UNIVERSITY OF HELSINKI

Feedback practices in elementary school mathematics education

A brief view on how elementary school teachers provide feedback

University of Helsinki
Master's Programme in Education
Master's thesis, 30 cr
Educational Sciences
May 2026
Sabina Sirén

Supervisor: Fritjof Sahlström

UNIVERSITY OF HELSINKI

Tiedekunta - Fakultet - Faculty
Faculty of Educational Sciences

Tekijä - Författare - Author
Sabina Sirén

Työn nimi - Arbetets title - Title
Master's Thesis

Title
Feedback practices in elementary school mathematics education - A brief view on how elementary school teachers provide feedback

Oppiaine - Läroämne - Subject
Pedagogy

Työn laji/ Ohjaaja - Arbetets art/Handledare - Level/Supervisor	Aika - Datum - Month and year	Sivumäärä - Sidoantal - Number of pages
Master's Thesis / Fritjof Sahlström	May 2026	54 pp. + 10 pages of appendices

Tiivistelmä - Referat - Abstract

Objectives. Feedback is a significant part of school life and a fundamental part of learning. As it plays such a vital role, it is essential to understand how it is used in the school environment today. Both the forms of feedback and methods of giving it are important factors to research. The thesis seeks to get insight into how teachers provide feedback to their students in mathematics and how they involve their students in the feedback process

Methods. This is a quantitative interview study. Four teachers teaching in Swedish speaking primary schools in Southern Finland were interviewed. The interviews were about how the teachers give feedback to students, with a focus on mathematics education. The interviews were done both online and in person, depending on the preference of the interviewee. The interviews were subsequently analysed with an inductive thematic analysis method to create common themes and subthemes.

Results and conclusions. The result of the study shows that teachers were mostly focused on giving feedback verbally during class time. Results on tests and correcting homework were also mentioned as a common form of feedback provided. The focus of feedback was mostly on creating a positive learning environment and encouraging students to keep trying. This indicates that teachers value giving feedback that pushes the students forward, whilst keeping mathematical accuracy as one of the main goals of teaching. It also indicates that feedback is seen as a method of uplifting a student, and that teachers are aware of the possible negative consequences of feedback.

Keywords
mathematics, education, primary school education, teacher, feedback, students

Säilytyspaikka - Förvaringsställe - Where deposited
Helsinki University Library – Helda/E-thesis (theses)

Muita tietoja - Övriga uppgifter - Additional information

Tiedekunta - Fakultet - Faculty Pedagogiska fakultetet		
Tekijä - Författare - Author Sabina Sirén		
Työn nimi - Arbetets title - Titile Pro gradu avhandling		
Title Feedback practices in elementary school mathematics education - A brief view on how elementary school teachers provide feedback		
Oppiaine - Läroämne - Subject Pedagogik		
Työn laji/ Ohjaaja - Arbetets art/Handledare - Level/Supervisor Pro gradu-avhandling / Fritjof Sahlström	Aika - Datum - Month and year Maj 2026	Sivumäärä - Sidoantal - Number of pages 54 pages + 10 s. bilagor

Tiivistelmä - Referat - Abstract

Syfte. Respons är en stor del av skollivet och lärande. På grund av responsens betydelse är det meningsfullt att förstå hur det används i skolmiljön. Det är viktigt att undersöka både hur lärare ger respons, samt hurdan respons som ges. Syftet med denna undersökning är därmed att ta reda på hur lärare ger respons till sina elever i matematik, och hur de involverar sina elever i processen.

Metoder. Detta är en kvantitativ intervjustudie. Fyra klasslärare från svenskspråkiga grundskolor i södra Finland intervjuades. Intervjuerna handlade om hur lärarna ger respons till elever, med fokus på matematikundervisningen. Intervjuerna skedde både online och på plats, beroende på intervjupersonens behov. Intervjuerna var därefter analyserade med en induktiv tematisk analysmetod, och det skapade gemensamma teman och subteman.

Resultat och slutsatser. Lärarna var främst fokuserade på att ge verbal respons under lektionstid. Provresultat och rättande av hemläxor nämndes också flera gånger. Fokuset var också på att bygga upp en positiv inlärningsmiljö och uppmuntra elever att försöka om. Det här indikerar att lärarna värdesätter respons som pushar eleven framåt, utan att ignorera den matematiska noggrannheten. Det indikerat också att respons ses som en metod för att upplyfta eleven, och att lärarna är medvetna om de möjliga negativa konsekvenserna av respons.

