study, this occurs as a result of convergence of the answers to the questions generated in response to both the interview data and the observations data. At the same time, convergence between answers to questions asked about the data generated by the different teachers, also strengthens the validity of my analysis. While it is important to not just look for convergence but also to acknowledge when answers to any questions support opposing conclusions, this approach aims to emphasise that teachers make sense, and that apparent mismatches can be explained.

4.5 Summary

In this chapter I have explained the role of critical discourse analysis in this thesis and explained the research design and methods of my study. I have focused particularly on the implications of Gee’s (2014) theory and method for how the data analysis. I have also shown how Gee’s critical discourse analysis extends to the ethical issues involved in carrying out a study with teachers in this context. In the next three chapters I present the analysis of the three teachers in turn.

Chapter 5. Lena – the competent teacher

This chapter explores the multiple Discourses which emerge in Lena's enactment of herself as a mathematics teacher, and the way in which she navigates her way through them: the Discourse of the competent teacher, the Discourse of the good mathematics teacher and the Discourse of the caring teacher. The analysis reveals that Lena's enactment of these three Discourses appears in different parts of the data, but Gee's argument that a person may simultaneously enact multiple Discourses is especially illustrated by the ways in which these Discourses often appear to run in parallel, particularly in the observation data. Here, we see how Lena brings the different Discourses together almost seamlessly in her teaching. However, the interview data shows how Lena sometimes interrupts her enactment of one Discourse to acknowledge and take on another, underlining the potential for conflict between Discourses.

The analysis also reveals particular relationships between the different Discourses. The Discourse of the competent teacher appears to be dominant in Lena's enactment of herself as a mathematics teacher. However, she also enacts the Discourse of the caring teacher: while it emerges as an overarching Discourse for Lena as a teacher in general, in her enactment of herself as a *mathematics* teacher it appears to act in service of the competent teacher. In contrast to the dominant Discourse of the competent teacher, we see glimpses of the subordinate Discourse of the good mathematics teacher, but this is enacted in the interview data only. The three Discourses are underpinned by various figured worlds which connect across the Discourses in different ways: the analysis reveals how the figured world of fixed ability appears as particularly important in Lena's enactment of a mathematics teacher.

5.1 The Discourse of the competent teacher

As I will show, the Discourse of the competent teacher is dominant in Lena's enactment of a mathematics teacher, appearing throughout both the interview data and the observation data and particularly connected to a figured world of fixed ability. The Discourse of the competent teacher concerns the teacher who 'gets the job done', performing competence by teaching in accordance with the requirements of policy documents and the curriculum. This Discourse is thus driven by accountability and performativity demands that define and stress competence in terms of performance-related outcomes such as test results. The analysis reveals that Lena enacts the competent teacher partly through taking a procedural approach to teaching, which also seems to enable a sense of control in her teaching. The figured world of fixed ability which feeds into the Discourse of the competent teacher underpins Lena's interpretation of TPO and attainment grouping as a central component of mathematics teaching.

Enacting the competent teacher through TPO in attainment grouping

One stance in the Conversations in Norway about teaching for TPO and attainment grouping maintains that TPO entails the organisation of inclusive teaching within a whole class mixed group. An alternative stance, interpreted within a figured world of fixed ability, envisages teaching for TPO by means of attainment groups working at different levels. Enactment of the Discourse of the competent teacher, focusing as it does on accountability and performance demands, may thus legitimise an interpretation of TPO as requiring teaching in attainment groups, and also support a procedural approach to teaching which makes it easier to demonstrate that TPO requirements have been met as part of a tick box exercise.

When Lena starts to talk about teaching in attainment grouping in the pre-lesson interview, she connects this strongly to teaching for TPO and teachers' professional responsibility to adapt teaching to students' needs. Referring back to the origins of attainment groups at Berg school, she describes the difficulty of teaching TPO in whole class mixed groups – which the teachers interpreted as within-class differentiation - and the associated frustration. When talking about attainment grouping, Lena uses the euphemism *mastery groups* [mestringsgrupper]; this is the term used at Berg school for attainment groups, emphasising the more favourable idea of learning potential rather than the more explicit reference to levels which is entailed in the term *attainment groups*:

> *And we were a bit frustrated about how much we had to differentiate then (...). So, we felt that we planned a lot for each class. And we had also read a bit about how mastery groups [mestringsgrupper] have had a good effect elsewhere. And then we wanted to try it to make it a bit better for us teachers, to have a bit more control of the lesson then. (…) And we concluded that mastery groups [mestringsgrupper] across the classes from 1-4 have been best. Because then you get the whole range instead of taking high, low, average. Then you get, then everyone gets something at their level. And that's what we also argue, that it's TPO for all levels then… and*

it will make it easier for the teacher to adapt [their teaching] to their group. Where it's, everyone is almost on the same level then.[4]

Lena presents teaching in attainment groups as Berg school's solution to the difficulty of carrying out TPO by differentiating in whole class mixed groups. Underpinning this story is her apparent stance on the Conversations about TPO and attainment grouping. Although she doesn't express this stance directly, Lena positions herself as being on a particular side, arguing for teaching in attainment groups as the best way of teaching for TPO. Drawing on a figured world of fixed ability, she interprets TPO as a question of giving students different tasks and different types of pedagogy according to their membership of different groups or levels. Her stance also concerns the teacher's position in her argument that this is "better for us teachers": attainment grouping makes teaching for TPO easier to control, and this issue of control appears frequently as I will show throughout this chapter. Lena's stance on the Conversations about TPO and attainment grouping is part of her enactment of the competent teacher Discourse: the more control a teacher has, the better able they are to give the students what they need.

It is also noticeable that Lena uses the word 'level' when she describes teaching in attainment groups. This wording may be part of the Conversation about TPO and a related social language used among Norwegian teachers to describe how teaching for TPO is organised according to three levels of difficulty in mathematics content: low, average and high. This language of levels is also reflected in various teaching materials, tests, and other resources for planning and teaching TPO offered to schools. One example is textbooks which facilitate tasks structured according to differentiation at three levels. This social language also references the Norwegian curriculum and the role of competence levels. This uses a model of grading according to three levels of low, average and high attainment (Norwegian Directorate for Education and Training, 2020).

Thus, the social language of TPO and related policy appears as part of Lena's enactment of the competent teacher Discourse. However, Lena's description of levels goes beyond the TPO view and usage. She argues that it is best to organise attainment grouping by splitting the

[4] Også vi var litt sånn frustrert over hvor mye vi måtte differensiere da (…). Så vi følte at vi planla veldig mye for hver klasse. Også hadde vi også lest litt om at mestringsgrupper har hatt god effekt andre steder. Og da ønsket vi å prøve det for å gjøre det litt bedre for oss lærerne, å ha litt mere, kontroll på timen da. (…) Og vi har kommet fram til at mestringsgrupper på tvers av klasser i 1-4 har vært det beste. For da får du hele differansen i stedet for å ta høy, lav, middels. At du får da, at alle får litt på sitt nivå. Og det er jo det vi også begrunner at det er tilpassa opplæring på alle nivåer da… og vil gjøre det enklere for læreren å tilpasse til sin gruppe. Hvor det er da, alle er på likt nivå ca da.

students into more than three levels, as in her school, because more levels means that students can be placed more ‘accurately’. In so doing, Lena makes a shift from referring to different levels of mathematical *content*, to categorising *students* according to levels of mathematics learning ability. Thus, her enactment of the Discourse of the competent teacher and its incorporation of a particular stance on TPO and attainment grouping appears to draw on a figured world of fixed ability.

Drawing on a figured world of fixed ability

In the previous quote about teaching in attainment groups at Berg school, Lena emphasises what she sees as the advantage for the teachers, which is planning teaching for a homogeneous group: “Where it’s, everyone is almost on the same level then”. Her particular usage of the term ‘level’ assumes that it makes sense to talk about the students in terms of levels, and this idea recurs when she talks about splitting the students in four groups in order to achieve a better differentiation:

> *Everyone gets something on their own level (...). It [teaching] must be at the level they are (...) It mustn’t be too easy or too difficult. So it’s right where someone is (...). The others [in the class] have the same viewpoint, ... and everyone really thinks the same way* [5].

Lena’s use of the word *level* here, in terms of teaching “on their own level”, “at the level they are”, “not too easy or too difficult”, draws on a figured world of fixed ability which assumes that a ‘level’ is something a student “belongs to” or “has”, suggesting a bounded, discrete quality which can not only be defined in terms of what all students at this level share, but is also fixed. This is underlined by the way she describes a level as “right where someone is” and where “everyone really thinks the same way”. In line with this interpretation of the word ‘level’, Lena thus describes what characterises the students in the different groups or ‘levels’, and their different needs as mathematics learners. Lena draws on this sort of description throughout the interview data. For instance, she talks about the students as different *types* of students, referring to “that kind of student”. In the following quote she describes the various groups in terms of their capabilities and needs. She starts by talking about the lowest group, who, she says

[5] At alle får litt på sitt nivå (…). Det må være på det nivået dem er (…). At det ikke blir for enkelt eller for vanskelig. At det ligger akkurat der noen er (…). At de andre sitter med samme oppfatning, … og at alle egentlig tenker på samme måte.

…get it [the mathematics] in a slightly different way, so to speak. [It needs to be] a bit easier and a bit more practical. While those who are in the high group may need a bit more theoretical stuff because it's the way their brains are made in a way. They… don't have to visualise to the same extent and they… understand it much quicker ... And then can go in depth instead… to a much greater extent (...). We have tried to take this into account ... for example the weakest and second weakest groups have slightly fewer [students]. Because there you often need a bit, uh, a bit more help from the teacher. And instead [we have] more in the one [group] at the top where they often manage quite a bit themselves… and they can bounce ideas off each other. (...) When we come to, for example, to group 3 then… that's a bit like a group where most of the students need a bit of help, you have some of the same misconceptions and such[6].

It becomes evident that Lena's descriptions of the different groups are rather fixed and have clear boundaries. Drawing on the figured world of fixed ability, she makes explicit contrasts between the different groups, describing the mathematics in the lowest group as easier and more practical compared to what the highest group does. But more than this, she makes claims about the students' different needs on the basis of assumed characteristics, describing the high attainers as understanding more quickly and capable of more in depth learning because of how "their brains are made". Talking about the low attainers' needs, Lena uses the phrase "didactics of the weak" [7], which assumes they need a different and special approach:

Yes, in Group 1 for example ... they often DRAW on the board, DRAW the problem and go ... make everything very practical… Sometimes they are outside and work practically on things [the mathematics]. And if, when we have geometry, and we are outside and find geometric shapes, we also talk about it and do some calculating and show why things are as they are. While in the highest group they are…, there are things they learned already

[6] For å få det på en litt annen … måte å forklare det på for eksempel. Litt enklere og litt mer praktisk retta. Mens de som er på høy gruppe trenger kanskje litt mer teoretisk for sånn hjernen dems er lagd på en måte da. At de… trenger ikke å se for seg i like stor grad og at de… skjønner det mye fortere... Og da kan gå i dybden i stedet… i mye større grad. (…) Vi har prøvd å ta hensyn til at … for eksempel den svakeste og nest svakeste gruppa er litt færre. For der trenger man ofte litt, eh, … litt mere hjelp av lærer. Og heller litt større på den på toppen hvor de klarer seg ofte ganske mye sjøl … samtidig som de kan spille på hverandre. (…) Når vi kommer til for eksempel til, til gruppe 3 da … som er litt sånn, gruppe hvor de fleste trenger litt hjelp, man har litt samme misoppfatninger og sånn.

[7] … didaktikken for de svake

in primary school because they are a bit further ahead, and then it is more important to go in depth. Find … other ways one can solve it[8].

Lena contrasts the teaching approaches for Group 1 and Group 4 in terms of need, emphasising how the practical approach to the mathematics in Group 1 was something Group 4 students already did in primary school - now they know more. We can thus see how Lena's stance on TPO is filtered through the figured world of fixed ability in terms of what she considers as appropriate teaching for students in different attainment groups. She enacts the competent teacher in these terms, and this is also manifested in her description of how she plans her use of classroom talk in whole class mixed teaching, as well as how she plans to teach in general for a mixed group:

> *When I have a whole class mixed group, I often approach the level [of the group] when explaining concepts and… kind of, I don't go into depth that much in class discussion…. [I] Make them explain to me what they think… and then… I might sit and talk to three students then who explain to each other and then they have … that type of discussion then… in depth and about what, why have they thought…, problem-solving tasks, where it's a bit… high level then. (...) Because when I have whole mixed classes I go down, I still have a list of things to go through. But then I find, I often draw to show, write down how I have drawn and try to show. And then it can be a bit like show it that way too and try to show it in different ways. So you kind of have some choice then in which way you prefer.*[9]

Drawing on a fixed ability figured world, Lena weighs up focusing on concepts versus in-depth conversations and problem-solving tasks, seeing this as a too high level for a mixed whole class. She enacts the competent teacher by explaining how she facilitates a discussion

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[8] Ja, på gruppe 1 for eksempel.. så er det jo, … dem TEGNER ofte på tavla, TEGNER problemet og går liksom… gjør alt veldig praktisk… Hender at de er ute og viser ting praktisk der. Og hvis, når vi har geometri, og er ute og finner geometriske figurer, også snakker man om det og regner litt og viser hvorfor ting er som de er. Mens på den høyeste gruppa så er de…, det er ting dem lærte allerede på barneskolen for at dem er litt langt foran, og da er det viktigere å gå i dybden. Finne litt … andre måter en kan løse det på.

[9] Når jeg har hel klasse, så legger jeg ofte nivået på begreper og… liksom jeg går ikke så i dybden på klassesamtalene…. Får dem til å forklare meg hva dem tenker … og så … sitter jeg kanskje og snakker med tre stykk da som forklarer for hverandre, og så at de… den type samtale da… I stedet for … litt sånn i dybden og skal snakke om hva, hvorfor har dem tenkt…, problemløsningsoppgaver hvor det er litt … høyt nivå da. (...) For at når jeg har da klasser så går jeg ned, jeg har jo fortsatt lista over hva jeg skal gå igjennom. Men da finner jeg opp, ofte da tegner jeg opp det for å vise, skrive opp hvordan jeg har tegnet for å prøve å vise. Og så kan det være litt sånn også og vise det på den måten og prøver å vise det på forskjellige måter. Så man har liksom litt valg da på hvilken måte man foretrekker.

which she sees as fitting all the levels in the class, and then differentiating by talking to a few students at a time. As she says: "it's a bit harder to manage, to plan for a class conversation than when you are just one on one with a student"[10]

She pursues this theme of accommodating to all levels in her description of how she presents the content in multiple ways so that students can choose what is their preferred way. However, planning for teaching in Group 4, Lena describes a different approach:

> *Yes, ... when we are at the high level, then I have a list of what to go through. And then I go through it, but if there is someone who doesn't understand, then I go through it in a new way. But I kind of approach a level… that is manageable for them too. But for those who don't understand it then either, then I go through it in a different way. But only for those who, only for those who need it. Instead of taking it for everyone*[11].

Here, Lena explicitly focuses on one particular level and explains how she aims to 'go through' the content in just one way, but with a different explanation if required. As the competent teacher, she emphasises how she focuses on appropriate levels for different groups.

Enactment through positioning

The figured world of fixed ability is also apparent in Lena's self-positioning within the competent teacher Discourse. She prefers to teach in Group 4 because of her affinity with this group of students:

> *I like, I like it best in Group 4. Because they, I'm a bit bound by rules myself. Because I'm kind of the same type. Eh, so it's a bit like, [with them] I can see how it, why they think how they do too. Because that's also the direction I'm going*[12].

Drawing on a figured world of fixed ability which extends to assumptions of "types" of learners, Lena sees herself as sharing the Group 4 students' approach to mathematics and therefore as being more able to understand what she sees as their particular way of thinking in

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[10]Og det er liksom litt vanskeligere å styre, å planlegge en klassesamtale enn bare når du skal ta en og en elev.
[11] Ja, mens (...), … når vi er på det høye nivået, så er det egentlig, jeg har en liste over hva jeg skal gå gjennom. Også går jeg gjennom det, men hvis det er noen som ikke skjønner det da, så går jeg heller gjennom på en ny måte. Men jeg ligger liksom på… et nivå som er overkommelig for dem også. Men at de som ikke skjønner det da heller, så går jeg gjennom det på en annen måte. Men for den som, den det gjelder bare. I stedet for å ta det for alle.
[12] Jeg liker, trives best på Gruppe 4. Fordi at dem, jeg er litt sånn regelbunden sjøl. For jeg er litt samme typen. Eh, så det er litt sånn, der kan jeg jeg se hvordan det, hvorfor de tenker det dem gjør også. For det er også i den retninga jeg går.

mathematics. Enacting the Discourse of the competent teacher, Lena sees herself as the teacher for the high attainers, able to tune in to their needs, and to "control" what happens in the group – as we have seen, she sees this as supported by attainment grouping: "And then we wanted to try it to make it a bit better for us teachers, to have a bit, more control of the lesson then". This issue of control also becomes evident in Lena's account of how the teachers at Berg school decided which group each teacher should teach, focusing on the twin ideas of "being comfortable" and having control:

> *So, you don't end up with something you're a bit uncomfortable with… And then the one who has Group 1 [Jon] has in fact always had Group 1, he's very good at the didactics for the weak. He (…) has been involved in Ny Giv [a teaching practices course] and is very good with that type of student [low attainers]. So, he wanted to have that group. And given that the rest of us are not really completely comfortable with it… that level… then it was just natural that he took them... While the others were… really a bit er… didn't really matter.*[13]

A figured world of fixed ability levels re-emerges in how Lena positions the teachers in the group, in particular her strong positioning of Jon as the "right" teacher for the low attainers in terms of his specialist training and teaching aptitude, and his apparent good rapport with this "type" of student. As we can see, she credits him as both the best and also the obvious teacher for group 1, underlining this positioning by saying "he wanted to have that group". Lena simultaneously distances herself from the possibility of teaching this group and implicitly justifies her positioning as a Group 4 teacher – she has a different style.

Lena's self-positioning with respect to the other teachers in this matter of who should teach which group sheds further light on her overall enactment of the competent teacher. Her talk about teaching group 4 tends to imply that she considers it an important group for which she is well-qualified, but this does not mean that she looks down on Jon as a teacher. While she clearly sees herself as different from him, she expresses admiration for his teaching and his status as a teacher. This relationship to Jon is also evident in an episode from my observation of the first lesson in Group 4. Lena has just explained to the students the symbol for rounded

[13] Så ikke man ender opp med noe man er litt ukomfortabel med… Også da han som har gruppe 1, han har egentlig alltid hatt gruppe 1, som er veldig flink på didaktikken for de svake.
Han (…) har vært med i Ny Giv og er veldig flink med den type elever … Så han ville gjerne ha den gruppa. Og når vi andre egentlig ikke er helt komfortable med den… det nivået… så blei det litt naturlig at han fikk de.. Mens de andre var … egentlig litt eh… spilte egentlig ingen rolle…

numbers, (≈), and points out that numbers with several decimals should be by rounded up/down to be written "more easily" as a "shorter" number. Tom replies that he suddenly understood the meaning of the sign and comments on the rounding off to Lena:

> ***Classroom Extract 5.1***
> *Tom: Because you don't have energy to write all the other numbers? It's really a bit like cheating.*
> *Lena: Yes. Mathematicians are lazy, Jon says all the time.*
> *Filip: Make it as simple as possible.*
> *Lena: Very good point Filip. Make it as simple as possible, but not easier. Good!*
> *Filip: Jon says that.*
> *Lena: He does. He is a wise man.*

Lena's response to Tom indicates her relationship to Jon and how she positions him publicly. Jon's status as a mathematics teacher at Berg school is further confirmed when Filip joins in with this praise - he appears to hold a particular position both for Lena and the students.

Lena's relationship to Julie and Daniel, the fourth teacher in this group, appears to be rather different. In her earlier talk about the teaching in attainment groups ("we wanted to try it to make it a bit better for us teachers"), Lena refers to Julie and Daniel as members of the "we" involved in the collective decision-making at Berg school. However, her comment that "the others (…) didn't really matter" suggests that there was no particular group which was best for Julie or Daniel to teach; they do not stand out for Lena as Jon does. Furthermore, her presentation of herself as the right teacher for the high attainers in Group 4 has positioning implications for the other 9th grade mathematics teachers. Given that Jon is positioned as the right teacher in Group 1, Lena needs any assessment of Julie and Daniel to allow her to teach Group 4, and she positions any match between them and the students as "not mattering". The analysis thus reveals how Lena enacts the competent teacher by not only positioning herself in a particular way but also by her positioning of the other teachers, arguing about the importance of "comfortable" teaching for all.

Lena's positioning of the 9th grade mathematics teachers is also evident when she relates the details of their collective decision about attainment grouping:

> *We had also read something about how mastery groups have had a good effect elsewhere. (...) We've tried different ways of doing it actually … and*

we concluded that mastery groups across the classes from 1-4 have been best.[14]

Lena positions herself among the group of teachers in her use of the social language of 'we'; she also uses this to emphasise that they have arrived at a joint agreement about the benefits of attainment grouping. This contributes to her enactment of the competent teacher, based as it is on the teachers' interpretation of their professional experience at Berg school. This experience appears to take priority in Lena's Discourse; while her reference to "we had also read something" appears to validate the Berg teachers' experience by pointing to similar arguments which have taken place outside their school, Lena seems less concerned about research. This is evident in her pre-lesson interview account of a discussion with the school leaders about whether or not to adopt attainment grouping. Teaching in attainment groups had been initiated and put into practice by the teachers, despite some doubts from the school leaders. Later, the same leaders changed their minds because they had read 'research' which suggested attainment grouping was not entirely positive. Lena comments on how the leaders prioritised research over the teachers' own experience:

They read a lot of research ... and not so much about what we think in practice[15].

Lena's account suggests a disagreement between the teachers and the school leaders about the status of research knowledge versus experience in teaching, with experience-based knowledge being less valued by the school leaders. Drawing on a Conversation among teachers about the role of research-based theory in school practice, Lena appears to take up a stance which is somewhat negative about the role of research, emphasising experience-based knowledge of teaching as a solid ground for pedagogic practice. This positioning of the school leaders and the teacher group is another component of her enactment of the competent teacher as one who prioritises their professional experience and understanding of student need, despite the view of the school leaders.

Enacting the competent teacher in the classroom

In the classroom observations Lena mostly enacts a traditional teacher-led approach to teaching, beginning lessons by introducing and demonstrating the mathematics on the board

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[14] Også hadde vi også lest litt om at mestringsgrupper har hatt god effekt andre steder. (…) Vi har prøvd egentlig litt forskjellige måter å gjøre det på… og vi har kommet fram til at mestringsgrupper på tvers av klasser i 1-4 har vært det beste.
[15] De leser veldig mye forskning … og ikke så veldig mye om hva vi tenker i praksis.

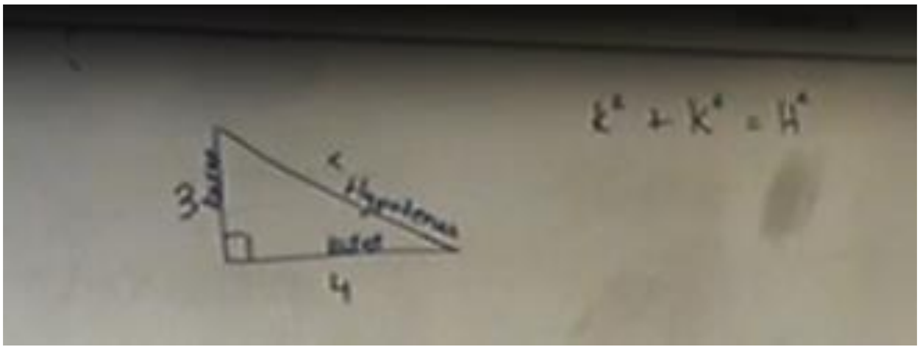
for the whole class, after which the students work on practice questions. The following extract is from the beginning of the first lesson with Group 4 where Lena teaches Pythagoras theorem and 'goes through' how to solve a problem by using Pythagoras to find the unknown hypotenuse:

Classroom Extract 5.2

Lena: And then when we write down and solve those problems, what do we always start with then? …

Kari: Write down the formula.

Lena: Write down that formula. $k^2 + k^2 = h^2$. (Lena writes the formula on the board. After this she goes on to ask the students if any of them can explain the formula).



Lena: Is there anyone who can EXPLAIN what it, that expression, says? $k^2 + k^2 = h^2$*?*

Sara: (calls out without being asked) *That you take* $k^2 + k^2$ *and that makes* h^2.

Lena: What does that mean then Sara?

Sara: What does that mean?

Lena: Yes k^2*, what does that mean?*

Sara: The side times the side.

Lena: Yes. Because what he [Pythagoras] found out was that the SQUARES on the sides (Lena draws the squares on all of the three sides on the board). *And if you add these two squares here* (points to the two squares on the sides), *then it makes, it is the same as that square of the hypotenuse* (Lena points to the big square).

From the beginning of this extract, Lena enacts the competent teacher who ensures that students are able to do the required mathematics by taking a procedural approach, and emphasising what she considers important details about how to write the solution correctly. This enactment continues as she asks questions of the students, focusing on explaining the formula and summarising the key points. She demonstrates her knowledge about Pythagoras and leads the teaching, taking control over the exchanges and enacting her responsibility for the students' learning by guiding them in how to work out and write down the solution.

The competent teacher makes sure that students know the correct procedures, and Lena prioritises this. This approach is strongly evident in the following extract which is from the last part of her demonstration of the example. Lena has written $4^2 + 3^2 = x^2$ on the board and asks the students:

Classroom Extract 5.3

Lena: And what do we on the next line then when THAT is done?

Maria: Then you calculate what $4^2 + 3^2$ is.

Lena: 4^2

Maria: Yes

Lena: What is it then?

Maria: It's 16

Lena: It is 16 (writing on the board) *3^2 is?*

Maria: 9

Lena: 9… is equal to x^2 (Lena writes the answers on the board). *And then? Next… line?*

Tom: It's going too fast

Lena: Am I going too fast? ... We'll look at that a bit afterwards.

Tom: Yes

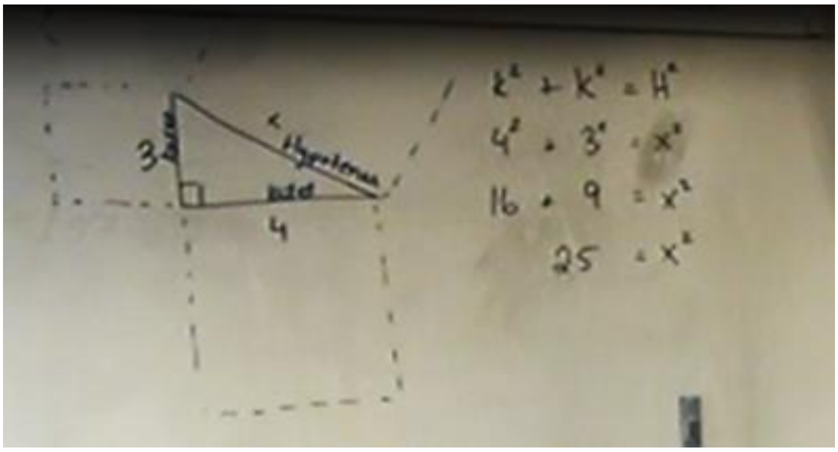
Lena: Yes…? And after we do that? ... Then we do Sara?

Sara: Adds 16 and 9

Lena: Which is?

Sara: 25

Lena: 25 (Lena writes $25 = x^2$) *And then… Because now we know what the whole area is like inside it, that square here…* (Lena points to the big square on the board). *Kari?*

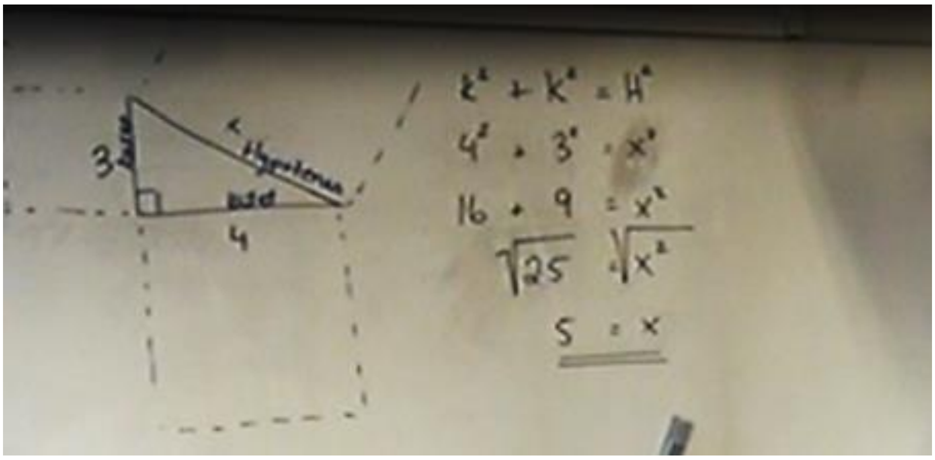


Kari: We take the square root

Lena: Square root (Lena enters the square root sign in the equation) *... and then we get ...*

Sara and Filip: 5

Lena: 5… is equal to… x. (Writes on the board while she also saying it). *Good! And what is it that is important to watch out for when we are going to WRITE pieces like this? I'm really fussy about that. (...) The equal symbols are below each other* (Lena points to her precise notation on the board) *... because then it looks much tidier.*



Lena's strong focus on rehearsing 'the proper way' to solve problems using Pythagoras' theorem comprises numerous closed questions which require short answers. She ends her demonstration by giving a summary and pointing out what she emphasises as important, for example writing the equal signs exactly below each other. Alongside this enactment of the competent teacher, Lena performs her own subject knowledge to the Group 4 students, showing to them that she is a mathematically able teacher. Informed by the figured world of fixed ability which she has indicated in the pre-lesson interview assumes that high attainers need fast-paced, formally driven, mathematics, Lena performs as an efficient mathematics teacher. She enacts the Discourse of the competent teacher as she guides the students through the “right” solution strategy, preparing them for what they need to pass the exam. Her emphasis on pace causes her to side-line Tom’s comment that things are going too fast, and she maintains control of the teaching.

Enacting the competent teacher for Lena is strongly connected to a focus on ‘how much mathematics you know’. This approach to mathematics learning becomes evident through her emphasis on practice questions. For instance, having finished the example on the board, Lena sets the students to work on individual practice, and writes the question numbers from the textbook on the board which she wants the students to work on. One of them comments to Lena that these are the same questions that they worked on the previous lesson. Lena responds:

> *Lena: Yes, but you haven’t finished. There are lots of questions still. It’s really important that you get “MASS TRAINING”. So we start there and we just WORK on further*[16].

In her emphasis on ‘mass training’ [mengdetrening], Lena enacts the competent teacher who focuses on ensuring that students know what they need to know. In the second lesson in Group 4, one of the students complains about the fact that they were to work on Pythagoras problems for most of the lesson, asking if they have to do all the questions. Lena replies “It’s good to have some mass training”, drawing on a figured world in which learning mathematics is a question of practicing. Claiming that the more tasks they do the more they will understand, Lena makes sure the students are covering enough pages of exercises, and takes control of their mathematics learning. At the same time, having planned for this mass training in Group 4, Lena also draws on a figured world of fixed ability which assumes that the students need to work more on formal mathematics.

5.2 The Discourse of the good mathematics teacher

Although the Discourse of the competent teacher is dominant in Lena’s enactment as a mathematics teacher, another Discourse is occasionally visible – this is the Discourse of “the good mathematics teacher” who uses their mathematical subject knowledge to keep an eye on the mathematical horizon, facilitating productive classroom discussion which enables deep

[16] Lena: Ja, men du har ikke blitt ferdig. Det er masse oppgaver nå. Det er bare viktig at du får MENGDETRENING. Så vi starter der også bare JOBBER vi videre.

understanding. It is underpinned by a figured world in which all students are able to contribute to discussion and to learn from each other, to the best of their potential. This figured world is in direct opposition to that of fixed ability which we see Lena drawing on, on multiple occasions. However, the Discourse of the good mathematics teacher is mainly evident in the interview data, where Lena enacts the good mathematics teacher as she talks to me, addressing the person she thinks I am. This is, then, an almost purely verbal enactment, in contrast to her more embodied enactment of the competent teacher in the classroom, where, as I will show, Lena struggles to enact the good mathematics teacher Discourse.

Verbally enacted in the interviews

The Discourse of the good mathematics teacher first emerges in the pre-lesson interview, when Lena suggests that the Group 4 students are more formally driven, but goes on to say that it is good to work beyond their desire for algorithms:

> *Ehm… because it's often… they often think of algorithms all the way. So then it's like, the challenge there is to go around the algorithms… and how can you use them in other settings. So it's really using more problem-solving tasks too…, a bit like tasks from Young Abel*[17] *and like that… to make them think a bit out of the box. Because they are a bit restricted by the algorithms. So, if they don't have an algorithm for it then they get a bit stuck.*[18]

Lena is critical here of too much emphasis on teaching algorithms because it may mean that Group 4 students are restricted 'inside the box' of being over-reliant on using algorithms. She advocates problem-solving and the importance of making connections (where algorithms apply in other contexts), and she emphases "the importance of talking about the maths" and students explaining their solution strategies:

> *They should always EXPLAIN how they think about what they do, and you can ask questions about it. Why did you choose this and that?*[19]

[17] A competition in mathematics for Norwegian students in lower secondary school.

[18] Ehm… for det er jo ofte… de tenker jo egentlig ofte algoritmer hele veien. Så da er jo liksom, utfordringa der er jo å gå rundt algoritmene … og hvordan kan du bruke dem i andre settinger. Så det er egentlig bruke mere problemløsningsoppgaver også…, litt sånn unge Abel og sånn… for å få dem til å tenke litt utenfor boksen. For de låser seg litt til algoritmene. Så hvis de ikke har en algoritme på det så kjører de seg litt fast.

[19] At de alltid skal FORKLARE hvordan de tenker det de gjør og man kan godt stille spørsmål til det. Hvorfor valgte du det og det?

She goes on to elaborate on the importance of students explaining to each other, and the classroom dynamics involved, emphasising the benefits of different student perspectives:

> *I feel that they get a better understanding of it [the mathematics] when they have to explain it in their own words and also explain it to someone else. Ehm, because that can also have been to a student who is a bit weaker than themselves. It doesn't have to be for someone in their own group who is on the same level. Eh, and being… that… support for those in the class too… and being able to bounce off each other… Because often it's the… the weak often have a different way of doing things too. That they can explain to someone on a higher level, … and that they get … exactly the same… They get the same answer, they get the same… yes, they have ways to figure it out… They get the same answer, it may not be the same way… but they are equally valid in a way. So you could explain it in your own words as well. Because I think it's very important that there are several roads to Rome… even though I'm not that good at it myself.*[20]

In this speech, Lena has left the Discourse of the competent teacher very much behind. Instead, she enacts the good mathematics teacher, drawing on a figured world in which all students are able to learn from each other even though (or because) they have different ways of understanding. Lena emphasises that this is the case for all students, referring to high and low 'levels' in a mixed group. Working together across different 'levels' despite students' different ways of explaining mathematics is valuable: "Because I think it's very important that there are several roads to Rome…". It is noticeable that Lena concludes this sentence with a somewhat ambiguous comment "even though I'm not that good at it myself"; it appears to be a comment on her own abilities, either as a mathematical thinker/explainer (she is 'not that good at' explaining her thinking/seeing different solutions) or as something she should be able to do as the good mathematics teacher (perhaps facilitate this kind of discussion), but not

[20] Jeg føler jo at de får en bedre forståelse av det når de må sette ord på det sjøl og forklare det for en annen. Ehm, fordi at det kunne jo også ha vært en elev som er litt svakere enn dem selv. Det hadde jo ikke trengt å være for noen på gruppa som er på likt nivå. Eh, og det å være… den… støttespiller for de i klassen også… og kunne spille på hverandre… For ofte så er det de …svake har jo ofte en annen måte å gjøre ting på også.
At de kan forklare til en på et høyere nivå, … og at de gjør… akkurat samme … De har samme svaret, de har samme … ja, de har måter å regne det ut… De får samme svar, det er kanskje ikke den samme måten… men de er likegyldige på en måte. At man kan diskutere og sette ord på det også. For jeg synes det er veldig viktig at det er flere veier til rom … selv om jeg ikke er så flink til det selv.

something she sees herself as skilled at. For Lena, the teacher's role in this situation is primarily to listen and learn:

> *I think it's very important that they have that discussion with each other as well. That you [the teacher] are not the one who is leading the discussion but are the one who is listening to the discussion. To hear the way they explain to each other and hear them talk and discuss the maths. Because you learn a lot more from that than just what the teacher tells. If I explain it to them, they can use it if they just follow the rules and algorithms I show, but to be able to explain to someone else a completely different kind of knowledge is required*[21].

Drawing on a figured world of mathematics teaching which emphasises the role of talk between students as crucial for learning, Lena enacts the Discourse of the good mathematics teacher in her emphasis on the importance of students developing "a completely different kind of knowledge" in contrast to the outcome of a teacher-led explanation which she seems to portray as inevitably leading to an algorithmic, procedural approach. Lena also enacts the good mathematics teacher in the post-lesson interview, but only with reference to lessons which I have not observed. When I ask her to reflect on her teaching in the classroom observations, she starts by giving a short summary of her lesson plan, which was to first demonstrate how to solve problems using Pythagoras theorem to find an unknown hypotenuse and then an unknown side. After this, the students would work on practice problems – "mengdetrening". Clearly, given this summary of her plans, Lena is not enacting the good mathematics teacher, but she avoids elaborating on the details of the observed lessons, and instead talks about what happened in the other lessons with Group 4 which I did not see. She first tells me about how she had taught Pythagoras differently way to another group of students on an earlier occasion:

> *… we've tried before with drawing Pythagoras, so they could find out for themselves what is really here? And then arrive at the theorem on their own … So, they could see the connection themselves (…). And then they made the… formula… kind of made the formula themselves. And then you get very*

[21] Jeg synes det er veldig viktig at de har den samtalen med hverandre også. At man ikke bare er den som styrer samtalen, men er den som hører på samtalen. Å høre på måten de forklarer til hverandre og høre de snakker og diskuterer om matematikken. For det lærer man veldig mye mere av enn bare læreren står og forteller. Hvis jeg forklarer til dem det. De kan jo bruke det hvis dem bare følger de reglene og algoritmene jeg viser, men for å kunne forklare til noen andre så kreves det en helt annen type kunnskap.

nice discussions … And then they also start to pull out… does it apply to every case? Eh, where, when is that not the case? And then they managed to find out about right-angled triangles. So you go that way then, from the discussion to formulas and expressions[22].

