Teachers’ Experiences with and Reported Use of a State-regulated Mapping Test in Numeracy

A mixed methods study

by

Jonas Juan Skjelbred Torkildsen

Thesis

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Teachers’ Experiences with and Reported use of a State-regulated Mapping Test in Numeracy

A mixed methods study
Abstract

This master’s thesis has investigated how a selection of 1st to 3rd grade level teachers use a state-regulated mapping test in numeracy. My study has been part of a larger follow-up study commissioned by the Norwegian Directorate for Education and Training and directed by the Department of Teacher Education and School Research (ILS) at the University of Oslo. These assessment tests have been developed by ILS as a tool for teachers to identify pupils with rigid counting strategies and naïve number sense. Test results are intended for use in assessment for learning for individual pupils who have test scores below a given threshold.

The overall research aim of this study is to investigate teachers’ experiences with and reported use of this mapping test. To support my inquiry, three auxiliary research questions have been defined to study which factors may influence the teachers’ experiences and practice with this test.

Research Question 1: Which intentions and beliefs can be deduced when teachers describe their own practice?

Research Question 2: Which motivational factors seem to influence the teachers’ work with the mapping test?

Research Question 3: What type of knowledge do teachers report using when working with the mapping test?

My thesis is based on in-depth interviews with two 3rd grade level teachers and survey responses from twenty-six 1st – 3rd grade level teachers, and the analysis is based on their reported experiences and practices but not observations of their behaviour and actions. The research procedures adhere to guidelines for mixed methods research, and the analysis has been both theory driven and data driven, underpinned by a dedicated theoretical bricolage. This bricolage is supported by literature on beliefs held by teachers (e.g. Fives & Gill, 2015), self-efficacy (Bandura, 1997), three concepts from self-determination theory (Deci & Ryan, 2000), a framework on mathematical knowledge for teaching (Ball, Thames & Phelps, 2008) and assessment for learning (Black, Harrison, Lee, Marshall & Wiliam, 2003; Wiliam, 2011a). Due to a smaller sample size than expected, only a few statistical calculations have
been carried out on the quantitative material, but survey data has been analysed qualitatively more extensively than what is common for such data.

It appears that teachers are interested in benefitting from test results; many report to study the guidance material carefully to e.g. learn the purpose of the test, to be confident about how to organize the test and wish to check whether dedicated measures are needed to assure proper and adequate test conditions. My research indicates variations in how teachers cooperate with colleagues on test organisation and completion. Some claim to work very closely; others report not to cooperate with anyone; findings from my interviews suggest that close cooperation increases efforts and satisfaction with test orchestration. It has been challenging to deduce which specific beliefs teachers hold, especially on mathematics, but their expressed follow-up activities indicate that learning is considered both an individual and a social practice. A high degree of self-efficacy (Bandura, 1997), i.e. strong confidence in one’s own teaching abilities, seems to be important if test results are to be used for further learning. Even though the mapping test is mandatory on the 2nd grade level only, it may be assumed that school management decides to also use the test on the 1st and 3rd grade levels. Teachers report to have latitude to plan and complete the mapping test, and post-process test results, i.e. they consider themselves to be autonomous (e.g. Deci & Ryan, 2002).

It has been challenging to derive what knowledge teachers employ, since they did not explicitly explain what they did to understand and analyse the responses of the pupils, but it has been possible to highlight knowledge on pupils as decisive to secure viable results and optimal test conditions, in particular during the preparation phase. Observations from this study suggest that teachers have positive attitudes towards the state-regulated mapping test and perceive it as an aid in their work with pupils. Well-functioning team collaboration seems to facilitate close follow-up of pupils below the level of concern by organizing dedicated course groups, as suggested in the guideline material.

Findings suggest that teachers with more than 30 credits in mathematics report to obtain new insight into what low-performing pupils master; teachers with less than 30 credits report that they do not obtain new information on what these pupils master. These observations are relevant, because other studies suggest that teachers make use of fairly sophisticated mathematics, even at lower primary levels (Ball et al., 2008). Even though my findings are not directly comparable to those by Ball et al., both studies indicate that teachers with strong background in mathematics are beneficial also for pupils in the lower primary levels.
Finally, the day has come when I too can submit my master’s thesis. What was originally planned as one year with intense writing, evolved into a two-year long race, which I felt interminable at times. Mental and physical distance from Blindern and its academic environment, but with a definite closeness to a wonderful group of 5th grade level pupils and in particular class 5A, where I am the head teacher, has been a balancing act. I highly appreciate being allowed to take part in your education processes, and many thanks to all of you for being who you are.

Now that downturns, fears and frustrations are behind me, pure joy and pleasure remain everlasting memories. I honestly have to admit that I am a bit proud of myself. But enough said about me; this thesis would never had come to fruition without a handful of people who in different ways have supported and helped me throughout this process.

First, I would like to express my infinite gratitude for all the support, love and everlasting beliefs in my abilities, generously shared by my parents Mona and Helge. Neither of you have an academic background, but you have all the same encouraged me to pursue a degree – but above all, you have taught me that through hard work and with a positive attitude, almost everything can be achieved. “Det gjelder å knokle på” are words of wisdom I have learned from my mother.

When it comes to facilitation, help, support and encouragement of my master’s thesis study, there are also people who deserve my appreciation.

I would like to thank all the interviewees and survey respondents. Unless you generously dedicated your time, there would not be material for this thesis.

I also owe many thanks to my supervisor Associate Professor Guri A. Nortvedt for offering me the opportunity to participate in the follow-up study which you manage, and your willingness to supervise and support me one extra year. Through these two years, you have always provided me with thorough, clear and well-substantiated feedback. You have inspired me to reach for more and be independent, for which I am grateful.

My friend Luis Cadahía-Lorenzo also deserves many thanks for all personal conversations, shared coffee breaks and not the least all the time you have dedicated and your engagement in
my work when I needed someone to discuss statistical methods with. I appreciate our friendship.

To all those who have contributed in different ways to a positive student experience at Blindern and who have had faith that I would fix this – you all know who you are. Thank you very much.

Last, but not least, I wish to thank Sigbjørn. Without you, I would never have been able to complete this race; your eternal confidence that I would succeed as well as offering a shoulder to lean on when things were rough has been decisive. The good discussions, especially when I talked about my project and ideas, both when inhaling and exhaling. In our discussions, you have challenged me to sharpen my arguments. You have been by my side, behind me and in front of me and cheered me all the way. For all your contributions, I am ever so grateful. I truly salute you.

Jonas Juan Skjelbred Torkildsen

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1 Introduction

This master’s thesis discusses how teachers use a state-regulated mapping test in numeracy\(^1\) for 1\(^{st}\) to 3\(^{rd}\) grade pupils in Norway, and my research is based on data from interviews and a survey. One of the goals is to gain insight into teachers’ experiences with these tests, based on intended and reported practices. In addition, it will be studied to what extent motivational factors may impact the teachers’ practice, and what type of knowledge they report to rely on. The term *pupil* is used to indicate that the scope for the mapping test is lower primary school pupils at the 1\(^{st}\) to 3\(^{rd}\) grade levels.

1.1 Background

The importance of education and its contribution to the development of modern society is widely recognized. Requirements imposed by society have varied throughout history in complex interplays with cultural, geographical, historical, religious and economic factors. One of the main aspirations of the core curriculum of Norwegian primary schools is to prepare children for their participation as responsible individuals and collective members of an increasingly global society (Ministry of Education and Research, 2006, p. 5). There are strong expectations with respect to what skills and knowledge should be acquired by school pupils, and these anticipations impose requirements on processes to facilitate and fulfil national educational goals, which are regulated and defined by Norwegian law. Education must be “adapted to the abilities and aptitudes of the individual pupil (…)” (The Education Act, 1998, §1-3), and pupils shall be encouraged and motivated by experiencing success and attainable challenges (Håstein & Werner, 2015). One of the primary purposes of mathematics education is stated as follows: “An active democracy requires citizens being able to study, understand and critically assess quantitative information, statistical analyses and economic prognoses. Therefore, mathematical competence is required in order to understand and influence processes in society.” (Ministry of Education and Research, 2013, p. 2). The mathematical capabilities which able citizens should master are often referred to by different terms in research, for instance *critical mathematical literacy*, *numeracy* and *mathemacy* (Niss & Jablonka, 2014, p. 392) or *mathematical proficiency* by Kilpatrick, Swafford and Findell

\(^1\) The Norwegian Directorate for Education and Training use the term *numeracy* when translating the Norwegian word *regning*. Due to this, numeracy it is used in the title though arithmetic would also be a viable term.
Although the nomenclature varies, all expressions seem to highlight “the awareness of the usefulness of and the ability to use mathematics in a range of different areas as an important goal of mathematics education” (Niss & Jablonka, 2014, p. 392).

Norwegian schools participate in both national and international comparative assessment tests, such as National Tests, Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMMS). The results are used to assess whether pupils have obtained the desired competencies. Some aspects of the performance of Norwegian pupils have been considered unsatisfactory (Kjærnsli, Lie, Olsen, Roe, 2007; Kjærnsli & Roe, 2010; Kjærnsli & Olsen, 2013). Even though the national and international tests are not run at the lower primary school level (1st to 4th grade levels), the Ministry of Education and Research expressed their concern in Report No. 16 Early Intervention for Lifelong Learning (2006-2007) that results do not meet expected standards. This was considered an alarming trend, and a measure to overcome the said deficiencies was the implementation of the National Curriculum for Knowledge Promotion 2006 (NCKP06). Results of subsequent assessment tests diverge; Norwegian pupils in the 4th and 8th grades scored close to the international average in mathematics in the TIMMS 2011 (Mullis, Martin, Foy, & Arora, 2012); results which may be considered acceptable. On the other hand, 91 percent of Norwegian 4th graders only reach the first of three levels, i.e. they obtain the TIMSS 2011 low international benchmarks (Mullis, 2013, p. 47), which clearly is below current ambitions.

It is essential to have a solid foundation in basic\textsuperscript{2} mathematics in order to do well in areas of pure and applied mathematics (Grønmo, 2012). Examples of pure mathematical knowledge may be comprehension of the relative values of numbers, relationships between numbers and understanding differences between integers and rational numbers. Such basic knowledge is known to be important if one wants to master calculations with confidence and flexibility (Lona Svingen, 2016). Thus, improving competencies in e.g. number sense and calculation skills is pivotal for learning more advanced mathematics. Number sense may be referred to as “a child’s fluidity and flexibility with numbers, the sense of what numbers mean, an ability to perform mental mathematics and to look at the world and make comparisons” (Gersten & Chard, 1999, pp. 19-20). Calculation skills may be described as “the abilities to calculate basic addition, subtraction, multiplication and division problems quickly, and accurately using

\textsuperscript{2}“basic” is interpreted as “essential foundation” or “fundamental”, but not “simple” or “easy” in this context.
mental methods, paper-and-pencil (…)” (Millans, 2011, p. 396). Research suggests that pupils who find mathematics particularly arduous often show indications of this early in their learning process; this may be due to e.g. insufficient number sense, few or naïve calculation strategies, or a combination of these factors (Baroody, 2003; Geary, 2003; Ostad, 2010; Verschaffel, Greer, & De Corte, 2007). However, teachers may have difficulties distinguishing between pupils who find mathematics difficult, and pupils who have a different mathematical development. A possible explanation why it may be challenging to distinguish between these two categories could be that even with naïve number sense and rigid mathematical strategies, pupils can find correct answers, although extended time might be needed (Ostad & Sorensen, 2007). Consequently, teachers run the risk of not detecting challenged pupils at a sufficiently early stage, making early intervention measures hard to implement.

The Norwegian Directorate for Education and Training requested the University of Oslo in 2012 to develop a second generation mapping test aimed at uncovering pupils in primary levels having weak number sense and calculation skills. These mapping tests are to date the only state-regulated tool which endeavours to identify such difficulties experienced by pupils in the 1st to 3rd grade levels (uv.uio.no3); the objective of the test is to employ the results of the lowest scoring pupils as part of their assessment for learning (udir.no4).

1.1.1 Personal interest of theme

Since my student years, and currently as a teacher with head responsibility for a class on the primary level (5th grade), I have been interested in how test results are used in the Norwegian school system. My initial interest was evoked during my first pre-service practice period in a school which organized a local mapping test in mathematics; I realized its potential as a tool to gain insight into pupils’ knowledge and to improve teaching practices if necessary. Unfortunately, the initial positive experience was counterbalanced by the realization that results were merely filed and used for bookkeeping purposes, i.e. to document that a mapping test had been carried out and little else. When I learned of the follow-up study after being admitted to the master’s program at the Department of Education at the University of Oslo, I saw an opportunity to contribute and participate in order to investigate teachers’ use of test

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3 www.uv.uio.no/ils/forskning/prosjekter/kartleggingsprover
4 www.udir.no/eksamen-og-prover/prover/kartlegging-gs/#formal-kven
results and which factors possibly influence their practice. My master thesis’ project is related to a follow-up study which aims at inquiring in more detail teachers’ practice with the second generation mapping test (cf. 1.2.2). However, my research topic and questions are based on my own decisions and judgements, in addition to guidelines given by the follow-up study and feedback from my supervisor.

1.2 Rationale and purpose

The Assessment for Learning Program was carried out by the National Directorate for Education and Training from 2010 to 2014. Its purpose was to strengthen and improve classroom assessment practices, and one of the findings was that even with close follow-up by the program, teachers reported insecurity and difficulties with respect to what should be assessed (Hopfenbeck, Tolo, Florez & El Masri, 2013). In addition, they expressed confusion on how to implement assessment for learning in accordance with the guidelines, and what was to be considered correct practice according to the program (Hopfenbeck et al., 2013, p. 68).

It is paramount to gain knowledge on how the mapping tests are used, since Norwegian teachers tend to rely on the prevailing ‘wait-and-see’ strategy, which is documented by Nordahl and Hausstätter (2009). Teachers rely on their pupils to catch up eventually, without knowing with sufficient certainty or confidence that they actually will (Nordahl & Hausstätter, 2009). The current practice may be justified since every pupil is unique and learns at his or her own pace. On the other hand, the success of the ‘wait-and-see’ approach is questionable, since the use of special needs’ education is substantially higher at the lower secondary school compared to the lower grades of the primary school (Solli, 2005). By the time pupils reach secondary school, a number of them have developed additional math-related difficulties (Solli, 2005), and in severe cases various degrees of math anxieties (see e.g. Ashcroft, Krause & Hopko, 2007). Thus, one should consider a more proactive approach to address mathematical learning issues as soon as they are sufficiently documented. By dealing with learning challenges and obstacles as early as possible, one may safely conjecture that fewer pupils will have learning difficulties later in life or require special needs’ education.

Implementing changes in complex and large organizations (e.g. the school system) often requires time and depends on a range of divergent factors (Davis, 2003; Ottesen & Møller, 2010). New guidelines, tests, curriculum etc., do not necessarily lead to desired changes or
improvements. In order to facilitate change, one needs mechanisms or performance indicators for evaluation and possible modifications of directions and measures continuously. Many mapping tests are used to identify and diagnose specific disabilities such as dyscalculia, dyslexia or other learning challenges; the mapping test in this study aims at identifying low-performing pupils without pointing to a specific diagnosis, but it is intended as a tool for teachers to devise learning goals and activities for the pupils in question (udir.no).

In order to improve future tests, it is hence important to investigate how teachers use information acquired by this state-regulated mapping test and to what extent their practice is in accordance with its objectives. It will also be conducive to clarify how teachers plan and facilitate further learning for these pupils. Gaining insight into the teachers’ experiences with and use of these tests is consequently relevant, because the teacher is considered an important factor for the learning outcome of pupils (Hattie, 2009).

1.2.1 Overall aim and research questions

With this background, the overall research aim of this study is to investigate the teachers’ experiences with and reported use of a state-regulated mapping test in numeracy. To support my investigation, three auxiliary research questions have been defined to study in more detail factors which may influence the teachers’ experiences and practice with the mapping test.

**Research Question 1**

Which intentions and beliefs can be deduced when teachers describe their own practice?

**Research Question 2**

Which motivational factors seem to influence the teachers’ work with the mapping test?

**Research Question 3**

What type of knowledge do teachers report using when working with the mapping test?

Given the open-ended and exploratory nature of my research questions, my ambition is not to reach conclusive answers, but to discuss various aspects from a primarily theoretical viewpoint, based on available data from interviews with two 3rd grade level teachers and

5 www.udir.no/eksamen-og-prover/prover/kartlegging-gs/#formal-kven
twenty-six survey respondents. For instance, I will refer to relevant theories on intentions and beliefs when analysing teachers’ statements on mapping test preparations, while at the same time endeavouring to explain their reported actions by referring to and making comparisons to motivational concepts and theories when applicable. An additional aim is to comprehend what type of knowledge teachers employ when they report on their practice with the mapping test, and my discussions will draw attention to relevant aspects and details, and point to plausible explanations and rationales for their reported actions.

1.2.2 The Context

When the University of Oslo was commissioned to develop a tool to identify low-performing pupils at an early stage, the Department of Teacher Education and School Research (ILS) organized the undertaking as a project with their research unit for Quantitative Educational Analysis in Education (EKVA). ILS started the development of the current test in 2012.

![Figure 1: Overall context timeline](image)

The first implementation of the second generation of the mapping test took place during the spring of 2014. Extensive guidance materials explaining how to use the test results for further learning were also published (udir.no⁶). After initial data analyses of the first live run, test results were sorted in numerical order, and the threshold indicating concern was set to the maximum score obtained by approximately 20 percent of the pupils in the lower end of the scale (uv.uio.no⁷). Figure gives a graphical illustration of the cut-score definition, which also takes into account the number of pupils considered manageable for one teacher to devote

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⁶ [https://www.udir.no/eksamen-og-prover/prover/kartlegging-gs/kartlegging-qs](https://www.udir.no/eksamen-og-prover/prover/kartlegging-gs/kartlegging-qs)

⁷ [uv.uio.no](https://uv.uio.no)
extra attention to during follow-up activities. However, the main goal remains to identify pupils who could benefit from closer interventions and follow-up.

![Diagram of cut-score definition]

**Figure 2: Cut-score definition.**

**Follow-up studies**

Since 2014, the second generation mapping test is followed in two subsequent studies at ILS. After the test has been run in different schools, data from a selection of pupils who are considered to be representative is collected to probe whether the test serves its intended purpose (uv.uio.no). Substantial data acquired from pupils scoring below the threshold of concern will thus become available over time, aimed at a better understanding of who they are, what they succeed with and what they are about to learn (uv.uio.no).

ILS initiated a study in the spring of 2015, directed by Associate Professor Guri A. Nortvedt, on the use of mapping tests in numeracy. In-depth interviews with teachers and school leaders were carried out (uv.uio.no) and the insight gained from the interviews with teachers and school leaders was then used to develop the surveys (uv.uio.no). The purpose is to acquire more knowledge on how schools use mapping test results to facilitate learning for those below the threshold of concern and investigate the following questions:

- How do teachers and schools managers prepare for the completion of the mapping test in arithmetic?
- How do teachers orchestrate and complete the mapping test with their pupils?
- How do teachers and school leaders follow up pupils with results below the cut-score, and how are test results used for assessment for learning with the pupils below the cut-score?

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7 [www.uv.uio.no/ils/forskning/prosjekter/kartleggingsprover/](http://www.uv.uio.no/ils/forskning/prosjekter/kartleggingsprover/)
**Research assistant role**

Prior to starting with the actual master thesis work, I contributed to the development of the interview guide and the survey questions and –design, but their structures cannot solely be attributed to my effort.

The interviews were a joint effort and conducted by Associate Professor Nortvedt and me. After the interviews were completed, we started improving the survey. I was employed a part of that period (June the 15th to 26th 2015) as a paid research assistant on the project and transcribed six interviews, in addition to commencing the work on the survey. At that stage, my role was not strictly that of a master student and Associate Professor Nortvedt that of a supervisor; rather we were fellow project members, even if Associate Professor Nortvedt held the formal position as project manager. During numerous meetings, topics regarding both the interviews and the subsequent survey were on the agenda and discussed thoroughly. I was encouraged to add improvements or issues of interest for closer investigation to the survey. Even though having the sense of adding a certain amount of personal flavour to the final result, I was very much aware that my research project should not become a side activity outside the scope of the main project. Therefore, I have been adamant to seek and identify data and aspects which merit further investigations within the frames of the project, while at the same time being open to go beyond the project charter.

**1.2.3 Research design of the thesis**

My research has been organized in three main phases. The first phase of my research project was dedicated to preparations, collection and initial analysis of interview data, followed by phase two, where the construction of the survey and collection of survey data were central tasks. In addition, the in-depth analyses of the interviews commenced during this phase. The third phase was dedicated to the analysis of survey data and further analysis of the interview data. Figure 3 gives an overview of the various steps of my research project; the asterisk (*) indicates activities where other resources associated with the ILS follow-up study were fully or partially responsible.
One of the advantages of this type of design\(^8\) is the potential contribution of information from the initial analysis of interview data to the final survey questions. Without this input when preparing survey questions, one may run the risk of defining questions which appear to be out of context, irrelevant or not applicable to survey respondents (Creswell & Plano Clark, 2011, p. 89). This design often has a penalty in terms of project duration and efforts, since two data collection activities will have to be carried out with the same level of rigour (Creswell & Plano Clark, 2011, p.89). However, since my ambition was to conduct research within the scope of the follow-up study, I assessed possible disadvantages to be equated by the benefits of two datasets, which enable thorough discussions of my research problem and –questions.

### 1.3 Structure and content of the thesis

Chapter 1 explains the general background information and educational assessment context for this work; the rationale and aims of my study are elaborated, and the connection with the ILS follow-up study is outlined to motivate and account for the scope of this thesis within the project charter.

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\(^8\) The use of e.g. one set of data to develop another instrument is commonly referred to as *exploratory sequential design* (Creswell & Plano Clark, 2011; Creswell, 2015).
Chapter 2 describes the theoretical framework of this study. Condensed recapitulations of social cognitive and social constructivist theories are presented first because they form a canvas for understanding my data. Additionally, elements of social constructivist theory and social cognitive theory are useful for the comprehension of the concepts employed in this thesis: beliefs, self-efficacy, autonomy, relatedness, competence, mathematical knowledge for teaching and assessment for learning. By using a theoretical bricolage rather than a single strand, the ambition is to capture wider aspects and comprehend better factors which influence teachers’ work with mapping tests. My underpinning assumption is that teachers’ practices are products of individual and external [social and contextual] factors.

In chapter 3, methodological choices, deliberations and procedures are presented and discussed. The objective is to give an honest account of the phases of the study to substantiate the claim that data has been collected and analysed according to best practices for such research. This includes, but is not limited to, interview techniques, selection of interviewees, development of the survey (questionnaire), statistical methods, sample sizes and validity and reliability considerations.

Supported by the theoretical framework of chapter 2, the data of this study are presented, discussed and analysed in chapter 4. The thematic organization of this chapter largely corresponds to a selection of the main phases of the teachers’ work with the mapping test in numeracy, i.e. preparations, analysis of test results and follow-up and implementation of measures. The test administration phase is devoted little attention, because it is considered to be relatively fixed and procedural with minor room for individual adaptations; hence it is considered to be less flavoured by personal variation, which might otherwise have shed light on individual practices and teachers’ intentions. For those mapping test phases which are addressed, theories from my bricolage are used to comprehend and possibly deduce which motivational factors, attitudes, beliefs, knowledge and learning views inspire and influence teachers, based on the interviews and the survey responses. A statistical analysis of answers to a small number of survey questions is also carried out; unfortunately, the response rate turned out to be too low and it has thus only to a limited extent been viable to employ statistical analysis methods on my data material.

A summary of the main findings are presented and commented in chapter 5; my three research questions are discussed and answered with references to my theoretical framework. I present some concluding remarks on the implications of my findings and observations, given
the aim to use test results as a part of assessment for learning with pupils below the cut-score. I end this chapter with comments on limitations for this study as well as pointing to some possible future work.
2 Theoretical framework

2.1 Introduction

Given the assumption that the work strategies of teachers are affected by multiple factors such as knowledge background, motivation and views on pupils learning, the theories in my bricolage have been selected for their relevance for the overall aim of my study and my research questions. As a consequence, the theoretical framework is not intended to be an exhaustive treatise on all theories and factors relevant for teachers’ work with the mapping test.

The following items will be elaborated:

- Teachers’ beliefs
- Motivational theories: Self-efficacy and self-determination
- Knowledge needed for teaching mathematics
- Assessment for learning

The above-mentioned concepts are introduced by definitions, followed by a brief description of their salient features, and essential parts of the concepts will be elaborated and related to the context of this thesis.

The framework labelled mathematical knowledge for teaching (MKT) is developed by Ball, Thames and Phelps (2008), and builds on Shulmans’ seminal research from (1986) and earlier work by Ball and Bass (2003). The MKT framework can briefly be described as an overview of certain components of the teacher’s work, ranging from subject matter skills to knowledge of pupils’ learning and how a professional teacher makes use of all necessary elements accordingly. This thesis is restricted to components which are believed to address practices related to the mapping test. Due to its theoretical focus, I consider the MKT framework (Ball et al., 2008) to be suited as a foundation for general discussions in this thesis, but it is beyond the scope to elaborate and discuss all components of the MKT framework. I employ Deci and Ryan’s three concepts of competence, relatedness and autonomy (e.g. 2000, 2002), Bandura’s self-efficacy concept (1997), research on beliefs held by teachers (e.g. Fives & Gill, (Eds.),
2015) and assessment for learning (AfL) (Black & Wiliam, 1998). The aim is to make use of the strengths of the various components in order to benefit from the “diverse theoretical and philosophical notions of the various elements encountered in the research act” (Kincheloe, 2001, p. 682). Following Kincheloe’s argument, these theories and concepts are intended to shed light on and facilitate the analysis of data collected by interviews and a survey with mathematics teachers.

2.1.1 Bricolage

As alluded to in chapter 1, the motivation behind my theoretical bricolage is to include several components which exert influence on teachers’ work when they assess test results and plan follow-up lessons for individual pupils. By analysing and interpreting data using the selected motivational theories, the objective is to investigate if or in which way motivational factors influence the work with the mapping test. The use of the SDT, for example, is justified because it builds on general (psychological) needs that are to be interpreted as “innate requirements rather than acquired motives” (Ryan & Deci, 2002, p. 7).

Some scholars criticize bricolage as being superficial; for example Kincheloe (2001), referring to Friedman (1998), McLeod (2000) and Palmer (1996), claims that “Attempting to know so much, the bricoleur not only knows nothing well, but also goes crazy in this misguided process” (p. 681). This is arguably a strong statement, however, diversity is meant to foster fruitful discussions inspired by the enhanced insight acquired through different perspectives. For instance, arguments from one perspective only may lead to suggested guidelines based on a limited understanding of which factors impact a teacher’s work with the mapping test. Consequently, there may be a biased emphasis on particular aspects or elements rather than a more global and holistic approach attempting to address the ‘bigger picture’.

Teachers’ reasons for their choice of plans of action and how to implement them can be motivated by a number of factors. For instance, research on teachers’ beliefs shows that teachers hold a range of thoughts and opinions about different aspects of their work (Schraw & Olafson, 2015, p. 87). Under these circumstances, certain beliefs may obfuscate others (Buehl & Beck, 2015, p. 72). Nevertheless, the amalgamation of beliefs will shape their practice in various ways; hence I find beliefs relevant for this study.
The differences between the concepts of the bricolage will also support my research with an ambition to “break away from consistency and a narrow focus on a particular aspect, to question weaknesses inherent in the mode of thought one embraces” (Alvesson & Skjöldberg, 2009, p. 270), and the endeavour is thus that “insofar as it is possible, all relevant voices are heard” (Denzin, 2010, p. 423).

2.1.2 Learning theories

This thesis uses social cognitive and social constructivist theories as starting points, because the theoretical framework consists of concepts which build upon or are part of either social constructivism or social cognitive theory. In this chapter, a brief description of what these concepts are and why they are considered relevant will be presented.

Social Constructivism

Schunk refers to Bruning et al. (2004) when he claims that constructivism is a psychological and philosophical perspective on how human beings construct and interpret their surroundings, i.e. understand it and act accordingly (2014, p. 231). He claims that constructivism is a type of knowledge formed within humans, rather than something which is imposed by its surroundings. It is claimed that constructivism is not really a theory, but an epistemological basis for “the nature of learning” (Schunk, 2014, p. 232). The term social constructivism is used in this context because it often is associated with mathematics (Alvesson & Skjöldberg, 2009, p. 51), and is concerned with cognitive structures and the extent to which we understand the world (Hjardemaal, 2014, p. 206). Gergen (1978) advocates a similar term: social constructionism (as cited in Alvesson & Skjöldberg, 2009), and it is worth noting that the two terms are often used interchangeably.