Keywords matematik, skola, grundskola, lågstadium, lärare, respons, elev	
Säilytyspaikka - Förvaringsställe - Where deposited Helsinki University Library – Helda/E-thesis (theses)	
Muita tietoja - Övriga uppgifter - Additional information	

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1 Introduction

Mathematics is a central school subject and it's one that follows the student through their entire school career. Some subjects come and go, whilst mathematics is seen as an essential part of education. Mathematics is also a school subject, where successes and mistakes are easily noticeable to the student and the teachers. For some students, this creates a fun challenge and motivates them to try harder, whilst other students might struggle. This is why the teacher's role matters, as they can both teach mathematics as well as motivate and encourage students to succeed. An essential skill that is taught in school is critical thinking and reasoning, and in mathematics it's known specifically as mathematical reasoning. According to OECD (2023), it's a skill that is becoming more important in society.

One of the most important aspects of teaching is giving feedback to students. Research suggests that feedback can support learning, but that the type of feedback matters (Wisniewski et al., 2020). Feedback can help students understand topics better, as well as understand how they are doing in the subject. The teacher can give feedback on strategies that the student is using, as well as fix misunderstandings. It is as much a part of teaching and the learning process, as it is the result of it. That is why it going to be interesting to hear how teachers give feedback in today's classrooms.

There are discoveries to be made on how teachers' methods in giving feedback differ from each other and how attitudes regarding evaluation and mathematics have evolved in different classrooms. The focus of this thesis is not to come up with the perfect ways to help a student achieve maximum success in their journey of understanding, but instead to get a better view of the current situation from the perspective of the teacher.

Therefore, the focus of this thesis is on the teachers' perspective on their feedback practices in mathematics. This study excludes the perspective of the

student's, the other staff in the school environment and the parents of the students. The reason for that is that there is enough to be explored from the perspective of the teachers.

2 Theoretical background

There are several different facets that go into understanding feedback and evaluation regarding mathematics education. The terms “feedback” and “evaluation” in themselves can be confusing as they are often used interchangeably. There are also questions of how it all relates back to mathematics. Aren’t all school feedback and evaluation the same? These questions and more will be answered in this part of the thesis, and it will work as a base for understanding the results of the study.

2.1 Definitions

In this thesis, several terms will be used. Some of the terms refer to feedback and others refer to mathematics. The definitions used are from the American Psychological Association and from the Cambridge dictionary. These are the terms and definitions used:

Formative feedback and assessment are a continues way of checking up on a student’s progress in each subject. Instead of focusing on the end score or result, a look at the middle parts is given. It is a continues process that might involve exercises provided by the teachers or general observation. (Cambridge Dictionary, n.d.)

Positive feedback is largely what it sounds like. It is encouragement and praise provided by somebody else. This is contrasted by **Negative feedback**, which is the opposite. It is feedback that is not appreciated by the recipient and can evoke sadness and frustration. This type of feedback is often nonconstructive. (American Psychological Association, 2023)

Differentiation is a commonly used word in the teaching field, and it refers to teachers building up the material in a way that takes the individual need of the

student into consideration. What one student might need can and will differ from what another student needs. (Cambridge Dictionary, n.d.)

Encouragement is something that can be given to somebody else. A teacher might say something that pushes the student to work harder. Encouragement can be delivered verbally or by actions. It is something that helps build up confidence. (Cambridge Dictionary, n.d.)

Self-assessment is also called self-concept. It is a way of seeing oneself. Self-assessment is a story of how a person evaluates themselves when it comes to their skills and even largely their identity. (American Psychological Association, 2018)

(Mathematical) accuracy refers to how objectively correct something is. In mathematics accuracy is an important factor. (Cambridge Dictionary, n.d.)

2.2 Mathematics education

To get a good picture of what mathematics in teaching is and how feedback is related to it, some ground theories that provide the needed context need to be described. The following chapters will present some of these theories.