Here, Lena draws on a figured world in which students learn through exploration and discussion, enacting the Discourse of the good mathematics teacher who values what she describes as "very nice discussions" in which students themselves generate questions about general cases. She holds on to this enactment of the good mathematics teacher as she reflects further on her teaching in Group 4, where she again emphasises the value of students' participation in discussion, without her intervention:

And I also want them to explain it in their own words. Not just give them the words. So they are allowed to think a bit on their own too. 'What if…'. And try with semicircles and so on we have tried that a bit. To check if it [Pythagoras theorem] works with semicircles instead of squares. And they've found out that that works too. (…) And they are very concerned about… they ask all the time why it's like that... And so, so they are very CURIOUS about things. Things like that are good for them, so I let them do that. (...) It's important that curiosity, and that they don't lose it. At least in terms of interest in science. (…) There are some students who ask a lot of good questions… Like they are kind of allowed to play on a bit further and you can sit down and talk a bit ABOUT. There are a lot of them who ask like I've never thought of before. And, and "this is what we need to find out"![23].

[22] …vi har jo prøvd før på tegninga av Pytagoras, også finne ut sjøl hva er det som egentlig er her? Også komme fram til læresetninga sjøl, … Så de fikk lov til å se sammenhengen sjøl (...). Og da lagde de… formelen… liksom formelen sjøl da. Og da får du jo veldig fine samtaler rundt… Og da begynner dem også å trekke fram… gjelder det på alle? Eh, hvor, når er det det ikke gjelder? Også klarte de da å koble det til rettvinkla trekanter. At man går den veien da, fra samtalen til formler og uttrykk da.

[23] Og jeg vil jo også at de skal sette ord på det sjøl. Ikke bare gi dem orda heller. At de får lov til å tenke litt sjøl og. Hva hvis… Og prøver med halvsirkler og sånn har vi jo prøvd litt. Å sjekke om det går med halvsirkler i stedet for kvadrater? Og det har dem jo finni ut at det også går (…) Og de er jo veldig opptatt av,… de spør jo hele tida hvorfor er det sånn. Og vil, er veldig sånn NYSGJERRIGE på ting da. Sånne ting det er sundt for dem så det lar jeg dem få gjøre. (...) Det er viktig den nysgjerrigheten, og ikke at dem ikke mister den. I hvert fall med tanke på interesse for realfag. (…) Det er noen elever som spør veldig mange bra spørsmål… Som dem liksom får lov til å spille litt videre på som man kan sette seg ned og snakke litt OM. Det er veldig mange av dem som spør litt sånn som jeg aldri har tenkt på før. Også, og det her må vi finne ut!

Lena values the students' own thinking here as she enacts the good mathematics teacher, emphasising the benefit of students' curiosity and their eagerness in asking "*good questions"*. She is impressed and surprised by what the students ask.

Enacting the good mathematics teacher here, Lena tells me a very different story in comparison to her brief summary of her lesson plan for the lessons I observed. One interpretation of this shift may be that she enacts this Discourse of the good mathematics teacher for me, to let me know that she can also teach Pythagoras in a way which would gain my approval – it is likely that Lena knows that my position as a researcher and a teacher educator leads me to favour this other way of teaching as more "appropriate". Lena knows what I value, for instance my focus on use of classroom talk in mathematics learning, and thus my figured world in which mathematics is taught through discussion which involves all students. This enactment of the good mathematics teacher for Lena may thus be affected by this, that she knows my stance. However, as noted above, her ambiguous comment "I think it's very important that there are several roads to Rome… even though I'm not that good at it myself" suggests that her spoken identity as a mathematics teacher goes beyond just saying what she thinks I want to hear – her account of the virtue of discussion in a mixed group appears genuine, but Lena somehow struggles to be the teacher she wants to be.

As we have seen, Lena enacts the Discourse of the good mathematics teacher in the interviews, but there is no evidence in the classroom observations that she teaches in the way she talks about - the good mathematics teacher appears to be absent from her actions in the lessons that I witnessed. Instead, she mainly performs the competent teacher, focusing on her procedural mode of teaching. In order to explore this mismatch, the next section focuses in detail on Lena's responses to the students' questions, where we see her failing to enact the good teacher Discourse on two occasions, despite the students' implicit requests that she do so.

Struggling to enact the Discourse of the good teacher

In extract 5.4, Sara suddenly interrupts Lena's demonstration of the first example of how to use Pythagoras theorem and stops Lena in her explanation. Lena has just pointed out the condition that Pythagoras theorem only applies to right-angled triangles:

> ***Classroom Extract 5.4***
>
> *Sara: I don't understand where, what, how do you find eh, how, what is the answer if it's NOT a right-angled triangle?*

Lena: Eh, then you can't use that method here to FIND out the length of the sides. (Lena points to the figure of the right-angled triangle).
Lukas: How do you find out it's not working?
Sara: Yes, how to find ... I don't understand, is it like that, how do you get to prove that it's not… Do you get a wrong answer or something…?
Lena: Eh, eh, you had a problem like that on the midyear test … for Christmas, where you had a triangle that was (Lena draws a triangle in the corner of the board). *An example just like this, it was 10, 12, 13.* (Writes the numbers on the sides of the triangle. Turns towards the class/Sara) *And then you had to find out if it was square.*

Sara: Yeah, wasn't that Pythagoras' triple?
Lena: Yes, Pythagorean triples. And then you just put in (Lena points to the figure) *this in the formula. So* $10^2 + 12^2 = 13^2$. (Lena writes on the board). *And then we checked if it was right. And then you get two different numbers on each side of the equal sign* (pointing to the formula) *and if they are exactly the same, then it's a right-angled triangle. That was the problem on the midyear test.* (All students seem to pay attention. Lukas picks up with another question).
Lukas: ...yes but if… So you can't find out if it's a right-angled…?

Lukas goes on to ask some more questions about the new example, apparently not following Lena's explanation. In response, Lena closes the questioning down by giving a short summary of the example:

Lena: When you need to find out if it's squared, you GET all three (Lena points to the three side lengths in examples 10, 12 and 13). *And then there won't be a box like that there* (points to the symbol that marks an angle of 90 degrees) *there to somehow… Find out, calculate and…, show with*

Pythagoras that the triangle is right angled. You won't be asked about this [if a triangle is right angled] on those [problems] (Lena points to the solution of the first figure on the board) *with two known sides given.*

At the beginning of this extract, we see that Sara is unwilling to accept the condition Lena presents that Pythagoras theorem only applies to right-angled triangles. She seeks further explanation of the role of Pythagoras theorem, and Lukas follows this up. Rather than engaging with the discussion they seek, Lena takes a procedural approach, referring to the problem about Pythagorean triples on the midyear test and presenting an example which explains the procedure for solving problems about Pythagorean triples. Although Sara and Lukas can be seen to be inviting - and in their persistence even pushing - Lena to enact the good mathematics teacher through asking for more discussion, Lena holds on to her enactment of the competent teacher, focusing on tests and procedures. This same enactment continues when, having given her explanation about Pythagorean triples, Lena returns to the calculation of the example she has already started and continues her demonstration for the whole group.

Extract 5.5 takes place in the last part of the first lesson in Group 4, when the students are working individually on practice problems using Pythagoras theorem. Lukas stops Lena as she circulates around the classroom:

Classroom Extract 5.5

Lukas: (To Lena). *But did you figure it out about quadrilateral and circle? Because it's the same.*

Lena: Difficult. But it's something about what are the criteria for a quadrilateral or what for a circle then.

Lukas: If you ever, if you had never heard about a circle and never heard about a quadrilateral.

Lena: That's not enough explanation.

Lukas: A circle is round.

Lena: Yes, but so what? There are several things that characterize a quadrilateral.

(Lukas continues to talk about definitions of figures.)

Lena: (interrupts) *Now you're just being annoying Lukas.*

Lukas wants to explore Pythagoras' theorem by replacing the three squares with semicircles, and invites Lena to engage in a deeper discussion about the mathematics in Pythagoras. Lena listens to him, but her response in terms of the criteria for a quadrilateral and what constitutes an adequate explanation is abrupt; she does not pick up on the opportunity for discussion and its associated enactment of the good mathematics teacher. Instead, she enacts the competent teacher, showing that she is a knowledgeable teacher who is in control of the mathematics, and moves on to talk to another student.

Although Lena enacts the Discourse of the good mathematics teacher when she talks to me in the pre- and post-lesson interviews, the analysis reveals that this is not the case in the lessons. Curiously, Lena's reference in the post-lesson interview to the students' exploration of Pythagoras and semicircles describes the very issue that Lukas raises in this extract. What she describes as a good question in the interview she does not pursue in the lesson. Despite the fact that the students act in ways that invite Lena to enact the good mathematics teacher, she keeps to her procedural approach and her enactment of the competent teacher.

What emerges, then, is a conflict between the Discourse of the competent teacher and the Discourse of the good mathematics teacher. While Lena talks about the value of discussion and different student perspectives in her enactment of the good mathematics teacher, she also enacts the competent teacher who focuses on following correct procedures. She does not seem to see the conflict between her emphasis on mass training [mengdetrening] on the one hand, and on discussion on the other. One explanation for this may be that her strongly-held figured world of fixed ability undermines the good mathematics teacher – although her comments on the value of discussion between students of different levels seem convincing, her strongest comments on the value of student discussion arise when she is talking about Group 4. At the same time, I have argued above that Lena's espousal of the good mathematics teacher Discourse is genuine. However, she herself suggests that she is 'not that good' at teaching in that way, and her emphasis on student discussion tends to focus on a teacher role of listening; she appears to find it difficult to engage in discussion herself. These conflicts are perhaps resolved for Lena by her enactment of a third Discourse - the Discourse of the caring teacher.

5.3 The Discourse of the caring teacher

Like the Discourse of the competent teacher, the Discourse of the caring teacher emerges in both the interview data and the observation data. However, whereas the Discourse of the competent teacher is the dominant Discourse with respect to Lena's enactment as a *mathematics* teacher, the Discourse of the caring teacher is not subject-specific, emerging in this sense as an overarching Discourse for Lena as a *teacher*. For Lena, the caring teacher sits alongside the competent teacher rather than being in competition with it, and she enacts the two Discourses in parallel or in combination. The caring teacher Discourse depicts the teacher who nurtures students' well-being and values good relationships with them. In the context of teaching, these values are enacted through a focus on students' motivation for learning and their social-emotional well-being. Hence, the Discourse of the caring teacher rests on a figured world in which a good relationship between the teacher and the student is the foundation for learning, with implications for what is considered appropriate subject content and pedagogic approach, including stances on the Conversations of TPO and attainment grouping.

Drawing on the figured world of good relationships as a basis for learning

In the interviews, Lena talks frequently about the importance of having a good relationship with the students. In the first interview, when I asked whether she liked to teach mathematics in attainment groups, she first responds by talking about the role of relationships with students:

> *Regardless of whether I teach in whole class or in attainment groups, I have very good relationships with the students. So, we always have very good, very good maths lessons no matter what.* [24]

Lena seems to be confident that she has a good relationship with the students and that this always leads to good mathematics lessons. Later in the interview I ask her about how she engages the students, and she starts to talk about relationships again:

> *…most of the job I do is to have a relationship with the students…. Getting a ... good chemistry with the students*[25].

Lena's reference to the role of good relationships as "*most of the job*" not only enacts the caring teacher but underlines this figured world of the importance of relationships as a foundation for Lena's identity, not just as a mathematics teacher, but as a teacher in general.

Lena also enacts the Discourse of the caring teacher throughout the observation data, evidenced by her way of talking to the students in a friendly tone, the way she takes time to talk to them and her general behaviour as an agreeable teacher. In all her lessons, as she

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[24] uansett om jeg er i klasse eller nivådeling så får jeg veldig gode relasjoner til elevene. Så vi har jo alltid uansett en veldig god, veldig gode mattetimer uansett.
[25] … det meste i jobben jeg gjør er å få relasjon til elevene …. Å få den … den gode kjemien med elevene.

circulates in the classroom as the students work, Lena frequently stops and asks, “how’s it going?” or “is it easy to understand?”. It appears that she wants to show her supportive interest in the students. These stops are brief, however; she tends not to stop for long or to spend time discussing the mathematics with the students.

Indeed, Lena’s enactment of the caring teacher seems to prioritise relationships over mathematics. She frequently chats with the students about other things than mathematics. One example is from the first lesson in Group 4 when the students are working on Pythagoras tasks. As Lena circulates the classroom, a few girls start complaining to her about food prices in the school canteen being too high. Lena stops and takes time to listen and join in, suggesting that they take it to the students’ council. Later, while the students are still working on problems, some start to ask about when they must deliver an assignment for a different subject. Lena takes time to answer their questions and she also explains a bit about the assignment. Lena enacts the caring teacher in these and other episodes, maintaining the good relationships with the students that are clearly important to her.

Lena’s focus on good relationships is reciprocated in how the students respond to her. One example is from the first lesson in Group 4 when Lena demonstrates Pythagoras. In the following extract she starts to draw a new triangle on the board:

> ***Classroom Extract 5.6***
> *Lena: New task. We draw a new one. We have to use a little imagination here then because I'm not very good at drawing.* (Lena appears to show a bit self-mockery).
> *Filip: Oh, yes. It’s very nice* (Saying it with a jolly tone with a twinkle in the eye).
> *Lena: Thanks* (Lena gives a friendly smile to Filip).

In the same lesson, Lena has pointed out for the students the importance of writing properly, making sure the equals signs are exactly below each other. One of the students asks if they will lose points on the test if they don’t do this, and then Tom continues:

> ***Classroom Extract 5.7***
> *Tom: So you get a bit cross if I don’t?*
> *Lena: I get a bit cross* (twinkle in the eye).
> *Tom: Yes, first I have to learn this then.*
> *Lena: Yes*

There is some banter here in these exchanges, indicating an ongoing friendly relationship between Lena and the students. This interpretation may also be strengthened in that it is Tom who makes this comment, although he is the one who was put aside when he did not manage to follow Lena's teaching of Pythagoras. This friendly way of speaking is also evident in how Lena talks about mathematics in her teaching. She mainly uses a colloquial language of mathematics, with little use of technical terms. For instance, when she explains to the students how they can recognise if a triangle is not right-angled, she points to a triangle drawn on the board, marked with the symbol of a 90-degree angle and says: "And then there won't be a box like this there". Lena's use of this everyday language appears to be a social language she uses with the intention of talking in a way which is similar to the students' language, on their level.

We can understand this overarching focus for Lena on good relationships with students in terms of the Conversation in Norway about care for the whole child as a primary concern: "What is in the best interests of the pupil must always be a fundamental consideration. (…) Teachers must therefore use their professional judgment so that each pupil is given the best possible care within the school environment" (Ministry of Education and Research, 2017, pp. 4, the official English translation). The curriculum also describes the teacher's role and responsibility for facilitating a good teaching environment: "Confidence-inspiring learning environments are developed and maintained by open, clear and caring adults who work in collaboration with the pupils" (Ministry of Education and Research, 2017, pp. 17, the official English translation). The analysis suggests that Lena takes a strong stance on this Conversation, as in her comment that relationships are "most of the job I do", and we can understand this as part of her figured world of good relationships as a basis for learning. She exemplifies this stance in the first interview, when she describes her classroom talk with individual students:

> *So that they feel that it's me they are talking to. That it's not in front of the rest of the class. That it's me and them who have the conversation there… and like the others are not there. And the others are good at respecting that too. So, if anyone else wants to speak, they keep quiet. Now it's this one [student] who gets to talk*[26].

[26] Og … fordi sånn når jeg da spør, hvorfor er det sånn? Så… at dem føler at det er meg dem snakker til. At det ikke er foran resten av klassen. At det er meg og han som har samtalen der og da… også de andre er ikke der. Og det er de andre flinke til å respektere også. Så hvis noen får ordet så er dem stille. Da er det den som får snakke.

Drawing on the figured world of fixed ability

Lena's focus on relationships and care for the students is also evident when she argues about teaching in attainment groups. Talking about the students in Group 4 she says:

> *…with mastery groups, the students might be slightly more comfortable, 'it's quite okay to be fairly good [at mathematics]. Because here everyone is good'. So you don't sit there and not dare to excel because someone else maybe doesn't succeed. Because there are a lot who have felt that way in the classroom. Or that the weak don't dare to raise their hand because there are so many good ones there.*[27]

Lena enacts the caring teacher here; she thinks that the students are more comfortable in homogeneous attainment groups, because of the emotional/psychological protection this affords. They will not be inhibited by self-consciousness, and this applies to both high- and low-attainers. She is concerned to preserve their self-esteem, and notes that her beliefs here are based on experience. Although Lena has also talked about the possibility that students might switch between groups so that they have "the opportunity to stretch if they wish" [28], she also applies the idea of care in the context of students' learning needs, arguing for limited content for the low attainers:

> *…because those in Group 1 might not get as far as Pythagoras with two unknowns ... when we do geometry, but they should at least be able to ..., be able to do well enough on the end of year test anyway*[29].

Reminiscent of how she talks about "the didactics of the weak", Lena enacts the caring teacher in this nurturing of the low attainers, seeing this limiting of the content as enabling them to 'get through' an adequate quantity of the mathematics content, and also enough to "do well enough" on the end of year test and to pass the exam. It is noticeable that she omits to consider the other side of the argument, that there is a potential negative impact of grouping on students, both low and high attainers. Lena's enactment of the caring teacher here acts in the service of the competent teacher, focusing as it does on the idea of targeted needs.

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[27] sånn bedre med mestringsgrupper er at man, elevene blir kanskje litt mer komfortable, at det liksom er litt greit å være litt god. For her er alle gode. At man ikke sitter der å ikke tør å briljere for at kanskje noen ikke får til. For det er det mange som har sittet og følt litt på i klasserommet. Eller at de svake ikke tør å rekke opp hånda for det er så mange flinke der.

[28] … de har muligheten til å strekke seg hvis de ønsker det.

[29] …for at de på gruppe 1 er kanskje ikke innom da Pytagoras med to ukjente … når vi driver med geometri, men at de skal hvert fall kunne …, kunne nok til å klare seg greit nok på tentamen uansett.

Drawing on the figured world of fixed ability, attainment grouping is legitimised for Lena in terms of her competence in selecting limited content in the interest of care for low attainers' well-being.

Lena also cares for Group 4 by supplying them with experiences which she says they like:

> *…they like to do exercises. (…) in a [high-attaining] group, they learn a lot from working on their own (…) And anyway they themselves want to work on practice problems* [30]*.*

The group 4 students are allowed to work on exercises because this is what they like doing. However, what Lena thinks the high attainers want is also in line with her approach to teaching Group 4 as evidenced in the classroom observations. Her enactment of the caring teacher in Group 4 is thus strongly influenced by the fixed ability figured world – what the students say they want is also what Lena likes to teach in her enactment of the competent teacher, in which she takes control in the teaching. As we have already seen, Lena sees herself as being like the students, and this is also evident in her account of how she engages with the students in her lessons with Group 4:

> *And… I get very enthusiastic when students answer correctly. It's a bit like that, yes! And then we cheer each other on a bit and stuff, and that's very good. So, I like to, try to involve as many as possible, get as many hands raised. At the same time, they know that if they don't, they can still be asked. You're not safe [to get away from answering] even if you don't raise your hand. And you dare to answer anyway. So, I wouldn't ask someone who I knew really didn't dare to answer [but] the relationship is such that you dare to answer no matter what.*[31]

Describing herself as an 'enthusiastic' teacher, Lena enacts the caring teacher who engages in the students' work and encourages them to get involved in solving problems. This caring teacher is also evident in how she describes her focus on facilitating a safe classroom culture

[30] de liker å gjøre oppgaver. (…) i hvert fall på høy gruppe, så lærer de masse av å jobbe sjøl (…) Og samtidig så er det oppgaveløsning som dem ønsker sjøl da.

[31] Og … jeg blir veldig entusiastisk når elevene svarer riktig. Det er litt sånn, yes! Og da heier vi litt på hverandre og sånn, og det er veldig bra. Så jeg liker da, prøver å involvere flest mulig, få flest mulig hender opp i været. Samtidig at vi veit at hvis man ikke rekker opp hånda kan man fortsatt bli spurt. Man er ikke trygg selv om man ikke rekker opp hånda. Og man tør å svare for det. Så jeg hadde jo ikke gjort det på noen jeg veit ikke hadde tørt å svare heller. Relasjonen er såpass at man tør å svare uansett.

while challenging the students to take part. She wants to push all students to engage, but at the same time she is clear that she would not press someone to speak.

Lena enacts the caring mathematics teacher differently for the different groups, particularly low versus high attainers. In the post-lesson interview, she explains that the 9th grade teachers at Berg had decided not to work on Pythagoras in the whole class mixed groups, just in the attainment groups:

> *Yes, what we have actually talked about is that we take… we work through [the main content] in the [attainment] groups. And then we have control over what to do in the [mixed] class lessons, either work on exercises… or do something we need for the midyear test … or revision. So … those in group 1… have not started with Pythagoras. There is more plus and minus, multiplication and division. If you (...) try to push it [Pythagoras] on them [Group 1 in the mixed group], the high attainers get [the content they need] … [but it is a problem]. So, then we just …. now we revise for the midyear test [in the whole class groups][32].*

Drawing on the figured world of fixed ability, Lena enacts the competent teacher who maintains control in mixed class lessons by treating them largely as revision lessons. At the same time, she enacts the caring teacher when she explains why they have chosen not to teach Pythagoras to Group 1 – they don't want to "push it on them". Strongly influenced by a fixed ability figured world, Lena argues that teaching Pythagoras only in attainment groups ensures that "the high attainers get theirs", what they need according to their 'level'.

Enacted alongside the competent teacher

As we have already seen, Lena enacts the Discourse of the caring teacher in parallel with the Discourse of the competent teacher. This parallel enactment is most evident in the classroom episodes, for example the episode with Tom in the first lesson in Group 4. When Tom stops Lena in her demonstration and tells her it is going too fast, Lena does not stop; instead, she chooses to take him aside later in the lesson. After she has finished the examples with the whole group, Tom calls for Lena:

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[32] Ja, det vi egentlig har snakka om er at vi tar … gjennomgang i gruppene. Også styrer vi litt onsdagstimene, enten tar arbeidstime … eller noe vi trenger til tentamen… eller repetisjon. Så da blei det egentlig med tanke på at de på gruppe 1 … har jo ikke begynt med Pytagoras. Det er jo mer pluss og minus, gange og dele. Hvis du begynner, i stedet for å begynne da å skal prøve å dytte det på dem og samtidig med at de høye får sitt … Så da har vi egentlig bare,…nå repeterer vi til tentamen.

Classroom Extract 5.8

Tom: Lena, can we go through the task now?

Lena: Now we can go through the task. (Lena sits down with Tom who is sitting at the front of the classroom).

Tom: Look, I drew this one (pointing to the first example on the board), *but not the other two. I just drew the triangle.*

Lena: Okay, Tom. He [Pythagoras] found out this about the squares here, right? From each of the sides. (Lena points to the figure in Tom's book). *And that the area of this, this square* (points in the book) *and the area of THAT square together is the area of that square here. So therefore, we always write that k^2, that is this here square* (points in the book) *plus k^2 which is that square…* (points further in the book)

Tom: Mm

Lena: Is equal to h^2 which is the one there.

Tom: Yes.

Lena: So that's the first thing you can start writing. Always this first. (Illustrates a line in the air). $k^2 + k^2 = h^2$. *ALWAYS this first.* (Tom writes, Lena watches). *Mm. And then we start to push in those numbers we have.*

Tom: Mm

Lena: And what numbers belong here? (Lena points to where Tom has written)

Tom: 3

(…)

Lena: So, if you, this is (pointing to the question done) *what the first questions are about. So if you go to your book and start on the first questions. Then you USE exactly what you have done there*. (Points to his solution of the task in his book).

Tom: Yes

Lena: Just follow it slavishly all the way.

Lena holds on to her procedural approach to teaching Pythagoras in this private episode with Tom. Enacting the competent teacher, she makes sure to guide Tom in how to follow the procedure to solve the problem and write it out correctly. She repeats her earlier demonstration but at a slower pace, enacting the caring teacher alongside the competent mathematics teacher by taking him aside to give him more time and individual attention.

5.4 Navigating different Discourses

This analysis reveals how Lena navigates three different Discourses in her enactment of her teacher identity. We can see how the Discourse of the competent teacher is dominant, primarily driving Lena in her enactment of a mathematics teacher in both the interview data and the observation data. This enactment of the competent teacher Discourse is strongly underpinned by a figured world of fixed ability which is reflected in her account of teaching TPO in attainment groups.

We also see evidence for the presence of two other Discourses – that of the good mathematics teacher, and that of the caring teacher. However, the Discourse of the good mathematics teacher only emerges in the interview data; it is not enacted in the classroom observations, although the students invite Lena to act in this way on more than one occasion. The presence of the good mathematics teacher in the interviews seems significant: Lena's portrayal of the good mathematics teacher is perhaps only presented for my benefit as she sends me the message that she knows how to teach in ways she knows I 'approve' of. At the same time, in the speech where she admits the difficulties of enacting the good mathematics teacher, Lena displays an honesty which suggests that this Discourse is potentially a genuinely espoused Discourse for her, but is one that she finds challenging.

The analysis shows a complexity in Lena which is to do with the relationship between the Discourse of the competent teacher and the Discourse of the good mathematics teacher. In the episode in section 5.2 where Lena says: "I'm not that good at this", we can see how she reflects deeply about the importance of students explaining the mathematics to each other. It is noticeable how she talks about the importance of student explanation across different levels of ability, valuing their different ways of understanding mathematics. This speech is distinguished from the other comments that Lena makes about teaching mathematics and student learning. We have seen how she describes herself as a certain kind of thinker and learner, and also a certain kind of teacher who is good for the students in Group 4. She also talks a lot about being comfortable in the classroom, which for her means teaching in Group 4 - she would not be comfortable teaching in Group 1:

> *And you may have to go down to the practical level, which I don't like. And then I get uncomfortable, and it all just gets messy. So that's one of the challenges I have as a teacher, that I am so bound by rules as I am.*[33]

Lena is not comfortable teaching in ways that she sees as "messy"; she sees this as related to the kind of teacher she is, being "bound by rules". We can also see this avoidance of discomfort and "messy stuff" in Lena's use of classroom discussion. She avoids whole class discussions and potential engagement with Sara or Lukas. Instead, Lena chooses to teach the students one to one. She values students talking to each other, but this entails leaving the talk to the students alone. She does not talk about her own potential role in guiding the discussion; instead, she describes student discussion as an opportunity for her to assess the students, to listen and learn.

We can see that Lena attempts to enact the good mathematics teacher but does not sustain it. She self-limits her enactment in her management of classroom discussion, and arguably too through her perception of herself as a certain kind of teacher – as in her assessment of the students, she accepts her own (fixed) inabilities, as in "I'm not good at this". We can understand this pattern by recalling that, for Lena, the good mathematics teacher is seen through the lens of the competent teacher. This is evident in the way in which the fixed ability figured world is a powerful presence in her general talk, coming through in how she talks about herself, the students, and ultimately how she talks about attainment grouping and TPO. The figured world in which all students are able to learn, with its strong connection to the Discourse of the good mathematics teacher, drops out of Lena's overall way of speaking. There is an apparent conflict between these two figured worlds.

However, Lena also enacts a third Discourse, that of the caring teacher. This Discourse may enter in as a resolution of these two conflicting figured worlds and Lena's problems in sustaining the Discourse of the good mathematics teacher. While the good mathematics teacher appreciates students' potential for mathematics, the caring teacher's emphasis on kindness appreciates the students primarily as people, not as mathematics learners. This is evident in Lena's talk about the importance of having good relationship with the students, which is "most of my job". By enacting the caring teacher Lena can divert her efforts towards nurturing students' social emotional well-being. For Lena, caring about the students' well-

[33] Også må du kanskje ned på det praktiske nivået og som jeg ikke er noe glad i da. Og da blir jeg ukomfortabel også blir det bare rot alt sammen. Mm, så det er jo en av de utfordringene jeg har som lærer, at jeg er så regelbundet som jeg er.

being trumps all other concerns. It remains the case though that this enactment of the caring teacher, while acting as a resolution for her, also calls in the powerful figured world of fixed ability. For Lena, the low attainers do not need an in depth understanding of the mathematics. What they need is just being able to pass the exam. What is more important is that she can make them feel good and enjoy the lesson. Lena ultimately emerges as the nurturing teacher.

Chapter 6. Julie – the “good” mathematics teacher

This chapter explores Julie’s enactment of the Discourse of the good mathematics teacher. It shows how this enactment is strongly influenced by the context of Berg school and Julie’s position as one of the 9th grade mathematics teachers and as a relatively recently hired teacher at the school. Her enactment of the good mathematics teacher emerges clearly throughout the pre-lesson interview, particularly in terms of her self-positioning and an espoused figured world in which exploring mathematics is important in students’ learning. In the classroom observations the Discourse of the good mathematics teacher varies in strength: it is very evident at the beginning of the lessons but we see that Julie does not appear to sustain her enactment as lessons go on, and the good mathematics teacher appears to collapse. Further light is shed on this in the post-lesson interview. The chapter will explore the dynamics of these interruptions to her enactment, which appear to involve both Julie and the students. Nevertheless, the analysis reveals that the good mathematics teacher does not totally disappear from Julie’s enactment as a mathematics teacher.

The good mathematics teacher Discourse depicts a teacher who enables all students to engage with mathematics, and who emphasises mathematical exploration with the aim of discovering connections and deepening understanding. They have good mathematical subject knowledge which enables them to keep an eye on the mathematical horizon as they facilitate productive classroom discussions which include every student. The Discourse of the good mathematics teacher is strongly underpinned by a figured world in which all students are able to learn to the best of their potential, supported by mathematical discussion and learning through inquiry.

6.1 Enacting the good mathematics teacher

As I will show, the Discourse of the good mathematics teacher emerges strongly throughout the whole pre-lesson interview with Julie. This is particularly evident in her focus on research literature, and the related figured world in which all students can learn mathematics through exploration. Julie’s pro-mixed teaching stance on the Conversations about TPO and attainment grouping is a major component of her enactment of the good mathematics teacher, and the particular figured worlds she draws on. Although the Discourse of the good mathematics teacher is mainly enacted in the pre-lesson interview, it is also evident in the classroom observations, but only at the beginning of the lessons.

Positioning in research-based knowledge

In the pre-lesson interview, when Julie starts to introduce herself, she quickly goes on to talk about her recently completed education as a mathematics teacher. Very early in the interview she points out that she has written a master's thesis about exploratory talk in algebra teaching.

> *So…[I] have written a master's thesis in mathematics DIDACTICS. Which was about algebra and teaching. And exploratory talk… in algebra teaching.*[34]

Julie enacts the good mathematics teacher in her self-positioning as a well-qualified teacher, credentialised by having written this master's thesis. This self-positioning is re-emphasised in her continued references to her master's degree later in the interview, as when she replies to my question about what she sees as the ideal mathematics teaching:

> *… so, now I have written a master's thesis… ABOUT this and… about exploratory working methods and… that they get to talk together as well. So… it's very important. And there's… more and more focus on that … eh, yes. Both in, in the literature and otherwise too*[35].

Julie enacts the good mathematics teacher who roots her arguments in theory, drawing on the figured world of the importance of exploratory talk in students' mathematics learning. Her statement that it is "very important" is legitimised by her reference to a growing focus on it which not only appears in the literature but "otherwise too". While she is vague as to what this means, it may be a reference to policy or the Conversation among teachers about "the value" of different teaching approaches in students' mathematics learning. This "otherwise" could also be a reference to her teacher education – she is a recently qualified teacher. Hence, besides valuing research literature Julie appears to pick up on what is happening in the general field of professional thinking about mathematics teaching. At another point in the interview, when I ask her about how students best learn mathematics, Julie once again refers to her master's thesis, and makes its connections to the research literature explicit:

> *Because I wrote a master's not so long ago… then it kind of stays with me that this is about exploratory working methods and… discussion… That was*

[34] Så… skrivi en masteroppgave i matematikk-DIDAKTIKK. Som handlet om algebra og undervisning. Og utforskende samtale… i algebraundervisning.
[35] Både… altså, nå har jo jeg skrivi en master … OM det her og… Det her med utforskende arbeidsmåter og… at dem får prate sammen også. Altså… det er jo kjempeviktig. Og det er jo… mer og mer fokus på det… eh, ja. Både i, i litteraturen og ellers og.

something I read a lot about. That, that's what… helps. … that the students… In a way of they get a bit more ownership … the mathematics. They've been involved and discovered things for themselves. Mm, been involved, have maybe been involved in formulating, connections or rules or… mmm.[36]

This emphasis on theory and research in Julie's talk suggests use of a social language about mathematics teaching which is in line with that of teacher educators. In her argument for explorative teaching and classroom discussions, she also refers to the Conversation about the value of these non-traditional teaching approaches when she says: "That was something I read a lot about. That, that's what… helps". Julie thus enacts the good mathematics teacher by arguing about what is 'the right thing' in mathematics teaching, and what best helps the students, 'proving' her case by rooting it in relevant literature and research.

Drawing on a figured world about learning for all students through exploration

As we can see from the previous quotes, Julie draws on a figured world in which students learn best through exploration as she enacts the good mathematics teacher. This is particularly clear in her use of the words *ownership, involved, formulating,* and *connections* which are part of the social language of the community of mathematics teachers she identifies with. Her enactment of the good mathematics teacher is also evident when I ask Julie to describe what successful teaching means for her, and she continues to talk about lessons which primarily involve student exploration:

But… a lesson where we have WORKED, a little like… a bit different. Yes. Get the students to think a bit differently. That it is a bit exploratory, that they have to… DISCOVER things a bit THEMSELVES. Without me SAYING it. Yes… I think that's nice. Mm.[37]

Julie's use of the words *exploratory* and *DISCOVER things THEMSELVES*, together with her clear stress on particular words emphasises her self-positioning and the fact that she has the

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[36] Siden jeg har skrivi en master for ikke så lenge siden … så ligger det jo litt sånn i meg at det her med utforskende arbeidsmåter og … samtaler … Det var noe jeg leste veldig mye om. At, det er jo det som … hjelper. Eh, altså… at elevene… Dem får på en måte litt mer eierskap til… matematikken. Har vært med og oppdage ting selv. Mm, har vært med, har kanskje vært med og formulere, sammenhenger eller regler eller … mmm.

[37] Men … en time der vi har JOBBA, litt sånn… litt annerledes. Ja. Fått med elevene, til å tenke litt annerledes. At det er litt utforskende, at de har … OPPDAGA ting litt SELV. Uten at jeg har SAGT det. Ja… Det synes jeg er litt fint. Mm.

knowledge to support exploratory teaching. Her emphasis on difference - "… a bit different"/ "Get the students to think a bit differently" alludes to her part in the Conversation about the need to move away from traditional chalk-and-talk teaching approaches, summed up at the end of her speech: "Without me SAYING it". This repositioning of both herself and the students as working together to explore mathematics is also reflected in her use of 'we', (we have worked). In this figured world, students also take responsibility as active participants in learning - "they have to… DISCOVER things a bit THEMSELVES". This repositioning of the students is also evident when Julie describes how she plans to use exploratory activities so that the students themselves discover and develop rules and formulae, understanding how they link to the underlying mathematics:

> *I try, where I kind of see that it fits in ... to maybe have… some activity, a bit, a bit that is exploratory… which leads to what they should ... eh… if it's a rule or formula or… it sorts of leads towards that then. Eh… I'm trying to do that. Mm.*[38]

However, this is not straightforward, and Julie reflects that she could manage this better:

> *But, there… there I kind of see that… there is potential for improvement for me then, at least. ... Actually, be able to actually LINK what they do to the rule they use. So, they see where… see the relevance. Mm. Often, often… there are a lot of students who… want a formula… and then…. do the tasks. Get the answer [the formula] first and then do the tasks afterwards. Mm. (…) It happens that… some students… yes… say that… that they don't understand the point of what we are doing and: 'can't we just get a formula and… just solve tasks?' But at the same time so… yes. It's… it's quite motivating when they get to manage it ... at least a part ...*[39].

She describes resistance from the students to working on the kind of links that she wants to foster - many prefer to "*just get a formula and… just solve tasks"*, favouring the more

[38] Jeg prøver, der jeg liksom ser at det passer… å kanskje ha… en eller annen aktivitet eller litt, litt utforskende… som leder fram mot det dem skal.. eh, … om det er en regel eller formel eller … at det leder liksom fram mot den da. Ehm… Det prøver jeg å få til. Mm.

[39] Men,… der ser jeg liksom at… Det er et forbedringspotensial hos meg selv da i hvert fall. Og litt sånn … Faktisk klare å KNYTTE det dem gjør til den regelen. Så dem ser hvor… ser relevansen. Mm. Ofte, ofte … eller det er jo mange elever som … ønsker seg en formel… og så…. gjøre oppgavene etterpå. Å få svaret først også gjøre oppgaver etterpå. Mm. (…) Det hender jo at … noen elever … ja… sier at … at de ikke skjønner vitsen med det vi holder på med og; kan vi ikke bare få en formel også …bare gjøre oppgaver? Men samtidig så … ja. Det er jo … det er jo litt motiverende når de får til... i alle fall en del ….

traditional approach which they are presumably used to: “want a formula… and then…. do the tasks”. However, Julie enacts the good mathematics teacher by refusing to give the students what they ask for and maintaining her conviction about the usefulness of an exploratory approach – it is ‘quite motivating’ when the students succeed, although it is unclear whether she is referring to herself or the students here. At the same time, she does not see herself as managing this approach to teaching easily - “there is potential for improvement for me”. This reflection also contributes to her enactment of the good mathematics teacher who seeks to improve and develop her teaching practice and indicates her awareness of the figured world she draws on – it is an espoused world and as such is crucial in her enactment of the good mathematics teacher. She appears as reflexive and conscious of her values and aims in mathematics teaching. She is willing to both reflect on and criticise her own teaching, and despite her experience of the difficulties and challenges in enacting this explorative teaching, Julie seems compelled to hold on to it.