Within the fields of constructivism and social constructionism, the two scientists Jean Piaget (1896-1980) and Lev Semenovich Vygotsky (1896-1934) made vital contributions (Woolfolk, 2014, p. 387). For Piaget, acquiring knowledge was a cognitive process with different stages. These stages involved existing knowledge which was reorganized with new knowledge through equilibration, i.e. “changing the nature of reality to fit existing structures (assimilation) or changing structures to incorporate reality (accommodation)” (Schunk, 2014, p. 276).

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9 The focus is on the individuals psychological processes – often referred to “first wave constructivism” (Woolfolk, 2014).
Vygotsky emphasized the significance of social factors in the acquisition of knowledge and learning (Schunk, 2014, p. 242); cognitive processes taking place within a person in conjunction with its surroundings are important in Vygotsky’s theories, which are often labelled socio-cultural theories, because they underline cultural and historical factors in this interplay (Woolfolk, 2014, p. 389). A pivotal notion in Vygotsky’s theory was and still is the concept of zone of proximal development (ZDP), which is defined as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers” (Vygotsky 1978, p. 86). ZDP is a metaphor for the view that the surroundings play an important role in learning, either as a motivator, e.g. one observes what others can do, or as a direct consequence of others aiding and supporting before one is able to ‘stand on one’s own feet’. In other words, “the social environment as a facilitator of development and learning” (Schunk, 2014, p. 276) is at the forefront for human development. In an educational setting, it is believed that the approach of social constructivism is more motivating and presents opportunities for involvement by cognitively engaging pupils using various strategies (Schunk, 2014, p. 277).

Social constructivism is today often associated with different methodological positions, e.g. grounded theory, hermeneutics, and critical theory (Alvesson & Sköldberg, 2009), i.e. it is multi-ranging and multi-faceted. Even though it is a general framework, a vital part of social constructivism is the understanding of “how reality is socially constructed” (Alvesson & Sköldberg, 2009, p. 23). In this thesis, social constructivism is interpreted as a theory based on learning and knowledge construction(s) as a reflexive relationship between social and individual practice (Skott, Jess & Hansen, 2008). Thus, it will be important to try to understand what views teachers have on mathematics and learning by acknowledging their views as individual issues (factors within the teachers) and as an interaction between teachers and their surroundings.

Social cognitive theory
Social cognitive theory is, similar to social constructivism, based on the assumption that learning is both an individual and a social undertaking. The origin of the social cognitive theory is founded on the thoughts and work of Bandura (1925 –). Behaviouristic theories

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The interplay between social/historical factors and individual dispositions are often referred to as the “second wave constructivism” (Woolfolk, 2014).
dominated the decades prior to the late 1960s, but were considered by Bandura to provide an incomplete rationale for explaining human development and behaviours (Schunk, Meece & Pintrich, 2014, p. 141). Albert Bandura is considered the originator of the social cognitive theory, which has been developed through several works. The basis for social cognitive theory is according to Bandura (1986) the development of skills and regulation of actions. It is further described as a multi-faceted theoretical system, which aims at explaining causal structures for human actions (as cited in Bandura, 1997, p. 34). Bandura views cognitive and social factors as dialectic relations in a dynamic system – labelled reciprocal determinism. This triadic system is supposed to explain human behaviour by understanding it as an interaction between the individual, the environment and the behaviour. In this system, the surrounding world can act as a model and supporter for learning, but at the same time, one is influenced by experience (related to past [behavioural] events) and personal factors such as beliefs, self-perceptions and expectations (Woolfolk, 2014, p. 10). A focus of social cognitive theory is the relationship between the acquisition of skills and the resulting actions, i.e. the use of what has been learned. Having learned something does not necessarily imply that it has been put to use or that it can be used (Schunk et al., 2014,). In this context, motivation is an important keyword and by applying the self-efficacy component of the social cognitive theory, one can investigate and understand the actions of human beings, due to the central role of the interaction between internal and external factors (Pajares, 2012, p. 112).

“Social cognitive theory encompasses a large set of factors that operate as regulators and motivators of established cognitive, social, and behavioural skills. These factors operate through the anticipative mechanism of forethought.” (Bandura, 1997, p. 35). For Bandura, beliefs constituted a central aspect for understanding human action, and in his work Self-Efficacy: The Exercise of Control (1997), the concept of self-efficacy is heavily promoted. Self-efficacy is applied in this thesis to e.g. explain certain actions of teachers, and will be revisited in section 2.3. Since teachers can be considered “both products and producers of their own environments and their social systems” (Pajares, 2012, p. 112), the ambition will be to comprehend what teachers express through interviews and the survey as a result of these factors.

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2.2 Teachers’ beliefs

Fenstermacher (1979) predicted that beliefs would be an important aspect to investigate for educational researchers (as cited in Pajares, 1992, p. 329) and in 1992, Pajares conceptualized beliefs as “individual’s judgment of the truth or falsity of a proposition” (p. 316). Although this definition seems to be the most widespread, it is noted by Pajares (1992) and Philipp (2007a) that it is a challenging construct to define. Fives and Buehl (2012, p. 473) do not endorse the claim that the belief construct is hard to define, since many scholars have done so. They point to the inconsistency of the defined construct, which is in use across disciplines. Nevertheless, in the following, Pajares’ (1992) definition will be applied to beliefs; it will be elaborated in what way these beliefs manifest themselves and consequences for the teachers’ work.

Bandura (1997) claims that beliefs probably have more impact on a persons’ actions in various situations than actual ‘facts’, i.e. “In the moment-to-moment existence of practice, teachers frequently rely on beliefs, particularly those that underlie their intuition, automaticity, and habit, to meet their demands of practice” (Gill & Fives, 2015, p. 1). On the other hand, Skott (2015, p.16) refers to works by several scholars (e.g., Fives & Buehl, 2012; Ledermann, 1992; Wilson & Cooney, 2002) when he claims that some of the research on teachers’ beliefs show tendencies of leaning towards a “deterministic expectation that beliefs significantly shape classroom process”. At any rate, one may assume that the teachers’ use of the mapping tests is influenced by their multitude of beliefs. This implies that in order to understand how one may benefit from mapping tests as part of further learning, one should comprehend how the intentions of teachers are expressed (overtly or indirectly) when they report how they use the test results. Pajares (1992) argues that beliefs “(…) can only be inferred from a collective understanding of what human beings say, intend, and do” (p. 316). The focus of this thesis is the potential impact of teachers’ expressed attitudes towards the mapping test and their understanding of the test results on their reported plans of action. This is in accordance with Pajares (1992) and how the construct of beliefs is elicited.

2.2.1 Beliefs about mathematical knowledge

Rokeach (1968) claims that beliefs can be inconsistent and sometimes even contradictory (as reported in Watt & Richardson, 2015, pp. 191-192; see also Buehl & Beck, 2015, p. 75). This implies that even though teachers participating in this study describe diverse ways of working
with mapping tests and possible justifications for various choices, they may not actually implement or adhere to these expressed principles (no observations have been made), and justifications may actually deviate from expressed practice. And yet, the attitudes of the teachers participating in this survey displaying “(...) professional attitudes about education, teaching and learning” (Watt & Richardson, 2015, p. 192) are relevant, because it may provide information on the conditions which are necessary to align intentions and practices better.

There is a multitude of research on beliefs about math-related knowledge and its impact on teaching (Drageset, 2010; Kuntze, 2012; Philipp et al., 2007b; Skott, 2009). Teachers’ epistemological beliefs related to mathematics may manifest themselves in different ways. Teachers having a more sophisticated view on mathematics often consider mathematical knowledge to be malleable; in other words, it can be discovered, developed and adapted by the learner through critical thinking and discussions, among other things (Schraw, Brownlee & Olafson, 2013, p. 268). Without such an advanced view, there will be emphasis on e.g. the mastery of skills through memorization of facts (Schraw et al., pp. 268-269).

### 2.2.2 Beliefs about teaching and learning

Nespor (1987) argued that teachers are to a large extent influenced by their beliefs; frequently, when it comes to ‘on the spot’ decisions, they tend to act more in accordance with and influenced by their beliefs than specific and substantiated knowledge. Numerous research efforts seem to justify this supposition by arguing that beliefs are considered to shape teachers’ practices to various degrees (Buehl & Beck, 2015, p, 68). It is thus pertinent to comprehend how beliefs and practices are connected or even interwoven. In this context, issues related to teachers’ beliefs will be explored through e.g. teachers’ intentions related to planning, classroom interactions and activities (Fives, Lacatena & Gerard, 2015, p. 249).

Uzuntiryaki, Boz, Kirbulut and Bektas (2010) point to inconsistencies in pre-service science teachers’ beliefs on constructivism (constructivist teaching approach). Although the pre-service teachers’ beliefs did not change per se, their planning and intentions differed from the actual and observed practice in a classroom setting. Based on these findings, one may reflect upon whether experienced teachers will differ in the same manner. Novices may be more inclined to perceive classroom teaching and associated requirements through ‘rose-coloured glasses’. It is common for teachers to express views on teaching in line with social
constructivism, i.e. that learning is a social and individual issue. This has ramifications for
their mode of teaching, e.g. by making efforts to use teaching methods promoting
independence, individual thinking and sense-making using discussions, argumentation,
reasoning and explorations etc. (Cobb & Yackel, 1991; Cobb & Yackel, 1996; Lampert,
2001). Other researchers, such as Hertzog (2011), show that the teachers’ beliefs about
content and practices depend on associated beliefs, such as professional views on pupils’
abilities to learn and how capable one is to enable this, i.e. teachers need to hold positive
attitudes with respect to pupils’ learning, as well as a high (positive) sense of self-efficacy
with respect to completing this mission of work (as cited in Buehl & Beck, 2015, p. 75).

2.3 Self-Efficacy

Self-efficacy is situated in social cognitive theory (e.g., Bandura 1997, 2001; Schunk, 2014).
The concept of self-efficacy (Bandura, 1977; 1997) mainly concerns the relation between
one’s perceived competence to master situational and contextualized task(s), often at a
specific time. This type of self-recognition or opinion about ones’ own capabilities is
sometimes referred to or incorporated into the construct of beliefs employed in research on
teachers’ conceptions of their skills and knowledge required in their teaching. Bandura (1997)
argues that “perceived self-efficacy is concerned not with the number of skills you have, but
with what you believe you can do with what you have under a variety of circumstances”(p.
37). This belief in one’s own aptitudes is often characterized as a positive (high) or negative
(low) self-recognition of one’s skills and capabilities to perform optimally in challenging
situations. Teachers’ self-efficacy may then have consequences for the level of engagement
caused by an adjudged knowledge and skills required to actually achieve desired goals or
results. Bandura states that “efficacy beliefs can be created and strengthened for personal and
social change ” (2004, p. 621). One’s self-efficacy will affect the engagement and dedication
to a task during, a specific lesson or learning situation, even if one initially wants to
participate or challenge oneself.

It is beyond the scope of this thesis to discuss distinctions between self-efficacy, self-esteem,
self-concepts etc. (e.g. Bong & Skaalvik, 2003; Pajares & Schunk, 2001).
2.3.1 Self-efficacy in teaching

According to Bandura (2004), one of the origins of one’s competence-related self-efficacy is the relation between self-efficacy and task-specific engagement, e.g. if one has a positive belief that one has the skills and the required knowledge, it will increase the efforts put in and the level of comfort felt in the given situation (Bandura, 2004; Pajares, 2012). The decisive matter is thus “the core belief that one has the power to effect changes by one’s actions” (Bandura, 2004, p. 622), regardless of different non-personal factors that may influence this matter. There is a large amount of research on motivation, and in a school context, this research often addresses pupils’ motivation for engaging in subject specific areas, such as mathematics, by employing task specific interventions (Wæge, 2007). Even though there is a growing interest in the subject of motivation and self-efficacy for teachers, most research focuses on teachers’ self-efficacy in conjunction with e.g. ICT literacy competence (e.g. Rega & Fanni, 2012) or knowledge of subject specific content in mathematics (e.g. Roche & Clarke, 2013).

Teachers with high degrees of self-confidence of their teaching abilities will probably be more likely to seek new challenges with a desire to master new skills, to acquire new knowledge and change, if necessary, their practices in the pursuit of enhancing, adopting and embracing new teaching qualifications and styles. Low self-efficacy on the other hand, is considered to cause avoidance of challenging situations or procrastinations, if one’s perceived potential to affect the desired result is disparaged (Klassen et al., 2009; Wang, Hall & Rahimi, 2015). This devaluation of one’s own abilities may be recognized through a number of factors; teaching is often heavily textbook based, focused on instrumental understanding of the subject with a tedious approach to the matter, as opposed to relational understanding (Skemp, 1976/2006). However, I would like to point out that tedious in this context should be understood as rigorous and inflexible, and often implies a ‘one size (should) fits all’ approach by providing tasks that demand low cognitive interaction (Skott et al., 2008).

According to Perry et al. (2005), teachers who emphasise and promote pupils’ ability to reproduce previously learned facts through schematically fixed procedures [instrumental] can often be associated with their level of knowledge of the subject or content (as cited in Cross Francis, Rapanicki & Eker, 2015, p. 345). Instrumental understanding concerns the use of algorithms without deeper understanding of the mathematics upon which they are based (Skemp, 1976/2006). This may, as an example, have implications for knowing when to use...
specific algorithms. Furthermore, it is suggested that teachers with high self-efficacy are more inclined to encourage pupils to try new approaches, strategies and have high(er) expectations for students’ engagement and beliefs about their capabilities (Swar, 2005, as cited in Cross Francis et al., 2015, p. 345). Teachers with high self-efficacy more frequently support pupils’ learning by employing tasks which require high-level, cognitive capabilities. This would indicate that the teaching approach is based upon the understanding of algorithms [relational], and less on memorization of specific algorithms (Skott et al., 2008, p. 214-222). Findings suggest that teachers are inclined to assess the procedural efforts of pupils, rather than their conceptual comprehension (Supovitz, Ebby & Sirinides, 2014).

It is unquestionable that being a teacher entails great responsibilities, thus "When people have to choose between courses of action that have significant personal consequences, (...) effort, and resources, then accurate self-appraisals serve as valuable guides for action" (Bandura, 1997, p. 396). Bandura (1997) argues that self-efficacy is context sensitive and therefore (often) dependent on former achievement, i.e. mastery experience, which briefly means that former achievement of success entails a positive bodily and mental memory. The importance of memory of past successful achievement is paraphrased by Shel Silverstein (1974): "If the track is tough and the hill is rough, THINKING you can just ain’t enough". For this to be true, past experience may be the single most important factor for increased self-efficacy.

### 2.4 Self Determination Theory

The Self Determination Theory (SDT) is an extensive motivational theory which can be classified as a social cognitive learning theory, although Ryan and Deci (2002) claim that SDT embodies several theory strands and they do not favour one in particular. One of the focal points of SDT is the fulfilment of the three basic psychological needs: Relatedness, autonomy and competence, as defined in Deci and Ryan’s basic needs’ theory (Deci & Ryan, 2000; Deci & Vansteenkiste, 2004; Niemiec & Ryan, 2009). These needs affect and depend on both motivation and personality characteristics. The SDT also emphasizes the importance of the relationship between inner and outer motivation. External motivation addresses commitment or actions motivated by the opportunity for gain or avoidance of negative consequences. Internal motivation is about engaging in an activity or performing actions because one feels a sense of personal value by doing so (Deci & Ryan, 2000).
2.4.1 Relatedness

According to Niemiec and Ryan (2009), the need for relatedness is an important factor to scaffold internalization of external motivation and goals. They argue that it is a human trait to adopt values and attitudes of a group one can relate to or wishes to be a part of. “In the classroom, relatedness is deeply associated with a student feeling that the teacher genuinely likes, respects, and values him or her”, (Niemiec & Ryan, 2009, p. 139). For teachers, these environments often involve collaborative work which enhances their skills and knowledge, and they probably assist one another in order to ease the workload. Van den Broeck, Vansteenkiste, De Witte and Lens (2008) claim that employees “who feel part of a team and free to express their work-related and personal troubles are more likely to have their need for belonging fulfilled than employees who feel lonely and lack confidants at work” (p. 280). Later research findings indicate that “social support was most strongly related to relatedness satisfaction” (Van den Broeck, Vansteenkiste, De Witte, Soenens, & Lens, 2010, p. 995).

Earlier and similar findings by Deci and Ryan (2000) indicate that pupils who worked together with a researcher on exciting tasks, seemingly lost the (inner) glow for work when their attempts to communicate with the experienced researcher were rejected (p. 235). It seems that the lack of communication weakens the sense of belonging, which in turn may be the cause of reduced motivation and subsequently, a negative learning outcome. Taking the basis of Cobb and Yackels (1996) research, teachers can support the need for relatedness through norms in a supportive classroom. On this account, teachers emphasize social relations among the pupils, which in turn are believed to lay foundations for solid learning in a classroom context. Research by Boaler (1997; 1998) and Wæge (2007) show that in such learning communities, pupils want, dare and appreciate practices which include sharing strategies and assumptions with their peers and the teacher, having the potential to improve mathematical learning.

Gagné and Deci (2005) stress that the need for relatedness at work and among peers are underrepresented elements in work-related satisfaction, and refer to work by James and Greenberg (1989), whose findings suggest that “identifying with a group, which facilitates internalization of group values, led to improved performance” (Gagné & Deci, 2005, p. 355). On the other hand, the wish to perform optimally is increased when the need for relatedness is satisfied, e.g. “[by] accomplishing the assigned task or by receiving social support from others” (Van den Broeck et al., 2010, p. 984).
2.4.2 Autonomy

“Autonomy refers to being the perceived origin or source of one's own behaviour”, (Ryan & Deci, 2002, p. 8). The autonomous teacher may be recognized by parameters such as the freedom to choose focus and experiment with an assortment of teaching strategies and change them, if need be (E. M. Skaalvik & S. Skaalvik, 2014, p. 69). On this basis, it is not unjustified to consider these factors as important for attaining or enhancing job satisfaction. Conversely, factors which prevent perceived autonomy by workers would be e.g. “imposed goals, time restraints, or contingent rewards” (Fernet, Guay, Senécal & Austin, 2012, p. 516). I would like to point out that this interpretation of autonomy does not preclude external influence, but that individual actions are primarily products of inner values and attitudes; teachers are thus not independent of others (Deci & Vansteenkiste, 2004, p. 25). Aelterman, Vansteenkiste, Van Keer, Haerens (2016) point out work by Pajares (1992) Aelterman et al. (2014) when advocating more emphasis on psychological needs in teacher’s education, and “changing teachers’ beliefs can be considered a primary proximal target of CPD [continuous professional development]” (Aelterman et al., 2016, p. 70). In this context, beliefs refer to the teacher’s confidence in or sensation of autonomy. This would imply that autonomy is a felt state which has to be experienced personally, and it cannot be imposed.

Continuous professional development will not be addressed further, as it is not the objective of my study to influence the beliefs of either interviewees or survey respondents.

2.4.3 Competence

“Competence refers to feeling effective in one’s ongoing interactions with the social environment and experiencing opportunities to exercise and express ones’ capacities” (Ryan & Deci, 2002, s. 7). According to SDT, competence is not related to specific skill(s) in a particular subject, but a general need which an individual wishes to hold. Furthermore, competencies may be understood as a feeling, rather than an act in its own right, implying that one seeks to various degrees to get this need fulfilled (Ryan & Deci, 2002, s. 7). According to Kaiser, Busse, Hoth, König & Blömeke (2015), experience is important for ”integrated usage of general pedagogical and mathematics pedagogical knowledge for developing adequate ways to deal with students’ misconceptions” (p. 384). Although competence as defined by SDT is a psychological need, it derives from actual competence, meaning that one needs ‘will and skills’ to obtain it. This complex need can be affected by and derived from different
sources, for instance: a) teachers’ self-efficacy, b) teachers’ beliefs and c) teachers’ knowledge of content and teaching. In this master thesis, the notion of need for competence will be used in an effort to unravel teachers’ intentions behind measures taken or plan(s) of action. Suitably challenging tasks need to be given to pupils, based on their existing knowledge and skills. I consider ‘existing’ as a keyword in this context, since teachers must know ‘where the shoe pinches’ in order to facilitate further learning. Conversely, if they are not able to use mapping test results to enhance further learning, they may miss an important tool to be used in early intervention.

The need for relatedness will be divided in two subdomains; one will refer to the teachers’ sense of belonging to a work-community and the way in which it impacts their work (processes); the other subdomain comprises efforts to organize classrooms and group measures for the identified pupils. The sense of autonomy will be addressed in relation to the extent to which teachers feel that they participate actively in mapping tests, irrespective of whether the said tests are obligatory or not. Competence concerns the notion of having control and experiencing success in specific situations (Niemiec & Ryan, 2009). The need to feel and perceive oneself as skilful will be pertinent for how competence influences the teacher’s analysis and understanding of test results, as well as subsequent use of acquired insights.

2.5 Knowledge for Teaching

In the 1980’s, Shulman and his colleagues addressed the gap between a teacher’s knowledge of a subject matter and the actual content taught to the pupils, i.e. how teachers “employ content expertise to generate new explanation, representation or clarification” (Shulman, 1986, p. 8), or stated differently, how they make use of several components of expertise to elicit various paths to understanding. Nevertheless, to my comprehension, the focus of Shulman’s framework is the content knowledge which a teacher needs to master. Subject Matter Content Knowledge (SCK) refers to the teacher’s skills beyond the subject matter alone:

Teachers must not only be capable of defining for students the accepted truths in a domain. They must also be able to explain why a particular proposition is deemed warranted, why it is worth knowing, and how it relates to other propositions, both within the discipline and without, both in theory and in practice. (Shulman, 1986, p. 9)
This citation articulates some of the inherent complexities associated with teaching. Shulman relates how one should master how to e.g. define or argue why a specific piece of knowledge is “worth knowing” to pupils, even if SCK does not require teacher-pupil(s) interaction per se. Pedagogical Content Knowledge (PCK) means that the teachers must not solely think of the subject matter, but also what aspects may be difficult for some pupils to comprehend and learn (Shulman, 1986). By employing PCK, teachers can adopt more individualized teaching approaches, e.g. by employing alternate forms of presenting topics. In the end, the aim is to give pupils a chance to grasp and learn the subject being taught. The professional teacher’s Curricular Knowledge (CK) is the “ability to relate the content of a given course or lesson to topics or issues being discussed simultaneously in other classes” (Shulman, 1986, p. 10). Ideally, the curriculum shall give the teacher a certain degree of structure and serve as a guideline.

2.5.1 Shulman’s framework

Based on subject matter content knowledge (SCK), pedagogical content knowledge (PCK) and curricular knowledge (CK), the following elements will, according to Shulman, capture the essence and core of the teacher’s knowledge: Propositional knowledge (PK), case knowledge (CK) and strategic knowledge (SK). PK comprises a teacher’s ability to use research actively in her practice, so that she can verify if the results of a given study or research findings are suitable for her class and how to possibly make adaptations. CK addresses how well she knows a subject, hence “Case knowledge is knowledge of specific, well-documented, and richly described events” (Shulman, 1986, p. 11). To know a subject or a specific case is described by Shulman and his colleagues as one’s ability to go beyond just informing about a phenomenon or describing it. The key is thus the faculty to know how the case can illustrate a point, explain why it does so and the quality of its features, for instance compared to other cases (Shulman, 1986). Shulman discusses if cases are memorable since they can be told as ‘stories’, and hence children would remember them better. When planning lesson(s), CK may enhance the teacher’s ability to choose and define tasks which will require sustained efforts and having the potential to be solved in more than one way. SK addresses how the teacher uses skills wisely to make decisions based on knowledge about teaching, students and previous experience; Shulman claims that SK is the “understanding beyond principle to the wisdom of practice (…) [to] transcend the limitations of particular principle or experiences (…). The professional holds knowledge, not only of how—the capacity for skilled
performance—but of what and why” (Shulman, 1986, p. 13). While Shulman’s (1986) intentions were to develop a more general theory on the type of knowledge required for teaching, he uses examples from mathematics; theories in this chapter are in a similar manner chiefly related to the teaching of mathematics and corresponding pedagogy.

### 2.5.2 The mathematical knowledge for teaching framework

Teachers need knowledge and insight of the topic(s) and operations which they shall teach (Ball et al., 2008). In a study from 2008, Ball and colleagues investigated which types of work teachers do daily, in order to unearth what explicit skills and knowledge are actually used when teaching, i.e. “how teachers need to know that content (…) [and] what else teachers need to know about mathematics and how and where teachers might use such mathematical knowledge in practice” (p. 395). In other words, the aim of their research was to elicit the role of content knowledge in practice-based teaching of mathematics. Teaching is interpreted as “everything that teachers must do to support the learning of their students” (Ball et al., 2008, p. 395). Therefore, the main focus lies within teachers’ need for competence related to teaching. Ball et al. (2008) divide mathematical knowledge for teaching into six sub-categories as showed in Figure 4.

![Figure 4: Mathematical Knowledge for Teaching (MKT) (Ball et al., 2008)](image)

The two following examples can illustrate which type of knowledge may underpin the analysis of pupils’ test results in slightly different ways. “Deciding whether a method or procedure would work in general requires mathematical knowledge and skill” (Ball et al., 2008, pp. 398-399) and “determining the validity of a mathematical argument, or selecting a mathematically appropriate representation” (Ball et al., 2008, p. 398). The difference between
the two is that the latter requires knowledge for teaching mathematics, whereas the former just assumes mathematical knowledge and skills. Neither presupposes any information about pupils in particular or teaching per se (Ball et al., 2008).

*Common content knowledge (CCK)* is defined as “the mathematical knowledge and skill used in settings other than teaching” (Ball et al., 2008, p. 399). In short, CCK concerns the teachers’ ability to distinguish between correct and incorrect answers, correctly use concepts and solve in a concise and efficient manner mathematical task which are given to pupils and know the mathematics in question. The last criterion is not necessarily specific to teachers and/or unique to a teaching situation (Ball et al., 2008, p. 399). Ball and her colleagues note that ‘common content knowledge’ does not refer to something everyone needs to know per se, but which may be considered advantageous knowledge for certain professions. When discussing mapping tests, this could refer to knowledge of number sense and calculation skills, which in turn are based on the understanding of fundamental mathematics (Ma, 2010).

The aim of *Specialized content knowledge (SCK)* is to capture all the “mathematical knowledge and skills unique to teaching” (Ball et al., 2008, p. 400). Typical manifestations of SCK in practice may be the ability to interpret errors made by pupils to uncover their trains of thought, present alternative ways to find solutions or explain phenomena or qualities, or pose questions to evoke mathematical reflection and cognition (Ball et al., 2008, p. 400). These qualifications will e.g. allow teachers to uncover their pupils’ trains of thought, reach more pupils through variation and raise their awareness of errors in reflections and reasoning.

*Knowledge of content and student (KCS)* deals with the knowledge related to the subject and the pupils. It is pointed out that “Teachers must anticipate what students are likely to think and what they will find confusing” (Ball et al., 2008, p. 401). The teacher must also have knowledge on students, including typical student errors, how young individuals learn and how to teach mathematics at different levels. In addition to subject matter knowledge, a professional teacher also needs to know what elements are prone to being misunderstood within a specific domain, for instance when calculating areas of surfaces. An interesting question is how extensive a teacher’s knowledge of a subject should be. Ball and her colleagues point out several reasons why these concepts are pertinent. Common content knowledge (CCK) is needed to identify something as erroneous; specialized content knowledge (SCK) is useful when determining the degree or severity of errors and what
possibly may be the root cause of the pupil’s misunderstanding, and finally, knowledge of content and pupils (KCS) may contribute to understanding the nature of the errors in a more pedagogical way. (2008, p. 401)

The amalgamation of knowledge on specific didactic issues and knowledge on content may be classified as Knowledge of content and teaching (KCT), which “combines knowing about teaching and knowing about mathematics” (Ball, et al., 2008, p. 401); this implies that teachers must reflect strategically about which forms of representation may be helpful and convenient, and which ones may potentially be confusing. Such deliberations are referred to as mathematical-pedagogical measures or –decisions and should be rooted in knowledge of the pupils and teaching methods.

The last two categories are Horizon content knowledge (HCK) and Knowledge of content and curriculum (KCC). HCK is concerned with the extent to which one is capable of comprehending how topics are related to other subjects, and how seemingly isolated topics may be parts of more complex and composite subjects. It may be discussed whether HCK in fact is a sub-category of e.g. subject matter knowledge (Ball et al., 2008, p. 403). Jakobsen claims, based on previous works by Ball and Bass (2009) and Jakobsen, Thames and Ribiero (2013) that HCK also addresses the need “to make sense of what students are saying and to act with an awareness of connections to topics that students may or may not meet in the future” (2014, p. 3). Lastly, KCC describes how the teacher can plan and address content knowledge in mathematics based on rules and guidelines imposed by the curriculum (Ball et al., 2008, pp. 399-403).