2.2.1 Instrumental and relational understanding in mathematics

Instrumental mathematics, according to Richard Skemp (1978) is one, if not the most common, type of mathematics taught at schools. It differs from relational math, which is also a common type of mathematics, in that it focuses on “simple” instruction to get to an answer. An example of instrumental mathematics would be knowing the formula to figure out the hypotenuse. It’s easy to teach and relatively easy for students to memorize. The formula doesn’t however teach the student why it’s used or how that information can be applied to other mathematics problems. This can lead to a shallow understanding of mathematics.

In contrast to instrumental mathematics, the relational understanding focuses on understanding the mechanics behind the mathematics (Skemp, 1978). Theoretically this type of understanding fosters an environment where other mathematical problems can be solved easier due to a strong understanding of the basic rules of mathematics. By knowing why something is done, it is more easily replicated in another similar situation.

Another easy way to highlight the differences would be to take one mathematical problem and see it in the two different ways.

Figure 1Illustrating the differences between instrumental and relational understanding

Instrumental	Relational
x + 5 = 10 Simply move the 5 to the other side with the number 10 and change it from a positive number to a negative number. End up with: x = 10 – 5 x = 5	x + 5 = 10 The left side has x + 5 and the right side has 10. We want to know what x is. We can do that by getting rid of the 5 that has been added to the x. We do that by subtracting the 5. To keep the equation balanced, we need to also subtract 5 from the other side. x + 5 – 5 = 10 – 5 x = 5 In conclusion, we did not move the 5 to the other side. Instead, we subtracted 5 from both sides to figure out what x was.

Skemp (1978) describes how the clash between students and teachers can sometimes be caused by the misunderstanding of each other. The teacher will ask a question wanting the student to showcase true understanding of the concepts and mechanics of the mathematical problem. The student, in turn, might not be able to describe a form of relational understanding. They might, however,

be able to get to the correct answer to the problem. This conflict in understanding can cause friction in the classroom.

This begs the question of which method or way of understanding is superior. At a quick glance at Skemps (1978) paper, you might think that he feels that relational understanding is far superior to instrumental understanding. Whilst he does express a clear preference for relational understanding, he still acknowledges the importance of instrumental understanding. Not every moment needs deep understanding of what goes behind the scenes of mathematics. Besides, instrumental mathematics is often much more easily understood, according to Skemp (1978, p.12). It also plays a big part in the most standardized part of mathematics class in school, working in the mathematics book. It's both more satisfying and faster to get through the exercises when you mechanically know how to do them step by step.

There are however more pros to relational understanding, according to Skemp (1978, p.12). Because it gives the student an understanding of the workings behind the obvious, it is more easily adaptable to other problems. If you know the logic behind it, you can apply that same logic to the next problem. The other point Skemp (1978, p.13) brings up is how much easier it is to remember. Instead of having to remember all the difficult formulas, a student can instead figure it out themselves because they know why and how it works. (Skemp, 1978)

2.2.2 The national curriculum

Mathematics in the national curriculum (Finnish National Agency for Education, 2014) is divided into grades 1—2 and grades 3—6. Grade 7—9 is also mentioned but they are not relevant to this thesis.

The mission for students in grades 1—2 is to gain a mathematical way of thinking, and the lessons should work as the building blocks for understanding and problem-solving skills. The national core curriculum (Finnish National Agency for Education, 2014, p. 195) also emphasizes the importance of fostering a positive

attitude and encourage independence. The feedback given to students, according to the national core curriculum (Finnish National Agency for Education, 2014, p.196), should be encouraging and the students should be taught to follow their own learning progress. This indicates that there is an understanding that for a student to be successful in mathematics, they need to mentally feel accomplished and supported by their teacher.

The mission for grades 3—6 is much in the same vein. The same aspects of encouragement and pushing the students forward are present. Another aspect that is mentioned is group work. The students should get feedback on their individual effort as well as the teamwork displayed. The teacher should get both verbal feedback as well as feedback in the form of numbers during evaluations. (Finnish National Agency for Education, 2014, p.521) Grading and results are mentioned more clearly for grades 3—6.

All in all, the national core curriculum emphasizes the importance of multifaceted feedback types and methods, which a teacher should follow in their teaching.

2.3 Feedback processes

Aside from mathematics as a subject and how it's handled in the national core curriculum (Finnish National Agency for Education, 2014), there is more to know about feedback processes. To understand this thesis and the analysis coming up, feedback needs to be addressed more broadly. This chapter will attempt to explain what feedback is and dive into some theories.