The strength of this espoused world for Julie is also evident in how she talks about explorative teaching with respect to the Group 2 students she teaches, the second lowest attainment group. The following quote must be seen in the context of teaching in attainment groups at Berg school, and the common agreement among the 9th grade mathematics teachers that teaching content would be partially limited for the low attainers. It is noticeable that Julie appears to be enormously hesitant in what she says, particularly evident in her overall hesitation and her use of the word ‘maybe’:

> *I have not, I have not had so much exploratory teaching YET… in that group that I teach now. I haven’t. I have had… yes, a bit, but not so much. But that’s always something I want to do… just because it may be a bit more… eh, yes... that they need a bit more variety. A bit more… to make it a bit more motivating. And, yes… And maybe also that they learn things better… if they are allowed to… to explore things then. But of course, it is… It takes a bit… maybe a bit more…* It needs to be pushed a little more into *action*[40].

[40] Jeg har jo ikke, jeg har ikke hatt så mye utforskende opplegg ENDA … i den gruppa som jeg har nå. Det har jeg ikke. Jeg har hatt… ja, littegrann, men ikke så mye. Men det er jo alltid noe jeg har lyst til… nettopp fordi det kanskje er litt mer… eh, ja, .. at de trenger litt mer variasjon. Litt mere… gjøre det litt mere motiverende. Og, ja… Og kanskje også at dem lærer ting bedre … hvis dem får lov til å… til å utforske ting da. Men det er klart, det er… Det krever litt… kanskje litt mere … Det må pushes litt mer i gang.

Drawing on a figured world in which all students can learn mathematics through exploration, Julie enacts the good mathematics teacher by arguing that this approach would broaden the Group 2 students' access to mathematical understanding. She appears confident in this approach but admits that she has not done much explorative teaching in Group 2 yet; it is unclear why exactly this is the case, or why they might not be 'allowed to', but her comment that "it needs to be pushed a little more into action" suggests that explorative teaching is more demanding in Group 2, and that she feels she needs to be more insistent on it in the classroom.

However, it is also noticeable that Julie comments that explorative teaching can "make [mathematics] a bit more motivating", making a shift to the social language of motivation as central to learning, a theme which does not relate directly to the mathematics subject focus of the Discourse of the good mathematics teacher. This social language of motivation may also underlie her argument about the Group 2 students' need for variety in teaching ("they need a bit more variety"), with exploration providing such variety, although this could potentially be a reference to variety as resistance to the agreement that lower attainers should have only limited mathematics content, building on Julie's espoused figured world. Hence, while the analysis reveals a strong espoused figured world, there is also some reserve and potential contradiction in Julie's enactment of the good mathematics teacher. This emerging hesitancy becomes also evident when Julie talks about attainment grouping as I discuss next.

Hesitating about TPO in attainment grouping

Julie's comments must be seen in the context of the common agreement among the 9th grade mathematics teachers at Berg school that they will address TPO through attainment grouping. Although she appears to position herself inside this group of teachers, she simultaneously projects other, contradictory arguments. This first becomes evident when I ask her to explain what characterises teaching in the different attainment groups. Julie focuses on the differing teaching content between the groups, related to the "level":

> *On the weakest group, the lowest… so… there is most focus on the very basic… things. Get in place… yes… both plus and minus and multiplication and division… actually. And the number line and… A bit basic, yes… fractions and percent. Yes. The most basic. So THAT [group] probably, that is,… a lot of the topics that the other groups have… Group 1 does NOT touch at all… actually. (…) Mm, [the three other groups are] quite similar in terms of themes, but a bit different… I have, so I have Group 2, the*

second… the second lowest. Eh… and we… So it [the teaching] will be on a simpler level. Eh… we have not worked on… Now we have had algebra and equations and we have not worked on… that is… we have not worked on the most difficult… things… in that topic then.[41]

In this description of the limited content offered to Group 2 and especially to Group 1, Julie appears hesitant, pausing and saying 'eh' a good deal, and using the modifier 'actually'. Her hesitance becomes more evident in the next extract when she explains how the attainment groups are organised:

…so then we have attainment groups… in those TWO lessons, and… or we started after the autumn holiday. Ehm… and then we try THAT. Yes. It… ehm, with… a third lesson then… separately in the mixed classes ….[42]

Along with her multiple pauses and false starts, her "and then we try THAT", suggests that she is not totally sure about the decision to teach in attainment groups. Julie appears to confirm this hesitance when I ask her if she likes teaching in attainment grouping, and she answers:

I think it [teaching in attainment groups] works well. Mm. But at the same time, it's okay with a little variety. Like we have got.[43]

And she continues to elaborate on this:

… that's maybe… Maybe also a bit because then I have … those who are in Group 2. It's sort of… It goes a bit slow… sometimes. It does. Oh, … Yes, stuff has to be repeated a lot and… It's maybe, maybe a bit more exciting in a way to have a whole [mixed] class. Different… different levels… mmm. (…) Yes. No there are maybe a few more possibilities…? So, but it, DEPENDS a bit on WHAT to… have about then. But… No… So… It's… It's an advantage to have… some strong students… who maybe help to… yes…

[41] På den svakeste gruppa, den laveste… så… er det nok mest fokus på de helt grunnleggende … tinga. Få på plass… ja… både pluss og minus og gange og dele … egentlig. Og tallinje og… Litt sånn enkel, ja … brøk og prosent. Ja. Det mest grunnleggende. Så DEN har nok mange, altså… mange av de temaene som de andre gruppene har… kommer IKKE gruppe 1 innom i det hele tatt… egentlig. (…) Mm, [De tre andre gruppene er] ganske like i forhold til tema, men litt forskjellige … Jeg har, altså jeg har gruppe 2, den nest … den nest laveste. Eh… og vi… Altså det blir jo på et enklere nivå. Eh… vi er jo ikke innom… Nå har vi hatt algebra og ligninger og vi er ikke innom … altså… vi er ikke innom de vanskeligste … tinga… i det temaet da.

[42] … så da har vi nivådeling … i DE TO timene, og … eller vi startet med det etter høstferien. Ehm… også prøver vi DET. Ja. Det… ehm, med… en tredje time da, … som klassene har hver for seg….

[43] Jeg synes det fungerer bra. Mm. Men samtidig er det jo greit med litt variasjon. Sånn som vi har.

push the teaching a bit. (...) It may have something to do with the… the motivation for mathematics isn't, maybe a bit less in general. That they… yes… They [the low attainers] don't quite believe that they can do it themselves maybe. That… that, if they don't immediately see how to work it out, they… maybe give up … a bit easily. Mm, so yes. [44]

Julie's uncertanty is strongly evident in the quote where she both says that attainment grouping works well, but also points out that she thinks it's OK to not just teach in attainment groups. Drawing on a figured world in which all students are able to learn mathematics, she enacts the good mathematics teacher who argues for the advantages of mixed group teaching because it is: "…a bit more exciting in a way to have a whole [mixed] class. Different… different levels…", having the whole variety of students present, including both the low attainers and the high attainers. At the same time, her ongoing use of the word 'maybe' means that Julie does not appear to be very assertive about teaching in mixed groups as the right solution: "Yes. No there are maybe a few more possibilities…?". This uncertainty is compounded in her shift to the social language of motivation in her reasoning of what she sees as challenging in Group 2: "It may have something to do with the… the motivation for mathematics isn't, [is] maybe a bit less in general."

Overall, Julie is highly equivocal in her talk about attainment grouping, as when she describes Group 2 as slow going and that she prefers teaching in mixed groups, but then worries about what happens to the Group 2 students in a mixed group:

So, if… if they [Group 2 students] are in [mixed] groups… with strong students. Then it CAN also, there's a danger that the strong students… kind

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[44] Nei det er kanskje… Kanskje også litt fordi jeg har… de som er på gruppe 2 da. Det er jo på en måte… Det går jo litt trått… iblant. Det gjør jo det. Å… Ja, det må repeteres mye og … Det er kanskje, kanskje litt mer spennende på en måte å ha en hel klasse. Forskjellige… forskjellige nivåer … mmm. (…) Ja. Nei det er kanskje litt mere muligheter…? Altså, men det kommer, KOMMER litt an på HVA man skal … ha om da. Men… Nei atte… Altså … Det er jo… Det er jo en fordel å ha… noen sterke elever … som kan kanskje hjelpe til med å … ja … At de drar undervisninga litt. (…) Men det er jo alltid noe jeg har lyst til… nettopp fordi det kanskje er litt mer… ja, .. at de trenger litt mer variasjon. Litt mere… gjøre det litt mere motiverende. Og, ja… Og kanskje også at dem lærer ting bedre … hvis dem får lov til å… til å utforske ting da. Men det er klart, det er… Det krever litt… kanskje litt mere … Det må pushes litt mer i gang. Det kan jo ha noe med atte… motivasjonen for matematikk ikke er, kanskje litt lavere generelt. At dem… ja… Dem har ikke helt troa på at dem klarer det selv kanskje. At… at hvis det noe dem ikke ser med en gang hvordan dem skal finne ut av, at dem… kanskje gir opp… litt lett. Mm, så ja.

of do everything then. Then the weak aren't allowed to get on PROPERLY. So I hope that we… that they benefit from being in a [attainment] group.[45]

Here Julie draws on the language of strong and weak students which does not fit her usually espoused figured world of potential inclusion for all students. A conflict arises between this pedagogic figured world and a social-emotional figured world which highlights the role of motivation and self-esteem in learning. Julie appears to run into this conflict between the figured worlds in her attempt to enact the good mathematics teacher. Her final: "So I hope that we… that they benefit from being in a [attainment] group", indicates an ongoing uncertainty which she still cannot resolve as she reflects further on the benefits:

> *So it is an advantage that you, that… yes, that you can adjust the LEVEL much easier. Mm, that we don't need to use… that is… we don't need to care so much about the most difficult things. That… maybe they wouldn't have managed that … anyway. So… we have to make sure to get that…*[46]

Drawing on the two conflicting figured worlds, Julie appears to struggle in what she says here. Her references to "adjust to the level" and "we don't need to care so much about the most difficult things" reflect a totally different stance compared to her previous arguments about teaching in mixed groups and the importance of exploration for low attainers. Here, Julie appears to draw on the social language in Berg School which is used to describe and justify the organisation of teaching in attainment groups and its limitation of content for low attainers. The equivocal nature of her remarks seems to be a product of her place and position in the context of Berg school: she positions herself within the group of teachers, and signals that she will not go against their joint decision. This positioning inside the group is clear when she describes how they allocated teachers to different groups:

> *Yes, we have also AGREED on this together. There are some who have… good experience of teaching the weakest students. And then there are some who are better with the strongest students. So then… yes…, but we agree*[47]

---

[45] Altså hvis… hvis dem er i grupper … med sterke elever. Så KAN det jo også, eller det er jo en fare for at de sterke elevene… på en måte gjør alt også. At ikke de svake får slippe ORDENTLIG til. Altså jeg håper jo at vi … at dem har et godt utbytte av å være på en gruppe.

[46] Altså det er jo en fordel at man, at… ja, at man kan tilpasse NIVÅET mye lettere. Mm, at vi kanskje ikke bruker… altså … vi bryr oss kanskje ikke så mye om de aller vanskeligst tinga. Det… ville dem kanskje ikke fått til… allikevel. Altså … vi må sørge for å få på plass det…

[47] Ja, det har vi også blitt ENIGE om i fellesskap. Det er noen som har … god erfaring med å undervise de svakeste elevene. Også er det noen som er flinkere med de sterkeste elevene. Så da… ja…, men vi blir enige.

Her use of ‘we’ and her participation in the joint understanding of who is good at what type of teaching signals her public positioning of herself as party to this decision even though she appears to distance herself from it in the other things she says to me. In the next quote, when she reflects on the issue of teaching permanently in one particular attainment group, her positioning inside the teacher group is not as evident:

> *Yes, for my own part, I think it's okay with a little variety. I think so. But then… I KNOW that there are some who LIKE to stick to THE group they have had as well. Mm. Yes for my own part so… it's okay and…. yes, vary a bit. Mm*[48]

Julie makes a more explicit distinction in this speech between ‘they’ and ‘I’, positioning herself outside the group, although this may be a product of her presentation of herself to me, probably guessing my own stance on the Conversations about attainment grouping and TPO. Her emphasis on variety not only for the students, but also for herself as not wanting to teach only one particular attainment group, is part of her enactment of the Discourse of the good mathematics teacher who prefers to teach students in mixed groups, focusing on exploration for all.

Enacting the good mathematics teacher in the classroom

In the classroom observations, Julie’s enactment of the Discourse of the good mathematics teacher is mostly evident early in the lessons; the analysis reveals an interruption to her enactment as the lessons progress. Turning to the first lesson in Group 2, Julie planned to introduce Pythagoras in accordance with the teachers’ earlier agreement. She had prepared an exercise exploring the mathematics of Pythagoras using GeoGebra, focusing on the connection between the areas of the three squares on a right-angled triangle:

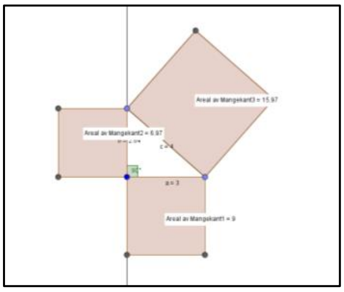


Figure 6.1 Pythagoras illustated on the GeoGebra task

[48] Ja, for min egen del så synes jeg det er greit med litt variasjon. Det synes jeg. Men så… jeg VEIT jo at det er noen som LIKER å holde seg til DEN gruppa dem har hatt også. Mm. Ja for min egen del så … er det greit og …. ja, variere litt. Mm.

The first part of the exercise involved a step-by-step instruction, with a detailed description of 15 steps for drawing the figure illustrating Pythagoras theorem in GeoGebra. The last two questions took a different approach, asking the students to use the drawn figure to explore the mathematics of Pythagoras. By moving around the top point on the triangle, the students were asked to look at how the areas changed and to look for any connections between the three areas (see Appendix 7).

Although Julie was supposed to introduce Pythagoras to the Group 2 students in this lesson, according to the teaching plan, some of the students had nevertheless already been introduced to it in their whole class mixed groups. Consequently, Pythagoras was not totally unknown to all the students. Julie makes a point about this situation when she starts the lesson. She tells the students that although some of them have already worked on Pythagoras in their mixed group, they will do it a different way in this lesson:

> ***Classroom Extract 6.1***
> *Julie: Today we're going to start on Pythagoras.* (Julie writes "Pythagoras" on the board). *Some of you have done a bit on it [Pythagoras] in the lesson [in their mixed group], that is, in your classes, but ... this, we're going to look at (...). Eh, we'll look at one right-angled triangle or we'll look at right-angled trianglES. We will look, we will look at the right-angled, you will get instructions here. But we will look at right-angled triangles, and then we will EXPLORE the right-angled triangles.* (After given this short introduction Julie hands out a worksheet to all the students with no further guidance.)

Julie enacts the good mathematics teacher here in her choice of exercise and her emphasis for the students that they are going to work on the mathematics of Pythagoras theorem through exploration. Her use of the word "but" ("but ... this, we're going to look at…") suggests that this explorative approach is different to the work on Pythagoras some of the students have done in mixed groups, implying that that was a more procedural approach.

Julie's enactment of the good mathematics teacher is also evident in the beginning of the mixed group lesson. In the following extract, which takes place one week before the Covid lockdown in Norway, Julie has planned for a classroom discussion based on the current situation about Coronavirus. Julie starts the lesson by showing a picture of the virus on the board and introduces this as the topic for this lesson. She tells the students to search on the internet to find numbers related to Coronavirus, saying that they will discuss these as a class afterwards.

> ***Classroom Extract 6.2***
>
> *Julie: You've heard of THIS virus here?* (Julie points to the picture on the board). *(...) We'll talk a bit about this and we'll look a bit at NUMBERS, regarding the Coronavirus.*
>
> *Jan: Do we have math now?*
>
> *Julie: We have math. Mm.*
>
> *Jan: Cool*
>
> (Julie changes to a new picture on the board which shows a description of a task. She goes on to tell the students what to do).
>
> *Julie: Eh, you. You can search on the internet, or, and chat a bit around the table, eh, where you sit.*
>
> *Aras: What does this have to do with math? I'm just wondering.*
>
> *Jan: Yes, but it's good, because I don't like math.*
>
> *Julie: Yes, but it has a lot to do with math.*
>
> *Aras: Has it?*
>
> *Julie: Yes, we are going to talk, so there's a lot, you are going to, the first thing you are going to do is to find a number or another that has to do with this outbreak of corona. And then we will talk about it afterwards.*
>
> *(...)*
>
> *Julie: You spend 5 minutes on, or 4 minutes on eh, find a number, and talk about it. And also discuss, what does this number mean? What does it tell you, and the source where you have found that number? Is it trustworthy? Then you can, then you can find, eh, your mobiles, you who put them* there (Julie points to where the students store their telephones), *you can go and get them. Eh, did you understand what to do?* (The students do not give any clear response, but they go ahead and pick up their phones).

Drawing on a figured world of exploratory mathematics, Julie enacts the good mathematics teacher by offering the students this deliberately contextualised task in the highly relevant situation of Coronavirus and intended as a starting point for a mathematics discussion. Compared to the exercise she introduces in the Group 2 discussed above, this task is more open, not having a single answer. The task enables a potential focus on the use of mathematics as well as the meaning of numbers in data representation and thus invites exploration and discussion not only of the mathematics itself but also its relevance in the students' everyday life.

This focus on the relevance of mathematics becomes evident when Aras, one of the students, asks Julie: "What does this have to do with math? I'm just wondering". His question suggests that the students are not used to do this type of task, or this approach in mathematics teaching. Julie's reply that it has "a lot to do with math", does not elaborate, but just continues: "Yes, we are going to talk, so there's a lot …". Although she enacts the good mathematics teacher in her choice of this task, it is not clear what her plan is for its mathematical outcomes, nor is it clear whether she realises the implications of the students' possible unfamiliarity with this type of task and approach. Julie does not give any further instructions to the students, and they start to search for relevant numbers. However, what emerges as the lesson moves on is that Julie struggles in her enactment of the good mathematics teacher, as I show in the following section.

6.2 The good mathematics teacher collapses

As we have seen, Julie's enactment of the Discourse of the good mathematics teacher is strongly evident in the pre-lesson interview and also in the lesson introductions. She chooses exploratory and open-ended tasks, and tries to contextualise the mathematics and invite the students to explore its underlying meanings. In the lesson in Group 2, the good mathematics teacher becomes particularly evident in how she signals to the students, and perhaps also to me as the observer and researcher, that this way of working on the mathematics is not what they usually do at Berg school. However, as the lessons proceed, Julie's enactment of the good mathematics teacher Discourse is interrupted – by Julie herself - and worked against by the students who, as we have already seen, have questioned what a mathematics lesson should look like. The students in Group 2 do not appear to play their part, but Julie herself appears to have problems in sustaining her enactment, switching to a more procedural approach in her teaching. As I will show, if we look back at the pre-lesson interview, there are in fact already signs of this self-interruption and difficulty in sustaining the Discourse.

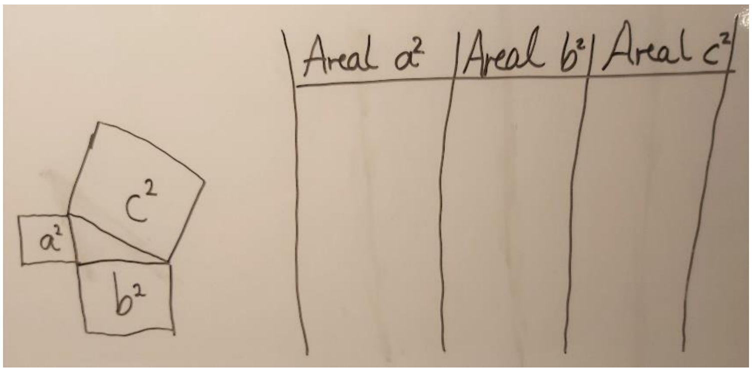
Students work against the good mathematics teacher

Returning to the first lesson in Group 2 on Pythagoras, introduced in the previous section, we re-join the lesson after Julie has handed out the worksheet. Just a few of the students start to work on the task with no more instructions. Most, however, seem unfocused and are talking to each other about things other than the mathematics. Julie ends up circulating in the classroom asking the students to get started with the exercise, and many do not start to work until she arrives at their desk - they are not “self-propelled”. Instead of reading the instructions, they ask Julie what to do. She ends up repeating the detailed description and leading the students step by step through the ‘recipe’.

> ***Classroom excerpt 6.3***
> *Adrian: What’s geometry mode?*
> *Julie: You don’t need, ie you don’t have axes and grids.*
> *Adrian: Okey*
> *Julie: If you open, open eh, at least in version 6 [of GeoGebra], then you get that kind of choice.*
> *Adrian: So just completely blank sheets?*
> *Julie: Yes*
> *Adrian: Mm.*
> *(...)*
> *Julie:* (Standing beside Silje). *Eh, go to settings and choose “show eh, name and value”.*
> *Silje: Like this?* (Silje shows her computer).
> *Julie: Yes, but when you push that* (points to one of the function buttons).
> *Silje: Like that?* (Silje shows to Julie again).
> *Julie: Mm, yes and then you can go to settings, mm, and then change to “name and value”, and then I also want that we call it a.*
> *Silje: a.*

Julie’s initial enactment of the good mathematics teacher who had prepared for an open task to explore Pythagoras theorem appears to be derailed by all these detailed questions about what to do. While we might speculate about what she could have done in these circumstances, and why she does not manage to sustain her planned enactment, what happens may most usefully be understood as part of the wider context of Berg School where, as Julie indicates, a different system or culture of teaching is the norm compared to her espoused figured world of explorative teaching. Her intended enactment of the good mathematics teacher ends up interrupted by a lot of classroom management work. Most of the Group 2 students appear to be unfocused and lacking in motivation and the classroom becomes rather noisy and chaotic. Consequently, Julie uses a lot of time trying to calm students down and keep them focused on the task. Despite this chaotic situation in the classroom, she persists with her plan. Towards the end of the lesson, with just under 15 minutes left, Julie goes to the board and starts to speak to the whole group of students:

> ***Classroom Extract 6.4***
>
> *Julie: Eh now we'll start collecting some information from you. Eh, for now, we have a triangle, which looks like this. And we have three squares. Like that.* (Some of the students follow what is happening on the board. Many are still unfocused.) *Here, eh, everyone has soon, or is about to get a figure that looks like this.* (There is still a lot of chatting in the room, but Julie keeps talking at the board). *Eh, then you have found some areas.* (Julie marks the three areas on the squares and starts to make a table with columns for each of the three areas on the board, but the students do not appear to follow). *Eh, Isak* (Julie has to calm down one of the students). *What you are going to do now is go up to the board and write down in the grid the areas that you have found.* (Some of the students are watching now, others are still unfocused). *But you, Silje, Emma.* (Julie comments to calm the students down). *You should call this side a, and this b and this c,* (Julie writes the names of the sides on the figure on the board. A few of the students follow.), *so that the area here* (Julie points to the figure and then to the columns in the table), *that you write in this here column. So* a^2 *and* b^2 *and* c^2. (Julie writes in the squares). *Okay, please.* (None of the students go to the board). *So just write, bring your computer with you, and just write down the areas you have found.*



Here, Julie enacts the good mathematics teacher in her call for the whole group to gather their answers together and collect them on the board. She emphasises that it is their work ("start collecting some information from you"). However, the students do not play their allotted part in this espoused figured world. They are quieter when Julie starts to talk, but do not appear to be more focused. Sitting in small groups of four, some have their backs turned to the board where Julie stands. Julie constantly stops to call on students who are not paying attention or are disturbing the discussion by name. Finally, she falls into a more instrumental approach to teaching, providing instructions about where to write the different numbers in the table: "You should call the side here a, and this b and this c, so that the area here, that you write in this here column. So a^2 and b^2 and c^2.", abandoning mathematical explanation. However, Julie does not leave her enactment of the good mathematics teacher entirely. When there are seven minutes left, she returns to the board, and tries again to gather the students together to sum up what they have done:

> ***Classroom Extract 6.5***
> *Julie: Eh, what is it, what is the connection between the areas, that is the big task. What is the connection?* (Jens raises his hand). *Jens has seen a connection.*
> *Jens: Yes, but isn't it that the two first, if you add them together, it will become the last one?* (Before Julie responds to Jens, she has to comment on two students who are talking. More of the students do not listen. It is noisy in the classroom).
> *Julie: What did Jens say? The two first, when you add them together it becomes the third. Eh, can you see that?* (Julie is pointing to the three numbers in the grid. Many of the students are not paying attention, but a few look at the board). *Eh, can you see what…* (Julie is cut off by a student asking what time it is). *Eh, but then, do you see it here?* (Julie points to the table on the board). *Eh, do you see that area there* (drawing on the board). *So, do you understand why we call it a^2? So, how do you calculate the area of a square?*
> *Isak: Side multiplied by side.*
> *Julie: Side multiplied by side? Yes, and then you get, a multiplied by a is exactly the same as a^2. Right. Mm. So the area of the one there plus the area of the other there, is equal to, the largest, the area of the largest square.* (Julie is pointing to the three different areas of the squares on the figure). *And that's Pythagoras. It's Pythagoras. On Thursday we will use this here in calculations.*

Julie's question about the "connection between the areas" attempts to keep the focus on the mathematics in Pythagoras theorem, once again enacting the Discourse of the good mathematics teacher. She includes Jens, and also Isak, in her summary, possibly aiming for a whole class discussion, particularly when she asks, "What did Jens say?" and "do you see", despite many of the students still being unfocused. She also asks the students about the meaning of a^2: "So, do you understand why we call it a^2?", inviting further focus on understanding the underlying mathematics. However, her follow-up speech undermines her enactment of the good mathematics teacher as she takes over from Isak, providing a procedural explanation of Pythagoras' theorem.

Not all the students work against Julie. A few, Jens in particular, engage in the lesson. In the second lesson with Group 2, Julie starts with a recap on the previous lesson, asking the students what they had discovered about Pythagoras. After a five second wait, she asks Jens to answer her question. Jens explains the connections between the three squares of the right-angled triangle and Julie draws the figure of the right-angled triangle with squares on the board while he explains. She asks the other students to repeat what Jens has said, but without response. She then goes on to repeat what Jens has said herself:

> ***Classroom Extract 6.6***
> *Julie: Pythagoras, eh Pythagoras applies to right-angled triangles. Are you following? Eh, and we saw that eh, we saw that the area of this one* (she marks the area of one of the squares on the figure) *and the area of this one* (she marks the other square on the figure), *together, became the area of the large one* (she marks the large square). *And that, it's a little quirky thing that Pythagoras', eh, he's at least got the credit for figuring it out. Eh, so we write, when we write it here as a formula. Then we write, we write a^2. Why do we write a^2?* (Julie marks a^2 in the square. Jens raises his hand. It's quiet in the room now, and some of the students are looking at the board. Julie waits 6 seconds.)
> *Mina: a multiplied by a.*
> *Julie: a multiplied a. Mm, why, so what is a multiplied a?* (Julie directs her question to one of the students who is not paying attention). *Why is it a multiplied a?* (Jens raises his hand. Julie writes a^2 and b^2 in the squares in the figure and c^2. She waits 6 seconds before she asks). *Jens?*
> *Jens: You have to multiply the height and breadth which are the two*

different [sides] (...) and then it becomes the square in the term.

Julie: We use a^2, b^2 and c^2 because, so, it's actually about the area of it, of the square that is on each side there (Julie points to the figure). *And a square, what's special about a square?*

Adrian: Oh, square, all the sides are exactly the same.

Julie: Yes. Therefore, it is a multiplied by a which is the same as a^2. b multiplied by b, b multiplied by b is the same as b^2, and c multiplied by c is the same as c^2. So, when we write this formula, we write $a^2 + b^2 = c^2$ (Julie is pointing to the squares on the figure. She writes the formula using the colours green and red matching the colours on the different squares on the figure. Now it is quiet in the room and some of the students appear to pay attention to what is written on the board).

Julie holds on to her enactment of the good mathematics teacher as she tries to lead a whole class discussion despite the fact that many students in the group are unfocused. Her extensive use of wait time rests on a figured world in which all students are able to respond and join the discussion. She focuses on the connections between the areas of the three squares and explaining the meaning of a^2, rejecting the possibility of settling for a procedural explanation when she asks the students to elaborate on Mina's answer "a multiplied by a". Jens' position as an active interested student stands out as important for Julie. She appears to rely quite heavily on him to help her to sustain the Discourse, but nevertheless she doesn't manage to involve most students in this enactment, and for the most part they do not play their part in her attempt to enact the good mathematics teacher. On the contrary, they tend to undermine it, as a result perhaps of the dominant classroom culture at Berg school and the different expectations that this generates. It thus appears that the figured worlds which feed the general culture at Berg School tend to militate against Julie's enactment of the good teacher, with her very different espoused figured world.

Interrupting herself in her enactment of the good mathematics teacher

This situation of the students' unfamiliarity with an explorative approach requires the teacher to establish a different classroom culture. For reasons which we do not know, Julie does not achieve this shift in culture, and in fact often appears to interrupt herself in her attempt to enact the good mathematics teacher. While we can understand her procedural collapse at the end of Classroom extract 6.6 as 'forced' by the students, this is not always the case, as in this extract from the second lesson in Group 2:

Classroom Extract 6.7

Julie: One example on the board, and then you are going to work on some tasks in the textbook. Some tasks. And then we'll summarize a bit, eventually. (...) (Julie starts writing on the board. She draws a right-angled triangle with the length of both the sides on.) *Eh, if this one side is 3 and that other 4, then what is the hypotenuse? Eh, so pay attention. We'll write it down properly so that you have an example, eh, in your rulebook that you somehow can, that you can follow.*

Julie begins by taking a procedural focus in her emphasis on following the example and how to "write it down properly". She continues:

Classroom Extract 6.8

Julie: Always start, always start by writing down this formula. (Julie writes down Pythagoras' theorem). *Write down the formula first. Eh, because if you don't eh, somehow manage the rest, you have at least shown that you understand that it's about Pythagoras. Yes. So,* (Julie points to the formula), *a^2 eh, then we put, so, these two* (Julie points to a^2 and b^2) *these are our sides. So, then we put, we can put 3, so which we put in, 3 or 4 for a or b, doesn't matter that much, because both are sides. Eh, but we can put in 3 for a. Then we write 3 multiplied by 3* (Julie writes on the board), *and, eh, what is b then? If we have called a, that a is 3.* (Jens raises his hand. 4 other students follow). *Jens?*

Jens: Four squared.

Julie: Four squared. Or 4 multiplied by 4. (Julie writes 4 in the formula). *And the c is the one we are going to find out. So, we leave that for so long.* (She writes in c^2). *Eh, 3 multiplied by 3?* (Julie waits 2 seconds).

Adrian: 9

Julie: 9. 4 multiplied by 4? (Julie waits 4 seconds).

Adrian: Eh, 16.

Julie: 16 (Writes 16 on the board). *4 multiplied by 4 is 16, mm.* (Julie writes an equal sign followed by c^2). *Eh, 9 + 16, where are we then?* (Julie waits in 2 seconds).

Adrian: 25

Julie: Then we're 25. (...) Yes. Eh, and now if we know that c^2, if we know

that c^2*, if we know that this one* (pointing to the largest square in the figure) *is 25. What must that side be then?* (Jens raises his hand. Julie waits for 6 seconds). *So, this area should be 25* (Julie points to the figure)*, and we know that it is a square, so that side multiplied to that side must be 25. Two numbers, equal numbers which we multiply and become 25.* (Apart from Jens, no students are responding. The others seem unfocused, some with their backs to the board, others laying their head on the desk. Julie waits for 8 seconds. Then Line raises her hand). *Yes, Line?*
Line: 5
Julie: It's 5. 5 multiplied by 5 is 25. (Julie writes the answer on the board). *So, like, what we actually do is to take the square root. And if we get something other than whole numbers, we have to use square root on either, on a calculator. Square root of 25 is 5. Yes, when we work with Pythagoras you must, you must remember to take the square root. Eh, because we are not, so we are not really interested in the area. We are interested in this particular line.*

Despite her noticeable use of wait time, we see a strongly procedural approach to teaching in this extract: emphasising correct procedure, Julie takes over and leads the explanation of the example herself with minimal focus on students' contributions. Her previous focus on building the connection between the areas of the squares is totally absent here. Furthermore, she makes a surprising departure from what she has said in the pre-lesson interview where she questioned limiting content for the low attainers – here, she seemingly accepts a limitation in the Group 2 students' capacity when she suggests that just writing down the formula is enough. Her comment that then they will have "shown that you understand that it is about Pythagoras" leaves understanding of the mathematics behind and instead treats learning as display. This procedural approach is also evident in her emphasis on how to use the formula ("we put in" the different numbers) and her repeated closed questions and funnelling as she guides the students to the right answer to the task, the length of the side of the square.

This procedural approach is also evident when Julie circulates the classroom. She guides the students through the tasks by asking closed questions or by offering a strategy for following the procedure of Pythagoras theorem. One example is when she talks to Mina about how to find the hypotenuse when two sides are known:

Classroom Extract 6.9

Julie: The point is kind of, the point is to find these areas. So, if this is 5, then is the area of it, this square on the side here then…?

Mina: Is it 5 times 5 then?

Julie: Yes, then it's 5 times 5.

Mina: Then it's 25.

Julie: And this one, 8. 8 times 8 this will be then. Mm. AND then what is the area here? (Julie points to the biggest square on the figure in the book).

Mina: Then I have to calculate this and this (Mina points to the two small areas).

Julie: You have to.

Mina: What is 8 times 8?

Julie: 64

Mina: 64 plus 25?

Julie: mm.

Mina: It will be 89, no.

Julie: Eh, yes, and, eh, but here (Julie points in the book) *89 eh, mm. To find out how long that side is so, you cannot take that in your head. You have to use a calculator to do this. Take the square root of 89.*

Julie's use of closed questions does not invite discussion and, finishing her talk with Mina, Julie moves on to guide another of the students, repeating this procedural approach.

In the mixed group lesson, as already described, Julie introduces an open task where the students are going to explore numbers related to Coronavirus. After the students have presented their numbers and explained how they relate to Coronavirus in different ways, Julie moves straight on without discussion to present a list of numbers she has prepared - the latest reported numbers from WHO about Coronavirus in China and globally. As soon as she has gone through the list of numbers on the board, Julie tells the students that they will use the numbers for calculations on percentages:

Classroom Extract 6.10

Julie: What percentage of the confirmed cases are in China? How do you calculate that?

Maria: Isn't it China divided by globally?

Julie: Yes (Julie writes a formula on the board). *Numbers in China divided* *by numbers globally. (...) Eh, but eh, has anyone calculated the percentage here?* (Julie calls some students by name to get them back on track). *Eh, when we are going to calculate percent, so how many, that is, so this is like a magic word then.* (Julie points to a word in the text). *OF. (...) Eh, when we're going to find percent, so look for this little word here; OF. Because that says something about what we are going to, so what we are going to find the percent of. Eh, and that, that is, so what percentage OF the confirmed cases. That means that we should have this eh, below here* (Julie points to the denominator in the formula). *We are going to find those who are IN China* (Julie points to the numerator) *of ALL in total (Julie points to denominator). So, this little word, sort of shows what should be below the fraction line. (...) Eh, so, but numbers in China* (Julie writes down the number of the numerator in the formula), *divided by numbers globally* (writes the number of the denominator in the formula). *Eh, Maria, did you calculate?*

Maria: Eh, yes it was ninety-one point two seven.

Julie: 91% (Julie writes the answer on the board).

Julie prepares the students to work on percentages by using numbers relating to the real Coronavirus situation; as noted above, this fits with an enactment of the good mathematics teacher. However, Julie rapidly moves away from this enactment and interrupts herself by not opening up for discussion or exploration of the numbers. Instead, drawing on a figured world in which learning mathematics is achieved by solving tasks and using formulae, she switches to a strongly procedural approach, asking the students how they calculate percent and accepting Maria's answer, writing down the formula on the board: "Numbers in China divided by numbers globally". This procedural focus is compounded by her explanation of how to best read a mathematics text, by identifying the right numbers to put into the formula, helped by the 'little word' *of*. Although this emphasis on the meaning of the word "*of"* can be explored to understand the underlying meaning of percentage, Julie does not take this conceptual focus, instead focusing on how to identify the right numbers to insert into the formula. At the end of this extract, she asks only for the result of the calculation without any further discussion, once again interrupting any enactment of the Discourse of the good mathematics teacher.

Julie maintains this procedural focusing on calculation and correct use of formulae throughout the lesson. Later, she also picks out the numbers the students need in another calculation:

> ***Classroom Extract 6.11***
> *Julie: Try to figure it out. What percentage of those confirmed sick have died? If we take China first then.* (Julie writes on the board). *There are so many [numbers presented], so that's the number you should use. And that number.* (Julie underlines the relevant numbers in the text). *2873 died out of 79968.*

In this extract, Julie appears purely concerned about where to place the numbers in order to calculate the right answer. Her account is only partly correct in that she does not include multiplying the fraction by 100 to convert it to percent. Overall, Julie does not try to involve the students in explanation or discussion of the calculations, but rather leads the calculation herself. Her intention to work on exploring numbers collapses into this strongly procedural teaching which appears to be purely caused by Julie herself, rather than being a product of classroom management problems.