2.5.3 Knowledge of content and students

Pupils who interact in the classroom by asking questions, proposing solutions, assessing their own and the others’ suggested strategies and presenting ideas may acquire insight into their own and others’ knowledge, as well as enhancing it. This approach to learning is an element of social constructivist learning theory (Skott et al., 2008), as described in chapter 2.1.2. A major part of a professional teachers’ work is interaction with pupils. In the day-to-day practice, there are skills one needs to master but cannot plan for. There may be questions and sudden and unexpected obstacles in pupils’ understanding, and one must meet these challenges efficiently; teachers need to be open-minded, self-confident and aware of what it means to know mathematics. This important question is discussed by Lampert in her article
When the problem is not the question and the solution is not the answer: Mathematical knowing and teaching (Lampert, 1990). Lampert refers to Polya (1954) when she explains what the nature of mathematics is in her opinion: “The nature of mathematical knowing is such that one can find out something about the characteristics of unknown quantities by studying patterns in numbers that one can observe” (Lampert, 1990, p. 44). The essence is that if a teacher has confidence in what knowledge in mathematics can be and how one can develop it, it will be easier to “deviate from an agenda” (Rowland et al., 2005, p. 263).

According to Lampert, a teacher with such confidence in mathematics can facilitate a classroom where pupils may be “arguing, defending, challenging, and proving one’s own ideas and those of others” (Lampert, 1990, p. 56). She advocates that this will not only help the learning of mathematics in itself, but will also make ‘school mathematics’ more robust and applicable to real life situations. Teachers need to use their knowledge of content and knowledge of their individual pupils in order to distinguish and identify those pupils who have a different mathematical evolvement; which may be a precursor to more severe mathematical difficulties (cf. chapter 1).

### 2.5.4 Knowledge of mathematical content and teaching in primary levels

In classroom situations, the teacher must know when there is time for clarification, what questions to ask different kinds of pupils and when to offer assistance and guidance to pupils who are unable to advance with a specific task. The teacher needs to know how she can, with the help of her knowledge of content and knowledge of teaching, help scaffold pupils without taking away the child’s opportunity to investigate, wonder and "find out for themselves" (Ball et al, 2008, p. 401). A significant factor for the teacher would e.g. be "knowing different instructionally viable models for place value, knowing what each can reveal about subtraction algorithms, and knowing how to deploy them effectively” (Ball et al., 2008, p. 402).

Knowing a subject well is not necessarily specific to teaching; research findings by Ball et al. (2008) indicate that teachers use fairly sophisticated content knowledge, encouraged by questions and discussions in a 3rd grade level classroom. An important point in this context is that mathematical content knowledge does not require any additional information of pupils or teaching per se. Ball et al. (2008) express it like this:

(…) tasks of teaching depend on mathematical knowledge, and, significantly, they have aspects that do not depend on knowledge of students or of teaching. (…) these tasks require knowing how knowledge is generated and structured in the discipline and how such considerations matter in teaching. (p. 402)
This may imply that it is essential for a teacher to know the subject well, but the knowledge of mathematics needed for teaching does not reflect the grade level, i.e. knowledge of content and which grade level one teaches are not directly linked. One may argue that KCT (Ball et al., 2008) in combination with case knowledge (CK) (Shulman, 1986) seemingly would enable teachers to focus more easily on other aspects of teaching, such as ways of giving instructions, appropriate task etc. Mathematical assessment will provide teachers with additional knowledge on all pupils, including those who need extra attention and follow-up, e.g. new ways of providing clarifications, alternative questions or strategies to alleviate and rectify misconceptions.

One should realize that teachers are a heterogeneous group; thus different views exist on what type of knowledge should and could be used in various situations, e.g. how to ask an appropriate question to engage pupils for deeper understanding of a subject. Does it take specialized content knowledge or knowledge of content and teaching? A model or framework will invariably represent a simplified mapping of reality. In real-life situations, transitions are less clear and not as ideal as the framework may seem to indicate. If the content is under control, the teacher may more easily focus on other aspects, such as time planning, parent dialogues, classroom management and attention to the psychosocial environment of the pupils.

### 2.6 Assessment for learning

The origin of the word *assessment* comes from the Latin word *assidere*\(^\text{12}\), which means “to sit beside”. Drummond (2003, p. 13) advocates that the term assessment should be defined as “describe the ways in which, in our everyday practice, we observe children’s learning, strive to understand it, and then put our understanding to good use” (in Marshall & Drummond, 2006, p. 134; Swaffield, 2011). *Assessment for Learning* (AfL) is a term which has no distinct origin; a similar term is *formative assessment* (FA) (Wiliam, 2007). Expressions such as *feedback, constructive feedback* or *feed up* are also found in more colloquial contexts; in this thesis, I make no sharp distinction between the two, since both concepts cover the rationale and aim of the mapping test (cf. section 1.2.2).

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\(^{12}\) Swaffield, 2011, p. 434
William (2011a) argues that any assessment functions formatively to the extent that evidence about student achievement is elicited, interpreted and used by teachers, learners, or their peers to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have made in the absence of the feedback. (p.43)

Wiliam (2011a) also claims that AfL is an opportunity for improving teaching practices and the learning-process of pupils (see e.g. Black, Harrison, Lee, Marshall & Wiliam, 2003). Nevertheless, assessment as a term has been “used primarily to describe processes of evaluating the effectiveness of sequences of instructional activities when the sequence was completed” (Wiliam, 2011b, p. 3), which has often been described as *summative assessment*. Schoenfeld (2015) defines summative assessment to be “examinations or performance opportunities the primary purpose of which is to assign students a score on the basis of their knowledge, such as end-of-course exams” [*sic*] (p. 184) etc. It is assumed that one can only assess learning if it can be observed. According to Griffin (1997), one has to base the evaluation on something which has been written, made, performed or spoken (as cited in Griffin 2009, p. 191). The more profound and extensive justifications one has, the more the more confidence one has to evaluate measures which will lift the learner from his or her current level to where that person should be; this is what Griffin claims to be the essence of assessment (p. 191).

Key characteristics of William’s (2011a) description of FA (formative assessment) are the elicitation of achievement and better [author’s emphasis] founded instructions. According to Stobart (2006), it is important that the teacher knows the specific assessment criteria for the assessment to be of value. A misinterpretation of these criteria may lead to misdirected learning (p. 146); teachers may have some difficulties in detecting sufficiently early low-achieving pupils or pupils at risk, or more accurately, fail to identify what they actually struggle with (cf. chapter 1).

### 2.6.1 Formative assessment

Black et al. (2003) claim that any information may be informative; the salient feature for it to be AfL is that the acquired knowledge of pupils’ learning and skills need to be directly refocused back to the learner. Otherwise, it “might be informative for the teacher, but not for the students” (Black et al., 2003, p. 122). One may interpret and regard any assessment results as summative information. Owing to the fact that tests may provide information about pupils’
current state (summative), irrespective of whether the aim of the test is to summarize knowledge gained after a specific time frame, or if the test is aimed at unveiling previously unknown information. The assessment will become AfL as described when new or complementary insight is put to use. It should be pointed out that in this context, the process must also include the pupil, who has to be an active participant in his or her own learning process, and not simply a passive recipient of assessments presented by the teacher (Harlen, 2006, p. 105).

**Teacher practices**

Black and William (1998) and colleagues performed a meta-study and reviewed material from 250 articles. One of their observations was that around 30 comparative studies indicate that in practices where formative assessment was acknowledged and appreciated, the formative assessment approach ”produced significant and often substantial learning gains” (as cited in Black & Wiliam, 2006, p. 11). Another conclusion was that gains are not easily achieved, especially in what one would categorize as ‘regular’ classrooms. Significant formative work involves “new ways to enhance feedback between those taught and the teacher, ways which require new modes of pedagogy and significant changes in classroom practice” (Black & Wiliam, 2006, p. 12). Therefore, successful formative work is closely linked to a teacher’s self-evaluation of her classroom teaching and subject preparation alone and with colleagues; otherwise, the assessment would be primarily summative. Formative assessment and assessment for learning are frequently used interchangeably, even if certain scholars claim they are distinct concepts, almost dichotomous standards (e.g. Swaffield, 2011).

Professional teachers carry out tasks that are not directly related to their classroom teaching, e.g. seeking further knowledge on a given subject, collaborating with peers, rehearsal of new strategies, etc. A substantial body of research is targeted towards e.g. development of teachers’ practice, enhanced insight into one’s own practice and knowledge of specific subject content. Hargreaves (2013, p. 328) refers to research done by e.g. Thompson & Wiliam (2008), who point out that development of teachers’ practices often focuses less on a holistic approach than specific elements of everyday practice. The former may encompass practices in which teachers reflect and judge their work as professionals. This often entails metacognition, which is concerned with e.g. learning in general, mandate of the schools and what they essentially work towards. The latter often focuses on specific elements of everyday

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13 The whole process yielded about 580 articles or chapters to study (Dylan, 2006, p 10-11).
teaching, such as assessment for learning, rich mathematics problems, information and communication technology (ICT) literacy and enhanced collaboration with peers.

The professional work and assessment practice of teachers may be described using Dale’s (1999) three levels of competence, which include recommended competence factors:

- Competence Level 1 concerns the teachers’ day-to-day work in the classroom and all the on-the-spot decisions that are being made concerning subject, pedagogical, and organizational issues (p. 35-41).

- Competence Level 2 addresses planning and preparations of classroom activities and teaching (p. 42-51).

- Competence Level 3 incorporates meta-reflection on work previously carried out at competence levels 1 and 2 (p. 51).

In the scope of mapping tests, activities related to competence level 1 may include observations of pupils sitting the test, giving various forms of instructions, time management and on-the-spot decisions to permit individual pupils to interrupt the test etc. Possible activities on competence level 2 may be the teacher’s study of manuals, planning the completion of the test, deciding the extent and nature of individual measures required to sit the test and implementation of special needs for assistance. Dale (1999, p. 51) argues that competence level 3 is a key element in the work of professional teachers. Therefore, the teacher must ponder about possible causes and explanations of results below the cut-score, how to implement efficient measures to improve and enhance the pupils’ competence, what are the possible individual consequences of being identified as performing below the cut-score and identification of potential educational system deficiencies.

When discussing assessment, one might argue that the test by itself is just one element in the evaluation of pupils’ knowledge and skills. Thus, assessment by teachers is an ongoing activity, since “teachers need to be aware of and think about what underlies the practices and to check constantly for the actual (as opposed to the intended) effects of practices” (Swaffield, 2011, p. 438). By adhering to these principles, assessment for learning can thus be a helping tool for the teachers.
3 Methodology

This chapter presents a detailed description of the research methods used in this master’s thesis, given the scope and conditions of the follow-up study by ILS (cf. section 1.2.2). Main choices and challenges are discussed using relevant literature and applicable theories on research.

A triangulation of research methods has been employed, which means that data has been collected by means of semi-structured interviews (Brinkmann & Kvale, 2015; Dalen, 2011) in combination with a survey (questionnaire) (e.g. Cohen, Manion & Morrison, 2011; de Vause, 2014). The research in this master’s thesis relies on in-depth analysis of two out of seven interviews, based on the inclusion criteria described in section 3.3.2, in addition to data from the survey. The interviewees and survey respondents were all teaching pupils on the 1st to 3rd grade levels during the spring of 2015 in a neighbouring municipality of the University of Oslo, and located in a different administrative county.

The triangulation of methods adheres to guidelines for mixed methods research (e.g. Creswell, 2014, 2015; Creswell & Plano Clark, 2011), and consequently both interview- and survey data will be used according to the rigorous guidelines for mixed method research.

This chapter is organized as follows:

- Description and discussion of the combination of two strands of data
- Elaboration of employed research procedures
- Analysis method(s) and structure of collected data
- Ethical reflections and considerations

By discussing research challenges and subsequent solutions, the aim of this chapter is to provide an honest and open account of my research, including issues which aided me and issues which restrained me (Spencer et al. 2003, as cited in Silverman, 2013, p. 354). The objective is to involve the reader by explaining and inviting him or her into significant decisions by using a somewhat more engaging approach than merely presenting a “series of
blunt assertions in the passive voice” (Silverman, 2013, p. 355). The purpose is to facilitate an informed and balanced judgement of the research presented in this thesis.

3.1 Mixed Method research

The mixed method approach is an increasingly popular research method. Although the 1980s are commonly referred to as the starting point of mixed method research, Creswell (2014) refers to work by Campbell and Fisk (1959) who used multiple methods in their research on psychological traits in the 1950s (p. 14). Today, different terms for combining datasets are proposed and used, such as mixed methodology (Tashakkori & Teddlie, 1998), multi-strategy (Bryman, 2006, p. 98), mixed research (Johnson, Onwuegbuzie & Turner, 2007, p. 112), and mixed methods (Creswell, 2010, p. 51; Creswell, 2014, p. 217). The last term appears to be the most frequent and widespread designation, and will thus be employed throughout this thesis.

Qualitative and quantitative techniques

My rationale for using semi-structured interviews is to gain deeper insight into the teachers’ mode of work and intentions behind their plans of actions based on the mapping test. Qualitative techniques such as interviews are frequently employed to allow why and how type questions to be used, which in turn may elicit more profound understanding of single cases or human experience. With interviews, one can evoke personal views, ideas and thoughts of the interviewees (Brinkmann & Kvale, 2015; Dalen, 2011). Even though the “research interview attempts to understand the world from the subjects’ point of view (...) [and] to uncover their lived world prior to scientific explanations” (Brinkmann & Kvale, 2015, p. 3), one must acknowledge that the researcher defines and controls the interview situations; the conversation is not among equal participants (Brinkman & Kvale, 2015, p. 6), but a semi-structured interview seeks to get valuable information from the interviewee’s lived life.

Quantitative techniques are characterized by data collection from many respondents. The large number of responses often permits statistical analysis of the phenomena (Creswell, 2014). Surveys as a quantitative data collection method can be classified as nonexperimental design (Kleven, 2002), because a “survey research provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (...) –with the intent of generalizing from a sample to a population” (Creswell,
The criterion for a nonexperimental design is that one does not attempt to alter or affect the object of research (Kleven, 2002), e.g. the classroom environment or the biological diversity of a river etc. through the research itself.

### 3.1.1 Combinations of strands

The mixed method approach aims at dealing better with various forms of bias associated with both qualitative and quantitative methods (Creswell, 2015, p. 15; Creswell & Plano Clark, 2011). When I use both interviews and surveys in my research, the aspiration is that this combination will represent multiple perspectives which contribute with fruitful and valuable insights, enabling a more profound and detailed understanding of my research topic.

My analyses and discussions are based on an iterative approach alternating between different data sets, which facilitate a so-called “across databases’ interpretation” (Creswell, 2014, p. 17) or between-methods triangulations, a term dubbed by Denzin (1978) and described as “the use of both quantitative and qualitative approaches” (as cited in Johnson et al., 2007, p. 114). In other words, a mixed methods approach is not simply hotchpotch of two approaches, since it claims to integrate data from both quantitative (e.g. questionnaire) and qualitative (e.g. interviews) methods; one may acquire a better understanding of the research phenomena.

When conducting mixed methods research, one should be aware that it takes time and effort, especially when doing it singlehandedly. It is often depicted as group research where teams build on the participants’ strong sides. Given the primary pragmatic philosophy which mixed methods research adheres to, I endeavour to “respect fully the wisdom of both of these viewpoints” (Johnson et al., 2007, p. 113). For my investigations, blending research methods has two main advantages. Firstly, interviews with in-service teachers could give deeper insight into the interviewees’ understanding of the mapping test results by using their own words and explaining how this knowledge was put to use for further learning. Secondly, the initial analysis of the interviews was used to strengthen the survey questions in order to better identify areas where we wanted supplementary information or information we for different reasons were unable to get during the interviews.

Collins, Onwuegbuzie and Sutton (2006) present and accent several rationales for conducting mixed methods research; two of those were important for this study, namely instrument fidelity and significant enhancement. The former has played a role in the design of the questionnaire: specifically how well suited the questions are to provide cognizance related to
our research aim. The latter is intended to facilitate richness and thickness of data by mixing both qualitative and quantitative techniques. Furthermore, Johnson et al. suggest a methodological rationale which is “a three-paradigm methodological world (…) because each approach has its strengths and weaknesses and time and place of need.” (2007, p. 117).

As mentioned earlier (cf. 1.2.2), the ambition was to acquire information about the teachers’ work with the mapping test on a larger scale, which will then serve as the basis of an even larger national survey on the same work.

3.2 The research interview

Semi-structured interviews (Brinkmann & Kvale, 2015; Dalen, 2011) were used in this study. While an interview is only one means of conducting qualitative research, it is probably the most common one. One of the strengths of semi-structured interviews is that they allow deviation from the agenda and structures outlined in the interview guide, when appropriate (Brinkmann & Kvale, 2015; Dalen, 2011). However, one must ascertain that the interview advances in the desired direction in order to obtain the requested information, without putting any pressure on the informants. Hence, the interview questions were mostly open-ended with the intention to “have [the] participants use their own words, not those predefined by the researcher, to discuss topics” (Yin, 2001, p. 135).

The motivation behind an open-ended style interview is to create a conversational dialogue atmosphere between interviewer and interviewee, where the interviewee perceives him- or herself as being a pundit providing answers to questions posed, and not an investigation into how well the person had worked with the mapping test. The adverb ‘well’ in this context refers to the interviewee possibly perceiving questions as a form of implicit or concealed control by the Norwegian Directorate for Education and Training (NDET). Aiming towards a friendly, inviting and comfortable interview ambiance, several measures were employed accordingly and simultaneously. H. J. Rubin and I. S. Rubin (2012) speak of intense listening, which they define as the interviewer’s ability to “to hear the meaning of what interviewees tell them” [Emphasised in original] (p.6).

Prior to the interviews, I decided to analyse them based on meaning condensation, and with this in mind, I was highly focused on following the interviewee where he or she was, in order
to assess what was said and pose follow-up questions on what was actually expressed, provided it was relevant and pertinent. Brinkmann and Kvale (2015) label the procedures for achieving this as *active listening* (p. 164). Furthermore, they add that by showing interest in what informants have to say, one has the added possibility of pursuing topics of interest during the interview, even with those deviating from the pre-approved agenda, without missing information one initially sought to obtain. Based on recommendations for intense and active listening, it was important during the interview to have focus on indications of uneasiness or reluctance from the interviewee, as well as situations where the person being interviewed displayed extra interest or enthusiasm for a particular question. In those cases, the question was redirected or diverted to other topics, or the question was re-phrased; possibly at a later stage and in a more neutral wording.

Follow-up questions and statements confirming the significance and relevance of information provided by the interviewee were also made, if pertinent to the situation and the research topics. According to Yin, it is important for researchers “to avoid blatant biases but also be sensitive to those who remain” (Yin, 2011, p. 138). As a novice in research, I acknowledge that one does not enter a new field completely open and unbiased, without having been influenced by experience and relevant literature or starting with a blank canvas (Latin: *tabula rasa*). Bearing in mind the sensitivity of the interview situation as a dialogue between unequal parties, awareness of the possibility for questions making the interview object uncomfortable or uneasy, we let the interviewee talk significantly more during the interview by adopting a *modest* and *nondirective* stance (Yin, 2011, p. 136). By adhering to this approach, we were considerate towards the informants and gave ourselves latitude to obtain as much information as possible during the interview, in line with the recommendations (e.g. Yin, 2011; H. J. Rubin & I. S. Rubin, 2012; Brinkmann & Kvale, 2015).

### 3.3 Interview procedures

#### 3.3.1 The interview guide

My first task in the follow-up study was to develop an interview guide and at this point in time, I received information on the research during initial discussions with my supervisor, Associate Professor Nortvedt. Reading material containing the project description and mapping tests with user guides were also used during this phase. It was considered
instrumental to get acquainted with the objective(s) of the project and the material which the teachers have been working with in order to develop a broad interview guide with questions closely linked to the teachers’ work and which would be perceived as relevant by the informants (Brinkmann & Kvale, 2015).

Brinkmann & Kvale (2015, p. 131) claim that the objectives of a study constitute the why question, and it was thus relevant to get an overview of literature on topics relevant for the study. The how question of the study includes my design of questions to cover in the best possible way the purpose of the interview and the survey (Brinkmann & Kvale, 2015; Dalen, 2011). Not all analytical tools to be used in my research had been determined at this point in time, but one of the main targets of the interviews was to acquire a general overview of the teachers’ practice with the mapping test, such as preparations, administration and follow-up. Based on an initial analysis of the interviews, a supplementary aim emerged: how motivation, beliefs and knowledge held by teachers influence their work. Brinkmann & Kvale (2015) claim that an interview-based study should be employed if the aim is to comprehend how something is experienced (p. 127) and this fits nicely with the scope of the follow-up study.

### 3.3.2 Recruitment and selection of interviewees

**Sampling**

The recruitment of interviewees was a combination of a *convenience* (Yin, 2011) and a *purposefully* (Robson, 2011) selected sample. The starting point for the former mode of selection is to engage and include available informants; however, Yin (2011) points to a weakness of this method of selection; since the final choice of informants is random, one would potentially jeopardize the suitability of one’s informants ability to generate knowledge relevant for the topics of the study. As a mitigating measure, and due to certain pre-defined initial criteria, factors for the latter mode were also employed, and it is frequently used as a recruitment method (Palinkas et al., 2015). These criteria were applied to secure to the involvement of in-service teachers with first-hand experience of completing the mapping test for mathematics during the period of 2012-2015 on the 1st to 3rd grade levels.

**Contact matrix**

Associate Professor Nortvedt contacted school principals and asked if they were willing to participate in the study; she also sought teachers having completed the mapping test within the given timeframe, and who were willing to participate on a voluntary basis. There was also
an additional request for participation of both novices and experienced teachers. This approach for establishing contact and recruiting participants has many common features with purposeful sampling; hence the sampling method of this study is a blend of convenience and purposeful sampling which adheres to the guidelines for the respective methods (Robson, 2011; Yin, 2011).

Consent
We gave our informants a clear and brief introduction to our research project in an invitation letter (Appendix B) where we explained what the objectives behind the interviews were, and the main topics of interest. We also stressed that person identifiable information such as name and workplace etc. would be anonymized, and only individuals involved with the research would have access to the collected data before publication of findings. The invitation letter stated explicitly that in case participants want to withdraw their engagement in the project at any stage and for any reason prior to publication, all data would be deleted following standard ethical guidelines set forth by the Norwegian Committee on Ethical Research in Humanities and Social Sciences (NSD). Furthermore, a potential withdrawal prior to the submission of this master thesis and research reports would not have any effect on the professional relationship with their employer. Based on this information, the interviewees gave verbal consent and no informants have later withdrawn from the study.

Inclusion criteria
The final sample for this study was reduced from seven \((N=7)\) to two \((N=2)\) teachers. Points made by Bernard (2002) and Spradley (1979) for choosing interviewees were important when I narrowed down the sample. One of the main inclusion criteria for my two focus interviewees was their “ability to communicate experiences and opinions in an articulate, expressive and reflective manner” (as cited in Palinkas et al., 2015, p 534). With these qualities, my two selected interviewees have contributed with rich and extensive information in line with the project’s purpose. However, it should be pointed out that the other interviews with subsequent transcriptions and initial analyses also influenced the decision to use two informants. Not because information provided by the other interviewees was not valuable or considered irrelevant for the follow-up study; however, based on the analysis of all interviews, data from the two selected interviewees were considered to yield better insight into motivational factors and beliefs, and impact on the work with the mapping test; experienced interviewees are arguably vital for their contribution to convincing results (H. J. Rubin & I. S. Rubin, 2005, p.
Knowledgeable interviewees who contribute to a multiplicity of perspectives are also important (H. J. Rubin & I. S. Rubin, 2005, p. 65-68). It can be argued that my chosen informants are too similar; however, due to the aim of this study, the experiences of the two focus interviewees have been pivotal since they seemed to have come further with their follow-up work than the other interviewees.

3.3.3 Goals of the interviews
The aim of the interviews was two-fold. Firstly, we wanted to acquire detailed descriptions of the work of a small number of teachers \((N=7)\) who had carried out the mapping tests and to various extent had initiated measures for assessment for learning (AfL). Secondly, we wanted to use information provided by an initial analysis of these interviews to prepare questions for the questionnaire.

A research question should always guide which method to use (Brinkmann & Kvale, 2015, p. 128). According to Brinkmann and Kvale (2015, p. 109), it is common practice to attempt to capture and record attitudes, opinions and experiences of the persons being interviewed – so-called pollsters. The focus of the interviews in this work were slightly modified after the first round of interviews with two teachers; the focus shifted towards what can be referred to as probes (Brinkmann & Kvale 2015), where the ambition became to collect as much information as possible on the intentions behind their subsequent work with the mapping test. This latter approach may be referred to as going “beyond the surface and inquire into deeper layers of the subject’s experimental world” (p.109). It should be pointed out that the role of the interviewer did not deviate into becoming “akin to a friend” (p.109), which may be a possible path for the ‘prober’. Even though we wanted a friendly and inviting atmosphere, the global objective was never compromised by seeking “emphatic relationship as a gateway to data” (Brinkmann & Kvale 2015, p. 111). Consequences of the probe approach may be interviewees responding according to a perceived notion of how they are expected to answer rather than expressing their actual personal opinions and views (Brinkmann & Kvale 2015, p. 111). I was interested in seeking understanding on how they used test results, i.e. how the analysis elicited knowledge of pupils’ difficulties and how it exerted influence on the teaching of the identified individuals. In addition, I made efforts not to let my e.g. previous knowledge (Alvesson & Skjöldberg, 2009) or personal interest or opinions favour some explanations over others.
3.3.4 Quality of the interviews

The quality of interviews is influenced by several factors; probably the most important element for a research interview is the ability to acquire information to analyse and answer the research problem in the best possible way. One may contemplate to what extent the length of an interview can improve quality, or if it is a question of ‘less is more’ in this context. Brinkmann and Kvale (2015) argue that density of information should not be equated to or considered proportional to the length of the interview. The ambition of the interviews should be to acquire information which is “dense and rich enough to instigate lengthy comments” (p.190). Based on this conjecture, they argue that “if one knows what to ask for, and how to ask, one can conduct short interviews that are rich in meaning” (p.190). I did extensive studies of relevant theories and literature on subjects pertaining to interviews as a research method in order to secure good conditions for the interview situation and pave the way for the interviewee to tell as much as possible, encouraged by subtle and discreet guidance. At the same time, it was salient to allow for spontaneous and unplanned deviations and meandering, which could be elaborated if they were considered to be of interest. Brinkmann and Kvale argue that “The interviewer is the key research instrument of an interview inquiry.” (2015, p. 193). Furthermore, it is adamant that the interviewee is honest, has good communication skills, knowledgeable and not consistently contradicting him- or herself (Brinkmann & Kvale, 2015, p. 193). It is further claimed that the ideal interviewee does not exist, but informants can contribute in different ways, depending on the purpose of the investigation and/or interview (Brinkmann & Kvale, 2015, p.193).

In order to get the most out of the informant, it was important that we showed interest during the interview situation, asked follow-up questions and from time-to-time repeated and reiterated what had been learned or understood so far in the process. The motivation behind such an approach was to make sure that we a) were on the right track, b) were on the same wavelengths and c) to check whether to ask additional questions on different topics or if elements should be ignored – in line with recommendations by Brinkmann and Kvale (2015, p. 194). The aim was ”to be sure that content and mannerisms of (…) responses to the participant’s words or queries [did] not convey [our] own biases or preferences that in turn [would] affect the participant’s subsequent retort” (Yin, 2011, p. 137). This concerns the issues of remaining neutral throughout the interview, and by being two researchers conducting the interviews together, the one leading the interview had the possibility to try to
follow the informant, possibly also when asking open-ended questions. By taking notes, the other would try to ensure that nothing of importance went unnoticed. Both interviewers engaged in follow-up questions: the lead during the interview and the other added new ones or reverted to earlier questions asked at the end of the sessions.

**Quality of knowledge**

Brinkmann and Kvale (2015) argue that information from an interview situation can be characterized by several core features pointing to how knowledge can be derived from the analysis. Thus, the analytic process must evaluate acquired data against these characteristics. This project relies on two of these pivotal features, namely *knowledge as produced* and *knowledge as contextual* (p. 63-64). Briefly stated, knowledge construction depends strongly on the processing of interview information. According to Brinkmann and Kvale (2015), interview knowledge is not merely something one can discover, but a result of various factors leading up to the final ‘results’; research conclusions are based on all important steps taken leading up to findings, i.e. production of knowledge. The contextual side of knowledge is intertwined with the production aspect, since interview statements are results of subjective contexts. Thus, analysis and reporting of such have to be unearthed through “thick contextual descriptions” (Brinkmann & Kvale, 2015, p. 64) of the setting in which the interviewee statements have been uttered, and which analytical lenses have been used to understand the data.