2.3.1 The role of feedback

There are different ways people interpret the word feedback. This thesis uses the well-known definition described by John Hattie and Helen Timperley (2007) as the basis of feedback. They described feedback in their paper on the power of feedback.

The definition goes as follows:

> “Feedback is conceptualized as information provided by an agent (…) regarding aspects of one’s performance or understanding.” (Hattie & Timperley, 2007, p.81)

In the case of this thesis, the agent focused on is the teacher. It is however good to know that the agent can be many things, like for example a parent or a friend. Something that is clear in Hattie and Timperley’s (2007) research is that the feedback should be constructive as well as an answer to something that requires it.

The next question then becomes “What is the purpose of feedback?”. Why do we need to give and get feedback on performance? When a student works on an exercise or answers a question, their result might not be correct. One way of fixing this situation is to provide constructive feedback. The feedback could be by for example coming up with reachable goals, so that the student can realistically reach it. Another is to cater the feedback to the student by using different strategies. According to Hattie and Timperley (2007), feedback should be the answer to three questions:

Figure 2The three questions feedback should answer, according to Hattie and Timperley (2007), and three possible answers.

What are the goals set for/by the student?	To be able to solve a difficult mathematical logic problem.
What is the current situation?	Student understands the problem but doesn’t know how to formulate and write down their answer.
What are the next steps to reach the goal?	Start by trying to solve the problem. After that, ask a friend to read through the answer and give feedback. Revise/fix your answer with the feedback you were given.

Feedback can be given on several different aspects of learning (Hattie & Timperley, 2007). A student who must write down a difficult mathematics problem most likely wants feedback on the results. A teacher might, however, give feedback on the grammar that the student used in their answer. In this case the student might feel a bit dissatisfied with the feedback. Therefore, it is important to have clear goals and for the teacher and student both to agree on them. If one of the goals was to also be mindful of grammar, then the teacher would be more justified in giving feedback on it.

In Hattie and Timperley's (2007) research, they describe four levels of the focus of feedback. These four levels describe the different aspects of the work that the feedback is focused on. This also leads to the knowledge that the feedback that a teacher gives can differ in effectiveness.

The first level described by Hattie and Timperley (2007) is feedback that is given on the work and result itself. In mathematics this is a level that is easily understood, as mathematics is an objective subject. A teacher would simply correct the student, for example saying that an answer was correct or incorrect. To make the feedback more substantial, the teacher could ask the student for elaboration.

The next level is feedback that is given about the process done to get to the answer (Hattie & Timperley, 2007). It serves to provide the students with an understanding of which strategies to utilize, and which aren't compatible. In mathematics, this could look like the teacher telling the student to break the problem up into several parts to understand it better and to not get overwhelmed.

The third level is about self-regulation. It's helpful when a teacher wants to encourage independence and confidence in a student. It is done by asking the student questions. The questions could revolve around what strategies they found useful or how they moved forward when they got stuck on something.

The final level is general praise. It is commonly used and often seen as less effective for learning. It can however be encouraging as it's more personal to the student themselves. An example of this level would be "You are really skilled at mathematics" or "You are smart". (Hattie & Timperley, 2007)

We can conclude that different levels of feedback can be used to reach different results and differing effectiveness. It is important to remain cognisant that these levels of feedback exist and how to use them in a way that serves the students interests and needs.

2.3.2 Feedback and cognition

Emily R. Fyfe, Marci S. DeCaro and Bethany Rittle-Johnson (2014) wrote a paper on feedback and on how it can be cognitively demanding. The paper describes different ways to provide students with feedback and different strategies a teacher can deploy. The focus of the study (Fyfe, DeCaro & Rittle-Johnson, 2014) was on how teachers give feedback on strategy versus outcome in mathematics learning. The type of feedback given to students should differ according to the individuals working memory capacities

In mathematics learning there is a distinct difference between giving feedback on the student's strategies versus the learning outcomes. Teachers often express their desire to teach students different strategies to solve problems and work with different topics. It is however curious, how feedback often focuses on the end results. The end results in the case of mathematics could be test-answers or grades. When solving problems, often several different strategies can be used, and they can all lead to the same correct answer (Fyfe, DeCaro & Rittle-Johnson, 2014). Using the same strategy on several different problems can however lead to wrong answers. In conclusion, giving feedback on strategies can help struggling students gain a better understanding of mathematics.