Conflicting figured worlds in the pre-lesson interview

As we have seen, Julie does not appear to sustain her enactment of the good mathematics teacher Discourse in the classroom. In fact, this is also evident in the pre-lesson interview where she makes a sudden shift to describing explorative teaching as the ideal, but also one way among others:

> *So… so ideally it is, there are a lot of things really… you SHOULD INCLUDE. (...) Eh… so it's an ideal… to get those things [exploratory working methods] included then. But at the same time, there must be training and practicing as well. Mm. So… a good combination*[49].

Her stress on *"should include"* when she talks about explorative mathematics teaching here indicates conflicting figured worlds in contrast to what she has previously said about the importance of exploration. In her discussion of explorative mathematics teaching as an ideal, she appears to distance herself from it, and she more or less leaves the good mathematics teacher behind when she points to "training and practicing" as an important part of teaching.

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[49] Altså… sånn ideelt sett så er det jo, det er jo veldig mange ting egentlig…du BØR FÅ MED. Eh… så det er jo et ønske… å få med de tinga [utforskende arbeidsmåter] da. Men samtidig så må det jo terpes og øves også. Mm. Så … en god kombinasjon.

Her enactment now appears to be more in line with the traditional mathematics teacher, drawing on a figured world which values training and practice, with exploratory learning as just one type of activity among others. This shift is also evident in her talk about the importance of variety in teaching:

> *I try to… trying to vary. Yes. You do that. Trying to vary a bit. Yes… different ways of working. Sometimes it's like… yes, more traditional … I talk, or write a bit on the board, and then they write in their rule book, and then this is followed by practicing on solving tasks. Other times … we work on a bit more realistic tasks… or yes, on the PC as well…. Sometimes… sometimes I find some resources… on the PC. Mm. They have to learn GeoGebra. Mm. Yes, and … sometimes I put in, put in some activities like … bingo and… They really like it. So, it's…, a lot of them have a BIG competitiveness. So, it's always, it's always fun. It engages! Yes. Very.*[50]

This speech is very different from what Julie says in the rest of the pre-lesson interview, which is characterised by her espoused figured world of explorative mathematics teaching. In this description of variety in teaching, with its explicit reference to traditional methods of demonstration on the board, student practice and use of rule book, Julie draws on the social language of motivation as central to learning, generating a need for 'fun' activities, games and competitiveness. Here, Julie clearly dissociates herself from the Discourse of the good mathematics teacher who emphasises exploration and intrinsic conceptual challenge. It is unclear why she does this, although we have some evidence that she feels she needs to improve her technique in guiding exploratory talk. In addition, as we have seen her problems in sustaining this Discourse may also have their roots in the conflicting figured worlds which circulate in Berg school and affect her position there.

6.3 The good mathematics teacher resigns

Given the eventual collapse of Julie's enactment of the Discourse of the good mathematics teacher, mainly emerging in the classroom observation, the post-lesson interview is important to get Julie's own reflections on her teaching. Surprisingly, what emerges in the analysis of

[50] Jeg prøver å … prøver å variere. Ja. Man gjør jo det. Prøver å variere litt. Ja… ulike arbeidsmåter. Noen ganger er det liksom … ja, mere tradisjonelt med … at jeg forteller, eller skriver litt på tavla også skriver de i regelboka, også er det oppgaveregning etterpå. Andre ganger så… kan vi jobbe med sånn litt mer faktiske oppgaver… eller ja, på pc også … Iblant… iblant finner jeg noen ressurser … på PC. Mm. GeoGebra skal de jo … lære seg. Mm. Ja, også … hender at jeg legger, legger inn litt sånn aktiviteter… bingo og … Det er de veldig glad i. Altså det er…, det er mange som har STORT konkurranseinstinkt. Så det er alltid, det er alltid morsomt. Det engasjerer! Ja. Veldig.

this interview is a possible absence of the Discourse of the good mathematics teacher. Instead of reflecting on her attempts to carry out explorative teaching as we might expect, Julie switches to talking about the role of students' motivation in learning and appears to take a nurturing approach, although some traces of the good mathematics teacher remain.

Taking a nurturing approach in the mixed group

When I ask Julie about the three lessons that I have observed, she starts by summing up the lesson in the mixed group and elaborating on her plans for this lesson:

> *Eh, yes. No, I think, eh… so… the lesson I had in whole class on Monday… I think, that one went pretty well. Eh, it was in a way what I had planned for, that there should be some discussions. Yes. (…) Yes, so it's a bit because… so it's [Covid19] very relevant. And the students have many questions. Yes, they have had many questions in the weeks before… about, about the Coronavirus and how dangerous it is and such. So, I thought it was time to simply take it here. And also… because that's third lesson on Monday … it's also a lesson where they… So, it's just before lunch. Eh and they are not always so motivated to sit down with math problems. So, to spend the lesson on a bit more kind of, talk a bit more instead. (…) So, we talked a little bit about percent. Percent was absolutely… This with… Yes, what percentage does and stuff like that. How many people become infected and yes, are assumed can be infected and… Mm. So that they could talk a bit about percent was also one of the purposes then.*[51]

Julie's initial description of her planned discussions may indicate an intended enactment of the good mathematics teacher, but as she goes on she appears to lose sight of the mathematics. First although she has planned to situate the mathematics in a highly relevant theme, she says nothing about a mathematical discussion, instead referring to the need to talk about Coronavirus in general. Secondly, her reason for using discussion is that the students are less

[51] Eh, ja. Nei jeg syns jo…, eh…altså … Den timen jeg hadde i hel klasse på mandag… den synes jeg, altså den gikk ganske greit. Eh, det var på en måte det jeg hadde lagt opp til at det skulle være litt diskusjon. Ja. (…) Ja, eh… Altså det er jo litt fordi… altså det er jo veldig aktuelt. Og elevene har mange spørsmål. Eh… nå var, ja… De har hatt mange spørsmål i ukene før … om, om Koronavirus og hvor farlig det er og sånn. Så jeg tenkte at det var på tide rett og slett… og ta det her. Og også … fordi at mandag tredje time … er også en time der dem… Altså det er rett før lunsj. Eh… og dem er ikke alltid så motivert til å … sette seg ned med matteoppgaver. Ehm, så å bruke timen på litt sånn snakke litt mer i stedet. Også matematikkfaglig da, jeg tenkte hvilke områder er det du på en måte… Altså vi prata litt om prosent. Prosent var jo absolutt… Det her med… Ja hvor mange prosent dør og sånt. Hvor mange som blir smitta og ja antas kan bli smitta og… Mm. Sånn at dem får snakke litt om prosent var jo også en av hensiktene da.

motivated to work on *math problems* in the lesson right before lunch: “they are not always so motivated to sit down with math problems. So, to spend the lesson on a bit more kind of, talk a bit more instead”. Instead of enacting the Discourse of the good mathematics teacher focusing on discussion of the use of number data, how data is represented, and what percent means, she takes a nurturing approach, planning for a lesson with *less* mathematics - discussion is a way to “avoid” “math problems”. This disconnection from the good mathematics teacher is also underlined when Julie describes her plans for the work on percent: “talk a little about percentage was also one of the purposes”. She does not give a pedagogic account of how she intended to unpack the concept of percent in connection to the Covid context. Her “I think, that one went pretty well” seems to lack the reflection we might expect.

This shift to a nurturing approach is also evident when Julie refers to a particular contribution from one of the boys, Frank, who also is one of the Group 1 students:

> *Then I think… that everyone has something to BRING IN, regardless of whether they are strong or weak. Mm. Yes, one of those who… Or he who answered that… ‘Yes it’s called Covid19’, and I have not realized that it is because it was 2019. But he who knew it, he is one who… is in Group 1 and who don’t tend to say much in class at all. So it… then I was very happy… when he could contribute a bit. Mm So yes. You have to try to plan for conversations… where everyone can contribute*[52].

Julie begins this speech with what seems to be a reference to a figured world in which all students are able to engage with mathematics and contribute to the lesson. However, as she goes on to describe Frank’s contribution, she takes a clearly nurturing approach in which she draws on a figured world of fixed ability, assuming only limited possibilities in mathematics for Frank, pleased that he can “just say something” in the lesson even though he is a Group 1 student.

[52] Eh, da tenker jeg atte… altså der har alle noe å komme MED, uansett, om dem er sterke eller svake. Mm. En … ja, en av de som … Eller han som svarte at… Ja det heter jo Covid19, og det har ikke jeg fått med meg at det er fordi det var 2019. Men han som visste det, det er en som… er på gruppe 1 og som ikke pleier å si så mye i klassen i det hele tatt. Så det… da blei jeg veldig glad… når han kunne bidra litt. Mm. Så ja. Man må jo prøve å legge opp til samtaler …der alle får bidra.

Drawing on a figured world of social-emotional bases of learning

Giving an ironic smile when she sums up the lessons in Group 2, Julie does not appear to be satisfied with how these lessons turned out. Instead, she focuses on the students' lack of motivation, with particular reference to the second lesson in Group 2. What Julie says about these lessons must be understood in context: the second lesson happened to be the last mathematics lesson organised in attainment groups this school year for the 9th grade. Because of this situation the three other attainment groups were going to have a different lesson, [kosetime], to play games and do other things than working on mathematics. However, because of the timing of my classroom observations, Julie had planned for an ordinary mathematics lesson in her own group. In the context of her initial plan of exploring the mathematics of Pythagoras theorem in these lessons, Julie almost appears to resign in what she says in this speech:

> *Eh… while the lessons I have had in [attainment] group [2]… this week… they may not have been so* (smiling) *so successful* (smiling) *to put it that way. (…) Yes, no, so… On Monday we worked in GeoGebra. Ehhh, and I really had a hope that we would, things would go a bit faster. That they… had done, eh had such a proper summary and review… at the end of the lesson. Eh… So we didn't make that. So that ... happened now. … in the lesson we had today. Ehhh, today they were very unmotivated. Due to that, it was the last lesson in the [attainment] group and all the other three groups were to have [kosetime]. So it was EXTRA little motivation today. You noticed that well. Eh… but at the same time, so we… Some of them did SOME tasks. They did. Ehm, yes. So all in all, hopefully they have … got some clue about what Pythagoras is about then. And it was… the goal that they had… that all the groups have, or at least Group 2, 3 and 4 … had gone through Pythagoras ... before we returned to the classes again. At least a bit. Mm*[53].

[53] Eh… mens de timene jeg har hatt i gruppe … denne uka … de har kanskje ikke vært så (smiler), så vellykka (smiler) for å si det sånn. (…) Ja, nei altså … På mandag så jobba vi jo i GeoGebra. Ehhh, og jeg hadde jo egentlig et håp om at vi skulle, ting skulle gå litt raskere. At de … fikk gjort, eh hatt en sånn ordentlig oppsummering og gjennomgang … i slutten av timen. Eh… Det rakk vi ikke da. Så det …. blei nå. … i timen vi hadde i dag. Ehhh, i dag var de veeeeldig lite motiverte. På grunn, det, det var siste time i gruppe og alle de tre andre gruppene skulle ha kosetime. Så det var EKSTRA lite motivasjon i dag. Det merka man jo godt. Eh… men samtidig, altså vi … En del av dem fikk gjort NOEN oppgaver. Det gjorde dem. Ehm, ja. Så sånn alt i alt så har dem forhåpentligvis … fått med seg litt sånn hva Pytagoras handler om da. Og det var… målet atte dem hadde

Julie's comment that her aim for the first lesson was to have "a proper summary and review at the end of the lesson" may signal her initial attempt to enact the good mathematics teacher aiming for a full discussion following the students' exploration of Pythagoras theorem. However, she leaves the good mathematics teacher behind as she continues to sum up these Group 2 lessons. First, she says: "… today they were very unmotivated" to account for why the lessons did not turn out as she had planned. As she continues - "Some of them did SOME tasks", and "hopefully they got some clue about Pythagoras" – she almost resigns her enactment of the good mathematics teacher here as she appears to accept the limitations in Group 2. Julie merely recounts how she has "ticked the boxes" in line with the agreed content differences between groups at Berg school - Group 2 has gone through Pythagoras and the students have done some tasks. In saying that the aim was to "go through Pythagoras" she indicates lower expectations for the students' mathematics learning compared to what she might hope from an explorative approach. Instead, she draws on the figured world of social-emotional bases of learning and the social language of motivation in learning to validate what has happened in the lessons.

Summing up the lessons in Group 2, Julie draws even more heavily on the issue of motivation:

> *So it is… I must admit that it is… I find it difficult to motivate this group. Absolutely. Eh, ... basically it's… we are … 23 students that… So SOME of them ARE interested in working. But most of them are those who slack off a bit. So… in the [mixed] classes it is maybe, ... then they are kind of… then you have… a greater breadth then. Then there are many who do a lot and do what they are supposed to and who take part and do all the hard work. Here it becomes an accumulation in a way. I had… Yes, many who are not that motivated… And that's a challenge. Mm.*[54]

Drawing on a figured world of fixed ability in the context of motivation, Julie describes the Group 2 students as one homogeneous group in terms of motivation. Her emphasis that

… at alle gruppene har, eller i hvert fall gruppe 2, 3 og 4 da… hadde gått gjennom Pytagoras ... før vi gikk tilbake til klasser igjen. I hvert fall litt. Mm.

[54] Altså det er… Jeg må jo innrømme at det er … jeg synes det er vanskelig å motivere denne gruppa. Absolutt. Eh, altså, eh.. Det er jo i utgangspunktet så er jo vi da samla … 23 stykker som… Altså NOEN av dem ER interessert i å jobbe. Men en god del av dem er jo de som sluntrer litt unna. Det… I klassene så er det jo kanskje, altså … eh, da er dem jo på en måte… da har man jo …en større bredde da. Da er det jo en god del som gjør mye og gjør det dem skal og som er med og drar lasset litt. Her blir det en opphopning på en måte. Jeg hadde … Ja, av mange som ikke er så motiverte… Og det er en utfordring. Mm.

“SOME of them ARE interested in working” highlights these students as an “exception to the rule” - “most of them are those who slack off a bit”. Ultimately, Julie describes as the challenges of teaching in Group 2 as due to the fact that they are as a group less motivated.

Positioning outside the group of teachers

What emerges through this analysis of the post-lesson interview is how Julie draws on the figured world of social-emotional bases for learning to explain why the Group 2 lessons did not turn out as planned, due to what she sees as the students’ fixed state of motivation. Drawing on the social language of motivation, she appears to see the students’ lack of motivation as an external obstacle. She does not appear to reflect on her own role in this situation. However, Julie also brings up another ‘external’ factor in her account of what made the lessons in Group 2 more difficult. She points out the challenge of introducing Pythagoras to Group 2 when many of the students had already worked on Pythagoras in their mixed groups. She alludes to the agreement among the teachers at Berg school about what to teach in the different groups:

> *Yes, we had… They have an… eh… on Wednesdays so the other… classes have… ehm, have math classes then. So yesterday, then it was… then it was, I know the others went through Pythagoras a bit too. Yes. (...) In the classes we have… we have spent some time on GeoGebra and use of digital tools, in the classes. Then we have had a bit more of geometry and Pythagoras now in the groups. Eh… but yesterday so… Yesterday they [the other teachers] probably found out that it was the time to do a bit of extra Pythagoras… So that was why it [the topic of Pythagoras] was a bit doubled up.*[55]

There are strong indications of positioning in how Julie uses the words *we, they, I,* and also *the others* in this speech, which is in fact quite difficult to follow because of these switches. Although she begins with ‘we’, she changes to talking about ‘they’ (“Yes, we had… They have an”), seeming to position herself outside the group of 9th grade teachers. This suggestion is underlined as she continues: “I know the others went through Pythagoras a bit too”. She does not appear to see herself as totally belonging to the group. This outsider positioning is

[55] Ja, vi hadde… De har jo en… eh… på onsdager så har de andre … klassene … ehm, har mattetimer da. Så i går, så var det… da var det, veit jeg at de andre gikk gjennom Pytagoras litt da og. Ja. (...) I klassene har vi… Vi har brukt litt tid på GeoGebra og bruk av digitale verktøy, i klassene. Så har vi hatt litt mer sånn geometri og Pytagoras nå i gruppene. Eh… men i går så … I går fant dem vel ut at det var på tide å ta litt ekstra Pytagoras… Så det var jo derfor det blei litt dobbelt opp.

also evident when she says, with a suggestion of irritation that "they probably found out that it was the time to a bit of extra", referring to how the other teachers have gone back on the agreement about the teaching content in the different groups. She seems to see this sudden decision on the part of the other teachers to teach Pythagoras in the mixed groups as making it more difficult for her to teach Pythagoras in Group 2, arguing that this "double up" made many of the students less motivated.

Julie's positioning here as 'being outside' must also be seen in the context of the organisation of the mathematics teaching at 9th grade at Berg school. Although all lessons in attainment groups happened in parallel, the mixed group lessons did not - for the three other teachers, mixed group lessons also happened in parallel, but Julie's mixed group lesson did not. Thus Julie was more dependent than the other teachers on everyone keeping to the plan, and the possibility and potential impact of being positioned as an outsider was amplified. This positioning may partly explain why Julie resigns her enactment of the good mathematics teacher and her espoused figured world of inclusive exploratory mathematics learning.

Despite this resignation, there are some traces of the good mathematics teacher in what Julie says at the end of the interview. This happens when she talks about different levels of motivation in the different attainment groups; although this seems to draw on a figured world of fixed ability, she says:

> *But at the same time, the students are VERY different, even if it is in a mastery group then. Eh, and there is a difference, yes, different how motivated they are to work and... Difference…, even though they are ALMOST at the same level… they are still different. Mm.*[56]

6.4 "Talking the talk" of the good mathematics teacher

Julie's enactment of the Discourse of the good mathematics teacher is strongly evident in the pre-lesson interview but also in her teaching, particularly at the beginning of her lessons. This enactment is strongly underpinned by a figured world in which all students are able to learn to the best of their potential, supported by mathematical discussion and exploration. However, as we have seen, Julie's enactment of the good mathematics teacher seems to collapse during the classroom observations, where she is interrupted by the students but also by her own actions -

[56] Men samtidig så er jo elevene VELDIG forskjellige selv om det er en mestringsgruppe da. Eh, og det er forskjell, ja, forskjellig hvor motivert de er til å jobbe og … Forskjell…, selv om de er NESTEN på samme nivå… er de allikevel forskjellig. Mm.

she struggles to sustain it. This struggle is in fact signalled in the pre-lesson interview, but much more noticeable is the way that Julie draws on her espoused figured world of explorative mathematics learning for all students, referring to the research literature and arguing “that's what helps” students in their mathematics learning. In the post-lesson interview the good mathematics teacher resigns, and Julie switches to drawing on a social-emotional figured world, focusing on the issue of the students’ motivation as presenting problems in her lessons.

The analysis reveals the importance of understanding Julie’s story in context of Berg school and the group of 9th grade mathematics teachers, and the conflict between this context and her espoused figured world of explorative teaching. Julie’s story thus turns out as a strong story of positioning, and we can hypothesise that she wants to be a different teacher within Berg school. There are various places where we can see evidence of this positioning, for instance when she describes the explorative approach to teaching that she prefers as somewhat unusual. Her positioning may be even more evident when she argues about the potential of explorative teaching for the Group 2 students, saying that “these students need more variety” and “maybe also that they learn things better” – suggesting that she will teach the Group 2 students in a different way from that they are used to. She does not overtly criticise the other teachers, however, emphasising her participation in the commonly teaching plan and the decision to group by attainment. Julie positions herself inside the group of teachers, but at the same time her uncertainty about teaching in attainment groups positions her as an outsider. This outsider position becomes more evident in the post lesson interview in her irritated description of the “double-up” episode of Pythagoras teaching.

Based on this evidence, we can see how Julie may position herself as a different teacher at Berg school. She has her espoused figured world of explorative teaching which she wants to enact through the Discourse of the good mathematics teacher. However, she struggles to realise this enactment within the context of Berg school: the students work against her, and do not play their role, presumably because of the ‘normal’ classroom culture and the context of Berg school. At the same time, Julie does not make it easy for the students to participate in her teaching. For whatever reason, she has problems establish the classroom culture she wants and she fails to give the students the guidance they need to explore mathematics or engage in classroom discussion. Although she picks topics such as the Coronavirus, she misses opportunities for discussing the related mathematics. Her consequent procedural approach undermines her desired enactment and the disconnection between what she wants to do and what she ends up with results in the resignation of the good mathematics teacher in the post-lesson interview in exchange for the teacher who operates on a figured world of social-emotional bases for learning. In her enactment of the good mathematics teacher, Julie knows how to talk the talk, but she is prevented – and sometimes prevents herself - from walking the walk.

Chapter 7. Jon – the old timer mathematics teacher

This chapter explores Jon's enactment of the Discourse of the old timer mathematics teacher who has long experience of teaching in a range of situations and has learned some practical wisdom. This long experience gives the old timer authority in the profession, both among other teachers and among students; he 'know what to do' and can be relied on in most situations. In terms of policy and practice trends in education the old timer has 'seen it all' and can take a more detached view of these trends. The old timer mathematics teacher can also be seen as the 'complete' teacher, someone who can be a good mentor and advisor to younger or less experienced colleagues.

Jon's enactment of the old timer emerges in his strong performance of the Discourse as enacted through language and actions which are associated with a particular 'Socratic' character who 'lectures' students and drives their understanding through carefully chosen questions. His overall enactment of the Discourse is underpinned by a figured world in which explanation is crucial in mathematics learning. Associated with this figured world are other figured worlds which prioritise careful teacher questioning and student exploration in the development of understanding.

While this self-positioning and the performance of the old timer mathematics teacher is striking in both the classroom and the pre-lesson interview, there is another side to Jon's enactment which draws on a long-term view of education and his role as a teacher. We see an alternative figured world which is focused on the need to educate 'the whole child' and a prioritisation of student-teacher relationships. Jon ultimately appears to be mostly concerned to support his students in developing the skills for a good life – hopefully remembering him as an important teacher in their lives.

7.1 Positioning and performing as the old timer mathematics teacher

As I will show, Jon's enactment of the old timer mathematics teacher emerges throughout the pre-lesson interview and the classroom observations in what appears as an undiluted positioning and performance of the Discourse of the old timer mathematics teacher. This takes a particular form in his enactment in terms of his alignment with a 'Socratic' lecturer character, drawing on twin figured worlds of the importance of explanation and the need to build on student understanding through questioning. His enactment of the Discourse of the old timer mathematics teacher emerges explicitly in *what* Jon says, but also it emerges in *how* he talks and acts. In this sense, Jon both *positions himself* as an old timer in his comments about his teaching, and *performs* the old timer in his manner of speaking to me and to the students, as well as in his actions in the classroom. There are two components to Jon's self-positioning in the old timer Discourse. First, he stresses his many years of teaching mathematics, frequently referring to his 'age'. Second, he presents the idea that his long-term knowledge of and interest in mathematics underpins a deep understanding of mathematics, which enables him to be good at explaining – and 'lecturing' on - mathematics in the classroom.

Learning over the years

> *When I started as a teacher so… I think a lot of teachers suffer from, "I should, I should try to show HOW good a teacher I am…" But as you start to get old* (Jon says this with a twinkle in the eye) *… then you are not so concerned with what people think of you, if you…, I, I have my assurance … I'm… I'm very good at teaching maths…*[57]

Jon's self-assurance as a mathematics teacher has been strengthened over the years. He no longer has to show that he is good. He has not only taught for twenty years but also "been involved in" multiple reforms, courses and development programs:

> *So I have been involved in … quite a lot of such internal reforms and such in mathematics teaching then. Everything from the "step-model" to grouping by level and … mixed classes … Yes.*[58]

He positions himself here as having 'been there, done that'. He has seen various emphases on teaching approaches which he implies are fashions ("everything from the "step-model" to grouping by level and … mixed classes"). He presents himself here as being able to take the long view, setting himself apart and able to put it all into perspective.

Looking back on his long experience as a mathematics teacher, Jon reminisces on how he has learned to focus on students' understanding rather than his own, as was the case earlier in his career. This is all indicative of his maturity, he says:

[57] Når jeg begynte som lærer så … tror jeg veldig mange lider av jeg skal, jeg skal prøve å vise HVOR flink lærer jeg er… Men etter hvert som du begynner å bli gammal (he,he)… så er du ikke så opptatt av hva folk synes om deg, om du…, jeg, jeg har min trygghet… Jeg er … Jeg er veldig god i å lære bort matte…
[58] Så jeg har vært med på … en god del sånne interne reformer og sånt i matematikkundervisninga da. Alt fra stigeløpet til differensierte… nivådifferensierte grupper og… reine klasse… Ja.

Before when I was younger, I thought that THIS is the way to do it… But the older you get, the more you see that ... you have to see where the student is… And this is Kierkegaard; if you, if you're going to help some people then you have to start where THEY are. And then we can develop. Eh… and it's a bit like… that's the solution to all work of help [hjelpekunst]. To see how…. But that's for sure maturity. Which comes with age. You don't have that as a recent graduate, I think. Eh, or as a younger… because then…, then… I think you get caught up in different, one direction… And that I think you… that one you are confident with, that's good and that's what you do.[59]

Referring once again to his age (although he is perhaps only in his late forties), Jon positions as the old timer who has an edge on the recent graduate. This is because – referring to Kierkegaard's argument that "if you're going to help some people then you have to start where THEY are" – understanding how students think is something that only comes with experience. Jon elaborates on this change later in the pre-lesson interview:

Before, I was probably more concerned about talking as much as I COULD. Now I'm probably more concerned with listening… and understanding what the students… don't manage… And then try… to ask active questions… but… "how would you start off if you had to try?" and then try to guide like that. Optimally speaking. But otherwise, so, otherwise it is a lot about visualising and drawing.[60]

Again, he compares his listening self now to the young teacher he was. Jon also talks about the value of students discussing with each other:

…when the students find out things TOGETHER and get aha-moments… where we teachers are more passive, standing back and observing and

[59] Før når jeg var yngre så gikk jeg inn og tenkte at DETTE er måten å gjøre det på… Men jo eldre du bli, jo mer ser du at... du må se hvor eleven er… Dette er jo Kierkegaard; skal du, skal du hjelpe noen mennesker så må du begynner der DE er. Og så må vi utvikle oss. Eh…, og det er jo litt sånn … det som er fasitsvaret på all hjelpekunst. Det å se hvordan…. Men det er modenhet altså. Som kommer med alderen. Den har du ikke som nyutdannet tror jeg. Eh, eller som yngre… for da…, da… tror jeg du henger deg opp i forskj, en retning … Og den tror jeg du… den er du trygg på, den er god og den gjør du.

[60] Før så var jeg vel mer opptatt av å prate det jeg KUNNE. Nå er jeg vel mere opptatt av å lytte … og forstå hva elevene… ikke får til… Og så prøve … å spørre aktive spørsmål … men, … hvordan ville du angrepet hvis du måtte prøve, også prøve å veilede sånn da. Optimalt sett da. Men ellers, så, ellers er det veldig mye det å visualisere og tegne.

maybe going in just to guide a bit. I have some trust in that… (…). Eh, but I think in many ways that the students GET a lot out OF it.[61]

Taking this passive role as the teacher is also about his maturity as a teacher:

When I was young, I was, I thought I was the one who was going to revolutionise… and get to… But now I'm getting more and more like… the participant who… withdraws so that the learning should take place among the students. Eh… but it takes some time before you get there. But then…, it is probably also a result that you… start to become confident in what you do. Yes.[62]

Again, Jon positions himself as the old timer looking back on his over-eager former self; now, he has learned how to take a different 'backseat' role so that the students can learn, indicating a figured world in which teachers need to guide by identifying and building on students' understanding through 'active questioning' and supporting student discussion. However, "it takes some time before you get there".

The teacher who "knows his stuff"

Linking together the two figured worlds of the importance of explanation and active questioning, Jon lays a lot of emphasis on his own depth of understanding. He tells me that he studied physics and mathematics at university, and he presents himself as always having had an interest in mathematics:

Yes, I have a great interest in maths, and I always have. It's kind of… it might be referred to as my hobby, and what I like to do. Yes.[63]

For Jon, a teacher's understanding of mathematics is crucial because they need to be able to explain "*in many different ways"*:

Yes, and that has something to do with the teachers. If the teacher hasn't fully understood it himself. And that's why I'm so preoccupied with this

[61] …når elevene SAMMEN finner ut av ting og får ah-a opplevelser … hvor vi lærerne er mer passive, tilbaketrukket og observerer og kanskje går inn og bare veileder litt. Jeg har litt tru på det (…) Eh, men jeg tror på mange måter at elevene FÅR veldig mye AV det.

[62] Når jeg var ung så var jeg, trodde jeg at jeg var den som skulle revolusjonere … og skulle få til… Mens nå blir jeg mer og mer sånn… aktør som… trekker meg tilbake også skal læringa skje i elevmassen. Eh… men det tar litt tid før man kommer dit. Men da… det er nok også et resultat at man… begynner å bli trygg på det man gjør. Ja.

[63] Ja, jeg har veldig forkjærlighet for matematikk, og det har jeg alltid hatt. Det er liksom … Det er jo kanskje å omtale som hobbyen min, og det jeg liker å drive med. Ja.

thing about, eh to explain things well then. Eh,… in many different ways. Then you show that you have…[understood it yourself].[64]

He elaborates:

Yes, but also for my own part because if I can explain things very well and in several different varied… or variations, then …, then you go deeper into the core of the mathematics.[65]

This self-positioning is also evident in one of his frequent long speeches when he presents himself as the right teacher for Group 1, the lowest of the attainment groups:

Because I have… I've often had the lowest group ... through all the years. There are two reasons for this. I think it's a bit less satisfying to teach in the high group. Because... Yes, that's more like A4 then ... While in Group 1 there you MUST actually… So, it's very easy to teach a higher group in maths… if you know your stuff. Eh, and I can. Uhm… then it's just like that… it becomes very like ... Eh… yes [in Group 4] there aren't that many challenges. You explain things, "THAT's how it is!" And then you can get some questions, and you elaborate on that a bit and then "we'll take, come up with some evidence" and such. And then they just work, and you start on new stuff. While in Group 1… eh, then I have a quote from Albert Einstein, "if you cannot explain… eh… advanced difficult things eh… to eh, to eh… in a simple way. Then it's very likely that you haven't understood it yourself". So doing this explaining, and it's often about pretty difficult things too. If you're not able to impart THAT in an easy way or in a varied way, then it's probably ... then you've probably not understood it in detail yourself...[66]

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[64] Ja, og det har jo litt med lærern'e. Hvis ikke lærer'n helt har skjønt det sjøl. Det er jo derfor jeg er så opptatt av dette here med , eh… å forklare ting godt da. Eh,… på mange forskjellige måter. Da viser du at du har [skjønt det sjøl.]

[65] Ja, men også for min egen del for hvis jeg kan forklare ting veldig godt og på veldig mange forskjellig varierte … eller variasjoner, så … , så går man dypere inn i kjernen av matematikken.

[66] For jeg har, …jeg har ofte vært på laveste gruppe jeg. .. Eh gjennom alle år. Det er to grunner til det. Jeg synes det er litt lite givende å undervise på høy gruppe. Fordi… Ja, det er mere sånn A4 da sånn… Mens på gruppe 1 der MÅ du faktisk … asså, det er veldig lett å undervise høy gruppe i matematikk… hvis du kan faget ditt. Eh, og det kan jeg. Ehm…, da er det bare sånn … det blir veldig sånn … Eh… ja det er ikke så mange utfordringer. Du forklarer ting, SÅNN er det! Også kan du få noen spørsmål, også kan du utdype det litt og så tar vi, gjerne komme med litt bevis og sånn. Også bare jobber dem, også tar du nytt stoff. Mens på gruppe 1… Eh, der har jeg et sitat fra Albert Einstein, at hvis du ikke klarer å forklare …eh… avanserte vanskelige ting eh,… til eh, til eh …, på en enkel måte. Så er sannsynligheten for at du ikke har skjønt det sjøl veldig tilstedeværende. Asså, det å

In this speech Jon positions himself as the right teacher to teach Group 1 because he "knows his stuff". He understands the mathematics and consequently he knows how to teach it. While teaching in Group 4 is straightforward and less challenging ("You explain things, 'THAT's how it is!'"), teaching mathematics in Group 1 requires that the teacher really knows the mathematics well because otherwise they cannot make it understandable for the students: "so if you cannot explain… eh… advanced difficult things eh… to eh, to eh… in a simple way. Then it's very likely that you haven't understood it yourself". Not for the first time, Jon refers to a 'big name' (here, Einstein, earlier Kierkegaard) in order to confirm not only his stance on teaching but also his own understanding and character. Similar references arise as he continues to talk about how he explains mathematics, comparing himself with other teachers:

> *And this is a bit about… Much of this concerns a lot, a lot about understanding of concepts… Get these hooks that the students already have… A bit like Vygotsky and stuff like that. About how can I take this here and hang eh, on hooks they understand. And, and… and make them understand this. And then it's the case that… I try to strive to have three, AT LEAST three angles…. eh… to explain… Maybe… one way eh… or three angles to explain… one issue in mathematics then. At least. Eh… because I may experience that many teachers… explain something or teach something… then the student says "I don't understand this here". Eh… and then… the teacher actually explains exactly the same thing once more, or in the same way… as if that would make a, a difference. There I also have something from Einstein that pure, pure idiocy is to try over and over again and believe that you will get a new, uh, a new result. Eh, then you just have to either enter into a dialogue with the student and say "are there any words I use now you don't understand? Or is it the logic in this…?". Eh… and I'm also a big supporter of… What is his name again? His name is Georg or George or…, a Hungarian mathematician named Polya … who has such a… eh…, almost a kind of a bible… for us who teach. This thing about understanding the mathematics. And then, he says that you can*

forklare, og det handler ofte om … ganske vanskelig ting også. Hvis du ikke klarer å formidle DET på en enkel måte eller på variert måte, … så er det sannsynligvis … så har du sannsynligvis ikke skjønt det helt inngående sjøl.

actually understand quite a lot of maths… not by calculating, but by drawing the problem…[67]

Jon displays for me his knowledge of the Vygotskian principle of building on what learners already know as he describes how he explains mathematics: "Get these hooks that the students already have". He emphasises how he supplies multiple explanations ("AT LEAST three angles"), comparing this way of teaching to other teachers who merely repeat themselves. Quoting Einstein again ("pure idiocy is to try over and over again") and then referring to Polya's role as "almost a kind of a bible… for us who teach", Jon validates his way of teaching and highlights the figured worlds he draws on, returning to talk more about how he uses Polya's problem-solving strategies later in the interview:

> *Eh… I have a bullet list of four, five bullets; draw the problem… eh… that's one thing. Can you reverse the problem and see it backwards? Eh, one of the most used methods is the simplification principle. I often ask in class, like… "how many of you are struggling with percent?" And then I get, maybe three quarters of the group raise their hand… so that, and then I say "what is 50 percent of 1000 kroner then?" Everyone can! Eh, but THAT is valuable… "Then you CAN[calculate] percent", and if you manage to set up that calculation… then you can often just fill in the numbers that are in the exercise. And use that… take them down to a level that is visual… very simple… and often you can draw the logical line up to the problem you are in.*[68]

[67] Og det handler litt om … Veldig mye handler veldig, veldig om begrepsforståelse … Få disse knaggene som elevene allerede har… Litt sånn Vygotsky og sånt asså. Det her med hvordan kan jeg ta dette her og henge eh, på knagger dem forstår. Og, og … og få dem til å forstå dette her. Og så er det nå sånn at … jeg prøver å bestrebe meg på å ha tre, HVERTFALL tre innfallsvinkler… Eh… For å forklare … kanskje … en måte eh,… eller…m tre innfallsvinkler for å forklare … en ting i matematikk da. Minst. Eh… fordi jeg opplever vel at mange lærere … forklarer noe eller underviser noe … så sier eleven; jeg skjønner ikke dette her. Eh… også … forklarer egentlig læreren akkurat det samme på en gang, eller på samme måte… som om det skulle gjøre en, en forskjell. Der har jeg også noe Einstein at; rein, rein idioti er å gjøre et forsøk om og om igjen … og tro at du skal få et nytt, eh, et nytt resultat. Eh, da må du bare … enten gå inn i dialog med eleven og si; er det noen ord du ikke skjønner jeg bruker nå? Eller er det logikken bak dette her…? Eh, … også er jeg innmari tilhenger av … Hva er det han heter for no'? Om han heter Georg eller George eller… , en ungarsk matematiker som heter Polia. … Som har en sånn… eh…, liten sånn bibel … for oss som underviser. Det her med å forstå matematikk. Og da, han sier at du kan forstå egentlig ganske mye matematikk, … ikke ved å regne, men ved å tegne problemet…

[68] Eh… Jeg har en sånn punktliste på fire, fem punkter; tegn problemet, … eh, … det er en ting. Kan du reversere problemet og se det baklengs? Eh, en av de mest brukte metodene er forenklingsprinsippet. Jeg spør ofte i klassen, sånn, … hvor mange av dere sliter med prosent? Også får jeg kanskje tre fjerdedeler av klassen opp med henda, ..atte det, også sier jeg hva er 50 % av 1000 kr da? Det kan alle! Eh, men DET er verdifullt, … Da KAN du prosent, og hvis du klarer å sette opp det regnestykket der… så kan du ofte bare fylle inn de tallene som står i

Self-positioning as a good explainer, Jon recounts how he uses the right strategies for simplifying an idea. Providing practical illustrations to make ideas memorable when explanation is too ‘advanced’ is also part of this figured world:

> *I also try, to be practical, so being practical… when I work with parentheses and stuff. Then I place desks and make parentheses with people. So when you have the signs, when you have the sign… eh, …rules, then it's minus and minus makes plus, and then, “why’s that”? Yes, you could certainly explain it, but that's a bit more advanced, but then instead I try to make an image of it. Two angry people, and then I put two students in front of each other, so I say “now you’re going to look at each other and you’re going to look angry”. And then they start to smile. So .. create some humour and some of these visuals, and “yes he said that if there were two angry faces then it would… then we started to laugh”. Yes, so things like that. I… because that, that they remember. Yes.*[69]

Jon emphasises that he is aware of ideas which students find difficult, turning to the issue of how students start at lower secondary school with a pre-understanding about algebra as something difficult, concerning “calculation with letters”. He tells me how he tackles this, re-enacting how he talks to the students:

> *“Do you know what, algebra it is an extension of the arithmetic. Eh... It's, it's not any new rules. There isn’t any single new rule seen in connection to eh, arithmetic. It's just that we introduce numbers we don’t know. And then you can make general expressions”. Eh… and, and just get them to understand this. Eh, so… “yes, but it’s letters?” “Yes, but… it’s not…. it's actually a number, but we don’t know what number, and then… We can actually use symbols. We can use anything, but we use… We can use n and use a and b and x and y. Eh… It… Because algebra, it's about recognition*

oppgaven. Og bruke den derre, … dra dem ned på et nivå som er visuelt, … veldig enkelt, … og ofte så kan du dra den logiske linja opp til det problemet du står i.