### 3.4 Survey

The starting point of a survey is a wish to map, often in quantitative forms, opinions, trends and/or frequencies in a population (Creswell, 2014). The size can vary, but the main objective when selecting a group to be surveyed is that it must represent a larger population, such as health care workers in the age from 30 to 50 years, or the number of secondary school teachers working in a commune. A survey may be classified as a collective interview, and there are various means of distributing the questionnaire to potential informants; in this study it was sent via e-mail with information on how respondents could log on by following an external link that lead them to a web-based online questionnaire (de Vause, 2014, p. 123).
3.4.1 Preparation

The preparation of the survey was initially based on the interview guide and its main components (3.4.3). The transcribed interviews were analysed with the objective of identifying areas and topics in the interviews where we for some reason had difficulties acquiring data. One observation which became apparent during the initial analysis was the way teachers responded to how they followed up the pupils who had been identified through the mapping test. This led to an extensive effort to improve and enrich the survey questions so that they would reflect and provide us with such information based on criteria for designing a questionnaire (Cohen et al., 2011; de Vause, 2014). It was essential to develop a questionnaire where the language was perceived as clear, concise and relevant for the intended target group (Cohen et al., 2011; de Vause, 2014). Respondents may have issues with specific academic terms (which could also have other and different context specific interpretations), and when being exposed to several statements of this character, a respondent may quickly lose interest in responding, feel inferior or discouraged from continuing.

For illustrative purposes, I have designed four hypothetical questions where the purpose is to find out how recommendations given in the guidelines are used to define follow-up measures for pupils below a cut-score. Each question is meant to illustrate pitfalls or unfortunate formulations, and may therefore appear exaggerated, and they are not used in the actual survey.

“How did you use the recommendations in the guidelines to define individual follow-up activities for pupils below the cut-score?” This question uses neutral wording and has a straight-forward structure. However, there is an implicit assumption that the guidelines actually have been used, and this may cause issues if the respondent for some reason did not employ them. The question may inadvertently incite respondent to answer under wrong assumptions.

“How did you benefit from the comprehensive recommendations in the guidelines to design high-quality follow-up activities for those unfortunate pupils below the cut-score?” While being relatively clear and concise, this question is leading or biased because the vocabulary is flavoured with non-neutral connotations, such as “comprehensive”, “high-quality”, “benefit” and “unfortunate”. It also suffers from the same implicit assumption used in the first example, i.e. that guidelines actually were used to device additional training activities.
“How were guidelines recommended to teachers to follow-up pupils when they were below the cut-score?” An obvious flaw of this question is the ambiguity with respect to the cut-score: it is not clear who has scored below the cut-score, even though an amenable interpretation implies that it has to be that it refers to the pupils and not the teachers. In addition, although syntactically correct, the meaning is not. The question asks how the guidelines were recommended, not how the recommendations [written] in the guidelines were used.

“Based on the expressed aspirations of the mapping test to facilitate assessment for learning, in conjunction with recommendations for proper subsequent counter-measures in case of sub-optimal performance, how were these employed to device pertinent continuation measures?” The main objection to this question is that it is unnecessarily long, with inserted sub-clauses and overuse of adjectives which are not strictly essential for the actual question. Also, the choice of wording appears too complicated or even bureaucratic, and a number of respondents may have issues with some of the academic terms.

On this account, it was adamant that questions were self-explanatory without losing lexical meaning, while at the same time avoiding over-simplifications which could complicate the subsequent analysis, be counterproductive or make the respondents feel belittled (Cohen et al., 2011; de Vause, 2014). These aspects were therefore taken into consideration when designing a comprehensible and self-explanatory survey, avoiding leading or biased questions, academic jargon or unacceptable length, to the extent possible.

### 3.4.2 Sample

A sample size in the range of at least sixty to one hundred teachers was originally considered desirable for the follow-up study and hence also for my master thesis. Since the follow-up study is a pilot, it was important to recruit a sufficiently high number of respondents, which could be used to generalize differences observed within the group, and which in turn would be applicable to a larger sample, i.e. a representative selection of Norwegian teachers within the target group. However, it turned out to be challenging to get the desired response rate; three attempts were made to get an adequate number of around one hundred teachers to respond. In the first attempt, the head of schools in Oslo assisted the research group by sending out invitations to school leaders, who then sent requests to those teachers who had completed the test on grade levels 1 to 3. Unfortunately, only nineteen (N=19) respondents answered this
first request, and after discussions with my supervisor, we decided to make a second attempt with a new selection of teachers from another municipality. To our disappointment, this second round also failed in getting a sufficiently high number of respondents; we only obtained a response rate of four (N=4), bringing the total to twenty-three (N=23) respondents.

This lack of feedback from a majority of the teachers was to some extent a setback for the work on my thesis; yet, when consulting my supervisor, she encouraged me to continue and use the data which had been collected, in spite of few respondents. Nevertheless, a third and final attempt was decided after discussions with my supervisor. The endeavour was handled by me, and I contacted department managers at two schools to request some of their staff to contribute to my study. It was also important to make clear that any data acquired from this supplementary request would not be used in the follow-up study by ILS, but solely as additional information for my thesis. This final request for additional respondents provided three (N=3) more respondents, bringing the total number to twenty-six (N=26). We do not know which factors may have contributed to this low response; some potential factors are discussed in chapter 4. Due to the low response rate, the analysis of the questionnaires has a more qualitative approach, similar to the interviews. This implies that data from the survey is used differently from what was originally planned; the analytical approach will focus more on qualitative characteristics than what is customary when analysing survey data. This subject will also be addressed in chapter 3.5.4, where the analytical process is discussed in more detail.

Person identifiable information or data is not registered; gender is registered but has been omitted due to the low number of male primary school teachers, i.e. ‘male’ as gender could inadvertently identify individuals.

3.4.3 Structure of the questionnaire

The questionnaire has been designed by Associate Professor Nortvedt, me and other resources affiliated with the project and the final draft was implemented on a custom-developed, in-house system at the University of Oslo (UiO) for online surveys\(^1\) under the supervision of Associate Professor Nortvedt. The questionnaire is composed of 40 questions (Appendix E) organized in four sections and with three main topics, following the main structure of the

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\(^1\) nettskjema.uio.no
interview guide, and it adheres to the extent possible to guidelines for designing of questionnaires (e.g. de Vause, 2014; Cohen et al., 2011). The sections are as follows:

- Background information on respondent (section A)
- Preparations prior to the test (section B)
- Administering the mapping test with pupils (section C)
- Follow-up of low-performing pupils (section D)

The questionnaire starts in section A with neutral questions, which will provide data in nominal form (Cohen et al., 2011, p. 398). These questions will give an overview of the teachers’ teaching experience, level of education in mathematics, previous experience with mapping tests in mathematics and on what grade levels they teach. We wanted data on parameters such as the number of years as primary school teacher, the number of credits in mathematics and how many times the mapping tests have been conducted previously.

The questionnaire contains two types of multiple choice questions which are structured to the extent possible using closed problem formats and Likert scale without neutral midpoints (Figure 5) (Sirnes, 2005). The difference between the two question types of Figure 6 is that questions with radio buttons are used when asking for one answer among several options, whereas squared buttons are meant to indicate that one may choose several options, if applicable. Figure 5 and Figure 6 show how question items appeared on the screen of the respondents.

![Figure 5: Screen-dump of question 26: Likert scale item](image-url)
The purpose of sections B and C is to find out how preparations are carried out, including practical considerations and institutional issues that may influence their work and ‘tricks-of-the-trade’, i.e. knowledge of their pupils and individual measures.

Information primarily from section B and the interviews will be analysed using my theoretical framework of motivational aspects and teachers’ beliefs. We seek information on individual practices and how schools organize mapping tests, such as who is involved, time dedicated to preparations, orchestration and administration of the test etc.

Section D addresses how the teachers’ work with the reported results. Based on the analysis of the test results, teachers determine next steps for the identified pupils as part of assessment for learning (AfL). The concept of AfL (Black & William, 1998) and the MKT framework (mathematical knowledge for teaching) (Ball et al., 2008) will contribute as analytical lenses to comprehend what teachers report to have done in this phase.

Information from the in-depth interviews has, as intended, influenced the content of the questionnaire. Feedback from interviewees contributed to the design of the various answer options; what was not expressed during the interviews was also important information,
because it contributed to fruitful discussions on how questions in the questionnaire might capture these missing elements. Multiple project-internal discussions were followed by test runs with participation of university employees at ILS as quality assurance, including the estimated survey completion time, which was estimated to approximately twenty to twenty-five minutes. This conforms to what is considered an acceptable amount of time to ask respondents to dedicate to complete a questionnaire.

3.5 Survey procedures

3.5.1 Completion of the interviews

The appointment for interviews was done via e-mail exchange with school principals. The choice of interview venue was partly determined by the topic and partly by the informants (Johannessen, Tufte & Kristoffersen, 2010). By conducting interviews at school premises, teachers did not need to take a leave of absence or use their own spare time to participate in a study related to their occupation.

After interviews were completed, Associate Professor Nortvedt and I discussed the suitability of using the schools’ administrative quarters as venue for interviews, or whether a classroom would be a more suitable location, since a teacher could terminate an interview taking place there without school managers becoming aware of it. In accordance with best practice (Brinkmann & Kvale, 2015; Cohen et al., 2011; Dalen, 201; Yin, 2011), the full anonymity and the option to withdraw were emphasized before and after the interviews. At the same time, it was important not to demote the purpose of the interview and the value of their contribution to it. Audio recordings of the interviews were also made, even if it might have held the interviewee back, potentially putting a filter on answers or restraining spontaneity. However, given all precautionary measures taken (cf. section 3.3), the recording of interviews was considered an important measure to secure good data when post-processing the interview situation (Brinkmann & Kvale, 2015). Also, my reflection notes, written after the interviews were completed, had analytical value (Dalen, 2011, pp. 56-57). Each interview lasted approximately 40-60 minutes.
3.5.2 Analysis of interview data

The analysis of the interviews was time consuming, and the initial analysis started immediately after the interviews were completed by discussing with Associate Professor Nortvedt what information had emerged on the objectives of the follow-up study. Ideas and associations related to the total interview situation were also discussed, i.e. questions such as “How did it feel?”, “Did we manage to create an inviting atmosphere?”, “What information did we obtain?” and “Were there some elements that we were not able to grasp?” These conversations were significant for my reflection notes.

Phase 1a - Transcribing

Transcribing interviews is not a mechanical process, and one must bear in mind the interpretive nature of the process “which gives rise to a series of practical and principal issues” (Brinkmann & Kvale, 2015, p. 203). The transcribing was performed by the help of InqScribe\textsuperscript{15} when I worked as research assistant (c.f. section 1.2.2). In the beginning, I was unsure whether transcriptions should be literal, including pauses and fill words such as “mhm”, “ehh” and “mmm”, and these were included in the transcriptions of the two first interviews, but were omitted for later interviews. Brinkmann and Kvale (2015) argue that there is no one correct way of transcribing; the research question and intended purpose and use of the interviews on the other hand are decisive factors. For the two selected focus informants, fill words and pauses are not included in the analysis chapter unless otherwise stated. By transcribing the interviews myself, I had the feeling of being back in the interview situation. I experienced through this work both affirmative information on what interviewees had described, as well as indications of contradictory information, which provided me with new insight. This means that my analysis actually started as I attempted to comprehend what had been said through the process of transcribing (Brinkmann & Kvale, 2015, p. 207). This process aided me to be sensitive to what was actually present in the data and not blindly focusing on what I wanted to find.

A transcription is an abstraction of verbal speech; hence one has to be clear on how transcriptions are produced. The spoken word is considered to be data in this context, whereas the written material is a product of a researcher’s assessments, deliberations and intentions (Brinkman & Kvale, 2015). The following conventions are used:

\textsuperscript{15} Transcription tool provided by ILS
• ‘(…)’ is used to indicate omitted words which are considered superfluous or redundant in the context where they appear.

• ‘…’ is used when the informant has been thinking for a while. This information is included to indicate additional nuances on how the interviewee has answered.

• ‘[Concept]’ is employed to explain or elaborate for the reader what is being said in the excerpt.

• ‘Respondents’ refer to the teachers having responded to the survey.

Intonation, linguistic skills, dialects etc. are treated as non-relevant information in this context and are therefore omitted to make excerpts as easy to read as possible. It should also be mentioned that efforts have been made to make transcripts and translations preserve a spoken character rather than written statements, and hence there may be deviations from standard orthographical and normative grammatical rules – in contrast to the rest of this report, which adheres to norms and standards to the extent possible. It is a deliberate choice not to use special characters if an informant appears to be ill at ease, hesitant, or emphasizing certain issues or pieces of information. If this were the case, it is explicitly stated, either in the subsequent text or prior to the excerpt. If a display of discomfort seems a central element of the interpretation or comprehension of the excerpt, I will indicate to the extent possible whether these are the interviewees’ expressed feelings or my interpretation of their statements. Those parts of the interviews which addressed other topics not related to my research were for the most part omitted, since they were assumed to be irrelevant, and not because they contradicted any initial views or interpretations.

**Phase 1b – Meaning condensation**
The starting point for processing interview data was the use of meaning condensation (Brinkmann & Kvale, 2015). The objective of this analysis approach is to start with what is being uttered, i.e. the content of the interview and corresponding excerpts, which are included in this thesis (see chapter 4). To derive inherent meanings which could shed light on the research aim and simultaneously preserve what interviewees actually expressed without over-interpretation or search for one type of opinion or view, the transcribed interviews have been perused thoroughly a number of times. Based on the condensed meaning, topics raised during
interviews were classified and revised in several iterations, such as knowledge, collaboration, motivation etc.

Throughout my analysis, I wanted to ‘give the data a chance’; the research aim with associated research questions and my theoretical framework acted as guidelines in this work. This implies that the categories and themes presented in chapter 4 are both “theory driven and data driven” (Brinkmann & Kvale, 2015, p. 232). By using theoretical concepts and themes derived from my data set, I have condensed interview statements into shorter formulations in phase 1 of the analysis phase, complying with the rigour of meaning condensation analysis (Brinkmann & Kvale, 2015, p. 233). Meaning condensation is not linked to specific methodological bases; even if it is commonly associated with a phenomenological approach (Brinkmann & Kvale, 2015, p. 235); the themes making up the analysis have been analysed and interpreted based on this thesis’ theoretical framework.

**Phase 2 - Bricolage**

The second phase of the analysis can be described as a bricolage (Brinkmann & Kvale, 2015, p. 267). Brinkmann and Kvale (2015) distinguish between an *eclectic* and a *theoretical* approach for data analysis; in this study, I would argue that the analysis approach is a combination of both. I have alternated somewhat freely between analytical techniques and concepts – in lines with an eclectic method (2015, p. 267). The interviews were read multiple times; the first iteration was to get overview of what they contained. During the second iteration, themes were developed using a strategy which can be described as a hermeneutical approach where I attempted to discern the overall picture as well as parts of it sequentially to create connections in the analysis. Drawings, categories, flow charts etc. were used in this process (Brinkmann & Kvale, 2015, p. 268). According to Hargreaves’ (1994, p. 122), one must avoid “to validate any presumed perspectives” (as cited in Brinkmann & Kvale, 2015, p. 271). Initial themes, figures, tables and condensed meanings were revisited several times and reflected upon theoretically. These measures were taken to prevent the analysis from becoming a confirmation of what I wanted to see; while at the same time, it was important to look for statements which could confirm my concepts and theories, equally important were observations which might not comply with my theoretical framework.
3.5.3 **Administration of the survey**

Before sending out the survey, we carried out a trial test among project members and academic employees at the University of Oslo. One might argue that such a test run should be carried out with participants from the target population, but given the pilot nature of the test, we concluded that internal prototype testing would suffice before it was sent out to the intended audience. At any rate, the objective of the prototype testing was to get an indication of how the structure of the survey and the actual questions would be perceived by others than those having designed the questionnaire (de Vaus, 2014; Johannessen et al., 2010).

**Invitations**

The first batch of invitations was sent out with the assistance of the head of the Oslo schools in October 2015; the second batch of potential respondents was recruited by Associated Professor Nortvedt from a group of teachers who attended a course she gave in January 2016. Both groups were given a response window of two weeks, and we initially planned for sending out reminder e-mails to those who had not answered, but this was discouraged by the school owner (Oslo).

The letter of invitation (Appendix D) enclosed with the survey provided an overview of the various sections. Brief and concise information about the aim of the survey, further use and the value of data provided by respondents were also enclosed in the online web form, as well as information on the voluntary and confidential nature of participation. Furthermore, it was essential that potential participants were properly informed about the aim of the research and their participation prior to being engaged in it (Cohen et al., 2011; de Vause, 2014). Similar to interview participants, survey respondents were also informed of the possibility to withdraw their consent at any point in time before publication of data, and that their possible withdrawal from the survey in no way would affect their professional relationship with their employer, a so-called *non-maleficence* clause (Cohen et al., 2011, p. 378).

3.5.4 **Coding and survey analysis**

**Coding**

Coding of the questions was as follows: For closed questions with three or four options (Likert scale) (Sirnes, 2008), answers were given numerical values from 1 to 3 (or 4) with scoring from left to right, i.e. “strongly agree (1)”, “agree (2)”, “disagree (3)”, “strongly disagree (4)”. Unanswered questions were coded with the numerical value ‘0’, and in multiple
choice questions, alternatives not being chosen were assigned ‘0’, whereas the selected option was assigned ‘1’.

Analysis
Data from the survey has been systematized using methods from descriptive statistical analysis, including methods for presentation and subsequent interpretation of data. Given the actual sample size, collected data has been analysed using non-parametric methods, an approach which is relatively common when processing questionnaire data (Cohen et al., 2011, p. 606). According to Cohen et al. non-parametric methods are characterized by making “no assumptions about the population” (2011, p. 606). The absence of assumptions on the population which the selection represents is frequently designated as a distribution-free test (Ho, 2006).

The software used in this analysis work was the Statistical Package for Social Sciences (SPSS), which is frequently employed in social sciences (Cohen et al., 2011, p. 604). In this context, both nominal and ordinal level data have been collected; nominal data has chiefly been amassed from the first section of the survey, including: ‘Number of Years as teacher’, ‘Education’, ‘Grade level taught the year when conducting the mapping test’ (2014-2016) or ‘Experience with the test from previous years in various grade levels’ (cf. section 3.4.3). This category of data represents “discrete variables entirely separate categories” (Cohen et al., 2011, p. 605). Ordinal data has the added advantage of also being capable of distinguishing, in addition to categorizing. In this survey, respondents were asked to assess to what extent they agreed with various statements, or if statements corresponded/did not correspond with their personal or school practice in different areas. These alternatives were coded with numerical values as previously stated. The analysis effort should however not lead to conclusions based on numerical values solely, but on patterns, irregularities etc. manifested by the material, because “one cannot assume that the distance between each point is equal” (Cohen et al., 2011, p.605). Since the sample size of twenty-six is (N=26) is quite small, numbers instead of percentages are frequently used in the text when presenting and discussing distributions, frequencies etc. For the same reason, numbers are mainly written with text rather than numerals.

Based on the composed pivot tables, analyses searching the data material for possible correlations between variables were executed. For the analysis of such data, Pearson Chi-square ($\chi^2$), Cramer’s V and Fisher tests have been used. The $\chi^2$ (Chi-square) was computed
to find and identify possible differences between observed and expected frequencies of the variables. Cramer’s V was used where the dimensions of the contingency tables exceeded 2x2. I decided to use a Fisher test as well, motivated by the wish to compress one of the tables to see if this rendered more convenient numbers to work with than a 2x2 table. When compressing tables, it is important that variables are purposefully similar. Where the Fisher test has been used, answer options ‘agree/strongly agree’ and ‘disagree/ strongly disagree’ were condensed into to two groups, rather than representing four discrete alternatives.

Another reason for compressing such a table is due to the outcome of a Chi-square: it becomes rather inaccurate when frequencies do not exceed five registrations in one or more cells (Howitt & Cramer, 2014, p. 205). Both the Cramer’s V and the Fisher tests have a correlation coefficient of -1 to 1; both extreme points indicate perfect correlation, whereas 0 indicates (complete) absence of correlation between the variables (Ho, 2006, p. 184). I have used both p<.05 and p<.01 as levels of significance in my statistical analysis, but I only report of cases where I find a significance level p<.05.

3.6 Research quality

Research quality depends on a range of various factors, e.g. rationale behind the conducted research, stakeholders involved, procedures taken in the completion, influence of researchers’ experience on the final outcome etc. Validity and reliability are two important concepts which designate the quality of research, but their relative importance is not the same when comparing qualitative and quantitative research methods. Since this is a mixed methods study, validity and reliability aspects are considered for both the qualitative part (interviews) and the quantitative part (survey).

3.6.1 Validity

For both research approaches, validity concerns checking data quality, interpretation and results (Creswell & Plano Clark, 2011, p.210). When employing qualitative research techniques, validity is generally considered more important than reliability, and addresses to which degree the account provided by the researcher is accurate and credible, and assumptions upon which the research is based (Creswell & Plano Clark, 2011, p.211; Brinkmann & Kvale, 2015 ). This also includes the craftsmanship and moral integrity of the researcher as important elements for research validity (Brinkmann & Kvale, 2015, p. 283).
All measures described in sections 3.3, 3.4 and 3.5, such adherence to research principles published in scientific literature, conducting interviews, questionnaire construction and design, documentation for transparency and tractability contributed to valid data. One may therefore speak of a means-end relationship, since the steps I have taken played their part in achieving the goal of a trustworthy account (Creswell & Plano Clark, 2011).

For the interviews, validity is a question of how well the questions asked scaffold the aim of the research, i.e. to which degree the questions succeed in eliciting information one seeks to obtain. Validity considerations also include how well one is prepared for the interview situation, and how well questions advance and support the aim of the research without being biased. For example, biased questions, follow-up question indicating negative or condescending judgement of statements expressed by the interviewee or questions with hidden ulterior motives must be avoided (cf. sections 3.2 and 3.3). For instance, it was important for us to avoid questions which could wrongly indicate an intention to check whether interviewees followed “correct practice” with the mapping test. Brinkmann and Kvale (2015, p. 283-284) argue that validation is not a situational action of a final product, but a continuous process, and hence requirements for validity must permeate the research undertaking from start to finish. In order to respect this principle, I adhere to the policies for mixed methods research and applicable scientific methodology in general. More specifically, the inclusion criteria for my focus interviewees are clearly stated (see section 3.3.2), the interviews were recorded with an audio recorder, and excerpts were selected according to pre-defined criteria, relevant for my research focus (section 3.5.2).

When it comes to validity in quantitative research, issues concern whether results can be generalized to a larger population and to what extent data represent meaningful indicators of what one seeks to measure (Creswell & Plano Clark, 2011, p. 210). The survey used in this thesis seeks to find out how teachers use the mapping test, and we needed to check whether questions reflected the aim of the follow-up study. To ensure that this objective was met, survey questions were thoroughly discussed by me and Associate Professor Nortvedt, in addition to reviews by other researchers at ILS; the survey was also subject to an interval test run with employees at UiO. When recruiting survey respondents, we aimed at geographical dispersion to reflect variations in practice and teaching experience to justify generalization to a larger population, and we required as a prerequisite that they all had carried out the mapping test. Our respondents had from four to over twenty years of professional experience, and they
are employed in three different communes in the Oslo area, which I considered would provide acceptable variation in the sample group composition. Unfortunately, external validity (Creswell & Plano Clark, 2011), i.e. whether results can be generalized to a larger population, has been weakened by the low response rate, which led me to analyse survey data more qualitatively than originally anticipated.

3.6.2 Reliability

Reliability addresses consistency and accuracy of data, i.e. how data has been collected and processed, and may also include questions on stability and consistency over time (Johannessen et al., 2010, p. 40; Creswell & Plano Clark, 2011, p. 211). Validity and reliability may appear to be distinct concepts; but I consider them to be intertwined. Reliability is more complicated in qualitative than quantitative methods, because qualitative research often has the option to change direction; in semi-structured interviews for instance, one may deviate from the original agenda. This obviously leads to research results where the role of the researcher, informants and associated processes are not constant factors (Dalen, 2011). The question of reliability is often a question of transparency when using qualitative methods and I have made efforts to be transparent when presenting and discussing choice of design, theoretical framework and research procedures, including analysis methods. When presenting results, I have endeavoured to contextualize excerpts in order to prevent interview answers from being detached from the contexts in which they were given (Brinkmann & Kvale, 2015).

For surveys, reliability involves aspects such as the robustness of questions (Creswell & Plano Clark, 2011); questions must be self-explanatory, be understood similarly by respondents and be understood as intended by the researchers. Since one cannot rephrase or explain the intended meaning of a question if a respondent misinterprets it, measures must be taken to avoid ambiguities or multiple interpretations (cf. section 3.4). In addition to careful wording and phrasing, we used multiple-items questions (de Vause, 2014, p. 50) in our survey. The aim of such batteries of questions is to prevent conclusions based on one answer only and to detect possible inconsistent responses, i.e. we wanted to understand more accurately what the reported practices were. Reliability is also a question of consistency of the survey, i.e. that it will provide similar results (but not similar interpretations) if someone else carried it out with a comparable population at another point in time (Creswell & Plano Clark, 2011, p. 211; de
Vause, 2014, p. 48); we believe that our internal reviews and test runs helped secure consistency to the extent possible.

To conclude this section on research quality, I would like to briefly discuss my own role, given my background as teacher and my motivation for selecting this research topic. Since the interviewees and I now have the same profession, certain issues and subject matter terms were familiar and did not require further explanations. This could e.g. inadvertently have lured me into accepting statements or answers which otherwise should have been met with requests for additional explanations. However, there were two of us conducting the interviews, and thus I consider this particular risk to have been sufficiently mitigated. Personal preferences, emotions and biases of researchers may affect research negatively. As explained in section 1.1.1, my first encounter with mapping tests took place during my pre-service teacher years; this experience aroused curiosity and motivated this thesis on how mapping test results can be used for further learning. I have made efforts not to be negatively influenced by my initial experience, and be critical and objective to the extent possible when analysing interview statements and survey responses. This is both a question of being critical towards the data itself, and presenting transparent accounts and interpretations (Johannessen et al. 2010, p. 232). Some associated issues are discussed in the next section.

3.7 Ethical considerations

As a researcher, one has the responsibility to act in a respectful manner towards the object one studies, whether it is humans, literature, films, animals or even plants. In this research, the follow-up study was submitted by project manager Associated Professor Nortvedt for approval by the Norwegian Centre for Research Data (NSD), an approval which also included my project (Appendix A). Approval by NSD (Norwegian Centre for Research Data) is crucial if one knows in advance that collected data will contain sensitive personal information such as age, name, gender, medical history or other person identifiable information. In this thesis, there is no information directly violating the guidelines for research comprised by the domains of Social Sciences and Humanities, Law and Theology, (NESH) and NSD. However, since audio recordings were planned, it was necessary and prudent to request pre-approval. Before our interviews commenced, interviewees were asked whether they had received and read the information pamphlet and letter of approval from NSD. Had they not, they were given the opportunity to do so in private before the interview started and without our
presence. In accordance with NESH guidelines (NESH, 2016), we informed that all publicized material, including the research report for the follow-up study and this master thesis would be made available to them should they wish to read it. Since research reports and master theses may contain scientific jargon or subject-specific terms, a summary of the study and other material were proposed as a beneficial service to the interviewees.

Due to the possibility that interviews with teachers might contain discussions related to their work with pupils below the cut-score, it was important to guarantee that these third parties would not be included with person identifiable information. It is emphasized by NESH (2016) that “Researchers should consider and anticipate effects on third parties that are not directly included in the research” (p. 20) Third parties mean “(...) those individuals who are directly or indirectly affected by the research project (p.20). Still, during the interview conversations, details emerged related to the work with individual pupils and therefore, descriptions of or reference to specific situations where individual pupils could have been identified, have been omitted to protect their anonymity.