Strategy-focused feedback is however not without flaws or negative aspects. A student working memory may become overworked when receiving strategy-

feedback, more so than outcome-feedback (Fyfe, DeCaro & Rittle-Johnson, 2014). A study conducted by Robert C. Pianta, Jay Belsky, Renate Houts and Fred Morrison (2007), done on over a thousand American school children in 400 school districts, observed the emotional and instructional climate in the classroom. The evidence pointed to a finding that teachers generally gave feedback focused on outcome. The feedback was generic and was directed at the answer's degree of correctness. This contrasted with feedback that would encourage or be focused on (Pianta et al., 2007). This seems to support the numerous accounts of teachers focusing on results rather than the journey to them. It might also partially explain why strategy-focused feedback is rarer and more taxing to both teachers and students alike.

Returning to the study on feedback and cognitive load, (Fyfe, DeCaro & Rittle-Johnson, 2014) the study was conducted and the students in the study were either given strategy-feedback or outcome-feedback by the teacher. Their working memory and reported cognitive load were also studied. All the students were from a previous study by Fyfe et al (2012). The students were tested and only those that fit the inclusion criteria were chosen to participate in the study. They students that were chosen for the study were given mathematical problems and when presenting the answer, the experimenter either focused on the numerical answer or the strategy that the student used to solve the problem. If the student got the strategy correctly, the experimenter would tell them that they used a good strategy, but they would not comment on the correctness of the answer. The opposite would happen when a different student asked for feedback on the result. For this to work the students were placed in different groups so all the students would get one form of feedback. (Fyfe, DeCaro & Rittle-Johnson, 2014)

The result showed that the students that received strategy-based feedback ended up more frustrated and expressed more effort during the experiment. This also opened the possibility that strategy-based feedback is not necessarily always a good thing. The study showed that students with low working memory capacity did not benefit from strategy-based feedback and the results for students

with high working memory capacity were not conclusive. (Fyfe, DeCaro & Rittle-Johnson, 2014)

2.4 Motivation process

This chapter focuses on explaining what attribution theory and growth mindset are and how they might play into teacher experience and expectations.

2.4.1 Attribution theory

There are many different theories that can be used to explain some of the relationships between teachers' expectations and views of their students, and the realities as the students themselves experience it. Those that investigate how people view and react to why something happened are called attribution theorists (Weiner, 1972). To put the theory in short, people tend to react differently when they think something happened out of pure chance or accident in comparison to deliberately.

Weiner (1972) describes four different attributional conflicts that arise in the classroom. According to Weiner (1972) people are predisposed to attribute failures or successes to either the effort they put in or their ability to do the task. There are also other factors like previous experiences that can change a person's view of their abilities and effort.

The first of the conflicts is the intra-student conflict. Rosenthal and Jacobson (1968) did a study that is highly controversial according to today's standards that revealed how students that were randomly given a title of having "unusual" intellectual growth fared in relation to other students in testing. The results were that the selected students ended up showing more development in the intellectual department, as described. A couple of years after the publication of Rosenthal and Jacobsons (1968) controversial study Weiner and Kukla (1970) decided to try and explain the phenomenon. According to their findings they concluded that teachers had attributed the failures of those students on their lack of effort instead of a lack of ability which they might have done for other students that were not

described as having unusual intellectual growth. So even when they didn't do so well the teacher just assumed that the reason was because they didn't put in the effort, but that they indeed had the ability. Because of these attributional conflicts there can often be a situation where a student and teacher is butting heads on the reason a student isn't performing as expected. The teacher might think the student isn't trying hard enough whilst the student thinks they aren't smart enough to complete the task. (Weiner, 1972)

The student-teacher Conflict is a bit clearer and easier to understand. It deals with how there exist stable attributes, that we may call traits, and unstable attributes. According to Jones and Nisbett (1971) people tend to react differently when someone else does something compared to when they themselves do something. So, the reason why you do something might be because someone made you do it compared to when someone else does something it might be because of an inherit trait that they possess. In situations where effort is an important factor, for example in reading for an upcoming exam or practising for a football tournament, can people's expectations vary wildly. Your view of how well you are going to do depends on if you see effort as a trait that you possess or as a thing that can change. (Weiner, 1972)