[69] Jeg prøver også, å praktisk, altså gjøre praktisk … når jeg jobber med parenteser og sånt. Så setter jeg ned pulter og lager parenteser og mennesker. Så at når du har fortegns, når du har fortegns… eh, -reglene, så er det jo minus og minus er pluss, også er, hvorfor det? Ja man kan gjerne gå inn og forklare det, men det er litt mer avansert, men så prøver jeg heller å lage et sånt bilde av det da. To sure mennesker, og da har jeg to elever foran hverandre, så jeg … nå skal der få lov til å se på hverandre og dere skal være sure, også begynner man å smile. Så.. skape litt humor og noen sånne visuelle, og ja han sa jo det at hvis det var to sure så ble det, … da begynte vi og glise. Ja, sånne ting da. Jeg … for det, det husker dem. Ja.

of patterns and it's quite fun". I ask them a bit like this, "where, where do you see patterns in this classroom?" And then they start. And then I get them to come along in a way.[70]

In this display, Jon self-positions once again as skilled in building on student understanding through questioning. His use of the social language of technical terms, and his emphasis on the connections between algebra and arithmetic positions him as a teacher with the extensive mathematics knowledge that is needed in order to put his figured worlds of teaching into practice.

Performing the old timer in the classroom

Jon's enactment of the old timer mathematics teacher is also evident in the classroom, where he presents himself as a knowledgeable teacher who the students can trust to help them through his explanations. In the first lesson with Group 1 he tells the students that they are going to work on algebra, and Eva replies that she does not understand it:

Classroom Extract 7.1
Eva: I don't understand algebra.
Jon: Yes, but if you don't understand algebra, I'll try to make it … so that you'll understand it today (Jon nods to Eva).

This assurance that he has the power to help Eva to understand algebra *"today"* despite her long-term problem with it is a typical component of his enactment of this Discourse. Following up on another student's comment that algebra is "crap" [dritt], Jon launches into an explanation of what algebra is:

Classroom Extract 7.2
Jon: Yes many think that algebra, if not crap [dritt], is quite challenging and difficult, but I'll TRY to break it down. But, have you learned before that algebra is calculating with letters? (No response from the students). *Yes, because that's not quite right then. Algebra is actually, and here you'll*

[70] «Vet du hva at algebra det er en forlengelse av aritmetikken. Eh, … det er, det er ikke no' nye regler. Det er ikke en eneste ny regel i forhold til eh, aritmetikken. Det er bare at vi introduserer tall som vi ikke kjenner. Også kan du lage generelle uttrykk». Eh, … og, og bare få dem til å forstå det der. Eh, at…, jammen det er jo bokstaver? Ja, men… Det er ikke…. Det er egentlig et tall, men vi vet ikke hva det tallet, og da… Vi kan egentlig bruke symboler. Vi kan bruke hva som helst, men vi bruker… Vi kan bruke n og bruke a og b og x og y da. …. Eh… Det… Fordi at algebra, det handler om mønstergjenkjenning og det er ganske artig. Jeg spør dem litt sånn, «hvor, hvor ser dere mønstre i dette klasserommet?» Også begynner dem. Også får jeg på en måte dem med.

get the right answer, eh ... (Jon goes to write on the board). *Algebra, that's actually recognition of patterns. Recognising patterns. And we're good at that. Can you take a look around in the classroom here now to see if you can see some patterns? Something that REPEATS with eh, periodic ...* (Jon writes "Recognition of patterns" on the board. Eva has raised her hand and wants to say something). *Wait a bit I'll just write it here.* (Jon goes to Mona) *Mona look at me now, not on the board. Algebra, it's?*

Mona: Recognition of patterns.

Jon: Yes, recognition of patterns.

Mona: Pattern recognition.

Jon: Pattern recognition. Yes (Eva still has her hand up). *Eva?*

Eva: That one (Eva points to the tiles over the sink).

Jon: We're going to find patterns yes.

Eva: I'm looking at the squares there by the sink.

Jon: Clearly. Here we have algebraic, here we have algebra. (Points to the tiles). *Here we have pattern recognition.*

As in his response to Eva, Jon reassures the students that "I'll try to break it down", and furthermore, "here you'll get the right answer". He moves into an enactment of the simplification that he has told me about, emphasising that algebra is "actually recognition of patterns". He asks the students to look for some patterns in the classroom and, after pointing out a few different examples, Jon continues his explanation in a long speech:

Classroom Extract 7.3

Jon: And why do we call algebra recognition of patterns? (Jon raises his voice). *Yes! Because if we were to have a formula for all the circles we have in the world, then we would have endless formulas. But we can, we can see a pattern that recurs. A pattern that recurs in all circles, and then we can find a gener… a formula for all circles. That's pattern! Right?* (Jon approaches the students). *That's why we come in or come to [work on] algebra. Eh, and then you know that Albert Einstein said "make things as simple as possible, but not simpler". Eh, so now we're going, now we'll take eh, now we'll simply take a look at, eh, how we can generalise. It's a bit of a difficult term, but how can we try and see systems in things around us. BUT, FIRST, I'll write the rule number 1 on the board, for algebra. And* *it's so, I think maybe it's the nicest rule you've ever seen before. And that is, rule number 1* (writes on the board). *Rule number, I write hashtag 1. And here it comes (…). Rule number 1, in algebra, and here it comes: There are no new rules!* (Jon writes the rule on the board while he says it). *Isn't that lovely? And then the question is, what do I mean by, 'there are no new rules'? Eh, yes because, this feels so, so difficult for maaany students.*

Jon performs the mathematics expert who knows what algebra is about, asking the rhetorical question "And why do we call algebra recognition of patterns?". He positions himself as the one to explain this as he continues to talk about formulas of circles as a recurring pattern, performing the expert in his use of the social language of technical terms. He underpins this role with his reference to Einstein – he understands the difficult mathematics stuff ("generalise. It's a bit of a difficult term") and he also knows all the "rules" and how to best teach them. The students can trust in him.

In the second lesson with Group 1, Jon enacts another, related, component of his old timer Discourse by presenting the students with a detailed account of his plan for the lesson. He adds into his performance an explicit 'lecturer' character:

Classroom Extract 7.4

Jon: Then it's like, the lesson today, is set up in the following way, eh, (Jon connects his computer to the projector at the board) *there will be a repetition of the start we made on algebra last lesson. Eh, and then I will give a* (Jon makes gestures with his hands) *a kind of a bit like, yes what can I say, I have a bit of a lecture for you. But you MUST also have your notebook ready, because during the lecture I'll ask some questions, and you'll solve them for me. Right.* (Jon circulates the room while he talks). *So it'll be a bit like an active lecture* (Jon makes gestures with his hands) *where I bring up things with you and you have to answer me back. Okay? (…) Yes. And algebra then is …*

Elias: Patterns

Jon: Pattern recognition. We see some patterns, and based on that we can create something in general. Right. So, so I want us to move away from the idea that we are going into a new universe [when we do algebra]. Now we're going to start calculating with letters, letter calculation [but] we, we still work with quantity, numbers, arithmetic.

Jon's repeated use of the word 'lecture' in the first part of this speech positions him as a knowledgeable teacher who has a particular kind of 'Socratic' style – he will ask questions and the students must be on the alert to answer, almost as though he were a university professor and they highly attentive students. Introducing the topic of algebra, he asks: "And algebra then is …?", allowing Elias' one-word answer (building on the previous lesson) before moving on to display his own knowledge of algebra as "Pattern recognition. We see some patterns, and based on that we can create something in general. Right". His enactment of the knowledgeable lecturer figure positions Jon not only for the students but also for me as someone special - a teacher who 'knows his stuff' and consequently can help the students to understand.

Jon consolidates this performance as the lesson continues. He focuses on making the students aware of the "invisible multiplication sign" between a number and a letter in an algebraic expression:

> ***Classroom Extract 7.5***
> *Jon: What arithmetical sign is between the number and the letter?*
> *Chris: Multiplication*
> *Jon: Good, Chris. Eh, it's multiplication, and you must remember because, actually 4a comes from a + a + a + a, right.* (Jon writes 4a and a+a+a+a on the board and marks with an arrow between) *and then I have repetitive addition and then I introduce multiplication. So, a + a + a + a, I can see that I have 4 a's. Then you MUST remember that it's multiplication. And you can ask me now, ask me now Elias, "why don't we put in that multiplication sign?"*
> *Elias: Why don't you put in that multiplication sign?*
> *Jon: That's because mathematicians are EXTREMELY lazy. So if they can, if they can, can create…*
> *Fredrik: Are you lazy? I see you go to the shop and stuff. I don't call that lazy.*
> *Jon: Yes but, (…) But that's it. This makes a lot, a lot of confusion for young people. Because they don't remember that when it's a number and a letter, it's multiplication in between. But this comes because we have repeated addition, right. So keep that in mind. If there's nothing between a number and a letter, then it's multiplication. And then there are a lot of people who*

want to say that, yes, but, if there are two numbers next to each other, is it multiplication there too then? No, then we don't. Because 22, that's something different than 2 times 2. So, you mustn't mix those things up.

Explaining the particular notation of the hidden multiplication sign by referring to mathematicians as "EXTREMELY lazy", Jon positions himself as a mathematician by aligning himself with this group. This positioning is also evident in how he uses the social language of technical terms in his detailed explanation of the rule: "then I have repetitive addition and then I introduce multiplication". He is a knowledgeable teacher who knows all the 'codes' and he is letting them into this knowledge, sending the message that this notation is difficult to understand: "This makes a lot, a lot of confusion for young people". As the teacher "who knows his stuff", Jon can give the students tips and tricks, taking an instrumental approach and focusing on what they *"MUST remember" about* this particular notation.

There is some abandonment here of the underpinning figured worlds of explanation and building on student understanding which were evident in the pre-lesson interview. A similar abandonment is also evident in Jon's description of a lesson in the mixed group where the students were discussing different solutions to a problem. Although Jon aims to encourage the students to explore the mathematics for themselves, he argues that the teacher needs to be careful that the students get the right answer in the end:

Also, they should listen to what someone, uh, the other student is saying. Also, the other student should listen to what the other is saying… also let them try and such… slowly but surely come to an answer then. So when they think they have the answer, they should sit down. But I often get five or six different answers on the board… We also analyse… what… is the right way of thinking and… why the others have come to… that… what is wrong then? (…) Eh… and I believe in that. That they… so engage the students in learning FROM each other and with each other. But then you have to be very concerned about what you have to correct in the end. Otherwise you can end up with wrong learning again.[71]

[71] Også skal de høre på hva noen, eh, den andre eleven sier. Også skal den andre eleven høre på hva den andre sier …også skal dem prøve og sånn … sakte men sikkert komme til et svar da. Så når de tror de har svaret så skal de sette seg ned. Men jeg får ofte fem-seks forskjellige svar på tavla… Også analyserer vi … hva som … er riktig tankegang og … hvorfor de andre har kommet fram til …det, … det som er feil da. (…) Eh… og det tror

For Jon, correcting wrong learning is a priority. Later in the pre-lesson interview he enlarges on this sense of responsibility in controlling what the students might conclude, suggesting once again that he 'takes over' to explain:

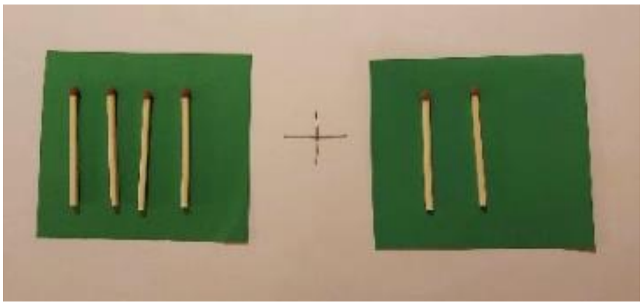
> *And then I mean that then learning takes place among the students. Eh… and if it's wrong then I'll show how it is at the end, what the right answer is. So that they adjust their thinking in relation to that.*[72]

The erosion of Jon's underpinning aim of building on student understanding becomes more visible as he continues with his lecture performance in the algebra lesson with Group 1. He had prepared a PowerPoint presentation showing a sequence of pictures displaying different groupings of matches and match boxes as an illustration of different expressions in algebra. Matchboxes with an unknown number of matches are intended to illustrate the variable and the matches illustrate known numbers. Jon starts by showing a picture of four matches and introducing numbers as a symbol of a quantity. He asks the students how many matches they can see:

> ***Classroom Extract 7.6***
> *Jon: How many matches do we have here?*
> *Eva: Four*
> *Jon: There are four matches yes.* (Jon stands at Eva's desk and waits 3 seconds before he returns to the board.)
> *Eva: Yes*
> *Jon: Yes this is a quantity. Four matches. We all now understand what this is all about. And Eva,* (Jon points to the picture of the four matches) *you are right on the first task.* (Jon switches to a new slide displaying two pictures, one with two matches and the other with four matches and a plus sign in between.)

jeg på. Det derre med at de … altså engasjere elevene i å lære AV hverandre og med hverandre, men så må du være veldig opptatt av at du må korrigere til slutt. Ellers så kan det igjen være feillæring.

[72] Og da mener jeg at da skjer jo læringa blant elevene. Eh… og hvis det er feil så viser jeg til slutt hvordan det er, hva som er det riktige svaret. Sånn at de korrigerer tankegangen sin i forhold til det.



Jon: Ivar, how many matches do we have here?

Ivar: Is it a plus?

Jon: Yes it says plus.

Ivar: Both pictures?

Jon: Yes, do what it says.

Ivar: Yes, then there will be six.

Jon: Six matches. Shall we check if that's correct? We have four matches in that pile (Jon points to the first picture) *and we have two matches in that pile. 4 + 2, then you have an understanding that we have six matches in total. Yes good. Elias, how many matches do I have there?* (Jon has changed picture which now just shows a matchbox. Jon turns to Elias). *Not box, how many MATCHES do I have here?*

Elias: Zero

Jon: Do you KNOW that we have zero matches?

Elias: Zero is what I see at least.

Jon: Yes you see zero, but there are some, there may be some matches inside the matchbox.

Elias: 25

Jon: 25, 0

Eva: 3

Jon: 3. Can't we just agree that we don't know then?

Elias: 20

Jon: You say 20, yes. (...) But now you're just guessing, and maths it's never about guessing. It's about, about pure facts. So how many matches do you see inside here now? (Jon points to the picture of the matchbox).

Eva: x

Jon: x, or I've used another, I've used a different letter. (Jon switches to a new slide in his presentation on the board where he has used the letter k which is written below the picture of the matchbox).

Jon: But we, when we don't know how many matches we have here, we must use symbols. And these symbols, it can be a, it can be x, it can be z. It may also be symbols we make up, triangles and such, but in mathematics we have introduced letters. So here we have (Jon is pointing to the picture on the board) *so here we have x matches or k matches. But a matches or k matches that's the same. If we use, if I had replaced this here letter now with a or x or something, doesn't matter. So in this matchbox here now I have k matches.* (Jon switches to a new slide which shows an open matchbox with three matches inside.) *BUT, then I OPEN the matchbox. And how many matches do you see now?*

Fredrik: Three

Jon: Yes. So then I had (Jon finds a marker to write on the board), *I had k matches* (Jon writes k on the board). *I didn't know what k was. Then I OPENED the matchbox and then I suddenly saw that it was 3 so then I can insert the number 3 instead of k and then I end up with 3 matches.* (Jon writes the number 3 on the board and marks an arrow between k and 3, then writes k = 3.)

And the difficulty is around this. "Yes but why should I write k, can't I just open [the matchbox] and so?" Yes, I'll get to this a bit later. Because then, sometimes we make general expressions that we can use EVERYWHERE we are on the planet and in the universe. But we have one formula for all figures or all eh, things like, as we see in nature. In other words, we know that we have, k = 3. So before we opened there were k matches. Now we know it's 3. Now there'll soon be some problems to solve here. (Jon switches to a new slide which shows a picture of four matchboxes. Jon points to the picture and approaches the students). *Now there were 3 matches in the matchbox in the previous problem. You don't know that now.*

This is something new. Now you can…, but what we do know is that there are the same number of matches in each box. Okay, so my question now is, can you pick up your notebook? Notebook up. Can you make? (…) Here we have some patterns, right, repeating patterns. But can you now MAKE an expression for me? An algebraic expression? We know that in these matchboxes there are some matches. We don't know how many there are. My question is, but we know that there are EQUALLY many matches in EACH of the matchboxes. How many matches do we have now?
Eva: In the previous one there were 3.
Jon: Yes, but the previous one we don't care about. This is new. So here it can be 25, here it can be 4 here it can be 2. But can you, can you, do something about this here? This is very similar to what we did with the teacups on Monday, you know? What happened when we had cups with the same colour? Under those, under the cups on Monday, there was one dice with a number and then I said that the SAME colour on the cups means the same dice value. This here is exactly the same, just that now I've moved away from cups and dice, and switched to matches and matchboxes, or matchboxes and matches. (Jon points to the picture on the board. The students are given 10 seconds waiting time). *Yes, if you rewind a little Ole. What did we call that matchbox before?*
Ole: k
Jon: k yes. (Jon writes k on the matchbox on the board). *What do we call this here then?* (Jon points to the next matchbox on the picture and approaches Ole).
Ole: a
Jon: Yes, yes but, you have that information: There are JUST as many matches in each box, so if it is k matches there (Jon points to the first box), *how many matches is here then?* (Jon points to the second box).
Ole: Oh yes, k.
Jon: Yes, and then it's (Jon points to box number three).
Ole: k, and then k in the last one
Jon: Yes, can you do something with this expression then? (Turid raises her hand). *Turid?*
Turid: 4k

Jon: 4k. Eh, what you mean is that we add this and then we get 4 times k. And now I rewind a bit. Because, repetitive addition, that is, when we add numbers or letters together, the same value, 2 + 2 + 2 + 2, then we introduce multiplication. And the same happens in algebra. We have k matches in that match box (Jon points to the first box). *We don't know yet what it is. We have k matches in that box* (Jon points to box number two). *So if there are 8 matches there* (Jon points to box 1) *then there are 8 in this and 8 in this and 8 in this* (Jon points to all the boxes)*, but we don't know that. We don't know how many there are. Then we end up with 4k, Turid thinks. Does anyone disagree?*

Throughout the whole excerpt, Jon asks closed questions, dominating the lesson with his own explanations in long responses to their short answers. He controls the dialogue and leads the explanation, prioritising his own conception as when Eva suggests calling the unknown numbers of matches in a box x. Jon takes over with a lengthy explanation: "x, or I've used another [k], I've used a different letter. But we, when we don't know how many matches we have here, we must use symbols. And these symbols, it can be a, it can be x, it can be z". He dictates how to write algebraic expressions ("I had k matches. I didn't know what k was. Then I OPENED the matchbox and then I suddenly saw that it was 3 so then I can insert the number 3 instead of k and then I end up with 3 matches"), stressing particular words and leading the students step by step through the process. Dropping hints as in his reference to the similar teacup activity from the previous lesson, he can also be seen to be funnelling as in his exchange with Ole about what he has named the second match box. In response to Ole's first answer "a", Jon asks "There are JUST as many matches in each box, so if it is k matches there, how many matches is here then?", making sure that he gets the right answer. As elsewhere, he uses rhetorical questions ("Yes but why should I write k, can't I just open and so?"), not expecting the students to answer in his enactment of the old timer lecturer with a wide knowledge.

These classroom observations illustrate not only Jon's enactment of the old timer Discourse, but the way in which his performance of the lecturer character who is very knowledgeable – he is a mathematician – tends to override the figured worlds of teaching which he has talked about in the pre-lesson interview. In particular, his emphasis on explanation becomes more of a display of his own knowledge than an exploration of student understanding.

7.2 Teaching Group 1: taking the long-term view

As we have seen, although Jon draws on figured worlds of the importance of explanation and the need to build on students' understanding, in his enactment in the classroom he does not sustain what he tells me. Instead of building on students' answers, he prioritises his own understanding, resorting to funnelling and teaching memorable procedures. Despite his confident account of his teaching in the early part of the pre-lesson interview, Jon later admits to challenges and difficulties in teaching Group 1 which he repeats in the post-lesson interview. Drawing on a figured world in which emotional support is of major importance, his enactment of the old timer mathematics teacher focuses on a long-term view which centres on his relationship with the students and their future wellbeing.

Attainment grouping

Jon doesn't raise the issue of attainment grouping in his general talk, but when I ask him about it, he tells me that he is in favour because it addresses students' needs:

> *… Group 1 is the one, the group that needs more… most help. And which is perhaps most unmotivated in mathematics. And all the way up to Group 4 slash 5, who are the ones that are very self-propelled and… and there you go through the content at a much higher pace. While in Group 1 so… we can… dwell on things… at length. And we often work, very often we work with basic arithmetic skills. Yes.*[73]

He explains further about curriculum choices:

> *... at the beginning of the year, we sit down and make those half-yearly plans… about what topics and so on we are going to go through. And we [Jon and the students] in Group 1 we just, or me as the Group 1 teacher, I realise that they HAVE TO get through a lot. [But] I think that I can't do this. Eh… we stand and struggle a bit, eh, where we struggle we… and…[it takes] a lot of patience and a lot of time. Yes. I don't see the purpose of moving on… in the mathematics content… if one… struggles with basic things. And then I'm supposed to start teaching eh theory of functions just so that… I can tick the boxes. I think it's more important that you GET in*

[73] ... nivågruppe 1 er den som, den gruppa som trenger mer … mest hjelp. Og som kanskje er mest umotivert for matematikk. Og helt opp til gruppe 4 slash 5, som er de som er veldig selvdrevne og … og der går man igjennom fagstoffet i mye høyere tempo. Mens på gruppe 1 så … kan vi … dvele ved ting… veldig lenge. Og det er ofte vi jobber, veldig ofte vi jobber med de grunnleggende regneferdighetene. Ja.

place the… the things that are important. (…) Than just push on with maths and then you get even more upset because you don't understand anything…[74]

Jon's experience leads him to reject the demands for curriculum coverage and to reduce the teaching content not only to what the students need but also what enables them to cope. As an old timer he has the power to go against the agreed semester plan. He positions himself as the Group 1 teacher in his reference to 'I' and 'we' when he talks about teaching in Group 1 - he knows the students, he knows what they need, and he knows how best to teach them and manage their well-being.

Later, he elaborates on the reduced curriculum content for Group 1 in the context of motivating the students to learn skills for life:

> *I think that… I actually think that differentiation actually follows the groups. So, a bit like those who are in Group 1, eh there is a lot of work on motivation. Eh, and making them believe in themselves. Trying to explain why they need some maths. Eh, but also maybe [we need to] be a bit honest that… Yes, maybe… like quadratic equations and, and these square theorems and stuff, you don't need that so much. But you need basic arithmetic skills, eh arithmetic skills. And [we need to] be a bit clear that it's a bit bad to be in a store and not understand the concept of percent. So I kind of look at it that way. And the most important thing is that you finish secondary school with, with the basics… And then I think of the four arithmetical operations. Be able to use… eh a calculator and this about order of calculation … Eh, and then… ehm… and a bit of… units of measurement… eh, percent… Maybe a bit of simple fractions… Eh…, and, and actually a bit of the ability to think logically. Yes.* [75]

[74] .. på begynnelsen av året så setter vi oss ned og lager sånne halvårsplaner … om hva vi skal gjennom av tema og sånn. Og vi på gruppe 1 vi bare, eller jeg som er på gruppe 1 jeg registrerer at det SKAL mye av de andre gjennom. Mens jeg tenker at dette får ikke jeg gjort. Ehhh… vi står og stamper litt, eh, der vi stamper vi … også … mye tålmodighet og mye tid. Ja. Jeg ser ikke hensikten med å gå videre … i fagstoffet i matematikk … hvis man… sliter med grunnleggende ting. Og så skal jeg begynne å undervise eh i funksjonslære bare fordi atte … jeg kan krysse det av på et skjema. Jeg tenker at det er viktigere at man FÅR på plass de … de tinga som er viktig. Enn å bare pøse på med matematikk også blir man enda mer oppgitt for man skjønner ingen ting…

[75] Jeg tror at… Jeg tror egentlig den differensieringa der følger egentlig gruppene litt sånn at de som er på gruppe 1, eh der jobbes det veldig mye med motivasjon. … Eh, og få dem til å få troa på seg sjøl. Prøve å forklare hvorfor de trenger litt matematikk. Eh, men også kanskje være litt ærlig på at … Ja, kanskje … sånn annengradsligninger og, og disse her kvadratsetningene og sånt, det trenger dere ikke så godt, men dere trenger grunnleggende regneferdigheter, eh regneferdigheter. Og være litt tydelig på at det er litt kjedelig å stå i en

Drawing on the social language of motivation, Jon focuses initially on the Group 1 students' self-esteem ("make them believe in themselves") but this falls away to a sharper focus on their futures – his job is to explain the value of mathematics in their lives and to be honest about what mathematics they will actually need in everyday life, so that they finish school "with the basics". Returning to the role of motivation, Jon also talks about the need to preserve students' sense of having at least some mastery of mathematics:

> *That is, trying to stay away from what … building on what they do NOT UNDERSTAND. Instead, trying to focus on what they CAN understand and MANAGE. A SENSE OF MASTERY… I am very concerned with… if the feeling of mastery disappears then the motivation also disappears and then… you lose interest in the subject.*[76]

Admitting challenges

Later in the pre-lesson interview, Jon elaborates on how he works to motivate the Group 1 students:

> *I don't know, but I think that I often see a bit of fear in their eyes. That mathematics is connected to something… I think that… It's often easy to feel STUPID when you don't know mathematics. And I… And I spend quite a lot of time… saying that's not true [that they are not stupid]. Ehm… You are not stupid even if you don't understand mathematics. … Eh… but it's a bit about, with… Yes it's a bit about that feeling of mastery that has, sort of… when you have stopped and got stuck a bit and… didn't get the feeling of mastery and then it stops. So a lot of the time I spend on… I think I actually spend a bit on… eh, a bit like psychologically. Can be… No questions are stupid… and if you go to the board and calculate incorrectly then it's COMPLETELY okay because then we can… look a bit at what went wrong here. Because then there are probably ten others here in the class who are wondering the same thing… Eh, eh… That you not, not… not*

butikk og ikke skjønne begrepet prosent. Så jeg ser litt sånn på det. Og det viktigste er at dere kommer ut av ungdomsskolen med, med grunnleggende… Og da tenker jeg de fire regnearter. Kunne behandle … eh en kalkulator og dette med regnerekkefølge … Eh, og så …em… Også litt sånn … måleenheter… eh, prosent… Kanskje litt sånn enkel brøk… Eh…, og, og egentlig litt evnen til å tenke logisk. Ja.

[76] Det det er, prøve å holde seg borte fra den derre … å bygge oppunder den derre at dem IKKE FORSTÅR. Prøve heller å fokusere på de tinga de KAN forstå og FÅ til. MESTRINGSFØLELSE … jeg er veldig opptatt … hvis mestringsfølelsen blir borte så blir også motivasjonen borte og da … mister man interesse for faget.

eh… So, to create that sort of culture that it's… nice and okay to come to… to maths class. Focus on some games…, some humour. Eh…, but also knowledge… and get in place and, and very much like that… eh, literally, literally a bit like a pat on the back. Yes, this was good. Really great that you got it…. But it's a heavy, heavy group to work with.[77]

In this speech, Jon discusses in detail how he builds a positive classroom culture, so his final "But it's a heavy, heavy group to work with", is a rather surprising utterance. Suddenly, his earlier very confident enactment of the experienced teacher who knows best how to meet these students' needs falls away to an account of the challenges of teaching Group 1. He compares teaching this year's Group 1 to Group 1 in the previous year where the students were "very engaged". Usually, Jon starts to teach new classes and groups when the students are in 8th grade, but this was not the case with this year's Group 1, who he only began to teach after the autumn break in 9th grade. He blames this fact for his current difficulties in establishing the right classroom culture:

Like the one I had last year, where… there we managed quite a lot of things. The one I have now… The group I had last year, I followed in the 8th, 9th and 10th. I'll be… be careful to… touch wood… But… but this one I just suddenly got now … halfway through 9th grade. And then I kind of haven't quite established the same… eh, so the… These [students] seem a bit… harder to work with. Yes. So, that's being honest. Yes. So I have to try to figure out what works for this group? Yes.[78]

Jon continues to compare with the previous group:

[77] Jeg veit ikke, men jeg innbiller meg at jeg ser ofte litt sånn frykt i øya. At matematikk er forbundet med noe … Jeg tror at … Det er ofte lett å føle seg DUM når man ikke kan matematikk. Og som jeg… Og jeg bruker ganske mye tid på å … å si at det er ikke riktig. Ehm…. Man er ikke dum selv om man ikke skjønner matematikk. …Eh… men det handler litt om, med, … Ja det handler litt om det der med mestringsfølelse som har, liksom, … når man har stått og stanga litt og … ikke fikk kjent på mestringsfølelse og da stopper det opp. Så mye av tida bruker jeg på … synes jeg egentlig bruker litt på… eh, litt sånn psykologisk. Kan være… Ingen spørsmål er dumme…, og hvis dere går opp på tavla og regner feil så er det HELT i orden for da kan vi … se litt på hva er det som gikk gæærent her. For da er det antakeligvis ti andre her i klassen som lurer på det samme… Eh…, eh… At man ikke, ikke, …ikke eh… Altså, å skape en sånn kultur at det er… hyggelig og all right å komme på… til mattetimen. Fokus på litt leker…, litt humor. Eh…, men også kunnskap … og få på plass og, og veldig mye sånn, … eh, bokstavelig, bokstavelig talt litt sånn klapp på skulderen. Ja, dette var bra. Ordentlig morsomt at du fikk til det…. Men det er… tung, tung gruppe å jobbe med.

[78] Sånn som den jeg hadde i fjor, der… der fikk vi til en god del ting. Den jeg har nå,… Den gruppa jeg hadde i fjor den fulgte jeg 8., 9. og 10. Jeg skal… forsiktig med å… banke i bordet… Men,… men denne her fikk jeg nå plutselig… i fanget nå i … halvveis i 9. Og da har jeg liksom ikke helt etablert den samme … eh, så den … Disse her virker litt … vanskeligere å jobbe med. Ja. Så, det er en ærlig sak. Ja. Så jeg må prøve å finne ut hva er det som fungerer for denne gruppa? Ja.

Yes, the group I had last year … There we had teaching where the students went up to the board themselves to try to explain and things like that … While eh... so a pretty active… eh, group. Even though they struggled with maths. Still, uh…, now I have a much more passive group… To me it seems like they just want to sit and work on questions. And… that I will circulate and help. And then, there is no one who, there are a quite a lot who don't even raise their HAND. Who do NOTHING… So I have to try to be a bit on... Both have to push and nag and…. Yes. Yes[79]

Admitting the challenges of teaching this year's Group 1, Jon compares his positions in the two groups. Last year he was more part of the group ("There we had teaching where the students went up to the board themselves …"), whereas this year's passivity leaves him isolated in his teacher role because the students are so unresponsive. At the same time, as the responsible old timer mathematics teacher who cannot give up, Jon resolves to "figure out what works for this group". This responsible teacher is also evident in the following speech:

Because there are groups that are…, they are… heavy going, and you just have to… just be honest about that. But one must never give up. One must never say that okay, they don't bother so then I don't bother. Because it is and will be my responsibility as a teacher to motivate, engage, and try to… to get this to rub off on the students so then they also become [motivated].[80]

To some degree, Jon leaves behind his previous performance of the old timer mathematics teacher who knows best as he describes these difficulties in teaching Group 1, talking more candidly to me as the interviewer. At the same time, his "never give up" is a continuation of his enactment of the experienced mathematics teacher, albeit one who is more reflective and less assertive.

Putting things into perspective – taking the long-term view

In the post-lesson interview, when I ask Jon to reflect on his teaching in the classroom observations, he continues to enact the Discourse of the old timer mathematics teacher.

[79] Ja, den gruppa jeg hadde i fjor den … Der hadde vi tavleundervisning der elevene gikk opp selv og fikk prøve og forklare og alt sånt… Mens eh,.. så en ganske aktiv …eh, gruppe. Selv om de sleit med matte. Enda, eh…, Nå har jeg en mye mer passiv gruppe … For meg virker det som de bare har lyst til å sitte å jobbe med oppgaver. Også … går jeg rundt og hjelper. Også er det ingen som, det er en god del som ikke rekker opp HÅNDA en gang. Som ikke GJØR noe … Så jeg må prøve å være litt bort på…. Både må pushe og mase og…. Ja. Ja

[80] For det er klasser som er…, det er… tungdrevne, og det må man bare … rett og slett være ærlig på. Men man må aldri gi opp. Man må aldri si at okey, de gidder ikke så da gidder ikke jeg. For det er og blir mitt ansvar som lærer å motivere, engasjere, og prøve å…å smitte over på elevene så de blir det og da.

However, he takes a more reflective approach as he talks about teaching and the challenges he faces, but also those that the students face. We see him drawing more on a figured world in which emotional support for young people is crucial, and his enactment of the experienced mathematics teacher becomes focused on making a memorable difference to their lives.

Thinking about the lessons I have observed, Jon talks again about the challenges of teaching this year's Group 1, but he emphasises his sympathy for them given their likely earlier experiences:

> *Because it was very heavy… heavy going in the beginning. And so very… So… But so it's about never giving up then and all the time, my job is to… to be a moti… to motivate them to work and all the time get them to trust in themselves. Because these are young people who have… probably experienced quite, quite a lot of … downturns and not been seen and not been followed-up and like that so… And they have sort of eh… just surrendered to other things.*[81]

Creating a safe classroom culture is paramount:

> *[they are] …very dependent on security. I imagine that many feel that they… they are stupid if they cannot do maths. That it's a bit like that… then you're a bit stupid. And [we need to] remove that misconception, no, you're not stupid. Even if you find maths difficult. You do have [good] qualities and… you are maybe good at other things.*[82]

Jon is pleased about how the lessons I have observed have gone – "the lessons you have come to have been really GOOD lessons. We've had very good chemistry in the lessons before too… but not the flow that we had now…"[83]. He thinks that the students are gaining security:

> *Ehm, when that security when that one security… comes, and it begins to come now. And the thing about [the fact] that I see them and back them up*

[81] For det var veldig tung… tungkjørt i oppstarten. Og så veldig … Så … Men så det handler om det å aldri gi opp da og hele tida, min oppgave er å … å være en motiva… altså motivere dem til å jobbe og hele tida få trua på seg sjøl. For dette her er ungdommer som har… opplevd antakeligvis ganske, ganske mange sånne … nedturer og ikke blitt sett og ikke blitt fulgt opp og sånn så … Og de har liksom eh… bare overgitt … seg til andre ting.

[82] …veldig avhengig av trygghet. Jeg innbiller meg at veldig mange føler at de … de er dumme hvis de ikke klarer matematikk. At det er litt sånn … da er man litt dum. Og fjerne den misforståelsen der at, nei, man er ikke dum. Selv om man synes at matte er vanskelig. Man har bare egenskaper og … er kanskje flink i andre ting.

[83] Eh…, så de gangene du har kommet har vært egentlig veldig BRA timer. Vi har hatt veldig god kjemi i de timene tidligere og… men ikke den flyten som vi hadde nå….

> *and almost all the time say "good". "You managed this"… And then I think it's good with small groups. (…) much, much closer one to one then, teacher-student.*[84]

Jon sees one major advantage of attainment grouping to be the fact that "those who are struggling … finally they are SEEN". It seems that this benefit not only concerns seeing them mathematically but also seeing the 'whole student'. This care for the whole student is also evident when he points out that Group 1 students also may have other challenges than mathematics:

> *…in those groups where there are… students with… a bit of a lack of knowledge in maths… you also often get… students who … maybe are a bit… a bit challenging behaviourally too, right. Eh, so you have to set the standard very quickly. That's why I always end up in Group 1 [Jon smiles]. Eh, yes that… ehm, but… yes. They know who I am and what I stand for and… yes.*[85]

Being an experienced teacher, Jon knows how to handle these students. He is the old timer who has the authority needed in this group, being 'firm but fair''. In this post-lesson interview we see that his enactment of the old timer Discourse is about more than his knowledge and interest in mathematics; it is also about giving the students the best preparation for their lives beyond school. He prioritises relationships with them which are based on respect:

> *Eh, so it's a lot about… Eh, the presence, being present… eh…, take the students seriously. Like in my class, I always start the lesson by shaking hands and they [the students] must make eye contact with me. So that we [the students and Jon] have AT LEAST seen each other once.*[86]

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[84] Ehm, når den tryggheten, når den tryggheten der … kommer, og den begynner å komme nå. Og det der med at jeg ser dem og backer dem opp og liksom hele tida sier bra. Dette fikk du til … så , så tror jeg det er bra med små grupper. (…) mye, mye tettere en til en da, lærer-elev.

[85] …i sånne grupper hvor det er… elever med… litt sånn manglende kunnskap i matte… Der får du også ofte … elever som også … kanskje har litt sånn… litt utfordrende sånn atferdsmessig og ikke sant. Eh, sånn at du må sette standarden veldig kjapt. Det er derfor jeg alltid ender på gruppe 1 (Jon smiler). Eh, ja det også det, emn, men … ja. De vet hvem jeg er, og hva jeg står for og … ja.