When addressing ethical considerations, the role played by the researcher is pivotal and some aspects have been discussed throughout this chapter. Nevertheless, there are other important issues to be addressed, such as consequences of actions and confidentiality of participants. Confidentiality concerns the use of collected data, and the issue of participant anonymity discussed above; however, confidentiality is also a question of who has access to data during the research time-frame and how data is depicted and represented (Brinkmann & Kvale, 2015, p. 95). One should always take into consideration potential consequences of one’s actions when conducting research and reporting findings. When using interview data in particular, one has to be cautious with how informants are portrayed and one must be transparent on what basis conclusions are drawn and whether they are in accordance with the actual data. This does not solely apply to the involved parties, but also whether the participating informants actually represent the larger population in question (Brinkman and Kvale, 2015, p. 96), e.g. all graduate pre-service teachers from UiO, adult minority language speakers etc.

According to Brinkman and Kvale (2015, p. 97), a researcher has moral obligations when doing research; obligations which include respecting the personal integrity of oneself and ones’ informants, as well as the uniqueness of the subject being studied. One avenue to achieve this has been to be critically aware that the researcher is the “main instrument for obtaining knowledge” (p. 97). In this study, these aspects are taken into consideration and
adhered to by being cognizant of ethical standards and be compliant with applicable guidelines and recommendations from literature and research bodies as far as possible. It has been a deliberate decision to include the role of the researcher as a “reflective self” (Yin, 2011), i.e. documenting how I as a novice researcher have acquired skills to see and judge (Brinkman and Kvale, 2015, p.102) when and how ethical considerations are important in to respect involved participants. Equally important was the actual use of these skills in real research situations, ranging from my contribution to the development of the interview guide and survey instrument, conducting interviews and post-processing of data, to presentation of findings etc. Upholding and respecting ethical standards has been an integral part of all these steps and throughout this entire study, which is vital for “Ethical proficiency” (Brinkman & Kvale, 2015, p. 102).
4 Results and discussion

This chapter presents and discusses observations from the interviews and the survey. Findings are not necessarily presented chronologically with respect the order interviewees answered during interviews or the order of questions in the survey. The contexts of excerpts are provided to enhance readability and to strengthen validity in accordance with requirements for accountability and respect for the interview situation, i.e. recording of what was said there and then. Titles of the subsections refer to topics which are both data and theory driven (cf. section 3.5.2); my two data sets are indirectly merged through the discussions and presentation of findings, instead of being directly combined (Creswell & Plano Clark, 2011, p. 224), which is one possible approach when analysing data from disparate data sets.

As a consequence of the lower than desired response rate, survey results are analysed more qualitatively. The research questions and topic were guidelines for the selection of excerpts and survey questions to be studied; they were however not the only criteria. Pivotal questions and key statements are also probed into when relevant for the overall focus of this thesis. All interview excerpts and survey questions presented here have been translated from Norwegian to English by the author. Original transcript excerpts in Norwegian are juxtaposed with the English version for reference, and efforts have been made to preserve the semantic content of original texts and respect standard grammar rules and syntax in the translated version (cf. section 3.5.2)

4.1 Short description of informants

Daisy

Daisy carried out mapping tests in all three classes on the same grade level at her school and appears senior. She has several years of professional experience and displays confidence in her role as a teacher. She frequently addresses the use of mapping tests on a general school level during the interview. School management decided to employ the mapping test on the 3rd grade level where Daisy teaches, even if the test is not mandatory at this grade level.
Violet

Violet works in different school and organized the mapping test for two groups with twelve to fifteen pupils in each group from her own grade level. Violet has several years of teaching experience; her focus seems to be mainly on her own class and less on the school level; her own classroom dominates when she describes what she does. The management at Violet’s school decided to run the mapping test at the 3rd grade level.

4.2 Preparations prior to the mapping test

4.2.1 Individual preparations

The activities with the mapping tests may broadly be divided in three parts: Preparations, test administration and post-processing. On the question on how they prepare, Daisy and Violet state the following:

Daisy: Nei, det så mye ut når vi begynte men da er det noe med det å lese seg inn i å forstå hva og hvorfor skal vi gjøre det og bruke den tida på det synes jeg er viktig. Og så var det oppskrift på hvordan det skulle gjøres og da, når man har den og forhåpentligvis følger den, så blir jo, altså da er det lettere eller riktigere å bruke det materialet da. Da er forutsetningene mer like for ungene. [NO]

Violet: Ja, det tar jeg gjerne med meg hjem jeg. Det er min ting. Man kan sikkert få tid her og; det er en del av forarbeidstiden, ikke sant, så den [veiledningen] liker jeg å sitte med i ro og mak, og streke under det som er viktig i gult (…) eller sånn for meg selv i margen, så det er min forarbeidstid ja [NO]

Daisy: No, it did look like a lot when we started, but then there is the issue of reading up to understand what and why we should do it and spending time on that is what I find important. And there was a procedure for how to do it, and then, when you have it and hopefully follow it, it will be easier or more correct to use the material then. The conditions will be more similar for the kids. [ENG]

Violet: Yes, I don’t mind bringing it with me home. That’s my thing. Surely, you can get time here, and yes, it is part of the preparation time, so I prefer to sit in peace and quiet with it [the guidelines] and underline in yellow what is important or [make notes] for myself in the margin, so yes, this is my preparation time [ENG]

Excerpt 1

Excerpt 2

Dedicating time to familiarize themselves with the test guidelines is highlighted by both Daisy and Violet as an important factor for comprehending the reasons why the mapping test should be carried out. Their emphasis on the importance of understanding the background, motivation and objectives of the mapping test could be interpreted as an expression of their loyalty towards their pupils and their employers. In addition, Daisy claims that by adhering to
the guidelines for the test, the actual completion becomes more similar for all pupils. There may be several reasons why both Daisy and Violet decided to spend time on acquainting themselves with the guidelines for the mapping tests; understanding the objective(s) appears to be of value. In addition, it seems that both wished to be well prepared in order to benefit the most from the test. These statements may be an indication of teachers feeling autonomous (Ryan & Deci, 2002, p. 8) as professional workers; even if it was decided by school management to conduct the test on their grade level (and hence not up the interviewees). Both teachers seemed to take ownership and wished to benefit from the mapping test. Furthermore, underlining what is important and writing notes and comments in the margin might also indicate that Violet intended to put the results to use afterwards and in accordance with its intended purpose, i.e. making use of the assessment results for learning (Black and Wiliam, 1998; Wiliam, 2011a). It is plausible to assume that both Daisy and Violet have positive attitudes towards the mapping test, since they invested time in individual preparations.

Since the guidelines have been updated and extended (c.f. section 1.2.2), it is relevant to investigate the frequency distribution of the answers to the question: *How did you familiarize yourself with the guideline document and instructions for completion?* Figure 7 depicts the response distribution from my twenty-six respondents:

![Figure 7: Frequency of answers to question 2](image)

As can be observed, twenty out of twenty-six respondents have read through all the material prior to completion of the test. Such a response distribution would indicate that the teachers participating in this survey took the test seriously and wanted to be well prepared, quite similar to Daisy and Violet. It is difficult to determine if teachers’ beliefs on mathematics assessment are manifested here; no data is available to shed light on their choice of
preparation strategies. Nevertheless, as elaborated in section 2.2, beliefs held by teachers are assumed to influence their practice; those beliefs which scaffold their work in order to meet associated demands and requirements are of particular importance (Gill & Fives, 2015, p. 1). When Daisy and Violet justified reading the complete guidance material, both seemed to be driven by their own personal motivations for good and meticulous planning. Based on what both interviewees expressed and the results shown in Figure 7, being well prepared appears to be a priority. The need to be or feel in control of one’s situation is often a matter of feeling competent to cope with challenges. Ryan and Deci (2002) argue that the need for competence is a human need; one could claim that preparing for an activity is one approach to obtain this felt psychological state (cf. section 2.4.3). In addition to the personal benefits of being prepared, Violet highlighted the joint work effort with the guidance material, which she and her team colleagues carried out with the teachers working on the same grade level.

4.2.2 Collegial cooperation

On the question on how the teachers cooperate among affiliated team colleagues prior to the test, the two interviewees said:

**Daisy:** Nå valgte vi at jeg gjennomførte prøven i alle tre klassene, for at det skulle bli likt som mulig. Mest mulig likt. Så jeg hadde alle 70 ungene og kartla dem. [NO]

**Daisy:** We decided that I should conduct the test in all three classes, to make sure it became as similar as possible. So I had all 70 kids and mapped them. [ENG]

Excerpt 3

**Violet:** Vi jobber jo mye på trinn. Så i hvert fall...Det er veldig avhengig av hvilket trinn vi jobber på. Men jeg har et veldig godt samarbeid med dem jeg jobber sammen med (...) fordi da samarbeider vi veldig mye og leser og hvis man tolker ting og sånn. Hva tenker du her og sånn og at vi er sikre på at vi gjennomfører ting på lik måte og sånn. (...) Så vi er godt forberedt alle som skal gjennomføre testen med elevene. [NO]

**Violet:** We do work laterally. So at least... It depends a lot on what level we are working on. But I do cooperate very well together with those I work with (...) because we then cooperate a lot and read and interpret things and so on. What do you think here and so on, and to make sure that we are confident that we carry out things in similar fashions (...) So we are all well prepared, those of us who are to complete the test with the pupils. [ENG]

Excerpt 4

Daisy did not state anything about the extent of cooperation between herself and her colleagues prior to the test (Excerpt 3), and it is thus not possible to make any conjectures on the quality or degree of such cooperation; Violet, however, addressed this issue. As may be interpreted from her statement in Excerpt 4, team cooperation on the 3rd grade level seemed to
be functioning well, and the value and significance of everyone involved being well prepared was also pointed out. Violet highlighted the good cooperation with her colleagues who work on the same grade level as a success factor: “I find the way we do the orchestration working really well. It depends on everyone being present, all adults, right. We make it work” [Violet]. This seems to be in line with findings by Van den Broeck et al. (2010, p. 984), who claim that support from peers is an important factor when it comes to doing one’s best with the task at hand (cf. section 2.4.1).

It is relevant to find out to which extent teachers in general cooperate with other colleagues at their schools in order to understand whether the practice at Violet’s and Daisy’s schools was common or not. Teachers were asked whom they collaborated with prior to the test and Figure 8 shows the distribution of their responses. It turns out that those working in the same team and on the same grade level are the most frequent collaboration partners prior to the test.

![Figure 8: Cooperation partners during preparations](image)

**Who did you cooperate with during the preparations for the mapping test?**

<table>
<thead>
<tr>
<th>Collaboration Partner</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>My team/my grade level</td>
<td>24</td>
</tr>
<tr>
<td>Other mathematics teachers</td>
<td>2</td>
</tr>
<tr>
<td>Other teachers</td>
<td>2</td>
</tr>
<tr>
<td>School management</td>
<td>9</td>
</tr>
<tr>
<td>Special needs’ teachers</td>
<td>7</td>
</tr>
<tr>
<td>Assistants</td>
<td>4</td>
</tr>
<tr>
<td>I did not cooperate with…</td>
<td>1</td>
</tr>
</tbody>
</table>

Generally speaking, twenty-six respondents constitute a relatively small sample size; still, some qualitative remarks on the distributions in Figure 8 can be made. Firstly, I would have expected more cooperation with special needs’ teachers, because they could have helped to ensure optimal test conditions for those in peril of scoring in the grey zone or below (see Figure 2), provided that those pupils had already been identified.

Secondly, one might assume that having more than one cooperation partner, when appropriate, would have been of interest, e.g. to improve preparation efforts or to save time. Of the twenty-six respondents, thirteen report that they only have cooperated with one other
party; of those, eleven chose other team members; one chose another mathematics’ teacher and one reports not to have cooperated with anyone. These numbers might indicate that the respondents cooperated with those they worked with on a regular basis.

<table>
<thead>
<tr>
<th>Question 6: Consider your school: To which extent do you agree?</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

Table 1: Cooperation among colleagues

Finally, independently of the respondents’ preferred cooperation partners, there seems to a consensus that the cooperation between team members worked satisfactorily, as can be observed from Table 1. This would support a general assumption that cooperation seems to be appreciated, most likely because it adds value.

4.2.3 Preparation of the pupils

Daisy explained to her pupils that the mapping test presented an opportunity to demonstrate what they mastered, and that that would be essential knowledge for her when preparing and selecting teaching focus:

*Daisy:* Jeg forteller at vi er ute etter å vite at de skal vise meg hva de kan, og når vi skal bruke det etterpå er det med hvordan vi skal legge opp undervisningen videre. Det har jeg veldig fokus på. Det er ikke en test for å se hvor god du er eller hvor dårlig du er, men hvor ligger dere hen. *Daisy:* I tell them that we seek to find out what they know, and when we want to use that afterwards, it is to plan further teaching. I have a lot of focus on that. It is not a test to see how good or bad you are, but where you actually are. How I myself can do better when we continue. [ENG]

Excerpt 5

The statement of Excerpt 5 may indicate that she wished to reassure her pupils prior to the test by defusing individual scores; rather she wanted to verify her own teaching and thus stressed that the test is an instrument for her to improve, and not to test them [her pupils]. Obviously, Daisy knew that the aim is primarily to identify individuals requiring additional follow-up; only she chose an alternative explanation with the expressed intention to calm her pupils and make them less anxious for the test. When Daisy stated that she explained to her pupils that
her focus was on what they know, and not on “how good or bad you are”, I interpret this as her saying that the intention of the mapping test was to obtain feedback on her as a teacher and her pedagogical methods; focus is on the improvement of teaching practices, and not on individual results. This approach seems to be in accordance with William’s (2011a, p. 43) argument for formative use of assessment (cf. section 2.6); he claims that judgements of improvements are founded upon one’s elicited evidence.

Violet responded the following to the same question:

Violet: (...) elevene de tar det veldig lett de asså. Elevene forbereder jeg ved at vi går igjennom hvordan en kartleggingsprøve kan være og at man kanskje må jobbe på tid ikke sant og man kan ha noen oppgaver i forakt som ikke er kartlegginger. Der de kanskje må jobbe på tid. For dette er veldig nytt da. og for de små det å kunne jobbe på tid og ikke stresse men samtidig disponere hva det vil si ikke sant. (...) den første oppgaven går jo på at man skal føle hvor lang tid. Men det trenger man ofte å forberede seg på god tid i forveien. [NO]

Violet: (...) the pupils seem to understand it quickly. I prepare them by going through what a mapping test may look like and how you may have to work under time constraints and you may initially get some problems to solve, which are not related to the actual mapping. Where they may have to work with limited time. Because this is new; for the little ones to work under time constraints, not get stressed and spend time wisely at the same time. (...) the first problem is about getting a sense of how long it takes. But needs to prepare for that well in advance.[ENG]

Excerpt 6

The guidelines offer some rehearsal exercises while at the same time stating that too much rehearsal may have an adverse effect; one of the objectives of the test is to identify less convenient problem solving strategies, but excessive practice in advance may conceal unwanted or undesirable techniques. There are reasons to believe, based on the interview as a whole, that Violet, when focusing on rehearsing on elapsed time, wanted to make sure that pupils did not spend time on unnecessary activities which were irrelevant for test result and which might unduly have led to incorrect classifications. Examples of such activities may be spending too much time on pretty hand-writing, not getting started with test, staring out of the window etc. Based on her specific examples and justifications, it seemed that Violet employed SK (strategic knowledge) (Schulman 1986) and KCS (knowledge of content and students) (Ball et al., 2008). One could contend that her approach may have contributed to better results than vouched for by permitting her pupils to rehearse for the test; a consequence which would have defied the objectives. On the other hand, considering her statement that she dedicated time to acquaint herself with the purpose of the test and “makes notes in the
marge” (cf. Excerpt 2), she seemed motivated by a desire to use test results formatively and her actions should thus not be interpreted as a “teach for the test” strategy.

In social cognitive theory, the acquisition of knowledge and performance (cf. section 2.1.2) is a discussion on whether having the skills and knowledge to solve a problem will lead to actions to solve the problem. In my context, the question would be if pupils who know how to solve mathematical problems actually will do so. Social cognitive theory postulates that this would not automatically be the case, because human actions are influenced by both internal and external factors. According to this theory, each pupil will be influenced by a number of factors which may, as a consequence, divert attention from the actual problem solving during a mapping test. This may explain why Violet deemed it necessary to rehearse and to remove potentially disturbing factors during test execution. Table 2 lists the answer options to various statements on how pupils are informed about the mapping test and what its purpose is.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It is important to tell the pupils that we will have a mapping test</td>
<td>16</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>It is important to show the pupils the test booklet (one unanswered)</td>
<td>13</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>It is important to explain that the test is to provide me with insight into what they (the pupils) know</td>
<td>16</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>It is important to explain that I will use test results to adapt or change my teaching</td>
<td>16</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>It is important to explain that the test shall help me provide extra help to pupils who need it</td>
<td>13</td>
<td>8</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Types of information given to pupils

The responses seem to suggest that teachers considered it important to inform pupils of an upcoming mapping test. Both statements no. 1 and no. 2 include actions which are recommended in the guideline (Department of Education and Training, 2015). Showing sample problems from the test book is one of the recommended actions to calm or even solace pupils of the upcoming test situation (Department of Education and Training, 2015). Statements no. 3, no. 4 and no. 5 seem more related to the pedagogical practice. Efforts to reassure pupils that a mapping test is nothing to be afraid of and that it is okay to make mistakes or not understand a problem, would belong to the realm of the teacher’s pedagogical competence, for instance knowledge about pupils (Ball et al. 2008) (section 2.5.3).
4.3 Interpretation of test results

4.3.1 Teachers’ thoughts and reflections

According to Daisy, the registration of the pupils’ answers on the tests was straight-forward work. Regarding pupils who scored right below or above the cut-score, i.e. in the grey zone, she dedicated time trying to uncover where they may have lost score credits:

**Daisy**: Ja, for jeg tenker at ligger du ett poeng under er det like mye gråson i forhold til at du har de tallinjene hvor du kan ha fått to riktige, mens den ene har du bomma på...kanskje i en stresset situasjon, blyanten skir litt, bomma litt. [NO]

**Interviewer**: Akkurat de som ligger rundt bekymringsgrensen: Der er det jo noen som var litt heldig, og noen som er litt uheldig ikke sant. [NO]

**Daisy**: Der også har jeg gått inn på et par av dem og gått inn og sett på hvor er de feila, den er ikke så fardig faktisk, det er ikke så...Jeg har brukt litt tid å se på det. [NO]

**Daisy**: Well, in my thinking, if you are one point below, that is as much a grey area as the number lines where you might have scored two correct answers, but you have missed one on of them... maybe due to a stressful situation, the pen slips a bit, missing it slightly. [ENG]

**Interviewer**: In particular those around the cut score, there may be some fortunate ones and some unfortunate ones there, right? [ENG]

**Daisy**: Right, there too, I have looked more closely at a couple of them and investigated where the mistakes are made, it not such a big deal really, so... I have spent some time on that issue. [ENG]

Daisy does not elaborate whether she did this additional control only with pupils in the grey zone; she only stated that she had examined “a couple of them” more closely. She looked for errors which might have been avoided and/or explained by reasons unrelated to insufficient mathematical skills, but which nevertheless would have led to pupils falling into the group of concern. Daisy stated that she decided whether mistakes that were made were critical or not; she appeared to be employing her knowledge of her pupils as well as knowledge obtained through experience to determine the nature of the mistakes (cf. section 2.5.1). Her approach bears resemblance to Shulmans’ concept of strategic knowledge (SK) (1986); by including additional information in her test result evaluation, she acquired a more complete and accurate picture of her pupils’ aptitudes and skills. This in turn may be valuable when defining follow-up measures in terms of what the focus should be, the extent of the measures and possible duration. The observations which Violet made of her group of pupils seemed to indicate that she to some extent initiated a preliminary analysis when they sat the test:
**Interviewer**: Den andre tingen vi lurere på er...jeg tror du gjør det, men vi er litt usikre. Når de sitter og jobber du får du noen inntrykk av hva de får til og ikke får til, gjør du det? [NO]

**Violet**: Ja, jeg får inntrykk av dem bare ved å skotte rundt ja. Man får raskt inntrykk. Noen ganger var det forventet og noen ganger tenker jeg oii, her er det liksom... Her får man litt kontrabeskjed på at man trodde ting var annerledes enn det man... man får et annet inntrykk når det er flere elever i klassen ikke sant, enn når de sitter over 20 stykker. Så får du inntrykk når de jobber, når det gjelder hurtighet, og når det gjelder på en måte hva de egentlig mestrer av de forskjellige emnene. [NO]

**Interviewer**: The other thing we wonder about is ... I think you do this, but we are not quite sure. When they sit and work, do you get an impression of what they manage and what they don’t? [ENG]

**Violet**: Yes, I do get an impression of them just by glancing around. One gets quickly an impression. Sometimes it has been as expected, and sometimes I think: Oh, this is as if... You get some kind of counter message with respect to what you initially believed... You get a differing view when there are fewer pupils present, right, compared to when you have got over twenty sitting there. Then you get an impression when they work in terms of speed and in a sense what they actually master of the different topics. [ENG]

**Excerpt 8**

Violet discovered that the state for some of her pupils deviated somewhat from what she initially had assumed. She referred to this as a “counter message” and it seemed to facilitate a broader picture of a pupil’s achievements and contribute to focus on her own practice, such as observing additional and diverse aspects of classroom situations. Griffin (1997) claims that people provide information based on what they do and what they say [emphasised in original] (Griffin, 2009, p.191). Thus, when Violet observed her pupils during the test situation and attempted to correlate their behaviour with test results, she seemed to be employing Griffin’s assumption. Furthermore, she claimed to feed her observations back to her regular classroom practice and put them to use there as well, which would also seem to be consistent with such a strategy of extended observance.

**Table 3: Interpretation of test results**

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>I peruse carefully the test booklets of pupils below the level of concern</td>
<td>16</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I check if pupils make mistakes which are described in the guidance material</td>
<td>8</td>
<td>14</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>I check if several of my pupils struggle with the same test tasks</td>
<td>12</td>
<td>13</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I assess whether my teaching may have influenced the learning of my pupils (one answer missing)</td>
<td>11</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

In question 28 (Table 3) in the survey, we ask respondents how they worked with the interpretation of the results. As can be observed from Table 3, the answers are clustered
around *strongly agree* or *agree*. It would be interesting to probe further into why four respondents report that they do not verify whether pupils made mistakes of the types described in the guide, and how the four teachers who *disagree* or *strongly disagree* with statement 3 verified or categorized mistakes. One possible explanation might be that they rely on professional experience and thus consider that consulting the guidance material was not needed. Their teaching experience and credits in mathematics is summarized in Table 4:

<table>
<thead>
<tr>
<th>Professional experience</th>
<th>Respondent #1</th>
<th>Respondent #2</th>
<th>Respondent #3</th>
<th>Respondent #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>17</td>
<td>20</td>
<td>26</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Credits in mathematics</th>
<th>Respondent #1</th>
<th>Respondent #2</th>
<th>Respondent #3</th>
<th>Respondent #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>46-60</td>
<td>46-60</td>
<td>16-30</td>
<td>1-15</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4: Background of teachers**

At a first glance, their background and experience might explain why they did not consult the guidance material for typical mistakes made by pupils. With one exception, they have around twenty years of experience, and one might thus assume that they dispose of a repertoire of other techniques for establishing possible links between type of errors and challenges in particular areas. However, when examining the profiles of the remaining twenty-two respondents, their professional experiences range from four years to thirty-two years, with an average duration of over sixteen years; one has no credits in mathematics; five have 1-15 credits; nine are in the 16-30 credits category; five have 31-45 credits and the remaining two have 46-60 or more credits. In other words, those who do not consult the guidance material for common mistakes cannot be distinguished based on their professional experience or credits in mathematics. Furthermore, these four teachers also reported that they had read all of the guidance material prior to completion, which leaves the question open why they did not consult the guidelines to classify mistakes. As can be observed from Table 3, twenty-three out of twenty-six either *strongly agree* or *agree* that they assessed their own teaching practice to find out how it may have influenced the learning of their pupils. Given the number of respondents stating that they *strongly agree* and *agree* with statement 5, one might ponder whether respondents were influenced by what they conceived as acceptable answers and not reflecting how they actually assessed their own teaching practice. There is also a certain degree of latitude in the interpretation of the statement, i.e. respondents may have understood it differently and answered according to personal assumptions. One aspect which might have left room for interpretation is related to how actively teachers assessed their own teaching in
combination with the results of pupils below the cut-score; another facet would be to which extent teachers considered themselves responsible for test results or if the pupils’ performance was mainly due to other external factors. Nevertheless, based on the available data, the practice of assessing whether their teaching may have impacted pupils’ learning seems to be in accordance with Swaffield (2011), who addresses professional teachers’ ability to continuously judge and evaluate the effect or potential effect of choices made and actual teaching. Given the distribution of answers to statement 5 in Table 4, a majority would seem to have reached Dale’s competence level 3 (Dale, 1999), which in turn would imply that they incorporated meta-reflections on work carried out at competence levels 1 and 2.

### 4.3.2 One-on-one conversations with pupils

Violet described a practice where conversations between pupil and teacher are important for the subsequent work. Excerpt 9, Excerpt 10 and Excerpt 11 illustrate this:

**Violet:** (...) Jeg må jo først registrere så kan jeg snakke med eleven. (...) hva var det som gjorde det vanskelig her? Er det det at du ikke forsto hva som skulle gjøres? Jo det kan kan skje være det. Hvis det er det vil jeg notere med det ikke sant det er på grunn av misforståelse eller om det er rett og slett ikke har forstått. Forstått det med minus da - jeg forstår fortsatt ikke det med minus; okei, eller det er blitt for dårlig tid. [NO]

**Excerpt 9**

**Violet:** (...) First, I have to enter the results, and then I can discuss results with the pupil (...) what made it difficult here? Is it because you did not understand what to do? Yes, that might be the case; if yes, I will make notes explaining it was not due to a misunderstanding, or quite simply not having understood at all. Having understood subtraction – I still don’t understand the thing with subtraction: okay, or is it simply because there was too little time? [ENG]

**Violet:** (...) Og så har vi samtale med hver enkelt elev, det jeg har gjort noen ganger er at jeg har rettet så har jeg snakket litt med hver enkelt elev. Kanskje var det bare en misforståelse. Eller så ser jeg at her har de rett og slett ikke forstått. Så det er på en måte, man kjenner gruppa såpass godt at man kan veit noen er i stand til å samtale: Å nei, er det sånn var... Asså er misforståelsen retta opp. Så noterer jeg for meg selv at det her var kun misforstått. Så det går på samtale med enkelt elever. [NO]

**Excerpt 10**

**Violet:** (...) And then we have a conversation with each pupil, what I have done sometimes is to correct the test and then have a little chat with each pupil. Maybe it was a misunderstanding. Or I see that they simply have not understood, so in a way, since you know your group so well, you know what they are capable of, and during the conversation, they realize how it was meant ... the misunderstanding is rectified. So I make a note that it was just a misunderstanding. So it is about the conversation with each pupil. [ENG]
Violet: (...) Det går rett og slett på den samtalen da. Det du ikke har fått registrert (...) så det er på en måte den samtalen hele veien. Med hver og enkelt. [NO]

Violet: (...) It is simply about that conversation. What you have not registered (...) so it’s about that conversation all the way. With each and every one. [ENG]

Excerpt 11

Violet addressed arithmetic operations and used a pupil scoring low on subtraction problems as an example. It seemed to be crucial for her to find out whether the pupil might have misunderstood the problem description, or whether he or she may have had issues with subtraction as an operation. It is pointed out in Excerpt 9, Excerpt 10 and Excerpt 11 that the conversations with the pupils were important: Violet tried to learn if there were misunderstandings due to language difficulties or if the pupil simply did not comprehend the question, i.e. could not solve the problem due to mathematical difficulties and not textual comprehension or language challenges. Schoenfeld (2007) advocates: “The more that teachers can ‘get inside their students’ heads’ in an ongoing way (...) the more they will be able to tailor their instruction to students’ needs” (p. 277). It is plausible to interpret Violet’s expressed actions, based on her statements, as an attempt to look beyond results to obtain a more complete view of the individual pupil’s performance.