The third conflict is called the Teacher-Observer Conflict, and it shows a quite drastic difference in opinion or view depending on who's experiencing the situation. A study that Beckman (1970) conducted showed how a teachers and observers views differed in a situation where the teacher was teaching a group of students some mathematics. The teacher seemed to praise themselves when some students did well. They seemed to look at themselves as having done a good job in getting the students to understand the subject. The observers on the other hand blamed the teacher for the failures of the students that didn't perform as well. These are called ego-enhancing and ego-defensive attributions that are employed when you're essentially in "charge" of a situation. (Weiner, 1972)

The last and final conflict is the observer-observer conflict that just presents the possibility that even observers may interpret their own observations differently or even observe different behaviours. (Weiner, 1972)

Less studies have been made about how students viscerally feel about these different conflicts. According to a study by Paul C. Burnett (2001) 91% of students want to be praised either sometimes or often, compared to only 9% of students who never want to be praised. Most students (50%) also wanted to be praised more on the effort they put in, where-as 35% of students wanted praise on their ability. Interestingly, the was no difference between wanting to get praise for achievement versus behaviour in the younger students. High school students did report to caring more about praise for achievement than behaviour. What this seems to imply is that the want for feedback and praise for achievement is something that doesn't go away as students age. (Paul C. Burnett, 2001)

2.4.2 Growth mindset

Another aspect of learning and development is something called growth mindset. Although there is debate in the field about how accurate the theory is within itself. More on that later.

Carol Dweck (2006) describes the term growth mindset in her work "Mindset: The New Psychology of Success". According to her there are two different types of mindsets. One is the now well-known growth mindset and the other is the fixed mindset. I will start by explaining what each mindset means and how Dweck (2006) has defined them.

Fixed mindset is the belief that your qualities are fixed in place (Dweck, 2006). You are born or developed certain traits and maybe even intelligence, that is unchanging. There is no flexibility and therefore it creates an enormous need and want to prove your worth. According to Dweck (2006), some people live with this mindset since a young age. As this description might suggest, people with a fixed mindset might not believe that exerting themselves or asking for help does anything. Because, as already stated, there would not be anything to be gained. (Dweck, 2006)

According to Dweck (2006), the fixed mindset is something that can be gained during school. People in general tend to fear failure, and children are no exception. It is only natural that the fear and anxiety that revolves around failing is strong and visible during those very formative school years in a child's life. It is only a bigger problem because a lot of school is evaluations and feedback. All which can instil a sense of unworthiness in a child. This all ties into mathematics class. Mathematics is also one of the subjects where correctness is valued deeply. It is also usually clear when you answer correctly to a question versus incorrectly to a question. Students with a fixed mindset might fear exposing their weaknesses and therefore might not ask questions or dare to answers the teachers' enquiries. Dweck (2006) also discovered this when asking students not fluent in English attending an English-speaking university in Hong Kong, if they wanted to take an English-language course to help them in their studies. The students with a growth mindset showed more interested in the proposition, that the students with a fixed mindset. Their mindset was evaluated separately by questions. (Dweck, 2006)

The other mindset is the growth mindset (Dweck, 2006). This means that you are not simply doomed to the qualities you got since birth or throughout your childhood. Instead, you are always a work in progress, able to learn and adapt your skills and qualities with time and effort. As Dweck (2006) puts it, "a person's true potential is unknown". Dweck (2006) points out that she saw how primary school aged children with different mindsets reacted to puzzles. The puzzles that the children had an easy time solving were very interesting to the students with a fixed mindset. It was however when the difficulty changed and the puzzles became more complicated that the difference in mindsets became clear. The students with a growth mindset were far more interested in solving those puzzles, whist students with a fixed mindset avoided them. Dweck (2006) mentions that even very skilled students with a fixed mindset avoided the hard puzzles. This seems to signify that people with a fixed mindset act similarly in situations, regardless of their skill level. (Dweck, 2006)

Dweck (2006) emphasizes how it's worth it to try and improve your abilities instead of always having to prove them. This is the true difference between

growth mindset and fixed mindset. The growth mindset makes sure that you can feel hopeful whilst the fixed mindset limits you. (Dweck, 2006)

As mentioned before, this theory is not without its critiques. Burgoyne et al., (2020) challenges Dweck's (2006) mindset theory in their study where they examined 438 participants. They concluded that mindset theory could not fully live up to some of the stronger claims.