[86] Eh, så det handler jo veldig mye om… Eh, nærværet, det å være tilstede,… eh…, ta elevene på alvor. Sånn som i min klasse nå så begynner jeg alltid timen med å håndhilse og de skal møte øynene mine. Sånn at vi HVERT fall har sett hverandre en gang.

He elaborates on the students' need to be seen:

> *It's… now I've worked as I said… I've worked for 20 years. And there are these basic… needs… eh, in both adults, but especially for children and young people, and that's about being seen. And the thing about feeling that the teacher cares about you. And I think that may be a bit more lost in big classes. I remember when I went to school and… if the teacher came and said: "and Jon, this was good". Then, then I grew so much. You think that these [Group 1 students] are so tough and it doesn't look like [they need this], but it's nonsense. It's an act, or it's just… so that "great!". You shouldn't underestimate. That bit of physical contact, a bit of ruffling of their hair, or a small pat on the back and saying "VERY good". And meaning it! That's important. They see through you if you just walk around and talk nonsense.*[87]

Drawing on a figured world in which emotional support is essential for all young people but perhaps especially Group 1, Jon wants to be the teacher who sees them and cares about them. He compares these practical insights with the theoretical approach of development programmes:

> *We have a local school development programme at school right now about all the principles. Eh… And [they are] very good principles and… but… teaching is often far away from the theoretical. It's a completely different dynamic going on and there's a LOT, there is a lot, it's like… (...) What we had in the local development programme, what principles are important in teaching? And then I mean that, it sounds like something banal and a stock phrase but: 'make sure all the students understand that you love them and wish them well'. So… Let them experience that you believe in them. And if you lose that then…. Yes, but the worst of it, or both the best and the worst of all, is that these students take these stories with them for the rest of their*

[87] Det er … nå har jeg jobba som jeg sa … sist jeg har jobba i 20 år. Og det er noen sånne grunnleggende … behov… eh, hos både voksne mennesker, men spesielt hos barn og ungdom, og det er det å bli sett. Og det der å føle at lærer'n bryr seg om deg. Og DEN tror jeg blir litt mere borte i store klasser. Jeg husker de gangene jeg gikk på skolen og … hvis lærer'n kom og sa, og dette var bra Jon. Så, så vokste jeg så mye. Så tror du at disse her er så tøffe og det ser ikke ut som, men det er tull altså. Det er, det er et skalkeskjul eller det er bare sånn…. Så det der med å liksom… kjempebra! Det der skal du ikke undervurdere altså. Den derre, litt den dere fysiske kontakten, litt sånn rufsing i håret…. Det… eller … et lite klapp, på jenta på skulder'n og si VELDIG bra. Og mene det! Det er viktig. Dem gjennomskuer deg hvis du bare går rundt og … og prater tull altså.

> *lives. When they are 70-year-olds they'll say: 'I had a teacher I…' So what I do now… it will create ripple effects for the rest of their life, and you must be so humble about that… . Does that mean I do everything right? Not at all… But I am also… I am also… good at apologising if I have… made a mistake or… Yes, so… So be a team player with them…*[88]

Ultimately, Jon wants to be the teacher that the students remember because he helped them to leave school feeling good about themselves. He echoes here a desire that he has expressed in the pre-lesson interview:

> *… if they feel that they have LEARNED something…, either from a fellow student, or that they have understood something themselves…. … And that maybe I've just sown the little seed which develops then… I'm happy. I'm very concerned about that thing about … sowing seeds. Eh… and then the thinking can grow big and strong itself… And that might be in relation to morality, ethics or making wise choices or mathematics or other subjects. Not standing and saying that this is the answer, but… getting the students to reflect upon the little seed you have… sown… yes.*[89]

Jon takes a long-term perspective here on what learning and education is about. His job is about more than mathematics, being closer to the perspective of *bildung*[90] and the care for the whole child. As the experienced mathematics teacher, Jon has learned what matters in teaching:

[88] Vi har jo sånn dere desentralisert kompetanseheving nå om alle prinsippene. Eh… Og veldig mye gode prinsipper og… men … undervisninga er ofte langt fra det teoretiske. Det er en helt annen dynamikk som foregår og det er MASSE, det er masse, det er sånn som… (...) Det vi hadde på den desentralisert kompetanseheving, hvilke prinsipper er viktig i undervisning? Og da mener jeg at det, det høres ut som noe banalt og en floskel men, sørg for at alle elevene forstår at du er glad i dem og vil dem vel. Altså… La de oppleve at du tror på dem. Og mister du den så…. Ja, men at det verste av, eller både det beste og det verste av alt er at disse elevene tar med seg disse historiene resten av livet. De kommer til som 70 åringer å si, du jeg hadde en lærer jeg… Så det jeg gjør nå… det vil skape ringvirkninger resten av livet, og det, det der skal du være så ydmyk… i forhold til. Betyr det at jeg gjør alt riktig? Overhodet ikke … Men jeg er også… Jeg er også … flink til å be om unnskyldning hvis jeg har … gjort en feil eller… Ja, så … Så spill på lag med dem…

[89] …hvis de føler sjøl at de har LÆRT noe … av , enten av en medelev, eller at de har skjønt noe sjøl…. Så… Og at kanskje jeg har bare sådd det lille frøet som, som utvikler seg da… er jeg fornøyd. Jeg er veldig opptatt av det dere med … å så frø. Eh, … også får tankene vokse seg store og sterke sjøl… Og det er enten i forhold til moral, etikk eller ta kloke valg eller matematikk eller fag. Ikke stå og si at dette her er fasiten, men… få elevene til å reflektere rundt det lille frøet du har … sådd … ja.

[90] Originally a German stance on the philosophy of education with priorities of the development of independency and humanity of an individual in education, about the whole child. Norwegian traditional ideology of education is very close to this idea of *bildung*, using the Norwegian word *danning*.

> *No, so there is something behind… behind every single… young person, and behind the facade, there are often vulnerable… nice young people who just need to be seen and heard. I'm more and more back to such basic …principles.*[91]

7.3 The old timer - standing back

This analysis of Jon reveals a strong enactment of the Discourse of the old timer mathematics teacher throughout all the data. At the same time, he emerges as a complex figure as different figured worlds move in and out of prominence. In my early discussion with him, we see him drawing on twin figured worlds which value explanation and building on students' understanding, positioning himself as the knowledgeable and experienced teacher. He is assertive about his ability to teach well. In the classroom, Jon enacts the lecturer figure of the old timer mathematics teacher with his 'Socratic style', questioning students and expounding on the meaning of mathematical ideas. However, in so doing, Jon does not in fact do the teaching he says he does; his explanation and questioning does not seek to build on students' understanding. Instead, he tends towards funnelling and highlighting tips for answering questions.

However, as Jon reflects more on his own teaching and talks about the challenges of teaching Group 1, his concern for the students becomes evident. Drawing on a figured world which prioritises emotional support, he emerges as largely future-oriented, seeing his role in terms of the bigger picture. He wants the students to do well beyond school, and in this sense appears to be less concerned about their short-term mathematics achievement rather than their longer-term wellbeing. He takes what may be seen to be a realistic or practical view about the Group 1 students, suggesting that it is more important that he gives them the basic skills that they need, and that they feel good about their achievements. Most of all, he wants to be the teacher they like and remember.

Exploring the figured worlds that Jon draws on is important in understanding his enactment of the old timer mathematics teacher. His admission of difficulties in teaching in Group 1 may partly explain his lecturer approach and why he does not sustain the twin figured worlds of explanation and skilful questioning. At the same time, the role of a figured world which prioritises emotional wellbeing contributes to explaining even more of what we see in the

[91] Nei så er det et eller annet bak… bak hver eneste… ungdom, og bak den fasaden de er så er det ofte sårbare … fine ungdom som trenger å bare bli sett på og bli hørt på. Jeg er mer og mer tilbake til sånne grunnleggende… prinsipper.

classroom. What we see in his teaching centres mostly on Jon having a good relationship with the students, rather than a focus on teaching mathematics.

In the end, Jon stands out as the old timer mathematics teacher who focuses on the whole child, almost in the tradition of *bildung*. This care for the students is clearly evident in his talk about shaking hands at the beginning of lessons and the importance of ‘seeing’ them. It is also evident in his focus on more than mathematics when he describes his teaching as ‘sowing a seed’. At the same time, his care for the students is also evident in how he shows them that he can teach them algebra and they can learn it. It is not something to be frightened of, although honesty dictates that the Group 1 students do not really need such things as functions. What is most important in the end is his care for the whole students’ future possibilities.

Chapter 8. Discussion

This thesis explores three teachers' mathematics teaching as they work within the context of their local school culture and its decision to use attainment grouping, and also within the broader Norwegian education tradition of inclusive teaching and its policy of TPO. My review of the literature, in particular its juxtaposition of research on attainment grouping and on the impact of cultures of performativity, highlights the importance of recognising situatedness in understanding mathematics teachers' practice. For example, Hordern and Tatto (2018) point out how educational knowledge production and conceptions of teaching are not only influenced by global reforms through the culture of performativity but also by national contexts of education, as in the role of *bildung* in German education. Similarly, in their research on teaching in attainment groups, McGillicuddy and Devine (2018) find that teachers were influenced not only by the internal school context and organisation of teaching, but also by external pressure on test results in a culture of performativity. Hence, all of the research questions in this thesis address situatedness.

Gee's theory of critical discourse analysis offers a lens for exploring these issues through its emphasis on how 'saying-doing-being' always gains meaning in context, and the role of social forces and power in social practices. He argues that:

> *social goods are potentially at stake any time we speak or write so as to state or imply that something or someone is "adequate", "normal", "good", or "acceptable" (or the opposite) in some fashion important to some group in society or society as a whole (Gee, 2014, p. 34).*

This critical approach enables us to question what we see as 'normal'. This thesis thus aims to raise questions about the growing practice of attainment grouping as a means of delivering TPO in Norway despite the fact that international research casts doubt on its usefulness, and also that the practice conflicts with Norwegian humanistic values and an inclusive education ideology. It does this through a focus on the ways in which Lena, Julie and Jon position themselves in relation to each other and to the decision to group by attainment at Berg school. As illustrated in Chapter 2, Ball's early work on the terrors of performativity generated a number of research studies which focused on teacher identity with respect to policy. Parallels with these studies emerged through my analysis of Julie, Lena and Jon as performing Discourses of 'the "good" mathematics teacher' (Ball's 'lost soul' who is unable to be the teacher she wants to be), 'the competent mathematics teacher' (Holloway and Brass' ‘performative’ teacher who has known nothing else), and ‘the old timer mathematics teacher’ (Priestley et al’s agentic ‘experienced teacher’) respectively. In this discussion, I address each of the research questions of this thesis, focusing on the relationships and relative positions of the three teachers as they navigate the external and internal discourses in Berg School. I conclude that although humanistic values are antithetical to performativity, teachers can see attainment grouping as a means of delivering TPO despite the implied contradiction. At the same time, because of the way in which attainment grouping is glossed as caring for students, this humanist ideology can be a false resolution.

8.1 RQ1: How do Norwegian teachers enact mathematics teaching within a context of attainment grouping?

As we have seen in chapter 3, Gee describes ‘big D’ Discourse as “ways of combining and integrating language, actions, interactions, ways of thinking, believing, valuing, and using various symbols, tools, and objects, to enact a particular sort of socially recognisable identity” (Gee, 2014, p. 46). Applied to teaching, this emphasises the joint role of saying, doing and being as a teacher, and combines classroom practice with teachers’ reflections on that practice, focusing on the ways in which these come together to bring about a particular type of teacher identity – a ‘big D’ Discourse. Thus, this first research question asks about teachers’ enactment of mathematics teaching within a school which operates attainment grouping, aiming to understand each teacher’s (self)positioning through words and actions.

Saying, doing, being: positioning in a performative culture

As we have seen in the analysis, the three teachers are at different stages in their careers, and this is reflected in their positionality within Berg school and its delivery of TPO through attainment grouping.

In an account which is most akin to Ball’s (2003) teachers, Julie positions herself as uncomfortable with teaching in attainment groups: frequently emphasising her masters research as symbolic of values and knowledge which oppose those of Berg school, she also communicates a need to fit in with the others in the group. The result is “guilt, uncertainty, instability … [and] … a kind of *values schizophrenia*, … a potential ‘splitting’ between the teachers own judgement about ‘good practice’ and students ‘needs’ and the rigours of performance” (p.221). Although she claims that she agrees with the use of attainment grouping and follows the common agreement of the “we-culture”, her mode of expression “and then we try THAT” indicates her criticism of the “normal” at Berg school. As a consequence, Julie partly positions herself outside the group of teachers, contrasting “the others” and “myself” when she talks about decisions she does not agree with. This positioning is also evident when she describes how the teachers decided among themselves what groups to teach, leaving her with Group 2. Her account corresponds to Bradbury’s (2019) observation that there may be little space for alternatives when teachers are critical of attainment grouping. Her criticism goes beyond organisation, too: as we have seen, Julie’s enactment of ‘the good mathematics teacher’ involves strong advocacy of explorative teaching for all students when she talks to me. However, her uncertainty is also evident here as she claims that explorative teaching needs to be combined with a more traditional mathematics teaching: “But at the same time, there must be training and practicing as well”. As a junior teacher at Berg school, she is not in a position to go against the teacher group, like the early career teachers in studies by Sullivan et al. (2021) and Gray and Seiki (2020): despite having their own professional agendas, they struggled to enact the teaching they aimed for within a culture of performativity.

Lena, on the other hand, is wholly invested in the attainment grouping decision. She is the most vocal of the teachers in explaining the organisation in attainment groups. Like Holloway and Brass’ (2018) performative teachers, for whom the “language, calculations, and knowledge that were once ‘out there’ in the standards and testing apparatus” had become “the ‘inner’ knowledge that structured their fields of possible thought and action” (p. 378), Lena’s narrow experience of education – she has gone from school to teacher education to teaching at Berg - has left her with a performative sense of self. This was evident in her strong positioning of herself as ‘*the* Group 4 teacher’ - she is the ‘right’ teacher for Group 4, claiming a particular affinity with these students in terms of being someone who is also ‘a bit bound by rules’. Like Holloway and Brass’s teachers, her talk indicated values that “knowledge of good teaching resides in standards, rubrics, numbers, and related performance indicators” (p. 378). Group 4 is a context in which she has the requisite knowledge and skills to stay in control, and to ensure that her students get the grades they need. Comparing Jon’s teaching practice with her own, she argues that his style makes him the best teacher for Group 1 where “the didactics of the weak” is a requirement, something she would not be comfortable with.

Jon, by contrast, is self-assured in his enactment of the ‘old timer mathematics teacher’ who can stand outside the performative apparatus. He does not appear to take part in the ‘we-culture’ which Lena describes and in fact does not talk much about teaching in attainment groups at all. Nevertheless, he strongly positions as the Group 1 teacher who 'knows his stuff'. As an experienced teacher, he has seen fashions come and go, he has taken a lot of different teaching courses and he knows how to work with these students. Positioning as the old timer, Jon can choose to cover only the curriculum that he feels his students need and will benefit from, rather than teaching "just so that… I can tick the boxes". Like Priestly et al.'s (2015) finding that teachers with varied and broad experience were able to work within curriculum constraints, Jon goes along with the decision to teach in attainment groups, but as an old timer justifies making his own decisions within his own classroom.

Saying, doing and being: teaching mathematics

Gee describes socially-situated practice as "a socially recognized and institutionally or culturally supported endeavour that usually involves sequencing or combining actions in certain specified ways" (Gee, 2014, p. 32). We can apply this description to mathematics teaching as the practice of "sequencing or combining actions in certain specified ways". As the literature shows, the practice of mathematics teaching is often described in terms of two opposing approaches to teaching, the traditional or procedural approach, and the explorative or reform-oriented approach (Hiebert & Lefevre, 1986). Research suggests that there is a higher likelihood of procedural teaching in schools where there is a culture of attainment grouping (Boaler et al., 2000; Francome & Hewitt, 2018), and that government policy encourages the use of attainment grouping as a mechanism for increasing student performance (Ireson et al., 2005; McGillicuddy & Devine, 2018). This pattern is also underlined by Wake and Burkhardt (2013) who note that although inquiry-based teaching is widely promoted, it is undermined by a focus on measurement and what "knowledge" is desired. This also appears to be the case in Berg school, where the culture of performativity can be seen closely connected to its practice of teaching in attainment groups as a means of delivering TPO.

Lena's teaching is the most procedural of the three, despite her claim in our pre-lesson interview that it is important that students talk about mathematics. In her Holloway and Brass-style enactment of the 'competent mathematics teacher', her pedagogy is mostly teacher-led, and 'mengdetrening' has a particular function and value in ensuring that her students reach the grades they need. She highlights the importance of writing solutions 'properly' for the examiners. The significance of Lena's teaching is perhaps summarised in her frequently used word 'control': she concentrates on pace, and keeps control over classroom discussion, which does not take place between students but comprises teacher questioning and student responses. Lena does not question whether her approach restricts students' access to mathematics – this is the way she learns mathematics herself.

Jon's teaching reflects his old timer performance of the Socratic figure who is somewhat outside the system. Unlike Lena, he appears to see the Group 1 students as capable of engaging with the underlying concepts in mathematics, as in his exploration of algebra as patterns. Nevertheless, this highly individual enactment of 'doing and being' is in fact teacher-led as he both asks and answers his seemingly open questions, dominating the talk with his explanations, and even sometimes also funnelling the students. Ultimately, he appears to restrict the students' access to mathematics, an impression which is consolidated by his concern that he should correct ideas that are wrong.

Julie's particular position leaves her caught between the explorative mathematics teacher that she wants to be, telling the students that they are going to explore the mathematics of Pythagoras together, and sequences of actions which can only be described as a procedural teaching. Nevertheless, she persists with an explorative approach but finds that this is resisted by the students. As we have seen, the context of performativity leaves her uncertain as a teacher, and like Sullivan et al.'s (2021) early career teachers struggling to 'be the teacher they want to be' she is caught between the 'good' teacher promoted by her masters research and the 'quality' teacher that is demanded by policy.

For all three teachers, there is an apparent disconnection between their 'saying' and their 'doing and being', but a focus on Discourses helps us understand this complex picture, particularly in terms of their relative positions and career stages. Research Question 2 takes the investigation further, by exploring how teachers theorise and explain their practice through figured worlds.

8.2 RQ2: How do teachers explain and theorise their practice?

For Gee, figured worlds are what "mediates Discourses" (Gee, 2014, p. 95). A figured world is

> *… a theory, story, model, or image of a simplified world that captures what is taken to be typical or normal about people, practices, things, or interactions. (…) A figured world is a socially and culturally constructed way of recognizing particular characters and actors and actions and assigning them significance and value* (Gee, 2014, p. 226).

Hence, figured worlds are about what is ‘normal’ – they are simplified, and often taken-for-granted, theories about the world. I address Research Question 2 by focussing on the figured worlds or theories that Lena, Jon and Julie draw on as they talk about mathematics teaching - their students’ needs, students’ learning, and what these mean for how a mathematics teacher acts, what is important about those actions, and how these reflect who they are as mathematics teachers.

Figured worlds of mathematics teaching

The teachers’ theorisation of their practice is particularly evident in terms of what they see as normal or expected about “people, practices, things and interactions”. In the context of the contrast between procedural or inquiry-based mathematics teaching, each generates different expected *practices* and *interactions*, but also carries different expectations about people – the expected role of learners and teachers in the classroom, for example. Since figured worlds may be unconscious, these contrasts may not be explicitly drawn in what teachers say, nor might they be consistent - Gee argues that figured worlds “need not be complete, fully formed or consistent” (Gee, 2014, p. 111) - but all three teachers expressed simplifications of how they see the world of mathematics teaching which can be seen in terms of variations on procedural versus inquiry-based teaching. I begin with Lena, as the teacher who is most clearly aligned with a procedural approach.

Although Lena does not talk particularly about approaches to teaching, her enactment of the Discourse of the competent teacher draws strongly on a model of procedural teaching, in which she expects to be in control. This is evident through her teacher-led approach in which she presents mathematics as a body of knowledge to the students which they need to access through “*mass training*”. Lena’s theorising also includes expectations about learners, including herself, as captured in terms of types or levels. An assumption of fixed ability is thus key to her theorising of mathematics teaching and learning and this feeds and is fed by the practice of attainment grouping at Berg. As Bradbury (2019) reports, teachers teaching in attainment groups described students as having “a set amount of ability” which determined student needs. Similarly, McGillicuddy and Devine (2018) report that teachers who drew on a fixed ability view described attainment grouping as a tool for differentiation to meet diverse needs. Attainment grouping also lends itself to an assumption of different content and approaches for different groups, and this matches Lena’s view as captured in her phrase ‘didactics of the weak’, mirroring Mazenod et al.’s (2019) finding that teachers adapted their teaching for low attainers to match assumed needs of pace, content and a ‘non-challenging’ pedagogic approach. Despite her strong performative outlook, Lena shows awareness of a different theorising of mathematics teaching. At the end of her first interview, she reflects briefly that students can learn mathematics from each other even when they have different ways of understanding. It may be the case that this is something she says because she thinks I want to hear it. Even so, she goes on to say that she is "not good at this", perhaps justifying her normal practice; her dominant fixed ability figured world appears to underpin her whole theorising. As Fitzgerald et al. (2021) found, a persistent fixed ability view is a barrier to change in teachers' practice.

In keeping with her emphasis on explorative teaching, Julie's figured world is based on the importance of inquiry for learning, while her allegiance to mixed attainment teaching is underpinned by the idea that all students can therefore be successful in mathematics. Julie thus voices an espoused figured world - "a figured world people consciously say or think they believe" (Gee, 2014, p. 109). She holds on to this explicit theorising despite resistance from the students who "want to just get a formula …just solve tasks". However, as we have already seen, Julie's positioning as a junior teacher in a context where attainment grouping has a high profile makes her vulnerable to uncertainty, and we can see this in her frequent use of the word "kanskje" [maybe] in a lot of her talk about her theorising, and her suggestion that she can combine an explorative approach with more traditional and procedural teaching. Indeed, in the post-lesson interview, Julie voices a very different account of her practice, focusing instead on social-emotional bases for learning. I return to this issue below.

Jon theorises at length in his first interview about the importance of explaining mathematics and building on students' understanding, drawing on 'big names' such as Vygotsky, Einstein and Polya in his enactment of the educationally wise old timer – he both describes and performs this Socratic figure for me. This focus on students' understanding indicates an inquiry-based theorising of mathematics teaching as in his lengthy account of how he teaches algebra to the Group 1 students through exploration of patterns. However, in his second interview, Jon's theorising switches to a focus on the overall purpose of education and his own part in it; he expresses a concern for the future of Group 1 students and what they will actually gain from his mathematics teaching. He sees the main point of his practice to be the development of good relationships with his students and ensuring that they get on well in the world – and remember him as a nice teacher.

Theories of relationships in learning

Jon’s concern for his students reflects an overarching theme in Norwegian educational traditions – as described in Chapter 1, the origins of TPO lie in an emphasis on the importance of fostering development of the whole child. Norway is a system which is “marked by humanistic approaches and values, where the importance of developing the pupil, engaging in dialogue, care, democratic participation and other issues are not only recommended, but mandated” (Frostenson & Englund, 2020, p. 696). This background is evident in Lena and Jon’s theorising of their practice, where it plays a particular part in their positioning within the performative context.

A major element of the ‘doing and being’ of Lena’s practice is her focus on care for the students as a component of her mathematics teaching. It is easy to see that Lena has very good relationships with her students and is concerned about their general well-being: she chats with them about issues which are unrelated to mathematics – she is something of a ‘mate’ who sympathises with the students about the canteen prices, for instance. More subtle perhaps is the role of care in her actual teaching. Lena also operates with a figured world which maintains that the basis for teaching – and good mathematics lessons - lies in good relationships – this is “most of the job”. Thus as Chapter 5 shows, Lena’s practice emphasises her friendliness in how she talks to the students as they do mathematics; she adjusts to their way of talking, she uses fewer technical words, she is supportive - “how’s it going?”, “is it easy to understand?” – and she aims to build confidence. As I have argued in Chapter 5, this is all indicative of Lena’s strong stance on the Conversation about the teacher’s role and responsibilities. Taking this further, however, and understanding Lena as a post-performative teacher, her enactment and theorising illustrates what Frostenson and Englund (2020) report about teachers working in a performative school context where they are able to “embrace both performativity as an ideal and professional values of a humanistic kind” (p. 707). Like these teachers, Lena sees performative techniques – procedural teaching, attainment grouping, a focus on grades – not as contradictions to care but as a vehicle of care. Her fixed ability figured world emphasises that grouping means that the students “get what they need”, while emphasising what content is required on the exam and how to present their solutions provides the important details, they need to get good grades.

Relationships are also an important part of Jon’s theorising about his teaching and the purpose of education itself. Although far from being a performative teacher, Jon needs to navigate his way within the context of attainment grouping in Berg school. Doubting the usefulness of school mathematics for the Group 1 students, Jon is mostly concerned that the students feel good about themselves. No longer sure if his teaching works for the students, he emphasises the need to show respect for them, symbolised by his insistence on shaking hands with every student, so that he 'sees' them all. This emphasis on care and relationships is reminiscent of Frostenson and Englund's (2020) teachers again "when relating to their work, the teachers sincerely focus on the pupils and their development. You are there to motivate the pupils, to make them grow. It is the professional responsibility of the teacher" (p.702). Ensuring (self)respect for these students is part of his professional responsibility, linked to Jon's reflections on the purpose of teaching and what he ultimately sees as important in his role as a mathematics teacher - "I'm more back to such basic … principles".

For both Jon and Lena, the issue of relationships with students is closely connected to their mathematics teaching. Julie, on the other hand, does not subscribe to this particular theorising about relationships. As we know, she does not talk much at all about her relationship to the students. However, Julie *is* concerned about the students' relationships with mathematics. Her focus is on the role of mathematics teaching as a foundation for this relationship, in which she is member of a community of learners with the students - "and then we will EXPLORE…". It is in this sense that Julie has a relationship with the students, as part of her practice as an explorative mathematics teacher. As we have seen, this type of relationship is difficult to sustain within the context of Berg school.

As Gee emphasises, theories are socially and culturally constructed. Recognising situatedness means that the teachers' theorising provides some insights into the figured worlds that circulate in and define the culture at Berg school and the wider Norwegian education context. Research Question 3 thus widens the scope to understand the teachers' enactment and theorising in these wider contexts.

8.3 RQ3: What is the role of policy, social and cultural discourses in teachers' enactment of mathematics teaching?

Both the literature reviewed in Chapter 2 and Gee's theory/method highlight the role of situatedness in teachers' practice. Talking about the "terror of performativity" Ball (2003) emphasise how the culture of performativity changes both what education is about and who teachers are. As a result, teachers turn to "fabrication" and compromises, enacting "the other teacher" in order to be accountable. Responding to similar issues, Biesta (2008) raises the question of the purpose of education and how measuring learning outcomes controls what is valued in teaching and also limits what constitutes “good teaching”. As the literature review shows, other studies find that this situation results in teaching with less focus on deep learning and a more emphasis on standards-based teaching and procedural knowledge. This influence of performativity is even clearer in Perryman et al.’s (2018) description of panoptic performativity, in which teachers self-regulate in order to “tick the boxes”. There appears to be little room for alternatives within this culture, although some teachers manage to challenge it (Priestley et al., 2015). Hence, returning to what Ball (2003) almost warned would be the outcome of a culture of performativity in education, Holloway and Brass (2018) report some fifteen years later on the appearance of performative teachers who are socialised into the culture of performativity, and no longer question it.

Focusing on the influence of performativity in the context of mathematics teaching, Wake and Burkhardt (2013) find that the increased focus on measurement undermines moves to encourage inquiry-based learning rather than procedural teaching. This is also the case with respect to the persistence of attainment grouping as a teaching practice. Francis et al.’s (2017) study on why schools continue with teaching in attainment groups despite strong questioning of the practice in research, highlighted the role of discursive practices and policy narratives in establishing attainment grouping in a discourse of “natural order” in which it was seen as more effective. Discourses of (dis)ability also influence the practice of teaching in attainment groups, and Mazenod et al. (2019) report how assumptions about students’ ‘disability’ generate a perception that low attainers need to be nurtured with fewer demands and challenges, resulting in limited access to mathematics.

Thus a range of literature shows how performativity impacts on what happens in mathematics classrooms as a result of national education policy (Hordern & Tatto, 2018), as well as local school cultures (McGillicuddy & Devine, 2018). Looking to the case of Norway, it is noticeable and perhaps remarkable that a culture of performativity and teaching in attainment groups is developing despite Norway’s long tradition of humanistic values. So it is significant that Frostenson and Englund (2020) find that teachers working in such a culture manage to combine the conflicting values of performativity and care for the whole child. Understanding the teachers in this thesis requires seeing them in the context of Norwegian education culture and its policy of TPO for all students, mainstream schooling and inclusive teaching.

Hence, the final research question of this thesis focuses on the impact of education policy and the shifting social and cultural discourses in Norway on teachers’ enactment of mathematics teaching. As Gee reminds us, we need to understand the distribution of social goods and power: "…social goods are potentially always at stake any time we speak and write in a way that states or implies that something is "adequate", "normal", "good" or "acceptable" (…) to some group in society or society as a whole (Gee, 2014, p. 34). Gee thus emphasises that critical discourse analysis enables us to question what is taken for granted, and so reveal inequities in the distribution of power and social goods. As a social good, performance in mathematics impacts on students' lives beyond school, strongly connected as it is to assumptions about children's abilities and assumed disabilities. Williams (2012) argues that there is a "dual but contradictory value of mathematics education (…) - as an exchange value or as a use value"(p. 70); frequently, school mathematics becomes a social good which buys power and position. We can clearly see that Jon recognises this impact in what he says to me as he reflects on the long-term future of the Group 1 students, but the way in which all three teachers theorise their practice is influenced not only by Norwegian education policy but also the local school culture at Berg school and its taken-for-granted theories.

Local taken-for-granted-theories at Berg school

Gee (2014) describes how, entering a figured world, people learn to recognise and share what is valued and significant. At the same time, since we are not always conscious of figured worlds, we frequently incorporate taken-for-granted theories about the world which we operate within but do not question. Berg school can be seen as a local figured world in which certain practices, acts, tools and artefacts are valued and significant and associated with local taken-for-granted theories. The analysis suggests that in the world of Berg school, attainment grouping is seen as an obvious choice for delivering TPO in mathematics, and that this comes with an associated procedural teaching practice. It is important to note though that, unlike studies such as that by McGillicuddy and Devine (2018) which find that teachers are pressured towards attainment grouping as a result of accountability and performativity, attainment grouping was not imposed on the teachers at Berg school, nor was it the result of pressure in the school culture. This is clear from Lena's story about how the teachers decided to do attainment grouping. Although it is unclear what was the actual driver behind this decision, the role of TPO in Lena's account suggests that it needs to be seen as a response to the emphasis in the Norwegian curriculum on 'all students' rights to equal opportunities for learning' – as discussed in Chapter 1, attainment grouping is one potential solution to this policy, despite the fact that it appears to be in contradiction to values of inclusion.

For Lena, the figured world of Berg school is a source of local taken-for-granted theory. She does not question what is valued or significant in the school culture, and her own figured world of fixed ability feeds, and is fed by, by this figured world. For her, teaching in attainment groups is what makes TPO manageable for teachers, and is also the best way for the students to learn mathematics. Lena prioritises her own and other teachers' experience in her account, arguing that teaching in attainment groups provides students with what they *need*. This does not refer to their understanding but, rather, their *results*. As a performative teacher for whom the culture of performativity appears to be normalised, Lena is concerned as Biesta (2008) says to "tick the boxes" as she delivers the "results of TPO", reporting that she has done the teaching which is required, hence "discipline[ing] herself as a performative teacher" (Holloway & Brass, 2018, p. 378).

Although we can see Jon's figured world of mathematics teaching to be influenced by a procedural approach to teaching, he does not buy into the local theory at Berg school in the way that Lena does. Instead, taking up his positionality as the knowledgeable 'old timer', he chooses to stand outside, as in his second interview reflections on the Group 1 students' situation. Although he does not articulate his view explicitly, it is apparent that he is somewhat cynical about the usefulness of school mathematics for his students. Just as Williams (2012) questions the use value versus the exchange value of school mathematics, Jon recognises that the Group 1 students need some basic mathematics qualifications as exchange value in order to 'get on', as a "ticket to the future", even though this might not have any intrinsic value. At the same time, he wants them to have mathematics as use value, and as we see in the classroom observation, he promises them: 'you will understand this', and his attempt to explain the patterns in algebra reflects this aim. Nevertheless, in the post-lesson interview, he admits that his teaching of Group 1 is possibly not that useful after all. From his old timer perspective, he tells me how he has seen it all and sees through it: all the different initiatives and reforms are just fashion and politics.

However, Jon goes along with the local figured world and its practice of attainment groups. Although he does not totally engage in it, he neither challenges or resists it, despite what he says he sees as the purpose of education. Williams (2012) argues that critical teachers can challenge the emphasis on mathematics teaching as exchange value by offering access to the mathematics for all, and that this will involve resistance. Jon's emphasis on explanation demonstrates this desire to offer this access to all students, but the difficulties of teaching in Group 1 work against him, and the best he can do is to ensure that the students will do well in the future. Whereas Priestley et al. (2015) find that experienced teachers are more likely to go against the local school culture in their teaching practice, Jon does this only within his own classroom in a way which reflects what Hardy and Lewis (2017) describe as teachers' "doublethink", that is, accepting contradictory ways of thinking, both engaging in and also criticising a performative approach. He has to fit in and he does it in his way, emphasising explanation (even though he does not escape procedural teaching) and ultimately aiming to be a memorable teacher, teaching the students "beyond the exam" (Ro, 2021) . At the same time, being honest about the Group 1 students, he confesses to me that he cannot hope for much more than this. As I noted above, Jon does his best to be a professional in the circumstances.

Julie responds differently to the local taken-for-granted theory at Berg school, and to some degree resists it. She is clear that her preference is not to teach in attainment groups, and that she favours an explorative approach to teaching. She theorises her mathematics teaching on the basis of research that she has encountered in her masters' study. However, this theorising and her enthusiasm for explorative teaching is absent in the second interview, following her collapsed attempt in the lesson that I had observed before we talked. Instead, Julie appears to subscribe to the local taken-for-granted theory at Berg school that attainment grouping and the associated procedural teaching practice is good for the students. Reminiscent of Ball's (2003) fabricating 'other' teachers, she seems to be pleased that the students have worked on some tasks - "at least they did something". Instead of discussing the challenges of explorative teaching, she blames her difficulties on the students' lack of motivation. Restrictions on the organisation of her teaching together with the challenge to her theorising of her own practice prevent her from being "the teacher she wants to be" (Sullivan et al., 2021, p. 390) and force her towards a contradictory practice compared to own beliefs (Bradbury, 2019). Julie's position as a junior teacher becomes even clearer when we compare her situation to how Jon manages to operate within the local school culture at Berg school. Her lack of stature in the school pushes her towards self-regulation in a kind of panoptic performativity (Perryman, 2006) as she changes herself to fit with the expected teaching practice at Berg school.

The impact of increasing performativity

Although all three teachers enact different mathematics teacher Discourses, all are influenced by policy, social and cultural discourses, leading to tensions and conflicts. Taking a step out to the wider national educational context, we can see how the particular role of care is influenced by the Norwegian ideology of humanistic values. As Hordern and Tatto (2018) point out, educational knowledge production will always be strongly influenced by the national educational context where it is situated and operates, and the emphasis in Norwegian education policy documents on the importance of the whole child and relationships with students plays a particular role in this thesis, especially evident in Lena's Discourse.

As I noted in Chapter 1, teaching in attainment groups and focusing on students in terms of different levels does not at first appear consistent with the Norwegian tradition of inclusive education and its enactment through TPO. Nevertheless, an increased focus on student grades as a result of PISA-sjokket has combined with a narrowing of the interpretation of TPO towards a mechanism of accountability which is easily achieved through attainment grouping. The argument for doing so is evident in what Lena says in particular - it makes it easier for the teachers to address student 'needs' by organising them into apparently homogeneous groups through the language of levels. As noted above, this is an illustration of Frosentson and Englund's (2020) finding that post-performative teachers manage to combine the two conflicting cultures of performativity and humanistic values.

The main aim of this thesis has been to make sense of how the relationship between attainment grouping and TPO plays out in Norway. Using the lens provided by Gee's critical discourse analysis has enabled me to explore three very different teachers' 'saying, doing and being' with a focus on their situatedness within an increasingly performative culture which is in direct contradiction to deeply embedded traditions of inclusion and democracy. In the next chapter I will explore the implications of my findings for policy, practice and future research.

Chapter 9. Conclusion – revisiting the purpose of education

The major question I have explored in this thesis concerns what sense we can make of the increasing practice of attainment grouping in mathematics given the importance of humanistic ideals in Norwegian education, and the role of TPO in delivering those ideals. I have explored this issue through the lens of three teachers' enactment of mathematics teaching and their own sense-making of the contradictions between a focus on student results, their undoubted care for their students' wellbeing, and their professional aims as teachers. In this last chapter I will discuss how my analysis contributes to the field of research on policy impacts on mathematics teachers and teaching, and its implications for policy. I first focus on the methodological/theoretical contribution of my study, and how this underlines the need for a shift of focus in research on teachers' practice, particularly research on the impact of performativity. I next consider the implications of my approach, and my experiences as a researcher in the particular context I found myself in, for further research into teachers' practice and policy enactment. I end the chapter with some reflections on implications for education policy in Norway. I argue that there is a need to revisit the purpose of education, and to debate the role of attainment grouping in Norwegian education policy.