The role of the individual follow-up conversation was emphasized as one of the most significant means for Violet to acquire knowledge on their qualifications. It seemed that Violet worked continuously to comprehend where her pupils were in their learning processes. According to Violet, the issue was to find out which factors may have influenced the result, including those factors which have not been registered. As Violet points out, it is from the conversations that she obtained a more profound insight into how her pupils reasoned to solve the problems, and what they may have had issues with. Based on the questionnaire, there seems to be a general agreement among survey respondents that “it is important to discuss with the pupils how they reasoned when they solved the problems” (Question 34, statement 1): all twenty-six either strongly agree or agree. As Violet pointed out, it was from the conversations that she obtained a more profound insight into how her pupils reasoned to solve the problems, and what they may have had issues with. An ongoing dialogue between teacher and pupil could bring additional and pertinent insight into the pupil’s knowledge and counting strategies.
Benefits of test results

Table 5 lists the distribution of answers to the statement on what the respondents did with the results of the mapping tests.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>The test is a good starting point for further of the pupils’ skills</td>
<td>5</td>
<td>20</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>The mapping test in arithmetic does not provide teachers with new insight into what low-performing pupils master</td>
<td>5</td>
<td>8</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>The mapping test does not provide teachers with information on the pupils number sense and calculation skills, which can be used for follow-up of the pupils</td>
<td>2</td>
<td>3</td>
<td>17</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 5: Insights provided by the mapping test

Even if the sample size is not large enough to represent the given population; I nevertheless find it interesting that such a high number of respondents state that they did not consider the mapping test to be an aid to identify challenged pupils; individuals whom teachers, according to research, have issues identifying (Ostad, 2010). The discrepancy between the objectives of the mapping test and feedback given by the teachers on the perceived benefits may be due to several factors:

- There might a notion of excessive testing; given the assumption that there are many compulsory mapping tests in general, and not restricted to mathematics, an additional test might be perceived as superfluous and not providing new insight. However, there are relatively few compulsory assessment tests on the lower grade levels, and this would then not be the most plausible explanation. On the other hand, if one assumes that teachers consider the total amount on all grade levels combined to be too high, this might have influenced their perception.

- There may be elements of negative anticipation due to previous mapping tests, which may not have given new knowledge.

- Teachers may feel they already know where their pupils have issues and problems. For instance, Daisy states that she was not surprised when she learned the names of the two pupils who scored below the cut-score; whether she obtained new insight into
what these two low-performing pupils actually mastered was however not expressed in the interview.

- The mapping test may not reveal sufficiently clearly what low-performing pupils actually master.
- Teachers may have had issues deriving new information on the achievements of low-performing pupils from test results.

I assumed that few statistical observations could be deduced given the sample size; still, I did consider it to be a valuable exercise to perform some statistical calculations to see if conclusions possibly could be drawn. The four response categories in question 33, statement 7 (Table 5) are merged into two: strongly agree and agree are merged to one, and disagree and strongly disagree into another one. The respondents give feedback on the following statement: *The mapping test in arithmetic does not provide teachers with new insight into what low-achieving pupils master.* Originally, the length of the respondents’ education was subdivided into six distinct categories, which have been merged into two, representing 0 – 30 credits and 31+ credits respectively. The reason for merging into two-by-two categories is the aim to increase cell frequencies to improve the accuracy of SPSS calculations (cf. 3.5.4) (Howitt & Cramer, 2014). The rationale for setting the limit between the two groups at 30 credits is the observation that 30 credits or less correspond to maximum one full semester of mathematics in higher education. For both groups, the former teacher education program\(^{16}\), which complied to the national curriculum regulations, approved in 2003 (Ministry of Education and Research, 2003)\(^{17}\) and the current Primary teacher program for years 1 to 7, which follows regulations of 2010 (Ministry of Education and Research, 2010)\(^{18}\) where 30 credits in mathematics are mandatory. This implies that those with 30+ credits are more likely to have actively chosen deeper subject matter competency in mathematics as a school subject.

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16 This program was called *Allmennlærerutdanningen* in Norwegian.
Based on merged categories, a Fisher exact test has been computed in an attempt to generate values which will be more accurate than those based on non-merged categories. The Fisher test is based on cross tabulation between the two selected variables (see Figure 9). As previously stated, the Fisher exact test is used because the Chi-square ($\chi^2$) assumption cannot be met, i.e. cell frequencies are not 5 or higher. Unfortunately, these assumptions are still not met for the compressed 2x2 tables, but it does not affect the p-value of the Fisher test. Statistical analysis (two-sided Fisher exact test) seems to indicate that the variable Education (i.e. education length) may have an impact on how teachers responded to the statement *The mapping test in arithmetic does not provide teachers new insight into what low-performing pupils master*; twelve out of seventeen (within the group 0 – 30 credits), i.e. 70.6%, responded that they *strongly agree or agree*. Conversely, eight out of nine or 88.9% within the 31+ group *disagree or strongly disagree* (p<.05 for Fisher exact test). These results might indicate that teachers within the group 0 – 30 credits saw less merit in the mapping test, whereas teachers having 31+ credits in mathematics considered the test valuable for providing new insight. The observation suggests that a longer education in mathematics also make teachers more positive towards mapping tests as an aid to learn what low-performing pupils actually master. Conversely, less theoretical background in mathematics seems to make teachers less positive towards potential benefits of mapping tests used in the given context.
4.4 Implementation of follow-up measures

4.4.1 Organization of measures

Class level

In Daisy’s class, two pupils were reported as having performed below the cut-score, which spurred us to ask the following:

Interviewer: (...) da lur vi hvordan du fulgte opp dem [elevene]? [NO]

Daisy: De elevene…. Det var ingen overraskelse for meg. Jeg forventa at de skulle ligge etter, så dette er en oppfølgning vi allerede er i gang med og vi har ikke sett i gang andre tiltak etter det (...). [NO]

Interviewer: (...) so we wonder how you follow up those [pupils]? [ENG]

Daisy: Those pupils…that was not a surprise to me. I did expect they would lag behind, so this is an on-going follow-up we are working with and we have not initiated other measures after that (...). [ENG]

Excerpt 12

Daisy: Ja, altså, jeg begynte med de elevene nå i tredje. (Så du har ikke hatt de så lenge?). Jeg er vanligvis på fjerde, femte og sjette, (hmm) så er jeg nede og henter. Jeg har kansje en annen tanke på, jeg er veldig oppmerksom på hva som er viktig at de har med seg. Hvor er høla. Vi må tette de. Hvis ikke er det så vanskelig i sjette klasse. [NO]

Daisy: Well, I started with the pupils who now attend 3rd grade (So you have not had them for that long then?). I am usually on 4th, 5th and 6th, (hmm), so I go down one level and fetch them. I may have an additional view on that; I’m very much aware what they bring along. Identify where the gaps are. We must close those. If not, it will be difficult in the 6th grade. [ENG]

Excerpt 13

Daisy stated that no new measures were implemented as a result of the mapping test performance of her two pupils, because extra follow-up measures were already being implemented; no information is given to shed light on what the two were struggling with. In hindsight, a discussion on the performance of those two pupils might have given additional information on Daisy’s understanding of individual results. She claimed to have used the results from all pupils to improve her teaching on a class level, not only from those scoring below the cut-score, and it becomes evident that she puts high value on basic skills and aptitudes.

What skills and knowledge the pupils have acquired during the first years at school before moving on to more advanced topics, is emphasized by Daisy as important factors in her teaching practice. She explained that she during the school year 2014-2015 ‘went down’ one grade level and started teaching one year earlier the class she now has. It is not uncommon to
work as a substitute teacher on a different level from where one normally works. But it may be assumed that she ‘fetched’ them at her own volition and based on her beliefs on what children should learn at an early stage, one may contend that she has a high sense of self-efficacy (cf. section 2.3): Her teaching and mathematical self-efficacy may have inspired her to ensure that her pupils acquire necessary knowledge and skills required for further learning. Her actions thus seemed to be in line with Bandura’s reasoning that self-efficacy is relevant for one’s beliefs on the possibilities for influencing challenges one faces (2004, p. 622). Although it is not clear, based on what she expressed, what other train of thought she referred to or followed, or if she had an alternative approach or philosophy towards mathematics teaching and pupils’ mathematics learning. As a response to the same question (Excerpt 12), Violet brought forward the individual conversation between pupil and teacher as significant for the subsequent work (cf. 4.3.2).

When discussing follow-up measures, Daisy pointed out that they have chosen to put the textbook aside and work theme-based instead:

Daisy: Ja, jeg vil på en måte si at jeg har brukt et år på å kartlegge klassen min da, for å finne ut hvordan jeg burde undervise til neste år? Vi har valgt å legge vekk læreboka og jobbe temabasert. Og få inn de fire grunnleggende regningsartene. Det er det aller viktigste. Om vi ikke får tatt masse geometri, eller får tatt brøken. Nei vel, da venter vi. Det nytter ikke at vi begynner med brøk hvis de ikke forstår enkel multiplikasjon. Det jeg føler jeg har sett i år med ungene, gjør at vi prøver oss på noe nytt for og ikke bli styrt av den boka. [NO]

Daisy: Yes, in a sense I would say that I have spent one year on mapping my class to find out how I should teach next year? We have decided to put the text book aside and work theme-based. And introduce the four arithmetic functions. That is the most important. If we’re unable to cover a lot of geometry, or fractions. So be it – let’s wait with that. No point in starting with fractions if they do not understand simple multiplication. What I have observed this year with the kids makes us try something new to avoid being controlled too much by that book. [ENG]

Excerpt 14

Whether she already had implemented this practice, or she planned to initiate it as a result of the mapping test outcome is not clear. Buehl and Beck point to the importance of the teachers’ self-efficacy as a significant factor to succeed with teaching (2015, p. 75) and (section 2.3). Putting the textbook aside and working theme-based could be an indication that Daisy had a high sense of self-efficacy with respect to her abilities to modify teaching methods and practices. She did not elaborate in what way her mind-set might have differed from that of her colleagues (see also Excerpt 13) or if she had an alternative view on the role of the mathematics teacher in general. It would however have been interesting to probe further
into the effectiveness and possible success of her approach, and see how it fits with practices employed by her colleagues; i.e. baseline her approach in an environment where a number of factors are assumed to be similar, such as work environment, school management, pupils’ backgrounds etc. When Daisy stated that “they will try new approaches”, it is not clear if this applied to her own teaching and class, or whether she felt it should be applied to the whole grade level. Based on the interview context however, there are reasons to believe that the scope was to implement her principles on teaching strategies and focus areas across the whole grade level. When she talked about e.g. “put the textbook aside” there was no data to indicate whether this was restricted to her own teaching practice in the timeframe of the study only, or a commonly employed technique at her school, irrespective of the mapping test.

Daisy pointed to an aspect of her teaching which I find interesting: She wanted her pupils to engage in mathematical problems spontaneously and dare face challenges on a personal level. Getting support from one’s surroundings to work with and solve problems which one cannot automatically master alone may enhance development; this way of learning seems to be in line with the social constructivist perspective of Vygotsky’s (1978, p.86) (cf. section 2.1.2); undertaking potentially challenging tasks is a strategy which appears to have been practiced inconsistently at Daisy’s school:

Excerpt 15

There are reasons to believe that the statement in Excerpt 15 may have been motivated by what we [the interviewers] perceived as her senior role in the workplace; given reported observations on her pupils’ performance, she claimed that they [the teachers] intended to implement measures from the coming autumn. She justified this practice by citing professional reasons and wanted to make sure that her pupils obtained basic knowledge and comprehension of pivotal elements before proceeding to more advanced mathematical topics. Both interviewees explained that they employed a variety of teaching techniques in their respective classrooms. When asked what measures they took to address the whole class, Violet answered:
**Violet:** Går på gruppa generelt. At man tar opp tema. Det går på partner vurdering. At de kan sitte sammen og være veldig åpne på at dette fikk ikkje jeg helt til: så sier de «at dette kan jeg forklare deg». Så vi har vært veldig åpne på det også da. Og at man har laget opp tilsvarende oppgaver i ting man ser mange eller flere... skal vel ikke si sliter med, men har utfordringer med da. [NO]

**Excerpt 16**

Associated Professor Nortvedt and I found the peer assessment practice to be interesting, so we requested an elaboration:

**Violet:** Ja, partnervurdering jeg har i basisgruppa [klassen]. Jeg har en veldig heterogen gruppe. Det vil si at jeg har noen som kan veldig mye, dette går som en lek, mens andre synes det er forferdelig vanskelig. Og da kan man sitte som partnere og veilede. At en sitter og forklarer med andre ord enn det jeg kan og andre ganger igjen sitter jeg to som gjerne er jevngode sammen. Og de kan veildene hverandre. Hvis dem har noen småfeil som dem sammen kan finne ut av. Ahh, noen ganger har da riktig og noen ganger har jeg riktig. Det synes jeg også er veldig spennende at noen ganger er de jevngode men de trenger allikevel å dra hverandre opp, så det er litt variert. Man har mange muligheter i basisgruppa også (...). [NO]

**Violet:** Yes, I have peer assessment in my base group [class]. I have a very heterogeneous group, which means that I have some who know a lot, it’s like a walk in the park, while others find it terribly difficult. In that situation, one can sit as a partner and offer advice. That one is sitting explaining with other words than what I can, and at other times, I place two together who are even. And then they can advise each other. If they make small mistakes, they can work it out together. Sometimes you are right and other times you are wrong. I find that very interesting, that they are almost equal, but they still need to boost each other, so there is some variation. One has possibilities within the base group too (...). [ENG]

**Excerpt 17**

In Violet’s class, pupils reportedly had the opportunity to work together across different knowledge levels by sharing, guiding and supporting each other, which could further have developed their (original) perception of the subject and enhanced further learning. This teaching method seems to be in accordance with Lampert’s views on efficient classroom practices; listening in on discussions during pupils’ peer reviews and classroom discussions where their verbal participation may contribute to more profound insights into their knowledge (1990, p. 56). By employing such activities, one may assume that this presented Violet with an opportunity to observe and listen to the verbal engagements of her pupils. This may in turn have been an important element for comprehending how she could facilitate further learning.
Letting her pupils give advice to each other may have contributed to a collective understanding that they could learn and boost one another. It was important for Violet to benefit from all contributions of her pupils, “both correct and incorrect”, as advocated by Schoenfeld (2015, p. 189). Incorrect approaches may shed light on their informal mathematical mind-set and reasoning. It is an important part of teaching mathematics, in particular at the lower levels, to bridge the gap between the informal language of the pupils and the formal language used in mathematics (Aastrup & Johansen, 2014). To achieve this goal, pupils should experience or meet teachers who acknowledge their informal knowledge acquired outside of a school context. Aastrup and Johansen argue that teachers should adapt their language so that pupils more easily understand what is being uttered (2014, p. 770). Violet stated several times that the conversations with each individual pupil was important in order clarify whether there were language barriers or reading comprehension issues, which might have led to incorrect answers; one may even conjecture that she modified her own language to ascertain that she was clearly understood. Assuming this strategy, it may have helped scaffolding the transition from informal to formal mathematical knowledge, in accordance with the recommendations of Aastrup and Johansen.

In addition to identifying pupils below the cut-score, the mapping test should also be a tool to device measures to improve their skills; defining dedicated and individual learning goals ought to be part of this process. Furthermore, discussing new learning goals with each pupil must be seen as an integral part of setting and following up of these new targets, since it will be pivotal for the pupil to comprehend the aspirations and what steps will be needed to get there. Hence, in the context of this thesis, it is relevant to understand the teachers’ intentions, based on their reported follow-up practice. As a consequence, it will be pertinent to investigate if there is a connection between the number of credits in mathematics and answers to other survey questions/statements; this is inspired by the observations on the number of teachers’ credits in mathematics and perceived additional information provided by the mapping test (chapter 0). It would not be feasible or relevant to see in there is an apparent connection for all questions and statements of the survey versus the length of the respondents’ mathematics education.

Given my research questions, the answers to the following survey statement from question 35 are candidates for being inquired further: a) I define prioritized learning goals for each pupil and b) The pupil and I discuss together how the goals can be achieved. When it comes to a),
defining prioritized learning goals, eight respondents in the 31+ credits category strongly agree or agree, whereas only one disagrees or strongly disagrees. The distribution is somewhat less distinct for the 0-30 credits category, where eleven strongly agree or agree, and six disagree or strongly disagree to the statement. These numbers seem to indicate that teachers with more credits in mathematics are more inclined to define prioritized learning goals than those with fewer credits. Answers to statement b) are less conclusive: eight respondents in the 31+ credits group claimed that they discussed with their pupils how learning goals may be achieved, whereas only one disagrees or strongly disagrees. For the 0-30 credits group, fourteen strongly agree or agree, whereas three disagree or strongly disagree. The answers given by respondents in the 31+ credits category seem consistent for the two statements: a majority both defined learning goals and discussed them with their pupils. The response frequency between statements a) and b) for the 0-30 credits category appears less distinct; however, claiming that there are significant differences in the response frequencies to both statements a) and b) would stretch the interpretation beyond what is vouched for.

Another motivational factor for mapping tests in the lower primary school is to uncover pupils’ mathematical challenges at early stage. Thus, it will be of interest to see when teachers report to define individual and prioritized learning goals as a function of the grade level. The following statements from the survey: a) **I define prioritized learning goals for each pupil** (Table 6) and b) **The pupil and I discuss together how the goals can be achieved** (Table 7) are cross-tabulated (*) with the variable c) **Grade**, representing ‘On which grade did you execute the mapping test in 2015/2016 and have planned follow-up activities?’

<table>
<thead>
<tr>
<th>On which grade did you administer the mapping test in 2015/2016?</th>
<th>I define prioritized learning goals for each pupil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly agree</td>
</tr>
<tr>
<td>1(^{st}) grade</td>
<td>4</td>
</tr>
<tr>
<td>2(^{nd}) grade</td>
<td>1</td>
</tr>
<tr>
<td>3(^{rd}) grade</td>
<td>1</td>
</tr>
<tr>
<td>Multiple grades</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

Table 6: Crosstab of Grade taught vs. prioritized learning goals
As explained in section 3.5.4, the normal starting point for a chi-square ($\chi^2$) is to see if there is any form of correlation between two categorical variables (Ho, 2006, p. 363). In Table 6, one can observe that seven out of twenty-six respondents either *disagree* or *strongly disagree* that they define prioritized learning goals for pupil(s) below the cut-score. The motivation for running a $\chi^2$ calculation was to detect potential patterns, trends or possible links, depending on the level taught in relation to the definition of prioritized learning goals. Unfortunately, since the data sample is quite small, no clear patterns can be observed by inspecting Table 6; still, a $\chi^2$ test was run. The purpose of this test is to check whether the observed frequency is significantly different from what could be expected by chance in the different cells, i.e. a significant difference between observed and expected counts, given a representative selection.

Although we can observe a certain cluster around the options *strongly agree* or *agree* in the answers cited in Table 6, i.e. nineteen out of twenty-six report that they define prioritized learning goals for the pupils; there is no significant difference between the distributions of the answers to the question on prioritized learning goals and grade level where they had the mapping test; $\chi^2 (9, N = 26) = 9.196, p = 0.419$. I find it pertinent to once again repeat the challenge with $\chi^2$ calculations on cross tables when the frequency is lower than 5 in each cell; calculations become inaccurate (Howitt & Cramer, 2014, p. 205). As a result of this cross tabulation exceeding a 2x2 table, calculations will be based on Cramer’s V with $p = 0.419$; a $p$-value of 0.343 indicate that the correlation is not significant. There is a discrepancy between what is summarized in Table 5 on the perceived value of the mapping test, i.e. thirteen of twenty-six, whereas nineteen out of twenty-six state that they define learning goals for their pupils (cf. Table 6), and this may be attributed to teachers’ feeling obliged to respond that they do indeed define learning goals. Alternatively, common measures could have been implemented in regular classes, without dedicated and specific individual learning goals. In other words, little can be said about a possible link between the grade level being taught and definition of individual learning goals. The question remains relevant though, because early intervention also implies individual goals and measures to improve learning, and it is thus important to find out when teachers actually start considering early intervention measures for their pupils.

From Table 7 one can observe that twenty-two of twenty-six teachers claim that they *strongly agree* or *agree* with the statement *The pupil and I discuss how the goals can be achieved.*
Given the distribution of Table 7 however, none of the 1\textsuperscript{st} grade teachers responded that they disagree or strongly disagree to the statement \textit{Do you have follow-up conversations with your pupils on the achievement of personal learning goals;} in other words, it is not unfounded to assume that all have had these conversations; but the nature of these conversations is not known; neither the content nor the duration or how it was perceived by the participants, and most importantly, possible benefits are unknown.

An important element of assessment for learning is the participation of the pupil in the definition of goals and how they may be achieved. Otherwise, one runs the risk of test results being informative for teachers, but not for pupils (Black et al., 2003). Even if the mapping test is designed to give a broader picture of both conceptual and procedural knowledge, follow-up conversations addressing how to achieve new goals (and not exclusively discussing test results) are desirable in order to supplement the overall evaluation of mapping test results. The issue is thus how to make use of assessment for formative purposes (Harlen, 2006). As pointed out in chapter 2, conceptual knowledge or understanding is an important factor in the e.g. development of number sense. Findings by Supovitz et al. (2014) indicate that teachers tend to emphasize efforts targeted towards understanding “what students do (procedural) rather than what they understand (conceptual)” (p. 27). According to Ma (2010), a \textit{profound understanding of fundamental mathematics} is needed when using statements from pupils to corroborate and evolve their mathematical understanding, i.e. a mathematical knowledge which Ma defines as “an understanding of the terrain of fundamental mathematics that is broad, deep, and thorough” (p. 124). Therefore, follow-up conversations are helpful in finding out what pupils understand, but these conversations offer little guarantee that the teacher obtains this desirable and comprehensive view. It seems to be challenging for teachers to use
test results formatively (cf. section 1.2), which in this context also would include follow-up conversations. Without additional information, it is difficult to understand why four respondents (see Table 7) state that they do not have these conversations.

4.4.2 School level/grade level

Chapter 4.4.1 focused on the teachers’ measures directed at one particular class. In the following chapter, measures and activities aimed at the whole grade level will be treated. The guidance material (Directorate of Education and Training, 2014) offers some hints and advice how to possibly organize course groups across classes when it seems possible, e.g. when pupils in several classes have similar challenges. These course groups may not necessarily be reserved for those scoring below the cut-score. On the question how measures were organized for these, Daisy explains:

Daisy: (...) Men jeg ser jo i forhold til trinnet nå, så gjør jo vi tiltak når vi starter opp til høsten (...). [NO]

Daisy: (...)But when I consider this level, we do have measures when we start this autumn (...). [ENG]

Excerpt 18

Daisy did not report what the actual results were, but it seems likely that the overall school test results were unsatisfactory, since changes were to be implemented for everyone on the 3rd grade level, and not just for those below the cut-score:

Daisy: (...) I forhold til å legge matte på samme tid på hele trinnet: at vi kanskje kan justere gruppende litt annerledes når vi har matte. At vi kanskje kan lage en forsterkede gruppe på «bånn» da. At de får en større gruppe, men at de er litt på samme nivå (...). [NO]

Daisy: (...) When organizing math classes at the same time for the whole level: we might adjust the groups somewhat differently when we teach math. We may put together a reinforced group “at the bottom”. That they get a larger group, but still they are more at the same level (...). [ENG]

Excerpt 19

In other words, organizing mathematics classes at the same hours across the whole grade level can facilitate reinforced groups for low-performing pupils more easily (cf. Excerpt 19); the second benefit would be possible coordination of activities across the whole grade level, giving more coherent mathematics teaching (cf. Excerpt 15). No elaboration on group composition is given during the interviews. The guidance material19 (Directorate of Education and Training, 2014) suggests dedicated courses for individual pupils during limited periods

19 https://www.udir.no/eksamen-og-prover/prover/kartlegging-gs/#larerveiledninger
only, and not as permanent measures or alteration of schooling structures. There is no data available indicating whether the measures described by Daisy in Excerpt 19 complies with the suggested course groups or not. On the same question, Violet replied:

**Violet:** (...) Vi har kjørt noen ganger litt kursgruppe da... vi retter... jeg tenker jo at kartlegging er for å se hvor elevene er i terrenget og hva man trenger å øve på. Så har man kjørt litt kursgruppe for eksempel hvis man ser så mange som har utfordringer hvis det gjelder ett emne, så har man kjørt dem sammen. Og det er på tvers av trimmene da, for det er tre klasser hos oss. Så jeg synes det går helt kurant. [NO]

**Violet:** (...) We have been running some course groups a couple of times... we correct ... In my mind, mapping is to find out where pupils are and what needs to be rehearsed further. So one has organized course groups for instance if one sees that many have the same challenges with a certain topic; then one has put them together across the level; there are three classes here by us. So I find that to be working quite okay. [ENG]

Excerpt 20

In other words, Violet’s school seemed to adhere to the guidelines on this particular issue. As pointed out in chapter 4.2.2, collaboration appeared to be functioning satisfactorily on her grade level, and they may actually have formed such groups irrespective of mapping test guidelines. In the survey, we asked what types of activities were organised for pupils below the cut-score (Table 8):

| Question 36: Consider the teaching activities you carried out with the pupils below the cut-score. To what extent do you agree with the statements below? |
|---|---|---|---|---|
| No. | Statement | Strongly agree | Agree | Disagree | Strongly disagree |
| 1 | We rehearse counting with confidence and flexibly in class | 13 | 12 | 1 |
| 7 | We rehearse automating number facts in class | 15 | 11 |  |
| 8 | I develop courses for some pupils where we rehearse automating number facts | 9 | 6 | 10 | 1 |
| 9 | We rehearse using the number line for counting and solving problems in class | 16 | 9 | 1 |
| 10 | I develop courses for some pupils where we rehearse using the number line for counting and solving problems (one unanswered) | 9 | 6 | 9 | 1 |

Table 8: Selection of statements relevant for question 36

Twenty-five out of twenty-six respondents stated that they rehearsed counting flexibly and with confidence in their class (i.e. they strongly agree or agree to statement no. 1 in Table 8), and all teachers responded that they strongly agree or agree with statement no. 7. It can hardly be refuted that knowledge on numbers such as their relative values, relationships
between numbers and simple arithmetic (number facts) are integral parts of being able to count with confidence and flexibility (Lona Svingen, 2016). Motivated by e.g. Daisy’s statements given in Excerpt 15 on the challenges with open math problems, specific and concrete tools to aid the investigative learning process are desirable (Grønmo, 2012), (cf. chapter 1). Even though all respondents stated that they practiced number facts in class, less than half of them (eleven respondents) actually seemed to have had dedicated course groups on number facts (statement no. 8 in Table 8). The response patterns of statements no. 7 and no. 8 seems to reappear in statements no. 9 and no. 10; almost all agree (twenty-five out of twenty-six either strongly agree or agree) that they used the number line to rehearse counting and solving problems in class, but approximately one-third (ten respondents) did not organize dedicated groups for those below the cut-score to work specifically with the number line. While the answers to statements no. 7 and no. 9, and no. 8 and no. 10 respectively, appear to be consistent, i.e. virtually all rehearsed on number facts and the number line for counting, more than one-third stated that they did not organize dedicated groups. This is slightly surprising, as one would expect that such groups were considered efficient and of particular benefit for those below the cut-score and would have been a relatively obvious means to improve skills. One possible explanation might have been that respondents consider knowledge in these two areas so important that activities should include all pupils, and not only those below the cut-score.

4.4.3 Collegial support

Question 37 of the survey addresses how often teachers cooperated with other members of the pedagogical staff at their schools; fourteen respondents reported that they always did this, whereas eleven claimed to have done this usually and one claimed to have done it sometimes; question 38 (Table 9) elaborates whom they actually cooperated with; respondents had the option to select more than one statement.

<table>
<thead>
<tr>
<th>No.</th>
<th>Alternatives</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Other teachers on the grade level</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>Assistant</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Special needs’ teacher</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>School management</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 9: Cooperation partners
Assistants seemed to play a minor role as cooperation partners – only two out of twenty-six respondents stated that they collaborated with assistants when planning additional activities. On the other hand, data from other studies suggest that assistants are used frequently when pupils need extra follow-up in various subjects and for a number of different reasons (Bachmann, Haug & Nordahl, 2016; Utdanningsforbundet, 2013; Utdanningsforbundet, 2017). One would therefore expect that assistants were more frequent cooperation partners when planning additional measures and follow-up than indicated by the response frequency of Table 9. Possible explanations may be that the use of assistants was less common at the workplaces of the interviewees and the respondents; also, there could be a more deliberate and careful delegation of tasks to assistants, which would exclude them from participating in further mapping activities. My current data set gives no indication of why cooperation with assistants seemed to be infrequent, but it is known that the use of assistants varies between schools and between communes (Utdanningsforbundet, 2013); such a preliminary finding notwithstanding, further inquiries into the roles of assistants in follow-up activities emanating from mapping test results seems merited.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>We cooperate on the grade level to develop teaching activities and measures</td>
<td>13</td>
<td>10</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>We distribute pupils between us on the grade level to provide better follow-up</td>
<td>5</td>
<td>9</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cooperation with others help me provide better follow-up</td>
<td>9</td>
<td>15</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 10: How does the cooperation work?