9.1 Contribution to knowledge – a shift of focus

I began this thesis by describing the role of humanistic values in the Norwegian education system and explaining the strong links between the principle of TPO and those values in terms of the inclusion of all students in schooling and a concern for equal opportunities for learning. I also described how the interpretation of TPO has gradually narrowed in recent years, as a result of the strong influence of neoliberal discourses. As I showed in Chapter 2, many researchers from Ball (2003) onward have noted the impact of a focus on results and resultant performativity on teachers' practice and identities. In mathematics education, Wake and Burkhardt (2013) show that the culture of performativity is highly influential on teachers' practice as they turn to procedural teaching despite the input of professional development courses which highlight the benefits of inquiry approaches. Research has noted that teachers navigate these conflicts with difficulty, although 'post-performative' teachers have been seen to re-construct their professional knowledge to take in a normalised emphasis on results.

The particular issue of attainment grouping in mathematics has often been researched from an evaluative point of view, considering teachers' practice in different groups. This research has tended to focus on teachers' perceptions of students, largely fed by fixed ability discourses (eg Mazenod et al., 2019). The contribution of this thesis has been to use Gee's critical approach to discourse analysis to broaden our understanding of teachers' practice in attainment groups, linking the ongoing attraction of attainment grouping (see Francis, Archer, et al., 2017) to the way in which performativity affects the nature of mathematics teaching. My analysis has often noted how teachers' accounts of their practice do not match with their actual practice. However, instead of focusing on these mismatches and the potential deficit view of teachers that this implies (both Lena and Julie could easily be construed as lacking in skill at various points), this thesis focuses on the policy context and how teachers enact that policy. What emerges from this shift of view is that their practice is more rightly understood as a product of their attempts to merge humanistic values of education with a growing focus on results in the Norwegian education system.

Hence this thesis unpicks how teachers make sense of what they do as they work within the contradictory context of performativity coupled with humanistic values. While Julie is more recognisable as the kind of 'lost soul' teacher who Ball (2003) writes about, and Jon invokes the conflict between exchange and use-value that Williams (2012) discussed, Lena clearly sees attainment grouping as a means of delivering TPO, channelling humanistic values through performative systems as Frostenson and Englund (2020) also observe. In her argument for attainment grouping as a means of TPO she "squares the circle" of the apparent contradiction between her care for students and her advocacy of grouping as she invokes student 'need' with respect to test results. This makes sense in the current Norwegian context. As I showed in chapter 1, despite a strong emphasis in the core curriculum on TPO as a key principle of inclusive teaching, the vagueness of the account of TPO results in an interpretation which is influenced by neoliberal discourses. A concern with results dominates arguments for attainment grouping as a means for delivering TPO, providing an illustration of Biesta's (2008) 'learnification'. In such circumstances, it is difficult to hold on to the purpose of education as stated in the core curriculum.

Gee's critical approach reveals how the power of an emphasis on testing and measurement plays out in teachers' practice, restricting what they do. Teachers responsible for delivering TPO find themselves in an impossible situation of teaching for humanistic values and neoliberal concerns. This thesis shows that changing teachers' practice is not the teachers' responsibility but a question of policy.

9.2 Implications for further research

I began this study with the aim of focusing on teachers' practice, expecting teaching to differ in relation to the composition of attainment groups as suggested by some of the research reviewed in chapter 2. My idea was to investigate how teachers adapted their practice with different groups in order to meet the principle of TPO. This aim was partly due to my connection with the Inclusive Mathematics Teaching research project (IMaT) (Research Council of Norway, 2023), which also started out with the remit of mapping and investigating the nature of grouping and teachers' practice in Norway. The scale of the IMaT project enabled data collection in a number of schools and municipalities, leading to an overall finding that grouping as an organisational practice is highly variable and local (Eriksen et al., 2022; Mausethagen et al., 2022). Preliminary analysis of teachers' pedagogic practice shows a complex mix of struggles with meeting the demands of TPO, concern with test results and student welfare (Eriksen et al., 2022) and also the impact on teachers' practice of pedagogic 'buzz words' which had high currency at municipal level (Foyn & Gray, 2022). My own study provided a unique additional opportunity to look in depth at teachers' practice in one school where attainment grouping had been unambiguously introduced in comparison to several schools in the IMaT project which had engaged in partial grouping only. As I have noted in chapter 1, my own feeling was that attainment grouping was not good practice, and access to Berg school gave me the opportunity to look closely at this situation.

However, once I started to collect and analyse the data, I realised that it was not possible to provide answers to my original questions about how practice differed between attainment groups. I recognised that teaching in attainment groups was strongly linked to policy and its interpretation by the teachers in the school. Reflecting on this now in retrospect, if I had started with this realisation about the role of policy, I would have collected additional data. To fully explore the impact and mechanisms of performativity, I would have collected further data which provided insights into the impact of policy within the school context, including the perceptions of students, parents, school leaders and school owners, but also other types of data - documentary data on the school aims and policies, minutes of meetings at school and departmental level, recordings of teacher planning discussions and decision-making. My late realisation of the potential contribution of such an extended dataset restricted my study, and I was unable to remedy this because of restrictions due to the Covid-19 pandemic. Carrying out my study at the beginning of the Covid lockdown had already caused restrictions on the data collection. In addition to cutting down on my available data collection time, I was unable to go back to collect any more data at the school. Although there are inevitably restrictions on what one person can do in carrying out a study within the frame of a PhD thesis, there were additional limitations as a result of the timing of my data collection. Further study would involve collecting data from a wider range of informants than the teachers, and would include documentary data as detailed above.

9.3 Implications for policy – revisiting the purpose of education

This thesis begins by asking how TPO can be delivered through attainment grouping. How can a principle of inclusion be interpreted as supporting a practice which is widely discredited in the research in terms of student learning and is, rather, a mechanism of exclusion? What becomes evident in this thesis is that despite the strong position on humanistic values of education and inclusive teaching in Norway, there has been a narrowing of the interpretation of TPO in recent years which undermines those same values. Strongly influenced by New Public Management (NPM), a discursive shift towards a focus on skills and competency in the curriculum contrasts sharply with its core humanistic values. As a number of commentators have argued (Fasting, 2013; Jenssen & Lillejord, 2009; Solhaug, 2011), the influence of neo-liberal discourse has changed the basic premises of inclusive teaching and TPO. At the same time, in the newly revised core curriculum (Ministry of Education and Research, 2017), we can see a renewed emphasis on the role of humanistic values and inclusive teaching, focusing on the whole child and education of the democratic citizen, and what is described as the double social responsibility for schools of both education and bildung. The contradictions of the fourth era of TPO (see Jenssen & Lillejord, 2009), in which the idea of learning community is strengthened alongside a neoliberal focus on results persist. Despite the renewed focus on humanistic values in the core curriculum, an emphasis on competencies and skills in the individual subject curricula opens the way for neoliberal discourses to dominate over and undermine humanistic values.

It appears that Norwegian teachers and policy-makers have failed to observe the narrowing of interpretations of TPO and its connection to the perceived validity of teaching in attainment grouping. While many teachers worry about the impact of attainment grouping on students, its use in addressing TPO has not been questioned. None of my three teachers really questioned this connection, with the possible exception of Julie, who struggled to articulate what was wrong. I argue that the gradual narrowing of understandings of TPO and the discursive shift towards the importance of what can be easily measured has led to a crucial absence of debate about values in education, or a silencing of voices of concern. This matches my personal experience of talking to teachers who clearly fight for humanistic values in education, but still justify teaching in attainment groups without recognising the inherent contradictions between the values of attainment grouping and of TPO.

As Frostenson and Englund (2020) show, the subtle shift towards seeing performativity "inside" humanistic value enables a glossing of the mechanisms of performativity which leads teachers to prioritise results as important for their students despite their misgivings about the pressures on those same students. As a result, performative techniques are used to argue about humanistic values. One example of this is the limiting of mathematics content for low attaining students which is justified as a means of inclusion and care in terms of the reduction of challenge which it is assumed they cannot meet, and a prioritisation of the basic procedures which will enable them to pass the test. In practice, this leads to restricted access to mathematics for these students, which really cannot be justified as inclusive teaching. However, as Francis, Archer, et al. (2017) find, the negative research on attainment grouping has no impact because of the assumed connection with student ability, and the prioritisation of narrow measures of performance. As this thesis has shown, in teachers' attempts to meet the demands of performativity, humanistic values almost occur as a "resolution" to their difficulties in ensuring that all students can meet test demands. Care for students, loosely defined in terms of student well-being rather than access to mathematics, provides something to hold on to as they manage the difficulty of delivering TPO for all students. This is particularly evident in how Lena talks about her work, and is clearly a disturbance for Jon in his long-term reflections on the point of what he is doing. While Julie tries to address the issue of access to mathematics, and has serious doubts about attainment grouping, the pressure on her to fit in with the general approach at Berg school is clear.

Against this background, I claim that there is a need for a public debate in Norway about TPO in the context of humanistic values of education and inclusive teaching. Despite the renewed emphasis on humanistic values in the core curriculum, this is separate from the details of the subject curricula, where mechanisms of performativity easily dominate. We need to recognise the contradictions within the curriculum and the influence of neoliberal discourses on Norwegian education policy. We need to see the core curriculum and the individual subject curricula as equal components and develop and understanding of how they can be brought together. The vagueness of TPO in the documentation has become problematic, and a discussion about what TPO actually means is required. Given the role of mathematics in both national and international comparisons, revisiting the intention of TPO as a pedagogical principle and how this applies to mathematics teaching is particularly important. While the focus remains on tests, it will be difficult to support teachers such as Julie in her development of teaching exploratory mathematics.

We also need to talk about the contradiction in using attainment grouping for TPO. Attainment grouping clearly does not work. It may raise results for some groups of students, but it also leads to limited access to mathematics for others. In the current climate it may appear to be a “well organised” way of teaching mathematics for TPO, but instead it leads to a restricted TPO. There is therefore a need to push back against arguments for attainment grouping as a means of raising students’ skills in mathematics. Attainment grouping needs to be thought through, and policy makers need to take research on attainment grouping seriously. Students’ performance in mathematics in Norway is not a problem which it is teachers’ responsibility to solve. It is a policy problem. This thesis has shown how teachers struggle to operationalise the policy of TPO in classrooms. In many ways, teachers are asked to do the impossible as they navigate contradictions between their professional aims and the demands of what Biesta (2008) calls ‘learnification’. This is not a question of improving teachers’ education or skills, as is often assumed, but of providing teachers with the opportunity to engage in pedagogical debate. Teachers in Norway are well educated, but while policy conflicts with professional knowledge, they have no opportunity for discussion or development, as Julie’s case illustrates. Unhappy with her teaching, she struggles to voice and address her concerns.

TPO as a principle for inclusion has been seriously undermined, therefore. In this thesis I have argued that teaching for TPO is not compatible with a culture of performativity and a focus on results. Biesta (2008) points out that a focus on results stands in the way of what we see as the purpose of education. As Jon says, “there is more to education than doing the exams”. We need to revisit the purpose of education and recognise how this has been overtaken by neoliberal discourses. In the absence of debate, we risk losing sight of central Norwegian ideals of inclusion and what these means for pedagogy which enables all students to access a deep mathematical understanding.

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Appendices

Appendix 1: Interview guide pre lesson interview

Intervjuguide lærer obs-skole 1.

Mål: Å få data omkring:

- Skolenivå; skolens syn på organisering for TPO gjennom mestringsgrupper/nivådeling.
- Lærerens syn på/antakelser om; hvordan elever lærer, beste måten å undervise, elevers evner (fixed or growth), om nivå og nivådeling og TPO. Elevers tilgang til matematikklæring.
- Lærerens tilnærming til undervisning i matematikk
- Hvordan læreren engasjerer/aktiviserer elevene

Skolens begrunnelse for undervisning med nivådeling (kun fagansvarlig)

- Hva er skolens syn på/begrunnelse for organisering ved nivådeling?
- Er organiseringen styrt av skolens ledelse eller lærerne?
- Hvordan organiseres nivådeling? For flere fag?

Spørsmålsguide - Intervju med læreren

Kort introduksjon

- Jeg ønsker å høre om dine erfaringer som matematikklærer. Målet med intervjuet er å få vite mer om dine synspunkter og dine tanker om egne erfaringer med bruk av matematikksamtalen og undervisning i nivådelte grupper. Det finnes ikke riktige svar og heller ikke gale svar. Alt du sier her er konfidensielt.

- Fortell kort om din bakgrunn som lærer; utdanningsbakgrunn og praksiserfaring.

Spørsmålsguide

1. Matematikkundervisning etter nivådeling.
   Dere organiserer deler av matematikkundervisningen etter nivådeling. Kan du fortelle om hvordan dette organiseres?
   - Hvilke kriterier bruker du/ dere for å lage gruppene og eventuelt revidere gruppesammensetning?
   - Bare utfra resultater eller også på bakgrunn av elevenes bidrag i undervisningen?
   - Hvem bestemmer gruppene?
   - Hvordan bestemmes det på skolen hvem som skal undervise på de ulike gruppene?
   - Hvilke forskjeller er det mellom hvordan undervisningen foregår i gruppene? Eksempler?

2. TPO og nivågrupper i matematikkundervisningen.
   Hvordan er du fornøyd med matematikkundervisningen organisert på denne måten? Fortell om hvordan du synes det fungerer?
   - Ulik undervisning til ulike grupper?
   - Hvilke nivågruppe underviser du på?
   - Hvilke nivågruppe ønsker du å undervise på?

- Hvordan er elevenes fornøyd med en slik organisering?

3. Din matematikkundervisning
   Fortell om hva du mener er den beste måten å undervise på (den ideelle matematikktime)?
   - Når føler du at du lykkes med undervisning og at du er en god matematikklærer?
   - Når føler du at du ikke lykkes?
   - Hvordan engasjerer du elevene?
   - Hvordan deltar elevene?
   - Hva gjør du for at så mange som mulig av elevene skal være aktive?
   - Hvem gir du ordet til? Bare frivillige som deltar?

4. Elevers matematikklæring
   - Hvordan mener du at elever best lærer matematikk?
   - Hvordan tenker du på hvordan elevene best lærer matematikk når du legger opp din undervisning? Blir undervisningen slik du har lagt opp til, eller må du justere underveis? Fortell.
   - Hva tenker du om elevers matematikklæring i nivådelte grupper/ ulike grupper?

5. Samtaler i matematikkundervisningen.
   Jeg er interessert i samtaler i matematikklasserommet.
   Hvordan legger du opp til samtaler i matematikkundervisningen? Beskriv gjerne eksempler.
   - Felles klassesamtale samtale mellom elever, samtale mellom lærer og elev?
   - Hvem snakker? Hvem leder? Hvordan involvere elever i helklassesamtale?
   - Diskuterer dere matematikk uten å komme fram til/fokusere på en løsning?
   - Bruk av samtale i ulike nivågrupper?

   Hvordan ser du på bruk av samtale for elevers læring i matematikk? Gi et eksempel.

Interview guide teacher School 1 (translated version)

Aim of the interview: To get data about:

- School level; the school's view on organization of TPO through mastery groups/attainment grouping.
- The teacher's view of/assumptions about; how students learn, the best way to teach, students' abilities (fixed or growth), about levels and attainment grouping and TPO. Students' access to mathematics learning.
- The teacher's teaching approach to mathematics
- How the teacher engages/activates the students

The school's justification for using attainment grouping in mathematics teaching (lead teacher)

- What is the school's view of/justification for organisation by attainment grouping?
- Is the organisation controlled by the school leaders or the teachers? Are the school leaders or the teachers in charge of the organisation
- How is the attainment grouping organised? What about other subjects?

Interview guide – Interview with the teachers

Short introduction

- I would like to hear about your experiences as a mathematics teacher. The aim of the interview is to get to know more about your views and your thoughts about your own experiences of using classroom talk and teaching in attainment groups. There is no right or wrong answer. Everything you say will be handled confidentially.

- Tell us briefly about your background as a teacher; educational background and teaching experience.

Question guide

6. Mathematics teaching in attainment groups.
   You organise parts of the mathematics teaching in attainment groups. Can you explain more about how this is organised?
   - What criteria do you use to decide the groups and possibly revise the composition of the groups?
   - Is grouping just based on students' results or also on the basis of the students' participation in lessons?
   - Who decides the groups?
   - How is it decided who will teach the various groups?
   - What differences are there regarding teaching in the different groups? Examples?

7. TPO and attainment groups in the mathematics teaching.
   How do you like this way of organising mathematics teaching? Please tell me how you think it works.
   - Different teaching in different groups?
   - In which attainment group do you teach?
   - In which attainment group would you prefer teaching?

- how are students’ thoughts about this way of organising teaching?

8. Your mathematics teaching
   Please tell me about what you see as the best way of teaching mathematics (the ideal mathematics lesson).
   - When do you feel you succeed in your teaching and see yourself as a good mathematics teacher?
   - When do you feel to not succeed?
   - How do you engage the students?
   - How participates the students?
   - What do you do to prepare for most of the students to participate?
   - Who do you get to speak? Just those who volunteer?

9. Student’s mathematics learning
   - How do you think students best learn mathematics?
   - How do you include how students best learn mathematics when you prepare and plan your teaching? Does your teaching become what you plan for, or do you need to make adjustments during the lesson? Explain.
   - What do you think about students’ mathematics learning in attainment grouping?

10. Classroom talk in the mathematics teaching.
    I am interested in discussions in the mathematics classroom.
    How do you prepare for discussions in the mathematics teaching? Please give examples.
    - Common discussions between students, talk between teacher and students?
    - Who talks? Who leads? How to involve students in a whole class discussion?
    - Do you discuss the mathematics without arriving /focusing on one solution or answer?
    - Use of classroom talk in different attainment groups?

    What do you mean about use of classroom talk in students learning of mathematics? Please give examples.

Appendix 2: Interview guide post-lesson interview

Oppsummerende intervju med lærer etter observasjon, skole 1.

1. Hvordan vil du selv oppsummere disse tre undervisningstimene, to i mestringsgruppe og en i hel klasse?

- Plan/mål for timen.
- Ble de som planlagt?
- Hva fungerte bra/fungerte mindre bra?

2. Hva vil du si om organisering/ tilrettelegging for TPO i undervisningen?
- Mestringsgrupper
- Hel klasse

3. Hvordan planla/ brukte du for samtale i undervisningen?

- I mestringsgruppe og i hel klasse
- Ulike typer samtale (mellom elever, mellom lærer-elev, i hel gruppe/klasse)

Post-lesson interview with teacher School 1 (translated version)

1. How will you summarise your teaching in these three lessons, the two in the attainment group and the one in whole class?

- The plan/ aim of the lessons.
- Did it turn out the way you had planned for?
- What worked well/ not so well?

2. What will you say about organising/ preparing for TPO in the teaching?
- Attainment group
- Whole class

3. How did you plan for use of / used classroom talk in the teaching?

- In attainment group and in whole class
- Different types of talk (between students, between teacher-student, in whole class)

Appendix 3: Original Classroom Extracts

Classroom Extracts chapter 5 – Lena

Classroom Extract 5.1

Tom: Fordi man ikke orker å skrive alle de andre tallene? Det er egentlig sånn juks.
Lena: Ja. Matematikere er late sier Jon hele tida.
Filip: Gjør det så enkelt som mulig.
Lena: Veldig godt poeng Filip. Gjør det så enkelt som mulig, men ikke enklere. Bra!
Filip: Det sier Jon.
Lena: Han gjør det. Han er en klok mann.

Classroom Extract 5.2

Lena: Og så når vi skal skrive opp og løse de oppgavene, hva er det vi alltid starter med da?...
Kari: Skriver opp den formelen.
Lena: Skriver opp den formelen. $k^2+k^2=h^2$ (Lena skriver opp formelen på tavla før hun spør elevene videre om noen kan forklare formelen).
Lena: Er det noen som kan forklare hva den, det uttrykket sier? $k^2+k^2=h^2$
Sara: (Tar ordet) *At man tar* k^2+k^2 *og det blir* h^2.
Lena: Hva betyr det da Sara?
Sara: Hva det betyr?
Lena: Ja k^2 *hva betyr det?*
Sara: Katet gange katet
Lena: Ja. For det han fant ut det var jo det at KVADRATENE ut fra sidene (Lena tegner inn kvadratene til alle de tre sidene på figuren på tavla). *At hvis man plusser på de to kvadratene her* (peker på kvadratene til katetene) *så blir det, tilsvarer det, det kvadratet til hypotenusen* (peker på det siste kvadratet).

Classroom Extract 5.3

Lena: Og hva gjør vi på neste linje da når DET er gjort? Maria?
Maria: Da regner du ut hva $4^2 + 3^2$ *er.*
Lena: 4^2
Maria: Ja
Lena: Hva er det for noe da?
Maria: Det er 16
Lena: Det er 16 (skriver på tavla) 3^2 *er?*
Maria: 9
Lena: 9 ... er lik x^2 (Lena skriver svarene på tavla). *Og så da? Neste... linje?*
Tom: Det går for fort
Lena: Går jeg for fort?... Vi skal se litt på det etterpå.
Tom: Ja
Lena: Ja...? Og etter at vi har gjort det?... Så gjør vi Sara?
Sara: Legger sammen 16 og 9
Lena: Som er?
Sara: 25
Lena: 25 (Lena skriver $25 = x^2$) *Og så da... For nå veit vi jo hva hele arealet er liksom inni den, det kvadratet her* (Lena peker på det store kvadratet) *Kari?*
Kari: Vi tar kvadratroten

Lena: Kvadratrot (Lena skriver inn kvadratrottegnet i ligningen) *… og da får vi at…*
Sara og Filip: 5
Lena: 5 … er lik… x. (Skriver på tavla). *Bra! Og hva er det som er viktig å passe på når vi skal FØRE sånne her stykker? Det pirker jeg veldig på. (…) Er lik tegn under hverandre… for da ser det mye ryddigere ut.*

Classroom Extract 5.4

Sara: Jeg skjønner ikke hvor, hva hvordan finner du eh, hvordan, hva blir liksom svaret hvis det IKKE er en rettvinkla trekant.
Lena: Eh, da kan du ikke bruke den metoden her for å FINNE ut hvor lange sidene er. (Lena peker på figuren av den rettvinkla trekanten)
Lukas: Hvordan finner du ut at den ikke fungerer?
Sara: Ja hvordan finner.. jeg skjønner ikke, er det sånn, hvordan får du bevist at den ikke ER… Får du feil svar eller liksom…?
Lena: Eh, eh, dere hadde jo en sånn oppgave på tentamen nå … til jul, hvor det stod at dere hadde fått en trekant som var (Lena tegner en trekant på tavla). *Bare sånn eksempel da at den var 10, 12, 13.* (Skriver opp tallene på sidene i trekanten. Snur seg mot klassen/Sara) *også skulle dere finne ut om den var rettvinkla.*
Sara: Ja, var det ikke noe sånn Pytagoras tripler?
Lena: Jo, Pytagoreiske tripler. Og da satt man jo bare inn (Lena peker på figuren) *det her i den formelen. Så $10^2+12^2=13^2$.* (Lena skriver opp på tavla). *Også så vi om det stemte. Og da vil du da få to forskjellige tall på hver sin side av er-lik tegnet* (peker på formelen) *og hvis de er helt like, så er'n rettvinkla. Det var det oppgaven gikk ut på på tentamen.* (Alle elevene følger tilsynelatende med. Lukas tar ordet og stiller et nytt spørsmål).
Lukas: ... ja men hvis… Så kan vi ikke finne ut om det er en rettvinkla…
Lena: Når du skal finne ut om det er en rettvinkla så FÅR du alle tre (Lena peker på de tre sidelengdene i eksempelet 10, 12 og 13). *Og da vil det heller ikke stå en sånn boks der* (peker på symbolet som markerer 90 graders vinkel) *der for å liksom… Finn ut, regn og…,vis med Pytagoras at trekanten er rettvinkla. Dere vil ikke få det med sånne [oppgaver]* (Lena peker på løsningen av den første figuren på tavla) *som har to sider.*

Classroom Extract 5.5

Lukas: Men har du finni ut det med firkant og sirkel? (spør Lena) *Fordi det er jo det samme.*
Lena: Vanskelig. Men det er jo litt med kriterier for hva som er en firkant da eller hva som er en sirkel.
Lukas: Hvis du noen gang, hvis du aldri hadde hørt om en sirkel og aldri hadde hørt om en firkant.
Lena: Da er ikke det nok forklaring
Lukas: En sirkel er rund
Lena: Ja, men hva videre? Det er jo flere ting som kjennetegner en firkant. (Lukas fortsetter å snakke om definisjoner av figurer.)
Lena: (Avbryter) *Nå er du bare irriterende Lukas.*

Classroom Extract 5.6

Lena: Ny oppgave. Vi tegner opp en ny en til. (Lena tegner en ny figur på tavla). *Vi må bruke litt fantasien her da for jeg er ikke så veldig flink til å tegne.* (Lena er selvironisk)
Filip: Jo'a kjempefint. (Kommenterer til Lena i en munter tone og med glimt i øyet).
Lena: Takk. (Kommentarer tilbake med et vennlig smil til Filip).

Classroom Extract 5.7

Tom: Så du bli litt sur om ikke jeg gjør det?
Lena: Jeg blir litt sur (glimt i øyet).
Tom: Ja først må jeg lære meg det her da.
Lena: Ja.

Classroom Extract 5.8

Tom: Lena, kan vi gå gjennom oppgaven nå?
Lena: Nå kan vi gå gjennom oppgaven. (Lena setter seg hos Tom som sitter foran ved kateteret).
Tom: Se, jeg har tegna den der (peker på det første eksempelet på tavla), *men ikke de andre to. Jeg har bare tegna trekanten.*
Lena: Okey. Tom. Han fant jo ut det med de kvadratene her ikke sant. Ut fra hver katet. (Lena peker på figuren i boka til Tom). *Og at arealet av den, det kvadratet* (peker i boka) *og arealet av DET kvadratet skal til sammen være arealet av det kvadratet her. Så derfor så skriver vi alltid at, k^2, det er det kvadratet der* (peker i boka) *pluss k^2 som er det kvadratet der* (peker videre)
Tom: Mm
Lena: Er lik h^2 som er den der.
Tom: Ja.
Lena: Så det er det første du kan starte med å skrive. Alltid den først. (Illustrerer en linje i lufta*). $k^2+k^2=h^2$. ALLTID den først.* (Tom skriver, Lena ser på). *Mm. Også begynner vi å dytte inn de talla vi har.*
Tom: Mm
Lena: Og hvilke tall er det som hører til her? (Lena peker der Tom har skrevet)
Tom: 3
(…)
Lena: Så hvis du liksom, det er det her (peker på oppgaven som er gjort) *de første oppgavene går på. Så hvis du går i boka di også begynner du på de første oppgavene. Så BRUKER du akkurat det du har gjort der.* (Peker på løsningen i boka).
Tom: Ja
Lena: Bare følg det slavisk hele veien.

Classroom Extracts chapter 6 – Julie

Classroom Extract 6.1

Julie: I dag så skal vi begynne på Pytagoras (Julie skriver Pytagoras på tavla). *Noen av dere har vært borti det i timen, altså i klassene deres, men… det her, vi skal liksom se på, … Eh, vi skal se på en rettvinkla trekant eller rettvinkla trekanTER skal vi se på. Vi skal se på, vi skal se på rettvinkla, dere skal få oppskrift her. Eh, men vi skal se på rettvinkla trekanter, også skal vi UNDERSØKE de rettvinkla trekantene.* (Julie starter å dele ut oppgavearket til elevene slik de sitter i grupper).

Classroom Extract 6.2

Julie: Dere har hørt om DET viruset her. (…) Vi skal prate litt om det her og vi skal se litt på TALL, angående coronaviruset.
Jan: Har vi matte nå?
Julie: Vi har matte. Mm.
Jan: Kult
Julie: (Julie bytter lysbilde på tavla som viser beskrivelse av en oppgaven til elevene.) *Eh, dere. Dere skal søke på nettet, eller, og prate litt på bordet, eh, der dere sitter.*
Aras: Hva har det med matte å gjøre? Jeg bare lurer.
Jan: Ja, men det er bra, for jeg liker ikke matte.
Julie: Ja, men det har mye med matte å gjøre
Aras: Har det det?
Julie: Ja, vi skal prate, altså det er masse, dere skal, det første dere skal gjøre er å finne et eller annet tall som har med det her Corona-utbruddet å gjøre. Også skal vi prate om det etterpå.
(…)
Julie: Dere, bruk 5 minutter på, eller 4 minutter på å eh, finne et tall, og prat om det. Og diskuter også, hva betyr det her tallet. Hva er det det sier dere, og den kilden som dere har finni det tallet. Er det troverdig? Da kan dere, da kan dere finne, eh, mobilene deres, dere som satte dem der, (peker på mobilhotellet) *dere kan gå og hente dem. Eh, skjønte dere hva dere skulle gjøre?* (Elevene gir ingen tydelig respons, men henter mobiltelefonene sine og setter i gang).

Classroom Extract 6.3

Adrian: Hva er geoemtrimodus?
Julie: Du trenger ikke, altså at du ikke har akser og rutenett.
Adrian: Å, ja
Julie: Hvis du åpner eh, åpner eh, hvert fall versjon 6, så får du litt sånn valg.
Adrian: Så bare helt blankt ark?
Julie: Ja.
Adrian Mm.
(…)
Julie: (Julie står ved Silje). *Eh, gå på innstillinger også vis eh, navn og verdi.*
Silje: Sånn her liksom?
Julie: Ja, men når du trykker på den (peker på en av funksjonsknappene)
Silje: Sånn? (Silje viser til Julie).
Julie: Mm, ja også kan du gå innstillinger, mm, også endre til navn og verdi, også vil jeg også at vi kaller'n 'a'.
Silje: a

Classroom Extract 6.4

Julie: Eh nå skal vi begynne å samle litt opplysninger fra dere. Eh, for nå (Julie går til tavla og begynner å tegne). *Vi har en trekant, som ser sånn her ut. Og vi har tre kvadrater. Sånn.* (Julie har tegnet en rettvinklet trekant med tilhørende kvadrater på tavla. Noen av elevene følger med på hva som skjer på tavla. Mange er ufokuserte.) *Her, eh, har alle snart, eller er på vei til å få en figur som ser sånn ut.* (Fortsatt mye prat i rommet, men Julie fortsetter å snakke ved tavla). *Eh, så har dere finni noen arealer.* (Julie begynner å lage en tabell over de tre arealene på tavla. Ingen av elevene følger med). *Eh, Isak* (Julie må igjen roe ned elevene). *Det dere skal gjøre nå er å gå opp på tavla og skrive de arealene som dere har finni.* (Noen av elevene følger med nå, andre er fortsatt urolige og ukonsentrerte.) *Men dere, Silje, Emma.* (Julie kommenterer for å få ro). *Dere skulle kalle den sida her a og den b og den c* (Julie skriver sidenavnene på figuren på tavla. Noen få elever følger med). *Sånn at arealet her* (peker på figuren og så på tabellen). *Det skriver dere i den kolonna her. Altså a^2 og b^2og c^2* (Julie skriver dette inn i kvadratene). *Okei, vær så god.* (Ingen av elevene går opp til tavla). *Altså bare skriv, ta med pc'en opp også bare skriv av de arealene dere har finni.*

Classroom Extract 6.5

Julie: Eh, hva er det, hva er sammenhengen mellom arealene, er den store oppgaven. Hva er sammenhengen? (Jens rekker opp hånda). *Jens har sett en sammenheng.*
Jens: Jo er det ikke at de første to, hvis du legger de sammen så blir det det siste? (Før Julie kan svare tilbake til Jens må hun gå til to elever som ikke følger med. Det er flere elever som ikke følger med. Det er mye lyd i klasserommet).
Julie: Hva sa Jens? De to første, når man legger sammen de så blir det den tredje. Eh, ser dere det? (Julie peker på de tre tallene i tabellen. Elevene snakker igjen med hverandre, men noen få ser på tavla). *Eh, ser dere det som* (plutselig spør en elev hvor mye klokka er.) *Eh, men altså, ser dere det her?* (Julie går til tabellen og viser på tavla). *Eh, ser dere at det arealet der* (tegner på tavla). *Altså skjønner dere hvorfor vi kaller det a^2? Altså, hvordan regner man areal av et kvadrat?*
Isak: Side gange side
Julie: Side gange side? Ja, og da får man, a gange a er akkurat det samme som a^2. Ikke sant. Mm. Så arealet av den ene der pluss arealet av den andre der, er lik, det største, arealet av den største firkanten. (Julie peker på alle de tre kvadratene). *Og det er Pytagoras. Det er Pytagoras. På torsdag så skal vi bruke den her til å regne.*

Classroom Extract 6.6

Julie: Pytagoras, eh Pytagoras gjelder rettvinkla trekanter. Er dere med? Eh, og vi så at eh, vi så at arealet av den her (markerer det ene arealet på figuren) *og arealet av den her* (markerer det andre arealet på figuren), *til sammen, blei arealet av den store* (markerer det store kvadratet). *Og den, det er en litt sånn finurlig greie som Pytagoras, eh, han har i alle fall fått æren av å finne det ut. Eh, så vi skriver, når vi skriver det her som en formel, så skriver vi, vi skriver a^2. Hvorfor skriver vi a^2?* (Julie markerer a^2 på figuren. Jens rekker opp hånda. Det er rolig i klasserommet og noen av elevene ser mot tavla. Julie venter i seks sekunder.)
Mina: a gange a
Julie: a gange a. Mm, hvorfor, altså hva er a gange a? (Julie kommenterer til en elev som ikke følger med). *Hvorfor er det a gange a?* (Jens rekker opp hånda. Julie skriver a^2 og b^2 i kvadratene på figuren. Hun venter nye seks sekunder før hun spør Jens). *Jens?*
Jens: Du skal jo gange høyde og bredde som er de to forskjellige (...) og da blir det kvadratdelen av betegnelsen.
Julie: Vi bruker a^2, b^2og c^2 fordi, altså det er egentlig snakk om arealet av den, av det kvadratet som er på hver side der. Og et kvadrat, hva er det som er spesielt med et kvadrat?

Adrian: Å, kvadrat, der er alle sidene helt like.
Julie: Ja. Derfor er det a gange a som er det samme som a^2. b gange b, b gange b er det samme som (viser på kvadratet på figuren) *b^2, og c gange c er det samme som c^2. Så når vi skriver den her formelen vår så skriver vi $a^2+b^2=c^2$.* (Julie går til tavla. Hun bruker grønn og rød farge når hun skriver formelen som samstemmer med de ulike kvadratenes farger på figuren. Nå er det rolig i klasserommet og flere av elevene ser ut til å følge med på tavla.)

Classroom Extract 6.7

Julie: Et eksempel på tavla, også skal dere regne oppgaver i boka. Noen oppgaver. Og så skal vi liksom oppsummere litt, etter hvert. (...) (Julie begynner å skrive på tavla. Hun tegner et eksempel med en trekant og setter på sidestørrelser.) *Eh, hvis den ene sida er 3 og den andre 4, hva er da hypotenusen? Eh, også, altså følg med nå. Vi skal skrive det opp ordentlig sånn at dere har et eksempel, eh, i regelboka som dere liksom kan, som dere kan følge.*

Classroom Extract 6.8

Julie: Begynn alltid, begynn alltid med å skrive opp den her formelen. (Julie skriver opp Pytagoras setning). *Skriv opp formelen først. Eh, for uansett om dere ikke eh, liksom får til resten så har dere hvert fall vist at dere skjønner at det handler om Pytagoras. Ja, altså* (peker på formelen) *a^2, eh, da putter vi, altså de her to* (peker på a^2 og b^2) *det er katetene våre. Så da setter vi, vi kan sette tre, altså hvem vi putter inn, 3 eller 4 for a eller b spiller ikke så stor rolle, for begge er kateter. Eh, men vi kan putte 3 inn for a. Da kan vi skrive 3 gange 3* (Julie skriver opp på tavla), *og, eh, hva er b da? Hvis vi har kalt a, altså sagt at a er 3.* (Jens rekker opp hånda. Fire andre elever følger med). *Jens?*
Jens: 4 opphøyd i andre
Julie: 4 i andre. Eller 4 gange 4. (Julie skriver inn i formelen). *Og c'en er jo den vi skal finne ut. Så den lar vi stå så lenge.* (Skriver c^2). *Eh, 3 gange 3?* (Julie venter to sekunder).
Adrian: 9
Julie: 9. 4 gange 4? (Julie venter i fire sekunder).
Adrian: Eh, 16
Julie: 16 (skriver 16 på tavla) *4 gange 4 er 16, mm.* (Skriver videre er lik c^2.) *Eh, 9 + 16, hvor er vi hen da?* (Julie venter i to sekunder).
Adrian: 25
Julie: Da er vi på 25. (...) Ja. Eh, og nå hvis vi veit at c^2, hvis vi veit at c^2, hvis vi veit at den her (peker på det største kvadratet på figuren) *er 25. Hva må den linja være da?* (Jens rekker opp hånda. Julie venter nye seks sekunder). *Altså det arealet her skal være 25* (Julie peker på figuren). *Og vi veit at det er et kvadrat, så den sida gange den sida må bli 25. To tall, like tall som vi ganger sammen og blir 25.* (Bortsett fra at Jens rekker opp hånda er det ingen respons fra de andre elevene. Noen ligger på pulten, noen sitter med ryggen til. Julie venter i åtte sekunder. Så rekker plutselig Line opp hånda). *Ja, Line?*
Line: 5
Julie: Det er 5. 5 gange 5 er 25. (Julie skriver videre på tavla). *Sånn at, og det vi egentlig gjør er å ta kvadratrot. Og vi får noe annet enn hele tall, så må vi bruke kvadratrot på enten, altså på kalkulator. Kvadratrot av 25 er 5. Ja, når vi jobber med Pytagoras så må dere, dere må huske å ta kvadratrot. Eh, for vi er ikke, altså vi er egentlig ikke interessert i arealet. Vi er interessert i den ene linja.*

Classroom Extract 6.9

Julie: Poenget er liksom, poenget er å finne de her arealene. Altså, hvis den er 5, da er arealet av den, det kvadratet liksom på sida her da?
Mina: Er det 5 gange 5 da?
Julie: Ja, da er det 5 gange 5.