Responses given to questions 37, 38 and 39 (Table 9 and Table 10) leave an impression of a good corroborative climate with respect to the mapping test completion. Despite a favourable work environment, completion and follow-up of additional activities seemed to be left at the discretion and responsibility of individual teachers, and not a collective effort, which the response distribution to statement no. 2 of question 39 seems to suggest. During the interview, the team aspect was emphasized by Violet as significant, and this impression is reinforced by my analysis. She reported of follow-up which can coarsely be divided in two categories: a) measures implemented based on the structural cooperation between teachers, and b) the ongoing dialogue between teacher and pupil in her daily practice. On the issue of team impact and significance, Violet explained:
By considering all the pupils on the 3rd grade level as one group, as opposed to focusing on individual classes, teachers can support each other by building on collective strengths within their teams. This in turn makes it easier to follow up pupils, both those with strong aptitudes demonstrating good proficiency, and those who may have difficulties in certain areas. Based on Excerpt 21 and Excerpt 22, it may seem that follow-up of pupils below the cut-score was organized as interventions across all three classes on the grade level, rather than independently in each class. It is also worth noticing how Violet accentuated ‘we’ when referring to her team, and how they collectively seemed to achieve results. In this case, good team collaboration with commons goals may also have improved work efforts, which is a hallmark of supporting or collaborative work environments (Gagné & Deci, 2005). For the identified pupils, this could pave the way for better learning, since changes are made in an attempt to meet their needs accordingly.
5 Summary and concluding remarks

This chapter presents the main findings related to how lower primary school teachers experience and work with the state-regulated mapping test in numeracy, and factors which influence their efforts. Possible consequences for teachers’ work with assessment for learning are discussed and reflected upon. Finally, some suggestions for further research are indicated.

The focus of this study has been how teachers experience and use a mapping test in numeracy to identify pupils at the 1st to 3rd grade levels who need extra follow-up to improve their calculation skills and number sense. Teachers are employed in large and complex organizations with a range of tasks and responsibilities, and there are reasons to assume that their work is influenced by a number of factors such as knowledge of pupils, personal motivation, teaching experience etc. Three research questions were defined to investigate this multi-faceted professional environment. My purpose-designed theoretical bricolage was developed in order to analyse aspects of current practices with this state-regulated mapping test from different angles. I have used a mixed methods approach, based on data from in-depth interviews with two lower primary school teachers and survey responses from twenty-six lower primary school teachers. The analysis was both data and theory-driven (chapter 3).

5.1 Research question findings

In the following subsections, I respond to my three research questions based on findings and observations of this thesis. Given the exploratory nature of the research questions, my responses are not intended as generalizations, truths or hard fact-finding; rather, they present insight into current practices of the participating teachers by highlighting factors which appear to contribute when the mapping test is used as assessment for learning.

5.1.1 Intentions and beliefs of teachers

The aim of my first research question was to find out which intentions and beliefs could be deduced when teachers described their own practice. It is assumed that teachers’ beliefs contribute to shape their practice (Buehl & Beck, 2015), and this can be observed by how basic skills are valued and emphasized. Elementary skills in mathematics appeared to be highly valued by my two interviewees Daisy and Violet. Daisy reported that she was normally...
teaching on the 4\textsuperscript{th} grade level and higher, but had decided to start teaching pupils on the 3\textsuperscript{rd} grade level in order to prepare them for the 4\textsuperscript{th} grade level. Daisy’s approach can be interpreted as a sign of her reported conviction that mastering basic mathematical skills are essential, and this seemed to affect her practice. Data from the survey suggests that activities to ameliorate number sense and calculation skills were important elements of follow-up activities, as could be expected, given the objectives of the mapping test. Violet claimed that she obtained deeper insight into what pupils understood and mastered by having individual conversations with them; in her experience, wrong or incomplete answers may have been caused by both non-mathematical and mathematical issues. Her actions can be interpreted as engaging in mathematical discussions; a strategy which is often associated with teachers having sophisticated views on mathematics (Schraw, Brownlee & Olafson, 2013). Views expressed by the interviewees and survey respondents suggested that mathematical knowledge was considered malleable and not fixed.

The feedback which pupils get from their teacher is believed to be an important stimulator for their feeling of success (Niemiec & Ryan 2009), and it is hence essential that teachers strive to sustain, develop and improve the self-confidence of their pupils. Feedback must be specific, constructive and substantiated, meeting relevant and appropriate scientific standards for the grade level in question (Wæge, 2007, p.75). Somewhat surprisingly, there was little reference to feedback which aimed at boosting the self-confidence of pupils during follow-up conversations; one would expect that positive feedback would have been highlighted by the interviewees. It is therefore not known what type of evaluative information or positive encouragement pupils below the cut-score was given when they discussed test results in conjunction with further learning.

The teachers participating in this study all seemed to consider the learning process of their pupils and their own teaching as a combination of social and individual practices. Such considerations are often associated with a social constructivist teaching and learning views, i.e. the reflexive relationship between social and individual factors (Skott et al., 2008). My observations are based on the reported considerations for the needs of individual pupils during Violet’s team cooperation, Daisy’s reassurance of her pupils, and survey respondents who stated that they evaluated mapping test outcomes as results of their own practice. There is consensus that learning is encouraged by expressing and explaining one’s own understanding and concepts to others (Boaler, 1997, 1998; Wæge, 2007). Violet believed that peer reviewing
in class helped her pupils learn better; her belief seemed to be in accordance with findings from these scientists.

5.1.2 The influence of motivational factors

My second research question involves motivational factors and how they influence the teachers’ work with the mapping test. The analysis of the interviews suggests that a teacher’s self-efficacy has considerable impact on their efforts with the mapping test. This may be deduced from Daisy’s practice when she reported that she was mainly alone with the responsibility for the mapping test in all three classes on her grade level, even if she taught only one of the classes. She came across as self-confident when reporting of her practice during the interview. It is not clear if this was a consequence of her experience, knowledge of general mathematics, pedagogical knowledge or a combination of these factors (Ball et al., 2008; Shulman, 1986). Nevertheless, when she expressed that she altered her teaching practice if need be, one may assume that she has a high sense of self-efficacy (cf. chapter 2.3) with respect to her capabilities as a mathematics teacher; this observation was reinforced by specific examples which she presented; she also advocated modifications across the grade level and alternative classroom routines, i.e. beyond what she directly could control. This seems to be in line with characteristics of high self-efficacy (Bandura, 2004; Pajares, 2012), since she believes that she can impact procedures and routines, and be able to achieve specific goals and results.

A majority of the survey respondents and interviewees reported that they dedicated time and effort to understand the objectives and procedures of the test; i.e. an indication that they wanted to fulfill the recommended pre-requisites for organizing the test and orchestrating follow-up activities. One can assume that their preparations were directly motivated by a wish to organize the mapping test in a professional manner and to comply with its objectives, as can be expected from competent and proficient teachers. Alternatively, their readiness preparations can be regarded as an activity to nurture their psychological need for feeling competent (Deci & Ryan, 2000), i.e. a propensity towards fulfilling personal psychological needs rather than professional excellence. In practice, both explanations are viable, since being competent and feeling competent are linked, but not necessarily equivalent, and will usually result in beneficial behaviour and positive psychological states under normal circumstances. Additionally, if one feels supported, one is more likely to increase efforts
when solving specific tasks (Van den Broeck et al., 2010), and one may conjecture that Violet’s efforts and confidence were in part due to joint team contributions. Feeling part of a team is important for satisfying or obtaining the need for relatedness, as claimed by e.g. Van den Broeck et al. (2008). An interesting aspect in this context is the teachers’ sense of autonomy; running the mapping test was imposed either by school management or state directive, but not under the control of or decided by the individual teacher. Under circumstances where one is deprived of personal latitude or under impaired individual freedom, it is common to feel alienated, disenfranchised or devoid of control (Fernet et al., 2012). My interviewees and respondents in contrast, appear to retain their autonomy and take control of the situation without reported negative or even hostile stances towards the mapping test. Obviously, absence of personal control does not automatically cause alienation, but an understanding of the objectives of the mapping test can be assumed to influence attitudes and persuade teachers that it serves a specific purpose from which both teachers and pupils will benefit. The role of the guideline enclosed with the mapping test therefore appears significant, since it constitutes a major information source for the teachers, including conveying proper and astute motivational information. If judged by the teachers’ apparent sense of autonomy related to mapping test activities, the guideline seems to fulfil some of its intentions by instilling desired attitudes and inspiring appropriate activities, with reservations that the teachers participating in my study may have been positive towards the test even before they organized it.

5.1.3 Knowledge employed by teachers

My third research question addresses what type of knowledge teachers use when working with the mapping test. There are few indications in my data to explain how teachers employ their mathematical knowledge when planning additional teaching activities for those below the cut-score. Also, there is no direct data on the teachers’ use of subject matter content knowledge (SCK) when interpreting their pupils’ results; a knowledge which Shulman (1986) argues is important, because teachers need not only explain that certain solution proposals are incorrect, but also why they are incorrect. In the context of mapping tests, teachers should employ SCK to uncover possible root causes of why and how certain mistakes are made by pupils, and not just simply verify the correctness of an answer. Interestingly, there seems to be a relationship between the length of the teachers’ education in mathematics and their perception of the mapping test as providing new information on what pupils below the cut-
score master. Based on statistical analysis, a majority of teachers in the survey having 31+ credits of mathematics in their education reported that they acquired new information on low-performing pupils from the mapping test, whereas the opposite was the case for teachers having less than 31 credits of mathematics; those teachers were significantly more inclined to respond that the mapping test did not provide new information on low-performing pupils.

Shulman (1986) describes strategic knowledge (SK) as knowledge on pupils, teaching and previous experience with e.g. pupils, test forms and teaching methods, whereas Ball et al. (2008) emphasise that knowing about students entails teachers’ knowing about e.g. typical pupil errors, what they are likely to find confusing etc. There seems to be a common attitude among the teachers of this study that pupils should not experience stress or anxiety when sitting the mapping test. It was emphasised that pupils must comprehend why the test was necessary, and that they actually assisted the teacher in reaching his or her goals with respect to doing a good job. This reassurance approach also appears to be a measure to counterbalance potentially adverse impacts of non-mathematical issues to test outcomes, and Violet highlighted how she and her colleagues prepared by aiming to comprehend the text consistently and uniformly, while at the same time preparing for individual measures which had to be taken into account during test administration in order to obtain viable results. While the teachers of my study did not explicitly report that they relied on their knowledge of the behaviour and performance of individual pupils during the test preparation phase, they seemed to employ knowledge on pupil behaviour and needs in general, because they implemented countermeasures against potentially undesired behaviour, distraction factors or anxiety feelings during the test.

Test results are being reported as thoroughly perused to detect if distraction factors or stress issues might have impacted test scores, and this is consistent with the reported preparation activities; the teachers want accurate results in accordance with the aim of the test, and to filter out factors which might have contributed to test scores inaccurately reflecting the competence level of the pupils in the grey zone, i.e. around the cut-score.
5.2 Implications for assessment for learning

Not surprisingly, both interviewees and respondents expressed their ambition to use test results in assessment for learning and adapt teaching to cater for individual learning needs and hence, they appeared to adhere to the expressed purpose of the mapping test. For Violet, individual conversations were decisive when planning further actions, and she also referred to the use of peer reviewing and cooperation between pupils. Daisy claimed that she wanted to discover whether non-mathematical factors had influenced incorrect answers and thus classified pupils to be below the cut score, but she did not elaborate whether such pupils were actually identified.

Several teachers appear to have followed the advice to organize dedicated course groups and they also claimed that they used results to assess their own practice, which is seen as an important element of being a professional teacher according to e.g. Swaffield (2011) and Dale (1999). However, none of the interviewees explained how they planned to gauge the effects of possible measures to improve the skills of those below the cut-score. When initiating activities to improve numeracy skills of pupils below the cut-score, finding out if these measures, e.g. additional exercises, dedicated classes etc. have effect, should be part of the assessment for learning process. Generally speaking, any measure which seeks to correct unwanted effects or behaviour should also include means to assess if it actually works and has the desired effect(s). Without proper knowledge of actual, observed effects, it will be challenging to modify strategies or change action plans if required.

Twelve out of twenty-six teachers reported that they did not distribute pupils between them in order to give closer follow-up. This indicates that follow-up is considered an individual undertaking for each teacher and not a collective responsibility or task. Further analysis of data from the survey suggested that follow-up was in part done during regular classes or integrated in common sessions with all pupils present. One possible explanation behind such a follow-up strategy was that the results of the mapping test influenced the individual teacher’s work with mathematics’ instruction in general, but not necessarily targeted towards low-achieving pupils specifically. Also, it is plausible that teachers differentiated tasks during regular classes and thus catered to individual learning needs without separate course groups. The actual number of pupils below the cut score might have had an impact, since organising dedicated course groups with few pupils may be considered to be ineffective use of resources,
given the assumption that there are on the average 2-3 pupils below the cut-score in each class. The implications of motivational factors have in my judgement significant impact on the follow-up work with the identified pupils. It is essential that teachers have confidence in their own qualifications in order to lift the weakest pupils, while at the same time being capable of altering their own practice if need be. Teachers experiencing support from colleagues and collective responsibilities for individual pupils are in my opinion indispensable if mapping test results are to be used as assessment for learning.

It is not surprising that the teachers in this study considered that acquiring basic skills was an essential part of beginners’ learning. It is however key to what extent the good intentions actually were put to use, not just for a limited time period, but as an integral part of the daily teaching practice. If mapping tests are considered by teachers to give little or no new information on pupils below the cut-score, teachers will have difficulties in providing extra follow-up for that group. Conversely, if mapping tests are considered to be informative and provide teachers with additional knowledge on low-performing pupils, the test results are more likely used as assessment for learning and offer a good basis for devising follow-activities and plans. Combining these assumptions with my finding that teachers having 31+ credits in mathematics are more likely to find the mapping test a source of new information on low-performing pupils, will have implications for the assessment for learning. Teachers having 30+ credits in mathematics would seemingly be more likely to define and organize follow-up activities according to pupils’ needs, compared to those teachers with less than 30 credit in mathematics, who probably will be less inclined to define such activities, since they do not dispose of or obtain relevant information derived from the mapping test.

In my rationale (cf. section 1.2), I argued that obtaining knowledge on teachers’ practice with mapping tests is pivotal, because other studies have indicated that it may be challenging to know how results from assessment of pupils should be used for further learning, and also the observation that new guidelines and measures for improvement will not necessarily result in desired changes. Without discussing the current guideline structure and content, care must be taken to provide sufficient information to enable teachers to extract information on low-performing pupils from their mapping test results, and suggest follow-up activities and plans. As already mentioned, the word assessment originally means to sit beside. This should serve as a useful reminder; the origin of the term encapsulates what should be the essence of assessment, namely to sit together and discuss achievements and further learning.
5.2.1 Limitations and future work

One aim of this study has been to run a trial test of the questionnaire targeted towards a representative selection of Norwegian teachers. The trial test resulted in answers from twenty-six respondents, significantly fewer than the anticipated sixty to one hundred respondents considered necessary to provide a sufficient sample size for the follow-up study and this thesis. It turned out to be challenging to extract reliable observations for statistical calculations and analysis of my quantitative data material, with a few exceptions (cf. chapter 3.5.4). As a consequence, I adjusted my focus; more emphasis is dedicated to the interviews at the expense of a more profound survey data analysis. My discussions have thus preponderance towards qualitative, theory-driven analysis of both interviews and survey data, rather than statistical analysis of survey data. A limitation of my study would therefore be that my observations cannot be generalized to a population. On the other hand, my approach may document more clearly which beliefs, motivational factors and knowledge held by teachers contribute to the organization of the mapping test and follow-up measures.

The survey contains a total of 40 groups of multiple choice questions and –statements, and I selected a subset of these for further analysis, motivated by my research aim and questions. Little attention has been devoted to how the test itself was reported to have been carried out; I consider this phase of the mapping test to be of a more procedural and mechanical nature, and less likely to divulge relevant aspects pertaining to my research. In addition, it is fair to claim that my personal interests to some extent have influenced my approach and selection of survey themes and focus interviewees (cf. section 3.3.2). Retrospectively, it might have been pertinent and interesting to include an analysis of two additional interviewees for comparative purposes; however, this would have been at the expense of my survey data analysis, given the time and project constraints of this thesis. An alternative approach to deal with the low number of survey respondents could have been a purely qualitative study, which likely would have required different research questions and focus, possibly moving the scope of my research to the perimeter of the follow-up study. This was viewed as less desirable, given my aspiration to contribute to a larger research project.

Future work
I have not specifically addressed teachers working on the 2nd grade level; however, such focus will be of interest and relevance, since the mapping test is obligatory on this grade level. On the basis of the objectives of the mapping test, it is merited to know more about why those
teachers with more credits in mathematics tend to find the mapping test more useful and providing new insight, compared to those with less credits. Obtaining understanding of the practice of these groups of teachers may provide valuable feedback and help improve the guidance material and the mapping test, which in turn may better aid early intervention measures and strategies for those below the cut-score.
References


Appendices
Appendix A: Approval from Norwegian Social Science Data Service (NSD)

(Norwegian version only)
Personvernbudet for forskning

Prosjektvurdering - Kommentar

Prosjektet skal også innefattet en spørreundersøkelse, som utvikles på bakgrunn av intervjuene. Prosjektleder sendte endringsmelding om dette, samt etterlengter fordeg utenfor spørreundersøkelsen med tilpasset informasjonskriv når dette foreligger og før spørreundersøkelsen settes i gang, jf. telefonmøte 26.05.2015. Det er kun intervjuene som er behandlet her.

Utvalget informeres skriftlig om prosjektet og samtykker til deltakelse. Informasjonskriv mottatt 22.05.2015 er korrekt utformet, men vi har følgende endringer:
- Setningen "Vi høyrer du kan deltak i studien" endres til "Det er friwiligg å delta i studien" i begge informasjonskriver.
- Setningen "Dersom du ombestemmer deg, kan du slik som helst trekke tilbake samtykket uten at det får noen konsekvens" endres til "Dersom du ombestemmer deg, kan du slik som helst trekke tilbake samtykket, lydopptak vil da slett og datamaterialet anonymiseres omgående. Dette får ingen konsekvens for deg eller ved ditt arbeidsforhold."

Data innhentes ved personlig intervjue. Vi minner om at det av hensyn til herrerens usikkerhet ikke kan fremkomme identifiserbare opplysninger om enkeltleder. Vi anbefaler at forsker minner informasjoner om dette i.m. intervjue.

Personvernbudet legger til grunn at forsker etterfølger Universiteten i Oslo sine interne rutiner for dataskikket.

Forstøtet prosjektavslutt er 01.06.2017. Hvis prosjektavsluttelsen skal innsamlede opplysninger da anonymiseres. Anonymisering innebærer å bearbeide datamaterialet slik at ingen enkeltperson kan gjenkjennes. Det gjøres ved å:
- Slette direkte personopplysninger (som navn/koblingsmellomkort)
- Slette/enkelt individuelle personoppsynningar (identifisierende sammenstilling av bakgrunnsopplysninger som f.eks. bosted/arbiedsted, alder og kjønn)
- Slette digitale lyd/-bilde- og videoopptak.
Appendix B: Information letter: Interviews

(Norwegian version only)

UiO \textsuperscript{\textregistered} Universitetet i Oslo
Institutt for lærerutdanning og skoleforskning

Dato: 1. juni 2015

Oppfølgestudie av prosjektet «Nye kartleggingsprøver i regning»

Det brevet inneholder en forespørsel om å delta i en studie Institutt for lærerutdanning og skoleforskning gjennomfører på oppdrag for Utdanningsdirektoratet (det vil si at vi er behandlingsansvarlig institusjon).


Vi ønsker derfor å intjuxte deg som har gjennomført kartleggingsprøvene i regning med egne elever våren 2015. Vi vil snakke om fire temaer: a) forberedelser til gjennomføring, b) gjennomføring av prøven med elevene, c) oppfølgning med elev og foresatte, d) oppfølgning av prøven i klasserommet. Intervjuene vil være i omtrent en time, du vil bli tatt opp (lyd). Opptaking vil bare bli hørt av medarbeidere på prosjektet og av masterstudenter med tilknytning til studien. Vi vil bruke kunnskapen vi får fra intervjuet med deg og andre lærere og skoleledere til å utvikle et spørreskjema som vi kan sende ut til flere lærere for å få deres erfaringer med kartleggingsprøvene.

I tillegg vil vi bruke resultatene av intervjuene sammen med spørreundersøkelsen til en rapport til Utdanningsdirektoratet, i én masteroppgave våren 2016 og i to vitenskapelige forskningsartikler. Det kan også bli aktuelt å skrive en artikkel til bedre skole eller Spesialpedagogikk om bruk av prøveresultater.


Mvh
Guri A. Nortvedt

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E-post: g.a.nortvedt@ila.uio.no
www.ila.uio.no
Oppfølgingsstudie av prosjektet «Nye kartleggingsprover i regning»

Jeg bekrefter at jeg har fått informasjon om studien og gir mitt samtykke til deltagelse. Jeg er informert om at jeg når som helst kan trekke meg fra studien, og at det ikke vil ha noen konsekvenser for meg.

Navn med blokkbokstaver: ________________________________

______________________________
Dato Underskrift

Samtykkeskjemaet kan sendes på epost til g.a.nortvedt@ils.uio.no
Appendix C: Interview guide
(Norwegian version only)

LÆRERSKJEMA

Intervjuguide: semistrukturert intervjuer med lærere

(Idargjer rett til å trekke seg, minne om likte navnige personer eller dele personopplysninger)

(formål med studien er å undersøke hvordan lærere bruker kartleggingsprovene og veiledningsmateriellet og om hvordan de opplever det å bruke dette materialet)

(eftergangen vi gjør i intervjuene vil vi bruke til å utforme en spørreundersøkelse som kan gå ut til mange lærere slik at vi kan få en oversikt på nasjonalt nivå. Data fra intervjuene vil også brukes til å illustre spørreundersøkelsen)

I dette intervjuet som vi ønsker å ta opp med deg og høre dine erfaringer og refleksjoner til bruk av kartleggingsprovene i regning og veiledningsmateriellet. Vi vil gjeme intervju deg fordi du har gjennomført en eller flere slike kartlegginger.

Har du gjort dette flere ganger?

Tema 1: Forberedelse til gjennomføring

a) Kan du fortelle hvilke forberedelser du gjorde før gjennomføringen av kartleggingen?
   i) Del 1: Bruk av informasjon på nettsiden til Utdanningsdirektoratet
      i. Erfaringer med nettsiden?
         ii. Hvordan informasjonen på nettsiden til Utdanningsdirektoratet er benyttet?
         iii. Egen erfaring med veiledningsmateriet fra utdanningsdirektoratet.
   ii) Del 2: Kan du fortelle meg hvordan samarbeid på skolen foregikk i forbindelse av prøven?
        i. Samarbeid med kollega
        ii. Rådgiving med kollega og/eller eventuell spesialpedagog med erfaring
            omkring tema
        iii. Samarbeid med skoleleder
   iii) Del 3: Kan du fortelle meg hvordan forberedelse av elever og foresatte foregikk?
         i. Hvordan forbereder du elever?
         ii. Hvordan forbereder du foresatte?

Tema 2: Gjennomføring av prøven med elevene

b) Kan du fortelle hvordan du gjennomførte prøven med elevene?
   i) Klargjøring av klasserom
      ii) Øvning på prøvesituasjonen
      iii) Prinsipper for innhaling av elever i grupper
      iv) Bruk av assisten
   v) Kan du fortelle hvordan du opplever selve gjennomføringen?
      i. Hvordan er det å gi instruksjoner?
ii. Stressende
iii. Ubøllematisk med assistent hjelp
iv. Ubøllematisk å gjennomføre alene

- Hvordan ble pausa benyttet
  i. Eventuelt over flere dager?
- klarer du å følge med på elevene for å danne deg et intrykk av hvordan de arbeider?
- Er det greit å rette prøvene? – tar det mye tid?

Temate 3: Oppfølging med elever og foresatte

Det tredje temaet handler om oppfølging av resultatene av prøven, om samtalen med elev og foresatte når en elev er underbekymringsgrensen og om oppfølgingen av eleven.

c) Kan du fortelle hvordan oppfølgingen av elevene under bekymringsgrensen har forgått?
   i. Forberedelse til samtale
      1. Med foreldre
         a. Hvordan denne samarbeidet oppleves fra lærers side
      2. Med elevene
         o Prioriterer du noen tema?
           i. Hvilke og hvorfor?
         o Hvilke ressurser har du eller foder du at du trenger i arbeidet med å følge opp elevene?
         o I veiledningsmateriell står det at du skal involvere elevene og foresatte i videre pedagogisk arbeid – hvordan synes du det fungerer
           i. På hvilken måte involveres elevene og foresatte i ditt videre pedagogiske og fagdidaktiske arbeid?
           o Når trekkes skoleleder og eller (andre ressurspersoner på skolen inn?)

d) På hvilken måte har prøven blitt fulgt opp i klasserommet?
   i. hvordan snakker dere om prøven i ettertid?
   o Gjennomgå deler av eller hele prøven med hel klasse?
   o Er det noen resultater som bruker til å utforme undervisning – evt hvordan?
   o Hva gjør dere om en elev ikke har svart på hele prøven?

Tillegg:
1. Er det noe du vil endre i kartleggingstesten?
2. Er det noen annet du vil tilføyte utover det vi har prøtet om?

Takker så mye for samtalen og tiden du har gitt til oss ☺
Appendix D: Invitation letters for the survey

(Norwegian versions only)

Date: 8. november 2015

Invitasjon til deltagelse i forskningsprosjekt om kartleggingsprøvene i regning

Det brevet inneholder en foretrapport om å delta i en studie Institutt for lærerutdanning og skoleforskning gjennomfører på oppdrag for Utdanningsdirektoratet. Vi har inngått et samarbeid med Utdanningsdepartementet i Oslo kommune som hjelper oss med å kontakte skoler i Oslo for deltakelse i dette forskningsprosjektet.

Vi har tidligere utviklet de nye kartleggingsprøvene i regning som tilbyr barneinnretningene, også dette på oppdrag fra Utdanningsdirektoratet. Prøvene ble tatt i bruk våren 2014. De skal brukes til å identifisere elever som ligger under en bekymringsgrense og som kan ha behov for ekstra oppfølging. I den forbindelse er det ønskelig å få mer innblikk i hvordan skolene oppfatter og bruker prøver og velferdsmateriell i sitt arbeid.

Vi ønsker å invitere deg som har gjennomført kartleggingsprøver i regning med egne elever våren 2015, til å delta i en spørreundersøkelse. Undersøkelsen vil inneholde tre temaer: a) forbedringer til gjennomføring, b) gjennomføring av prøven, c) oppfølging av prøven.


Skjemaet du svarer på, skal senere videreutvikles og brukes i en nasjonal undersøkelse. I tillegg vil vi bruke resultatene av intervjuene sammen med spørreundersøkelsen til en rapport til Utdanningsdirektoratet, i en masteroppgave våren 2016 og i to vitenskapelige forskningsartikler. Utdanningsdepartementet og Osloskolene vil få tilgang til rapporten vi skriver til Utdanningsdirektoratet.


https://nettsjema.uio.no/answer/lærer.html

Ta gjerne kontakt dersom du har spørsmål. Kontaktdata nedenfor.

Med vennlig hilsen

Guri A. Nortvedt

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E-post: g.a.nortvedt@ilk.uio.no
Telefon: 22 85 43 32
www.ilk.uio.no

Guri A. Nortvedt

Prosjektleder, Nye kartleggingsprøver i regning
Appendix E: Survey (questionnaire)

(Norwegian version only)

Bruk av kartleggingsprøvene i regning - lærerundersøkelsen

Undersøkelsen gjennomføres av Institutt for lærerutdanning og skoleforskning ved Universitetet i Oslo. Hensikten med studien er å få mer innblikk i hvordan skolene bruker kartleggingsprøvene.

Erfaringer fra denne undersøkelsen skal også brukes til å lage en nasjonal undersøkelse våren 2010.


Spørsmålene i denne undersøkelsen er ferdigformulert.

- På spørsmål med rune knapper skal du velge alternativ
- På spørsmål med firkantete knapper kan du velge så mange svaralternativer du ønsker

Undersøkelsen har tre temaer med tilsammen 40 spørsmål. I tillegg ber vi om noen bakgrunn opplysninger.

A. Kjenn *
- Mann
- Kvinne

B. Antall år som lærer *

C. Utldanning *
Hvor mange studiepoeng har du i matematikk og matematikkdidaktikk til sammen? Tre studiepoeng tilsvarende ett "gammelt" vektall.
Trell studiepoeng tilsvarende en halvdannet.

- Ingen
- 1-15
- 16-30
- 31-45
- 46-60
- Flere enn 60

D. Hvilket trinn gjennomførte du kartleggingsprøve med i 2015?
- 1.trinn
- 2.trinn
- 3.trinn
- Flere av trinnene

E. Tidligere erfaringer med kartleggingsprøver i regning *
Har du gjennomført kartleggingsprøvet tidligere? Vannligst hvis av før de prøvene du menar å ha gjennomført tidligere.

- 1.trinn før 2014
- 2.trinn før 2014
- 3.trinn før 2014
- 1.trinn fra og med 2014
- 2.trinn fra og med 2014
- 3.trinn fra og med 2014

Tema A: Forberedelser til gjennomføring
På hjemmesiden til Utdanningsteknologi er det publisert informasjon om kartleggingsprøven. Her kan du også lese ned veiledningene til hver prøve. For å få innlogging til gjennomføring, må man logge inn på POT3C.
Spørsmål 1
Hvordan har du fått tilgang til veiledningsmaterialet?
☐ Lastet det ned selv
☐ Fått det utdelat av en ansvarlig person på skolen
☐ Fått det utdelat av skoleelevene
☐ Annet

Spørsmål 2
Hvordan har du gort deg kjent med veiledningsdokumentet og instruksen for gjennomføring?
☐ Jeg har lest gjennom alt før gjennomføring
☐ Jeg har lest gjennom viktigste deler av materialet før gjennomføring
☐ Jeg har bare lest instruksen
☐ Vi har hatt en felles gjennomgang på skolen
☐ Jeg har ikke hatt tid til å lese materialet før prøvedagen

Spørsmål 3
Tolk på veiledningsmaterialet. Hvor enig er du i påkledningene nedenfor?

<table>
<thead>
<tr>
<th></th>
<th>Eng</th>
<th>Delvis eng</th>
<th>Ueng</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veiledningen var skrevet på et enkelt språk</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Innholdet i veiledningen var enkelt å forstå</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Dokumentet var oversiktlig</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Jeg fikk vekn på det jeg skulle på</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Veiledningen var foromfattende</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Spørsmål 4
Hvem er ansvarlig for å planlegge gjennomføringen av prøvene?
(første vekn mulig)
☐ Alle kontaktpersoner
☐ Alle matematikklorene
☐ Trinnleder
☐ Skoleleder

Spørsmål 5
Hvem samarbeidet du med under forberedelsene til kartleggingsprøven våren 2016?
(første vekn mulig)
☐ Teamet til det trinnt mitt
☐ Andre matematikklorene
☐ Andre lærere
☐ Skoleelevene
☐ Spesialpedagog
☐ Assistent
☐ Jeg samarbeidet ikke med noen

Spørsmål 6
Tolk på skole: Hvor enig er du i påstendene nedenfor?
Spørsmål 7

Hvordan informerer du foreldre om kartleggingsprøven?
(fleire svar mulige)
- Sender hjem foreldreinformasjon fra Utdanningsdirektoratet
- Informerer om det på elevernes ukoplan
- Sender sporet
- Gjør det på skolens netside
- Informerer via læringsplattform (f.eks. It's learning eller fronter)
- Informerer på forbindelse

Spørsmål 8

Hva du ikke bruker foreldreinformasjonen, vil vi gerne vite hvorfor?
(fleire svar mulige)
- Jeg kjenner ikke til brosjyren
- Grunnet brosjyren oppfattes som vanskelig av foreldrene
- Jeg oppbevarer informasjonen til vår skoleferdighet
- Ingen av disse alternativene

Spørsmål 9

Tenk på hvordan du gir informasjon til eleverne dine: Hvor enig er du i påstandene nedenfor?

<table>
<thead>
<tr>
<th>Spørsmål</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Usig</th>
<th>Svært usig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Det er viktig å fortelle elevene at vi skal ha kartleggingsprøve</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Det er viktig å vise elevene prøvehistorien</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Det er viktig å fortelle at prøven skal gi meg informasjon om hvordan elevene kan vise sin beste</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Det er viktig å fortelle at jeg skal bruke prøveinformasjonen til å tilpasse eller endre underervaringen</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Det er viktig å fortelle at prøven skal hjelpe meg til å gi ekstra hjelp til elever som trenger det</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Spørsmål 10

Tenk på hvordan du forbereder elevene dine: Hvor enig er du i påstandene nedenfor?

<table>
<thead>
<tr>
<th>Spørsmål</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Usig</th>
<th>Svært usig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Det er viktig å øve på å gi og ta inn instruks</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Det er viktig å øve på å klare å gjøre oppgaver innerfor en tidssramme</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Det er viktig å gjøre øvingsepisoderne som ligger på nettet</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Det er viktig å øve på oppgaver som jeg ikke har hatt</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Det er viktig å øve på gjerne prøver</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Tema B: Gjennomføring av prøven med elevene
Vi vil nå spørre deg om selve gjennomføringen av kartleggingsproven sammen med elevene og om hvordan dere tilsvarer legger for elevene.

**Spørsmål 11**
Hvor mange elever har du i klassen/gruppen?

**Spørsmål 12**
Gjennomfører du vanligvis kartleggingsproven med hel eller delt grupe?
- [ ] Hel
- [ ] Delt

**Spørsmål 13**
Tenk på hvordan du organiserer elevgruppen din når elevene tar prøven. Hvor godt stemmer påståttene nedenfor?

<table>
<thead>
<tr>
<th></th>
<th>Stemmer godt</th>
<th>Stemmer i noen grad</th>
<th>Stemmer i hele grad</th>
<th>Stemmer ikke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jag liker å elevene godt, dører gjennomfører jeg med hele klasse</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Jeg deler elevene i to like grupper</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Jeg deler elevene i en liten gruppe og en stor gruppe</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Jeg deler elevene i flere små homogene grupper</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Jeg deler elevene i flere små heterogene grupper</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Jeg gjennomfører prøven en bilde om jeg tenker om elevene trenger det</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Vi har ikke ressurser til deling</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Vi har ikke behov for deling</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

**Spørsmål 14**
Dette spørsmålet skal du bare svare på dersom dere er trener eller lærer og assistent som gjennomfører kartleggingsproven i regning sammen. Hvor godt beskriver påståttene nedenfor hvordan dere vanligvis arbeider?

<table>
<thead>
<tr>
<th></th>
<th>Stemmer godt</th>
<th>Stemmer i noen grad</th>
<th>Stemmer i hele grad</th>
<th>Stemmer ikke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Én gir instruks mens den andre tar tid</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Én gjennomfører mens den andre observerer elevene</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Én gir instruks og tar tid mens den andre hjelper enkeltlever med å gjennomføre</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

**Spørsmål 15**
Delt av elevene med enhvilvestat for matematikkvansker på kartleggingsproven i regning?
- [ ] Ja
- [ ] Nei

**Spørsmål 16**
Hvem segjer om en elev i din klasse skal fristes fra kartleggingsproven?

(Flere svar mulig)
- [ ] Kontaktpersoner
- [ ] Spesialbedømming
Spørsmål 17
Hvor er prøvegjennomføringen og pause?
- Prøver gjennomføres over to dager
- Pause varer i minst 30 minutter og inneholder spisning og lek
- Eleverne får en pause på mellom 10 og 30 minutter til spisning og lek
- Eleverne får 10 min utlek
- Eleverne blir iklarommet under en kort pause

Spørsmål 18
Er prøven ferdig på riktig sted i praksen?
- Ja
- Prøven kom litt sent for mine elever
- Prøven kom litt tidlig for mine elever
- Eleverne trenger ikke pause

Spørsmål 19
Hvordan gir du instruks til eleverne under prøven?
- Jeg har lagt opp instruksen
- Jeg kopierer eksammenoppgaven for å visse den på overhod
- Jeg viser oppgaven på Smartboard
- Jeg tager eksamenoppgaven på tabellen som jeg gir instruks

Spørsmål 20
Fikk de forskjellige instruksjonene: Hvor enig er de på listen nedetfor?

<table>
<thead>
<tr>
<th></th>
<th>svært enig</th>
<th>enig</th>
<th>uenig</th>
<th>svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Det fungerte greit å gi instruks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det var enkelt for meg å forstå hva som var ment med instruksene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Spørsmål 21
Fikk de forskjellige instruksjonene fungerte for eleverne: Hvor enig er det på listen nedetfor?

<table>
<thead>
<tr>
<th></th>
<th>svært enig</th>
<th>enig</th>
<th>uenig</th>
<th>svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Det var enkelt for de fleste elever å forstå instruksene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Språkvar var vanskelig for elever</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det var enkelt for elever under bekyningsgrensen å forstå instruksene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det var vanskelig for noen elever å koncentre seg mens instruksene blir lest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det var vanskelig for minoritetsbøyelige elever med kort bold i Norge å forstå instruksene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Spørsmål 22
Observerer du eleverne mens de gjør kartleggingsprøven?
Spørsmål 23
Hva skjer om en elev er syk på prøvedagen?
- Ja, jeg observerer elever jeg vet er svake
- Ja, jeg forsøker å observere hele gruppen
- Nei, jeg har for stor gruppe til å klare å observere
- Nei, det blir for travelt når jeg skal gi instruks og ta tid
- Assistent eller annen lærer observerer

Spørsmål 24
Hvilke tiltak gjennomfører du om en elev gir opp underveis i prøven?
- Elever tar prøven senere med meg
- Elever tar prøven senere med spesialpedagog
- Elever tar prøven senere med en annen lærer
- Elever tar prøven senere med assistent
- Elever som er syke gjennomfører sammen
- Elever som er syke får ikke tilbud om å ta prøven i etertid

Spørsmål 25
Hva gjør du med elever i din gruppe som har enkeltevakt for matematikkvister?
(får svare mulig)
- De gjennomfører prøven i liten gruppe
- De gjennomfører prøven i liten gruppe, men med støtte fra pedagog eller assistent
- De gjennomfører en til en med meg eller spesialpedagog
- De gjennomfører en til en med assistent
- De tar ikke kartleggingsprøver

Spørsmål 26
Tenk på elevenes mestningsopplevelse i prøvestasjonen: Hvor eng er du i påstandene nedenfor?

<table>
<thead>
<tr>
<th></th>
<th>Svært eng</th>
<th>Eng</th>
<th>Ueng</th>
<th>Svært ueng</th>
</tr>
</thead>
<tbody>
<tr>
<td>De fleste elevene opplever mestring</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Elever undre bekymringsgrensen opplever mestring</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Bare faglig sterke elever opplever mestring</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Elever blir frustrerte av å ha prøven</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Spørsmål 27
Tenk på hvordan du oppfatter at elevene opplever å arbeide med en prøve der hver side i prøvenhet tenker en tidsegrensning: Hvor eng er du i påstandene nedenfor?
### Sidsteart

**Tema C: Oppfølg av resultatene**

Vi vil i dette temaet spørre deg om hvordan du tokter og følger opp resultater og om hvordan du tilbakevæler og snakker med elever og forældre når en elev av under bekymringsgrensen.

**Spørsmål 28**

Tenk på hvornår du arbeider med å toke resultatene. Hvor enig er du i påstandene nedenunder?

<table>
<thead>
<tr>
<th>Svært enig</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I etter som elever blir etalser og i tilknytningsevent et vulnerabels læring.

Jeg registrerer bare om en elev er over eller under bekymringsgrensen

Jeg gir nøyde gjennomhafting til elever som er inne i bekymringsgrensen

Jeg sjekker om elever gjør feil som er beskrevet i veiledningsheftet

Jeg sjekker om flere av mine elever strever med samme oppgaveutest

Jeg vurderer hvordan min undervisning kan ha påvirket elevens læring

Jeg synes det er vanskelig å forstå hva resultatene forteller om mine elever

Jeg synes det er vanskelig å tolke resultatene til de aller sakteste eleverne fordi de har fått til så lite

**Spørsmål 29**

Tenk på hvornår du samarbeider med andre når du toker resultatene. Hvor enig er du i påstandene?

<table>
<thead>
<tr>
<th>Svært enig</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Jeg samarbeider med andre lærere

Jeg samarbeider med spesialpedagog

Jeg diskuterer med skoleledelsen

**Spørsmål 30**

Hvem får tilbakemelding?

(føre svaremulig)

- [ ] Elever under bekymringsgrensen
- [ ] Foreløpige til elever under bekymringsgrensen
- [ ] Jeg snakker med hver av eleverne
- [ ] Alle foreldre får vendt resultatet til sitt barn
- [ ] Alle elever får med prøven sin hjem
- [ ] Trimmere får tilgang til klassens resultater
- [ ] Skoleleder får tilgang til klassens resultater
- [ ] Jeg gir ikke tilbakemeldinger

**Spørsmål 31**

Hvordan gir du tilbakemelding til foreldre?

(føre svaremulig)

- [ ] Jeg tar det opp i foreløpeamtale der eleven deltar
- [ ] Jeg tar det opp i foreløpeamtale uten eleven
- [ ] Jeg gir tilbakemelding på oppst
### Spørsmål 32

Tenk på hvordan du forbereder deg til samtale med foreldrene til elever som er under bekymringsgrensen: Hvor eng er du i påstandene nedenfor?

<table>
<thead>
<tr>
<th></th>
<th>Svært eng</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeg går røyt gjennom prøven til eleven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeg leser gjennom veiledningsheftet for å få hjelp til å planlegge samtalen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeg søker et konkrete tiltak som foreldre og elev kan arbeide med hjemme</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeg søker et konkrete tiltak som vi kan arbeide med på skolen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeg rådfører meg med specialpedagog eller kollager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeg rådfører meg med teamet eller skoleledelsen om tiltak skolen skal gjennomføre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Spørsmål 33

Tenk på at hensikten med kartleggingsprøven i regning er å gi insikt i hva lærerstendende elever kan og at resultatene skal kunne brukes til å følge opp elever under bekymringsgrensen. Hvor eng er du i påstandene nedenfor?

<table>
<thead>
<tr>
<th></th>
<th>Svært eng</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skoleledelsen er interessert i å bruke resultaterne av kartleggingsprøven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det er nok til mellom prøven og slutten av skoleåret til å gjennomføre tiltak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreldrene er interessert i resultaterne fra kartleggingsprøven</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det er nok til mellom prøven og slutten av skoleåret til å gjennomføre foreldresamtaler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreldrene vet allerede at eleven strever med regning fordi de ble informert om dette på foreldresamtale i før kartleggingsprøven ble gjennomført</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prøven er en godt utgangspunkt for videre kartlegging av hva elevene kan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kartleggingsprøven i regning gir ikke lærerne ny innsikt i hva svakt presterende elever mister</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kartleggingsprøven gir ikke lærere informasjon om elevenes introdusert og regnetenheter som kan brukes til oppfølging av elevene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Spørsmål 34

Tenk på hvordan du arbeider med videre kartlegging av elever under bekymringsgrensen: Hvor eng er du i påstandene nedenfor?

<table>
<thead>
<tr>
<th></th>
<th>Svært eng</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Det er viktig å snakke med elevene om hvordan de har tenkt når de løste oppgavene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det er viktig å la elevene gjøre ubevarte oppgaver i prøven mens han/hun fortsetter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det er viktig å observere eleven (i klassen) i matematikktimene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Det er viktig å bruke andre kartleggingsprøver for å finne ut mer om hva eleven kan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Spørsmål 35

Tenk på hvordan du arbeider med å planlegge videre undervisning for elever under bekymringsgrensen: Hvor eng er du i påstandene nedenfor?

<table>
<thead>
<tr>
<th></th>
<th>Svært eng</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeg setter opp prioriterte læringsmål for hver elev</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeg og eleven snakker sammen om hvordan målene kan nås</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Spørsmål 36

**Tenk på de læringssituasjonene du gjennomfører med elever under bekymringsgrensen: Hvor enig er du i påstandene nedenfor?**

<table>
<thead>
<tr>
<th>Uttrykk</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeg bruker resultatene fra fjorårets prøver til å planlegge neste skoleår</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Jeg planlegger kurs for flere elever som strever med de samme begrepsene</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Jeg planlegger kurs for flere elever som strever med å utvikle de samme ferdighetene</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### Spørsmål 37

**Samarbeider du med andre i det pedagogiske personalet på skolen din om videre kartlegging og oppfølging av elever under bekymringsgrensen?**

- ○ Ja, alltid
- ○ Som regel
- ○ Noen ganger
- ○ Sjelden
- ○ Nei, svært sjelden eller aldrig

### Spørsmål 38

**Hvem samarbeider du med om videre kartlegging og oppfølging av elever under bekymringsgrensen?**

(føre av mulig)

- □ Andre lærere på trinnet
- □ Assistent
- □ Specielpedagog
- □ Skolens leder

### Spørsmål 39

**Tenk på skolen din og på samarbeid og organisering som lærerne på trinnet ditt gjør for å følge opp elever under bekymringsgrensen. Hvor enig er du i påstandene nedenfor?**

<table>
<thead>
<tr>
<th>Uttrykk</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vi samarbeider på trinnet om å utvikle undervisningsaktiviteter og tiltak</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
### Spørsmål 40

Tenk på ressursene du har til å følge opp resultatene fra kartleggingsprøven. Hvor enig er du i påstandene nedenfor?

<table>
<thead>
<tr>
<th>Svar</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Uenig</th>
<th>Svært uenig</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_Tusen takk for at du svarte på alle spørsmålene våre._
Appendix F: Transcription excerpts

(Norwegian version only)

Transkribering

Lærer 1 - Daisy

Interviewer: Kan vi starte med det materialet som ligger på nett? Hva du synes om det og hvordan du har brukt det?

Interviewee: Ja, det var veldig greit å hente ned det vi trente der. Og god informasjon i det. Veldig lett å vise og følge gjennom. Så det synes jeg var veldig bra å jobbe med. (hmmh) (så dere brukte de sjeiklistene åå) hmmh (å synes det var til hjelp?), Ja.

Interviewer: Ja, du synes ikke det var mye?

Interviewee: Nei, eh det så mye ut når vi begynner men (ja) da er det noe med det å lese seg inn i å forstå hva og hvorfor skal vi gjøre det (hmmh) og bruke den tida på det synes jeg er viktig. Asså var det veldig oppskrift på hvordan det skulle gjøres (hmmh) og da, når man har det og forhåpentligvis følger den, så blir jo, asså da er det lettere eller riktigere å bruke det materialet da. Da er forutsetningene mer like for ungene.

Interviewer: Ja, det er jo meningen at man liker som standardiserer hvordan det skal gjøres. Sånn at det å være under bekymringsgrensen er det samme i nord og sør og øst og vest (ja) så det ligger jo under at vi prove å lage rammene lik i alle klasser (ja) så må jo man gjøre noen tilpasninger.

Interviewee: Ja, det blir jo det alltid.


Interviewee: Jeg forteller at vi er ute etter å vise at de skal vise meg hva de kan, (hmmh) og når vi skal bruke det etterpå er det med hvordan vi skal legge opp undervisningen videre (hmmh) det har jeg veldig fokus på. Det er ikke en test for å se hvor god du er eller hvor dårlig du er, hvor ligger dere hen. Hvordan kan JEG gjøre det bedre når vi fortsætter, (hmmh), og det synes de var greit? Ja.

Interviewer: Informasjon til foreldrene, ukeplan, mail, samtale?

Interviewer: Det kom både på ukeplan og mail.

Interviewer: Sø ut til alle foreldrene, at det ikke er alle foreldre som får tilbakemelding. For det sier jo vi at...

Interviewee: Nei, det gjorde jeg ikke. Jeg har snakket med de, jeg har to stykker hos meg (ja).

Interviewer: Det kommer vi tilbake til. Jeg tenkte at noen synes kanskje det er rart at det lages en prove hvor ikke alle foreldre ikke vil fålike mye tilbakemelding.

Interviewee: jeg tenker at vi tar andre kartlegger åå så hvor de ikke får resultatet med en gang, men som vi kanskje kan snakke om på en utviklingssamtale (hmmh).
**Interviewer:** Det synes de er helt greit? (Ja). For det var en av de tingene vi snakket mye om når vi laget den. Hvordan vil det fungere? At det står at... Det står åsså i det foreldre materialet som direktører har, at det er bærer noen som får beskjed. (Ja). Du er jo på et trinn, og jeg regner med at dere kanskje samarbeider litt på trinnet for dere gjennomfører og snakker sammen og sånn, (hmmh) eh kan du...?

**Interviewee:** Nå valgte vi at jeg gjennomførte prøven i alle tre klassene, for det skulle bli likt som mulig. Mest mulig likt. Så jeg hadde alle 70 ungene og kartla dem.

**Interviewer:** Hele klasser eller delte dere opp på noe vis?

**Interviewee:** Hele, men jeg hadde med meg en voksen. (Ja). Det var en forutsetning. (Det tenker jeg er en forutsetning når du gjør det med hel klasse).

**Interviewer:** Men nå har du jobba noen år som lærer regner jeg med, så du var liksom trygg i situasjonen.

**Interviewee:** Ja, vi henter dem, vi snakker med dem at det her er en viktig ting, (hmmh) og vi har forventninger til at de gjør som de får beskjed om. Og de er superflinke, for å være 8-9 år til å følge de beskjedene. (hmmh). Vi flytter åsså dem over i et klassesrom de idie er vant til, (ja) hvor de sitter en og en. Og blir litt sann, Oi, (ja) hoytidlig for dem virker det som. De er veldig utholdende og finke. (hmmh).

**Interviewer:** Det skjer jo myte fra 1. til 3. Masse. i forhold til å være utholdende og gjøre ting. Har du undervisning med alle til vanlig, eller tenkte dere at det skulle være litt så du gikk inn i alle klassene?

**Interviewee:** Jeg har ikke undervisning til vanlig i de to andre. Men de kjenner meg godt for det.

**Interviewer:** Ja, for dere jobber tett på team? (ja). Som man vanligvis gjør på en barneskole. I hvert fall med de minste. Det betyr at de andre lærerne gikk inn å hadde din undervisning for å frigjøre deg til å... (hmmh). Så hadde dere litt ekstra resurs, (ubehørlig) med en annen. (ja).

**Interviewee:** Ene gruppa hadde jeg ikkje det. (Nei). Det var siste gruppa, og jeg hadde kjørt det to ganger så det fungerte greit. (hmmh).

**Interviewer:** For ellers når du har en hel klasse alleine, så er jo det du som skal både tar tid, gi instruks og observere. Det kan jo være mye å gjøre når man er en person med en hel klasse?

**Interviewee:** Men samtidig kjenner jo man jo ungene ganske godt da. Så man vet jo hvem man skal observere litt ekstra.

**Interviewer:** Kjenner du at du får tid til å observere og se litt og sånn når dere holder på?

**Interviewee:** Det skal jo ikke skje noe særlig utenom. (nei). For da må det være en til. (hmmh). Så det er hurt å være to, i hvert fall hvis man kjører full klasse. (hmmh).
Transkribering

Lærer 2 – Violet

Interviewer: Om du kunne fortalt om den informasjonen utdanningsdirektoratet har på nettet og din erfaring med det?

Interviewee: Jeg synes det er veldig greit når man får den informasjonen, da man får den tilsenkt den da fra lederen sin, (hmmh) ikke sant. Da den tid er... så det er veldig greit å få, veldig nøye skrevet og den instruksjonen og veiledninga synes jeg er veldig bra, ehh. Det er lett tilgjengelig og lett å oppfatte hva man skal gjøre ja.

Interviewer: Har du tid til å gå ordentlig igjennom alt sammen?

Interviewee: Ja, det tar jeg gjerne med meg hjem jeg. Det er min ting. Man kan få tid sliddert her og (ja) det det er en del av forarbeidstiden, (hmmh) ikke sant, så den liker jeg å sitte med i ro og mak å streke under det som er viktig sånn i gult eller ikke sant. Eller sånn for meg selv i margen, så det er min forarbeidstid ja. (du har gjennomgått dette her hjemme da) Ja.

Interviewer: I forhold til samarbeid på skolen, hvordan?

Interviewee: Vi jobber jo mye på trinn. Så i hvert fall... det er veldig avhengig av hvilket trinn vi jobber på. Men jeg har et veldig godt samarbeid med dem jeg jobber sammen med. Det har jeg egentlig alltid hatt vært veldig heldig med de trinnene jeg har jobbet med. Eller sammen med da. Fordi da samarbeider vi veldig mye og leser og hvis man tolker ting og sånn å... hva tenker du her å sånn å... at vi er sikre på at vi gjennomfører ting på lik måte å sånn. (hmmh) Hvis det er noen ordlyder vi er usikre på eller sånn så samarbeider vi mye om det. Så vi er godt forberedt alle som skal gjennomføre testen med elevene. (hmmh)

Interviewer: Det herca ut i alle fall på deres trinn...?

Interviewee: Ja vi printer ut gjerne ut i papirformat det er delig å ha det der, for så gått i gjennom (du har gjerne sånne leser som du bører på) ja. Jeg liker det. Så har man de når man skal gjennomføre også. Notater i margen... hmmm

Interviewer: Sånn jeg forstår så jobber dere godt sammen. (hmmh) Har dere rådført dere med andre eventuelt spesialpedagoger eller? eller er det på trinnet...?

Interviewee: Ehh, ja, vi har jo leserlærere på trinnet. Men ofte er det det nye for dem. I alle fall de testene jeg har hatt til nå har vært ganske lett å forstå for oss vanlige klassestyrere (hmmh) at man leser og får en oppfatning av det. At man på en måte føler seg rusta da til det. I alle fall når det gjelder å forberede seg da.

Interviewer: Ja, har du vært involvert noe med skoleleder i denne prosessen?

Interviewee: Ja, det er avdelingslede ja. (hmmh). Som gir oss... sender det på mail ut.
Interviewere: Hvordan foregikk forberedelsen av elever og foresatte?

Interviewee: De får jo et skriv, eh, sånn en feil, eh, et skriv ut. (ja) I år har jeg ei som er da helt umisk norsk. Og resten da tospråklige barn. (hmmm) For min del er det best å jeg må nesten snakk med dem. Ikke sant, når de får en type informasjon der det er på en måte flere sider så... Den foreldre gruppa jeg har den dag i dag vil ikke mang av dem ikke sitte og lese seg gjennom det. (hmmm) Så da tenker jeg eventuelt at kanske man kunne hatt den jeg veit ikkje om den finnes på forskjellige språk. (det tror jeg det finnes på noen språk, om man går inn selv og prøver å laste ned så, det finnes i hvert fall om nasjonale prøver, men det er sann jeg skal notere meg bak øret).

Interviewee: Ja, for det jeg må være muntlig med mine foreldre. Og de veit egentlig ikkje når jeg sier kartleggingsprøve. Så er det på en måte lissom litt... For enkelte er det litt holdt på å si fremmed (hmmm). Som sagt så forbereder jeg dem på det. Ved at jeg snakker om det. Eh, og elevene det er det veldig lett de asså. Elevene forbereder jeg ved at vi går igjennom hvordan en kartleggingsprøve kan veit og at man kanske må jobbe på tid ikkje sant og man kan ha noen oppgaver i forakt som ikkje er kartlegger. Der de de kanske må jobbe på tid. For dette er veldig nytt da, og for de små det å kunne jobbe på tid og ikkje strøse men samtidig disponere hva det vil si ikkje sant. Selv om dere... den første oppgaven går jo på at man skal føde hvor lang tid. Men det trengs ofte å forberede i godt tid i forveien (hmmm). De minste men andre typen oppgaver... kanske... Nå snakker jeg vel bort i fra det (nei da, vi følger deg rundt vi, så henter vi oss tilbake eventuelt, jeg må bare notere meg sann gode ideer.). Med foreldre som sagt er det ikkje alle som bryr seg sånn, de tenker jaja, det er ikkje alle som har hatt barn på skolen før heller.

Interviewer: Kan du fortelle hvordan du gjennomførte selv?

Interviewee: Det vi gjør på vårt trinn. Vi vill ikkje ha alle i klasserommet samtidig. Da deler vi opp i grupper da. Og da tenker jeg litt homogene grupper. Fordi at de sterkeste for eksempel hos meg (hmmm)... da velger kanske da å ha en 15 stykker av dem. 12-15 fordvi er såpass, at jeg veit at dette kan de gjennomføre ute at det blir for mye stopp ååå så hva skal jeg gjøre nå og sånn (hmmm) så da har jeg kanske den gruppa. Asså har vi da enkelt elever da som er kanske da en til en. Blant annet de som har paragrafiner ikkje sant. Og enkelte i klassen min som er såpass svake at de trenger veldig lissom mye støtte, at de kanske gjennomfører på bruk av tid og sånn men på bittemå grupper på 5 kanske. Da har man brukt de hørene vi har på toppen til å ta ut smågrupper (hmmm). Men hovedsakelig har jeg ja brukta da som sagt to store relativt store grupper så har man på en måte differensiert litt der fordi at de enkelte hos meg veit jeg ehh er såpass kjappe at lissom de kan de kan gjennomføre nesten alt med en gang ikkje sant men andre trenger kanske litt annen tilpasning