Mina: Da er det 25
Julie: Og den her, 8, 8 gange 8 blir den da. Mm. OG hva er da arealet her? (Peker på figuren).
Mina: Da må jeg regne det og det da? (peker på de to arealene).
Julie: Det må du.
Mina: Hva er 8 gange 8?
Julie: 64
Mina: 64 pluss 25?
Julie: mm.
Mina: Det blir 89, nei.
Julie: Eh, jo, og, eh, men her (peker i boka) *89 eh, mm, for å finne hvor lang den sida er så, det klarer man ikke å ta i hode. Det må du bruke kalkulator for å få til. Ta kvadratrota av 89.*

Classroom Extract 6.10

Julie: Hvor mange prosent av de bekreftede tilfellene befinner seg i Kina? Hvordan regner dere ut det?
Maria: Er det ikke Kina delt på globalt?
Julie: Ja (Julie skriver denne formelen på tavla). *Antall i Kina delt på antall globalt. (...) Eh, men eh, er det noen som har regna ut prosenten her?* (Julie kommenterer noen elevnavn for å få de tilbake på sporet). *Eh, når vi skal regne prosent, altså hvor mange, altså, så la, altså det her er liksom et magisk ord da.* (Julie peker på et ord i oppgaveteksten). *AV. (...) Eh, når vi skal finne prosent, så leit ofte etter det lille ordet her; AV. For det sier noe om hva vi skal, altså hva vi skal finne prosenten av. Eh, og det, altså, hvor mange prosent AV de bekreftede tilfellene. Det betyr at vi skal ha de eh, under her* (Julie peker på nevneren i formelen). *Vi skal finne de som er I Kina* (Julie peker på teller) *av ALLE totalt* (Julie peker på nevner). *Så, det lille ordet der, viser liksom hva som skal være under brøkstreken. (...) Eh, altså, men antall i Kina* (Julie skriver ned tallet i teller)*, delt på antall globalt* (skriver tallet i nevner). *Eh, Maria hadde du regna ut?*
Maria: Eh, ja det var 91, 27.
Julie: 91 % (Skriver på tavla).

Classroom Extract 6.11

Julie: Prøv å regne ut. Hvor mange prosent av de som er bekreftet syke har dødd? Hvis vi tar Kina først da. (Julie går bort for å skrive på tavla). *Det er så mange, altså det er det tallet dere skal bruke. Og det tallet.* (Julie streker under de aktuelle tallene i teksten). *2873 døde av 79968.*

Classroom Extracts chapter 7 – Jon

Classroom Extract 7.1

Eva: Jeg skjønner ikke algebra.
Jon: Ja men hvis du ikke skjønner algebra skal jeg prøve å få det til… sånn at du forstår det i dag. (Jon nikker til Eva).

Classroom Extract 7.2

Jon: Ja mange synes at algebra, om ikke dritt, er ganske utfordrende og vanskelig, men jeg skal PRØVE å bryte det ned, ehh, Men. Er veldig, har dere lært at algebra er bokstavregning? (Lite respons). *Ja, for det er ikke helt riktig altså. Algebra er egentlig, og her skal dere få det riktige svaret, eh…* (går for å skrive på tavla). *Algebra, det er egentlig MØNSTERGJENKJENNING. Å kjenne igjen mønstre. Og det er vi flinke til. Kan dere se litt rundt i klasserommet her nå og se om dere ser noen mønstre. Noe som GJENTAR seg med eh, periodiske…* (Jon skriver på tavla; mønstergjenkjenning. Eva har hånda oppe og vil si noe) *Vent litt jeg skal bare skrive det her.* (Jon går bort til Mona) *Mona se på meg nå, ikke på tavla. Algebra det er?*
Mona: Gjenkjenning av mønstre
Jon: Ja gjenkjenning av mønstre,
Mona: Mønstergjenkjenning.
Jon: mønstergjenkjenning ja (Eva rekker fortsatt opp hånda). *Eva?*
Eva: Den der (peker på fliser over vasken)
Jon: Vi skal finne mønster ja.
Eva: Jeg ser på de rutene der ved vasken
Jon: Helt klart. Her har vi algebraiske, her har vi algebra. (Peker på flisene). *Her har vi mønstergjenkjenning.*

Classroom Extract 7.3

Jon: Og hvorfor kaller vi algebra mønstergjenkjenning? (hever stemmen litt). *Jo! Fordi hvis vi skulle hatt en formel for alle sirklene vi har i verden, så hadde vi hatt uendelig med formler. Men vi kan, vi kan se et mønster som går igjen. Et mønster som går igjen i alle sirkler, også kan vi finne en gener, EN formel for alle sirkler. Det er mønster det! Ikke sant.* (Jon «taler» til elevene). *Det er derfor vi kommer innafor, eller kommer innom algebra. Eh, og da veit dere at Albert Einstein han sa gjør ting så enkelt som mulig, men ikke enklere. Eh, så nå skal vi, nå skal vi ta eh, nå skal vi ta rett og slett og se på, eh, hvordan vi kan generalisere. Det er litt vanskelig uttrykk, men hvordan vi kan prøve og se systemer i ting rundt omkring oss. MEN, FØRST skal jeg skrive regel nummer 1 på tavla, i algebra. Og den er så, jeg tror kanskje det er den fineste regelen dere noen gang har sett før. Og det er at, regel nummer 1* (skriver på tavla) *Regel nummer, hashtag 1 skriver jeg. Og her kommer'n. Regel nummer 1, innafor algebra, og her kommer'n* (skriver på tavla mens han sier regelen høyt) *Det er ingen nye regler. E'kke det herlig? Og så er jo spørsmålet, hva mener jeg med at det ikke er noen nye regler? Eh, ja fordi, dette oppleves jo så, såpass vanskelig for mangeeee elever.*

Classroom Extract 7.4

Jon: Da er det slik at, timen i dag, den legger vi opp på følgende måte, eh, (Jon kobler klar en pc til projektor ved tavla) *det blir litt repetisjon fra oppstarten av algebra forrige time, eh, og så skal jeg ha en* (Jon viser med hendene) *en slags sånn litt sånn, ja hva kan man si, en litt sånn forelesning med dere, men dere MÅ også ha kladdeboka klar, fordi at under forelesningen så kommer jeg til å stille noen spørsmål. Og det skal dere løse for meg. Ikke sant.* (Jon går rundt i rommet mens han snakker). *Så det blir en litt sånn aktiv forelesning* (Jon viser med hendene frem og tilbake-bevegelser) *hvor jeg tar opp ting med dere også må dere*

gi meg svar (viser igjen med hendene frem-og-tilbake). *Okey? (...) Ja. Og algebra er da...*
Elias: Mønster
Jon : Mønstergjenkjenning. At vi ser noe mønstre, og ut ifra det så kan vi lage noe generelt. Ikke sant. Så, så jeg vil at vi skal bort fra den forståelsen om atte vi skal inn i et nytt univers. At nå skal vi begynne å regne med bokstaver, bokstavregning. For vi, vi jobber fremdeles med mengde, tall, aritmetikk.

Classroom Extract 7.5

Jon: Hvilket regnetegn befinner seg mellom tallet og bokstaven?
Chris: Gange
Jon: Bra, Chris. Eh, det er gange, og det må dere huske fordi, egentlig så stammer 4a, det stammer fra a+a+a+a. ikke sant. (Jon skriver dette på tavla med en pil til 4a) *og da har jeg repetitiv addisjon og da introduserer jeg multiplikasjon. Så a+a+a+a, jeg ser at jeg har 4 a-er. Da MÅ dere huske at det er gange. Også kan dere spørre meg nå. Spør meg nå Elias, hvorfor putter vi ikke på det gangetegnet?*
Elias: Hvorfor putter man ikke på det gangetegnet.
Jon: Det er fordi at matematikere er EKSTREMT late. Så hvis de kan, hvis de kan, kan skape...
Fredrik: Er du lat? Jeg syn's du går til butikken og sånt. Da vil jeg ikke kalle det lat.
Jon: Ja men (...) Men det der er. Dette her skaper mye, mye forvirring blant ungdommene. Fordi de husker ikke at når det står et tall og en bokstav så er det gange mellom, men det kommer jo fordi vi har repetert addisjon ikke sant. Så husk på det. Står det ikke noe mellom et tal og en bokstav, så er det gange. Og da er det veldig mange som har lyst til å si at, ja, men, hvis det står to tall ved siden av hverandre, er det gange der og da? Nei, da gjør vi ikke det. For 22, det er noe annet enn 2 gange 2. så det, dere må ikke blande de tinga der.

Classroom Extract 7.6

Jon: Mange fyrstikker har vi her?
Eva: Fire
Jon: Det er fire fyrstikker ja. (Jon står ved pulten til Eva og venter 3 sek før han går tilbake mot tavla.)
Eva: Ja
Jon: Ja det er en mengde. Fire fyrstikker. Alle vi skjønner nå hva det dreier seg om. Og Eva, (peker mot bildet av de fire fyrstikkene) *du har riktig på den første oppgaven.* (Jon skifter til neste bilde som viser to bilder, et med fire og et med to fyrstikker, og med et addisjonstegn mellom bildene. Han henvender seg til elevene.) *Ivar, hvor mange fyrstikker har vi her?*
Ivar: Står det pluss?
Jon: Ja det står pluss
Ivar: Begge bildene?
Jon: Ja gjør det som står der du.
Ivar: Ja da blir det seks
Jon: Seks fyrstikker. Skal vi se om det stemmer? Vi har fire fyrstikker i den bunken der (Jon peker på det første bildet) *også har vi to fyrstikker i den bunken der. 4+2, da har du en forståelse av at vi har seks fyrstikker til sammen. Ja, bra. Elias, hvor mange fyrstikker har jeg der?* (Jon har skiftet bilde. Bildet viser en fyrstikkeske. Jon henvender seg til Elias). *Ikke eske, hvor mange FYRSTIKKER har jeg der?*
Elias: Null
Jon: VET du at vi har null fyrstikker?
Elias: Det er null jeg ser hvert fall
Jon: Ja du ser null ja, men det ligger noen, det kan ligge noen fyrstikker oppi inni fyrstikkesken.

Elias: 25
Jon: 25, 0,
Eva: 3
Jon: 3. Kan vi ikke bli enig om at vi ikke veit da.
Elias: 20
Jon: Du sier 20 ja. (…) men det er bare det atte nå gjetter dere, og matematikk det handler aldri om gjetting. Det handler om, om rein fakta. Så hvor mange fyrstikker ser dere inni her nå? (Jon peker på bildet av fyrstikkesken).
Eva: x
Jon: x, eller jeg har brukt en annen, jeg har brukt en annen bokstav. (Jon skifter til et nytt bilde som viser esken med bokstavsymbol k).
Jon: Men vi, når vi ikke vet hvor mange fyrstikker vi har her så må vi bruke symboler. Og de symbolene det kan være a, det kan være x det kan være z. Det kan også være symboler som vi finner på, trekanter (tegner i lufta) *og sånt og, men i matematikken så har vi innført bokstaver. Så her har vi* (peker mot bildet på tavla) *så her har vi x fyrstikker eller k fyrstikker. Men a fyrstikker eller k fyrstikker det er det samme. Om vi bruker, om jeg hadde byttet ut den bokstaven der nå med a eller x eller sånt, spiller ingen rolle. Så i den fyrstikkesken her nå så har jeg k fyrstikker.* (Jon skifter bilde. Bildet viser nå en åpen fyrstikkeske med tre fyrstikker oppi.) *MEN, så ÅPNER jeg fyrstikkesken. Og hvor mange fyrstikker ser du nå?*
Fredrik: Tre
Jon: Ja. Så da hadde jeg (Jon finner en tusj for å skrive på tavla), *jeg hadde k fyrstikker* (skriver k på tavla). *Jeg visste ikke hva k var. Så ÅPNET jeg fyrstikkesken og da så jeg plutselig at det var 3 så da kan jeg sette inn tallet 3 i stedet for k og da ender jeg opp med 3 fyrstikker.* (Jon skriver 3 tallet på tavla og markerer en pil mellom k og 3, skriver så k=3.) *Og vanskeligheten rundt dette, ja men hvorfor skal jeg skrive k kan jeg ikke bare åpne og sånn? Ja dette kommer jeg til litt nærmere senere. Fordi atte, av og til så lager vi generelle uttrykk som vi kan bruke OVERALT hvor vi er på jordkloden og i universet. Men vi har en formel til alle figurer eller alle eh, ting som, som vi ser i naturen. Med andre ord, så vet vi at vi har, k=3. så før vi åpna så var det k fyrstikker. Nå vet vi at det er 3. Nå begynner det noen oppgaver her snart.* (Jon skifter bilde. Det viser bilde av fire fyrstikkesker. Jon peker på bildet og henvender seg til elevene). *Nå var det tre fyrstikker i fyrstikkesken i forrige oppgave. Det vet dere ikke nå. Dette her er noe nytt. Nå kan dere få lov til å…, men det vi vet er at det er like mange fyrstikker i hver eske. Okey, så spørsmålet mitt nå er, kan dere ta opp kladdeboka deres? Kladdeboka fram. Kan dere lage. (…) Her har vi noe mønster ikke sant, mønster som går igjen. Men kan dere nå LAGE et uttrykk for meg? Et algebraisk uttrykk? Vi vet at i disse fyrstikkeskene så ligger det noen fyrstikker. Vi vet ikke hvor mange som ligger der. Mitt spørsmål er, men vi vet at det er LIKE mange fyrstikke i HVER fyrstikkeske, hvor mange fyrstikker har vi nå?*
Eva: I den forrige var det tre
Jon: Ja men den forrige skal vi ikke bry oss noe om. Dette er nytt. Så her kan det være 25, her kan det være fire her kan det være to. Men kan dere, kan dere, gjøre noe med dette her? Dette her er veldig likt det vi hadde med disse her koppene på mandag vet du? Hva skjedde når vi hadde kopper med lik farge på? Under der så, under koppene våres på mandag så befant det seg en terning med tall og da sa jeg at, LIKE farger på koppene betyr samme terning under. Dette her er akkurat det samme, bare at nå har jeg gått bort fra kopper og terninger, og gått over til fyrstikker og fyrstikkesker, eller fyrstikkesker og fyrstikker. (Jon peker på bildet på tavla. Elevene får 10 sek ventetid). *Ja, hvis du spoler litt tilbake Ole. Hva kalte vi den fyrstikkesken der i stad?*
Ole: k
Jon: k ja. (Jon skriver k ved fyrstikkesken på tavla). *Hva kaller vi den der da?* (Jon peker på

neste fyrstikkeske og henvender seg til Ole).
Ole: a
Jon: Ja, ja men, du har jo den opplysninga. Det er LIKE mange fyrstikker i hver eske, så hvis det er k fyrstikker der (peker på den første esken), *hvor mange fyrstikker er det der da? (peker på den andre esken)*
Ole: Å ja, k.
Jon: Ja, også er det (peker på eske nummer tre)
Ole: k, også k på slutten.
Jon: Ja, kan du gjøre noe med dette uttrykket da? (Turid rekker opp hånda) Turid?
Turid: 4k
Jon: 4k. Eh, det du mener er at vi legger i sammen det også får vi 4 ganger k. Og nå spoler jeg litt tilbake. Fordi, repetitiv addisjon, altså når vi legger i sammen tall eller bokstaver, samme verdi, 2+2+2+2, da introduserer vi multiplikasjon. Og det sammen skjer i algebraen. Vi har k fyrstikker i den fyrstikkesken der (peker på eske 1). *Hva det er det vet vi ikke enda. Vi har k fyrstikker i den esken* (peker på eske 2). A*ltså er det 8 fyrstikker der* (peker på eske 1) *så er det 8 i den og 8 i den og 8 i den* (peker bortover på eskene), *men det vet vi ikke. Vi vet ikke hvor mange det er. Så sitter vi igjen med 4k mener Turid. Er det noen som er uenig?*

Appendix 4: Information letter students

Vil du delta i forskningsprosjektet

«Matematikksamtalen i klasserommet»?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å se på matematikksamtalen som foregår i matematikkundervisningen. I dette skrivet får du informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Dette prosjektet er en doktorgradsstudie om matematikksamtalen i matematikkundervisningen. Gjennom prosjektet er målet og se etter hvordan matematikksamtalen foregår både i helklasseundervisning og der undervisningen er organisert i ulike grupper.

Hvem er ansvarlig for forskningsprosjektet?
Oslo Met, storbyuniversitetet er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?
Deres skole er blitt spurt om delta på bakgrunn av at deres skole organiserer deler av matematikkundervisningen i ulike grupper.

Hva innebærer det for deg å delta?
Hvis du velger å delta i prosjektet, innebærer det at matematikkundervisningen i din klasse vil bli videofilmet. Undervisningen vil gjennomføres som normalt med din lærer tilstede. Det vil ikke innebære noen avbrytelser av undervisningen eller andre føringer for innholdet av undervisningen. Det vil bli gjort videoopptak av 3 - 6 undervisningstimer gjennom skoleåret 2019/2020.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan jeg oppbevarer og bruker dine opplysninger
Jeg vil bare bruke opplysningene om deg til formålene jeg har fortalt om i dette skrivet. Jeg behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- Det er bare prosjektansvarlig og veileder som vil ha tilgang til videoopptakene.

Navnet og kontaktopplysningene dine vil jeg erstatte med en kode som lagres på egen navneliste adskilt fra øvrige data. Jeg vil lagre datamaterialet kryptert på en egen forskningsserver.
Dere som deltakere vil anonymiseres og vil ikke kunne gjenkjennes i publikasjoner som vil publiseres.

Hva skjer med opplysningene dine når jeg avslutter forskningsprosjektet?
Prosjektet skal etter planen avsluttes 31.08.22. Alle personopplysninger og opptak vil da bli slettet.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,

- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir rett til å behandle personopplysninger om deg?
Jeg behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Oslo Met, storbyuniversitetet, har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

- Institutt for lærerutdanning og internasjonale studier Oslo Met, ved Sigrun Holmedal. Telefon; 67236630, epost; sigrun.holmedal@oslomet.no.
- Vårt personvernombud: Ingrid S. Jacobsen
- NSD – Norsk senter for forskningsdata AS, på epost: personvernombudet@nsd.no eller telefon: 55 58 21 17.

Med vennlig hilsen

Sigrun Holmedal
Prosjektansvarlig

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet Matematikksamtalen i klasserommet, og har fått anledning til å stille spørsmål. Jeg samtykker til:

☐ å delta i undervisningen som blir videofilmet

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 31.08.22.

(Signert av prosjektdeltaker, dato)

Jeg har mottatt og forstått informasjon om prosjektet Matematikksamtalen i klasserommet, og har fått anledning til å stille spørsmål. Jeg samtykker til:

☐ at mitt barn kan delta i undervisningen som blir videofilmet

Jeg samtykker til at opplysninger om mitt barn behandles frem til prosjektet er avsluttet, ca. 31.08.22.

(Signert av foreldre/foresatte, dato)

(Translated letter)

Do you want to participate in the research project “Classroom talk in mathematics teaching”?

This is a question for you about participating in a research project in which the purpose is to look at mathematical discussions that take place in mathematics lessons. In this document, you will receive information about the aims of the project and what participation will mean for you.

Purpose
This project is a PhD study on the classroom talk in mathematics teaching. The aim of the project is to find out how mathematical discussions takes place, both in whole-class teaching and where the teaching is organized in different groups.

Who is responsible for the research project?
Oslo Met, Oslo Metropolitan University is responsible for the project.

Why are you being asked to participate?
Your school has been invited to participate based on knowledge about that your school organises parts of the mathematics teaching in different groups.

What does it mean for you to participate?
If you choose to participate in the project, it means that the mathematics teaching in your class will be videorecorded. The teaching will be carried out as normal with your teacher present. This will not involve any interruptions to the teaching or other guidance for the content of the teaching. Video recordings of 3 - 6 lessons will be carried out throughout the school year 2019/2020.

Participation is voluntary
Participation in the project is voluntary. If you choose to participate, you can withdraw your consent at any time without having to give any reason. All information about you will be anonymised. There will be no negative consequences for you if you do not want to participate or later choose to withdraw.

Your privacy - how I store and use your data
I will only use the data about you for the purposes I have described in this letter. I process the information confidentially and in accordance with regulations of privacy.

- Only the project manager and the supervisor will have access to the video recordings.

I will replace your name and contact details with a code that is stored on a separate list of names separated from other data. I will store the data material encrypted on a separate research server.
As participants you will be anonymised, and you will not be recognized in publications that will be published.

What happens to your data when I end the research project?
The project is scheduled to end the 31st of August 2022. All personal data and recordings will then be deleted.

Your rights
As long as you can be identified in the data material, you have the right to:

- access personal data that is registered about you,

- have personal data about you corrected,
- have personal data about you deleted,
- be given a copy of your personal data (data portability), and
- send a complaint to the data protection officer or The Norwegian Data Protection Authority about the processing of your personal data.

What gives the right to process personal data about you?
I process information about you based on your consent.

On assignment from Oslo Metropolitan University, has NSD – Norsk senter for forskningsdata AS assessed that the processing of personal data in this project is in accordance with the Data protection regulations.

Where can I find out more?
If you have any questions about the study, or want to make use of your rights, please contact:

- Institutt for lærerutdanning og internasjonale studier Oslo Met, by Sigrun Holmedal. Telephone; 67236630, email; sigrun.holmedal@oslomet.no.
- Our data protection officer: Ingrid S. Jacobsen
- NSD – Norsk senter for forskningsdata AS, email: personvernombudet@nsd.no or telephone: 55 58 21 17.

With best regards

Sigrun Holmedal
Project manager

Consent declaration

I have received and understood information about the project Classroom talk in mathematics teaching and have been given the opportunity to ask questions. I agree to:

☐ to participate in the teaching which will be video recorded

I agree to my data being processed until the project is finished, around the 31st of August 2022.

(Signed by project participant, date)

I have received and understood information about the project Classroom talk in mathematics teaching and have been given the opportunity to ask questions. I agree to:

☐ my child can participate in the lessons that will be video recorded

I consent to information about my child being processed until the project is finished, around the 31st of August 2022.

(Signed by parent/guardian, date)

Appendix 5: Information letter teacher

Vil du delta i forskningsprosjektet

«Matematikksamtalen i klasserommet»?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å se på matematikksamtalen som foregår i matematikkundervisningen. I dette skrivet får du informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Dette prosjektet er en doktorgradsstudie om matematikksamtalen i matematikkundervisningen. Gjennom prosjektet er målet og se etter hvordan matematikksamtalen foregår både i helklasseundervisning og i undervisning organisert i ulike grupper.

Hvem er ansvarlig for forskningsprosjektet?
Oslo Met, storbyuniversitetet er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?
Deres skole er blitt spurt om delta på bakgrunn av at deres skole organiserer deler av matematikkundervisningen i ulike grupper.

Hva innebærer det for deg å delta?
Hvis du velger å delta i prosjektet, innebærer det at din matematikkundervisning vil bli videofilmet. Undervisningen vil gjennomføres som normalt med deg som lærer tilstede. Det vil ikke innebære noen avbrytelser av undervisningen eller andre føringer for innholdet av undervisningen. Det vil bli gjort videoopptak av 6 -12 undervisningstimer gjennom skoleåret 2019/2020. I tillegg vil du som lærer bli intervjuet om hvordan du bruker matematikksamtalen i din undervisning.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan jeg oppbevarer og bruker dine opplysninger
Jeg vil bare bruke opplysningene om deg til formålene jeg har fortalt om i dette skrivet. Jeg behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- Det er bare prosjektansvarlig og veileder som vil ha tilgang til videoopptakene.

Navnet og kontaktopplysningene dine vil jeg erstatte med en kode som lagres på egen navneliste adskilt fra øvrige data. Jeg vil lagre datamaterialet kryptert på en egen forskningsserver.
Dere som deltakere vil anonymiseres og vil ikke kunne gjenkjennes i publikasjoner som vil publiseres.

Hva skjer med opplysningene dine når jeg avslutter forskningsprosjektet?
Prosjektet skal etter planen avsluttes 31.08.22. Alle personopplysninger og opptak vil da bli slettet.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,

- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir rett til å behandle personopplysninger om deg?
Jeg behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Oslo Met, storbyuniversitetet, har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

- Institutt for lærerutdanning og internasjonale studier Oslo Met, ved Sigrun Holmedal. Telefon; 67236630, epost; sigrun.holmedal@oslomet.no.
- Vårt personvernombud: Ingrid S. Jacobsen
- NSD – Norsk senter for forskningsdata AS, på epost: personvernombudet@nsd.no eller telefon: 55 58 21 17.

Med vennlig hilsen

Sigrun Holmedal
Prosjektansvarlig

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet Matematikksamtalen i klasserommet, og har fått anledning til å stille spørsmål. Jeg samtykker til:

☐ å delta i undervisningen som blir videofilmet og delta i intervju som blir videofilmet

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 31.08.22.

(Signert av prosjektdeltaker, lærer, dato)

(Translated letter)

Do you want to participate in the research project "Classroom talk in mathematics teaching"?

This is a question for you about participating in a research project in which the purpose is to look at mathematical discussions that take place in mathematics lessons. In this document, you will receive information about the aims of the project and what participation will mean for you.

Purpose
This project is a PhD study on the classroom talk in mathematics teaching. The aim of the project is to find out how mathematical discussions takes place, both in whole-class teaching and where the teaching is organized in different groups.

Who is responsible for the research project?
Oslo Met, Oslo Metropolitan University is responsible for the project.

Why are you being asked to participate?
Your school has been invited to participate based on knowledge about that your school organises parts of the mathematics teaching in different groups.

What does it mean for you to participate?
If you choose to participate in the project, it means that your mathematics teaching will be video recorded. The teaching will be carried out as normal with you as the teacher present. This will not involve any interruptions to the teaching or other guidance for the content of the teaching. Video recordings of 6 -12 lessons will be made throughout the school year 2019/2020. In addition, you as a teacher will be interviewed about how you use classroom talk in your mathematics teaching.

Participation is voluntary
Participation in the project is voluntary. If you choose to participate, you can withdraw your consent at any time without having to give any reason. All information about you will be anonymised. There will be no negative consequences for you if you do not want to participate or later choose to withdraw.

Your privacy - how I store and use your data
I will only use the data about you for the purposes I have described in this letter. I process the information confidentially and in accordance with regulations of privacy.

- Only the project manager and the supervisor will have access to the video recordings.

I will replace your name and contact details with a code that is stored on a separate list of names separated from other data. I will store the data material encrypted on a separate research server.
As participants you will be anonymised, and you will not be recognized in publications that will be published.

What happens to your data when I end the research project?
The project is scheduled to end the 31st of August 2022. All personal data and recordings will then be deleted.

Your rights
As long as you can be identified in the data material, you have the right to:
- access personal data that is registered about you,
- have personal data about you corrected,
- have personal data about you deleted,
- be given a copy of your personal data (data portability), and
- send a complaint to the data protection officer or The Norwegian Data Protection Authority about the processing of your personal data.

What gives the right to process personal data about you?
I process information about you based on your consent.

On assignment from Oslo Metropolitan University, has NSD – Norsk senter for forskningsdata AS assessed that the processing of personal data in this project is in accordance with the Data protection regulations.

Where can I find out more?
If you have any questions about the study, or want to make use of your rights, please contact:

- Institutt for lærerutdanning og internasjonale studier Oslo Met, by Sigrun Holmedal. Telephone; 67236630, email; sigrun.holmedal@oslomet.no.
- Our data protection officer: Ingrid S. Jacobsen
- NSD – Norsk senter for forskningsdata AS, email: personvernombudet@nsd.no or telephone: 55 58 21 17.

With best regards

Sigrun Holmedal
Project manager

Consent declaration

I have received and understood information about the project Classroom talk in mathematics teaching and have been given the opportunity to ask questions. I agree to:

☐ to participate in the teaching which will be video recorded, and to participate in interviews which will be video recorded.

I agree to my data being processed until the project is finished, around the 31st of August 2022.

(Signed by project participant, teacher, date)

Appendix 6: Assessment of processing of personal data

Sikt

Notification form / Matematikksamtalen i nivådelte grupper / Assessment

Assessment of processing of personal data

Reference number
893406

Assessment type
Standard

Date
21.03.2019

Project title
Matematikksamtalen i nivådelte grupper

Data controller (institution responsible for the project)
OsloMet – storbyuniversitetet / Fakultet for lærerutdanning og internasjonale studier / Institutt for grunnskole- og faglærerutdanning

Project leader
Sigrun Holmedal

Project period
01.01.2019 - 31.08.2022

Categories of personal data
General

Legal basis
Consent (General Data Protection Regulation art. 6 nr. 1 a)

The processing of personal data is lawful, so long as it is carried out as stated in the notification form. The legal basis is valid until 31.12.2022.

Notification Form

Comment
Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet med vedlegg 21.03.19, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

MELD VESENTLIGE ENDRINGER
Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:

https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 31.12.22.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

Det er lagt til grunn at foreldre samtykket til elevens deltakelse. Samtykkeslippen må derfor tilpasses slik at foreldre kan oppgi elevens navn. Videre legger vi til grunn at lærer mottar et tilsvarende informasjonsskriv, og samtykker til egen deltakelse.
Det er nødvendig å legge til rette slik at elever som ikke deltar ikke blir med på opptak.

I tillegg må skolens rektor ha gitt tillatelse til at elever og lærer kan delta.

PERSONVERNPRINSIPPER
NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke behandles til nye, uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER
Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).

NSD vurderer at informasjonen om behandlingen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER
NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og/eller rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp ved underveis (hvert annet år) og planlagt avslutning for å avklare om behandlingen av personopplysningene pågår/er avsluttet i tråd med den behandlingen som er innsendt og dokumentert.

Lykke til med prosjektet!

Kontaktperson hos NSD: Kjersti Haugstvedt
Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Sikt

Notification form / Matematikksamtalen i nivådelte grupper / Assessment

Assessment of processing of personal data

Reference number	Assessment type	Date
893406	Standard	14.08.2019

Project title
Matematikksamtalen i nivådelte grupper

Data controller (institution responsible for the project)
OsloMet – storbyuniversitetet / Fakultet for lærerutdanning og internasjonale studier / Institutt for grunnskole- og faglærerutdanning

Project leader
Sigrun Holmedal

Project period
01.01.2019 - 31.08.2022

Categories of personal data
General

Legal basis
Consent (General Data Protection Regulation art. 6 nr. 1 a)

The processing of personal data is lawful, so long as it is carried out as stated in the notification form. The legal basis is valid until 31.12.2022.

Notification Form

Comment
NSD har vurdert endringen registrert 13.08.19.

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet med vedlegg den 14.08.19. Behandlingen kan fortsette.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Sikt

Notification form / Matematikksamtalen i nivådelte grupper / Assessment

Assessment of processing of personal data

Reference number	Assessment type	Date
893406	Standard	17.08.2021

Project title
Matematikksamtalen i nivådelte grupper

Data controller (institution responsible for the project)
OsloMet – storbyuniversitetet / Fakultet for lærerutdanning og internasjonale studier / Institutt for grunnskole- og faglærerutdanning

Project leader
Sigrun Holmedal

Project period
01.01.2019 - 19.10.2022

Categories of personal data
General

Legal basis
Consent (General Data Protection Regulation art. 6 nr. 1 a)

The processing of personal data is lawful, so long as it is carried out as stated in the notification form. The legal basis is valid until 31.12.2022.

Notification Form

Comment
NSD har vurdert endringen registrert 16.08.2021.

Vi har nå registrert 19.10.2022 som ny sluttdato for behandling av personopplysninger.

NSD vil følge opp ved ny planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Kontaktperson hos NSD: Elizabeth Blomstervik
Lykke til videre med prosjektet!

Sikt

Notification form / Matematikksamtalen i nivådelte grupper / Assessment

Assessment of processing of personal data

Reference number
893406

Assessment type
Standard

Date
24.06.2022

Project title
Matematikksamtalen i nivådelte grupper

Data controller (institution responsible for the project)
OsloMet – storbyuniversitetet / Fakultet for lærerutdanning og internasjonale studier / Institutt for grunnskole- og faglærerutdanning

Project leader
Sigrun Holmedal

Project period
01.01.2019 - 03.11.2022

Categories of personal data
General

Legal basis
Consent (General Data Protection Regulation art. 6 nr. 1 a)

The processing of personal data is lawful, so long as it is carried out as stated in the notification form. The legal basis is valid until 31.12.2022.

Notification Form

Comment
Personverntjenester har vurdert endringen i prosjektsluttdato.

Vi har nå registrert 03.11.2022 som ny sluttdato for behandling av personopplysninger.

Vi vil følge opp ved ny planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet/pågår i tråd med den behandlingen som er dokumentert.

Kontaktperson: Gry Henriksen
Lykke til videre med prosjektet!

Sikt

Notification form / Matematikksamtalen i nivådelte grupper / Assessment

Assessment of processing of personal data

Reference number
893406

Assessment type
Standard

Date
12.01.2023

Project title
Matematikksamtalen i nivådelte grupper

Data controller (institution responsible for the project)
OsloMet – storbyuniversitetet / Fakultet for lærerutdanning og internasjonale studier / Institutt for grunnskole- og faglærerutdanning

Project leader
Sigrun Holmedal

Project period
01.01.2019 - 31.01.2023

Categories of personal data
General

Legal basis
Consent (General Data Protection Regulation art. 6 nr. 1 a)

The processing of personal data is lawful, so long as it is carried out as stated in the notification form. The legal basis is valid until 31.01.2023.

Notification Form

Comment
Personverntjenester har vurdert endringen i prosjektsluttdato.

Vi har nå registrert 31.01.2023 som ny sluttdato for behandling av personopplysninger.

Vi vil følge opp ved ny planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet/pågår i tråd med den behandlingen som er dokumentert.

Kontaktperson: Gry Henriksen
Lykke til videre med prosjektet!

Appendix 7: GeoGebra task «Pythagoras»

GeoGebra-oppgave «Pytagoras»

1. Åpne GeoGebra (i geometri-modus)
2. Lag et linjestykke med bestemt lengde – velg en lengde mellom 1 og 100
3. Høyreklikk på linjestykket og gå til innstillinger. Gi linjestykket navnet a, og huk av vis «navn og verdi».
4. Lag en «Normal linje» gjennom et av punktene på linjestykket.
5. Lag et punkt litt opp på normalen.
6. Lag et linjestykke mellom disse to punktene som normalen går gjennom.
7. Høyreklikk på det nye linjestykket og gå til innstillinger. Gi dette linjestykket navnet b, og huk av vis «Navn og verdi».
8. Lag et «linjestykke mellom to punkter», slik at du får den tredje sida i trekanten. Høyreklikk, gå til innstillinger, gi linjestykket navnet c, og huk av vis «Navn og verdi».
9. Nå skal du ha en trekant, med sider a, b og c der lengdene synes.
10. Nå skal du bruke knappen «Regulær mangekant» til å lage kvadrater på de tre sidene i trekanten. Prøv deg fram hvilken rekkefølge du trykker på punktene, slik at kvadratene legger seg på utsiden av trekanten.
11. Zoom slik at du ser de tre kvadratene.
12. Bruk knappen «Areal» og trykk midt inni de tre kvadratene.
13. Skriv opp de tre arealene i skjemaet på tavla.
14. Bruk «Flytt»-pila og flytt på det øverste punktet på trekanten. Sjekk hvordan arealene endrer seg.
15. Kan du se noen sammenheng mellom de tre arealene????

GeoGebra task «Pythagoras» (translated to English)

1. Open GeoGebra (in geometry mode).

2. Create a line segment with a fixed length.

3. Right-click on the line-segment and go to Settings. Name the line segment a, and tick off "show name and value".

4. Create a "perpendicular" through one of the points on the line segment.

5. Mark a point a bit up on the perpendicular.

6. Create a line segment between the two points on the perpendicular

7. Right-click on this new line segment and go to stings. Name this line segment b, and tick "show name and value".

8. Make a "line segment between two points", which makes the third side of the triangle. Right-click, go to settings, name this line segment c, and tick "show name and value".

9. Now you have got a triangle, with the sides a, b, and c, and where the lengths of the sides are evident (visible).

10. Now you are going to use the button "Regular polygon" to create squares on the three sides of the triangle. Try out to figure out the order to push the different points, making sure that the squares are placed outside the triangle.

11. Zoom the screen so that all the three squares are visible.

12. Use the "Area" button and put the marker in the middle of the three squares.

13. Write up the three areas in the diagram on the board.

14. Use the "move" marker and move around the upper point of the triangle. Check out how the areas will change.

15. Do you notice any connections between the three areas????

Errata for doctoral thesis "The purpose of Education? Exploring the contradiction of inclusion through attainment grouping in Norwegian mathematics teaching", Sigrun Holmedal (2023)

Page	Para	Line	Original text	Corrected text
iii	1	3	is enable all	is to enable all
1	1	14	the old mathematics teacher	the old timer mathematics teacher
17	5	30	the old mathematics teacher	the old timer mathematics teacher
26	1	14	…educational orthodoxies	…educational orthodoxies"
72	1	7-9	such that 'Schools, classrooms, and (…) at macro-levels'	such that "Schools, classrooms, and (…) at macro-levels"
81	2	16	ordinary mathematics, and	ordinary mathematics lessons, and
90	2	22	competent teacher Overall	competent teacher. Overall
97	4	28-29	my study to Norsk senter for forskningsdata (NSD)	my study to Norsk senter for forskningsdata (NSD, Norwegian Centre for Research Data)
153	3	26	from WHO	from WHO (World Health Organisation)
158	1	6	a way to "avoid" "math problems".	a way to "avoid math problems".
163	2	18	in the commonly teaching plan	in the common teaching plan
197	3	28	'mengdetrening' has a	'mengdetrening' (masstraining) has a

Page	Original reference	Corrected reference
214	Barnes, Y., Cockerham, F., Hanley, U., & Solomon, Y. (2013). How do mathematics teaching enhancement programmes' work'?'. *Reframing Educational Research: Resisting the" What Works" Agenda. London*	Barnes, Y., Cockerham, F., Hanley, U., & Solomon, Y. (2013). How do mathematics teaching enhancement programmes 'work'? : Rethinking agency in regulative times. In V. Farnsworth & Y. Solomon (Eds.). *Reframing Educational Research: Resisting the "What Works" Agenda.* (pp. 37-49). Routledge.

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