These theories should provide a good framework for the following study. It will help provide context for the question being answered.

3 Research task and research questions

The research task of this study is to describe, analyse and interpret how teachers provide feedback to students in mathematics.

1. In what way do teachers in grades 1—6 provide feedback in the context of mathematics education?
2. To what extent do teachers in grade 1—6 include their students in the feedback and evaluation process?

The focus of this study is to interview teachers that teach in grades 1—6 in Swedish speaking schools in Southern Finland. Southern Finland was chosen as the area because there are several schools where the language spoken is Swedish. Four interviewees will be chosen, and the interviews will be held in person or online, depending on the wishes and availability of the interviewees.

4 Research work

In this chapter I will introduce my research strategy and methodology. I will also discuss how I chose my interview-participants.

4.1 Research strategy

The chosen research method was to do a qualitative study. This decision was made because of the desire to work with a smaller number of participants. A quantitative study would require a large data size and a lot of communication with a larger number of people. There was also interest in working with and analysing interviews, therefore it was the most logical way forward. The goal of this thesis is to provide understanding and not broad statistics that would be widely applicable. As mathematics is a complex subject, a perspective directly from teachers teaching in schools was seen as necessary.

The most important aspect of this study is the experiences of teachers that teach in grades 1-6 in Swedish speaking schools in southern Finland. These experiences are subjective and shed light on how feedback is given by these teachers. This study will answer questions of reasoning for the given feedback and help describe the situation that is ongoing in mathematics classes today.

The research method decided on was an interview study as that seemed to be the best way to get both complex and deep answers to questions I wanted to answer in this study. It also gave an opportunity for spontaneous questions as well as answers to follow up questions. Interviews can also provide an interesting discussion, as opposed to a questionnaire sent by email. A questionnaire might also miss some of the subtleties that might come up in a conversation. The only downside that I experienced with choosing interviews, was the fact that it was more challenging to get participants. The threshold for teachers to answer to a questionnaire could prove to be lower, resulting in both more participant and faster answers. There are however upsides to interviews as well. The interview situation gives teachers the opportunity to further explain what they mean and give practical examples from their own experiences. The questions might also

help them reflect on the student's perspective. In this study there was no intention to explore the questions from the perspective of students, but it is interesting and helpful to know what the teachers understanding of the students' experience might be. That already brings more layers to the analysis.

The perfect number of teachers to interview was difficult to decide. The number that was decided on ended up being four teachers. The goal of this study is not to create sweeping generalizations of how feedback is given to students in mathematics in general. This is merely a small part of a larger conversation that might spark from the findings of this study.

The method of analysis chosen for this thesis is an inductive thematic analysis (Braun & Clarke, 2006). It is a method that can be used to identify and analyse different themes that come up in data, in this case the transcribed interviews. The purpose was to do interviews and see the whole data instead of coming up with ready-made themes. Therefore, an inductive method worked the best for this thesis. An inductive method of analysis gives more room to explore the data and work from it. The themes come from the answers given by the interviewees. One of the good things about doing a thematic analysis is that it is flexible. (Braun & Clarke, 2006)

In an inductive thematic analysis, the themes are found in a data-driven way, as described previously (Braun & Clarke, 2006, p.18). This means that the themes are pulled out of the data by the researcher, making the process somewhat subjective and not necessarily driven by a hypothesis. The themes are therefore well connected to the data itself. When coming into the interviews, I did not write down any expected outcomes. There was a true openness and willingness to maybe find out something new or exciting. It was however not the goal to come up with new theories, but instead to shed light or various perspectives. The inductive method matched this goal. This is also why themes are often unrelated to the research questions or the researchers' expectations. (Braun & Clarke, 2006, p.12)

A theme is something that the researcher finds interesting in the given data (Braun & Clarke, 2006). It might be a word or an idea that comes up frequently. There needs to be some sort of pattern for it to be a theme. The frequency of the word or idea doesn't necessarily make it a theme, or even if it does, it doesn't mean that it's relevant to the study in question. A qualitative analysis gives more flexibility to choosing which themes are more relevant and need to be given more analysis. (Braun & Clarke, 2006, p.87)

This study does not include any observations in classrooms; therefore, it is solely reliant on the teachers' subjective experiences and thoughts. It does not include students' opinions and therefore this study answers the question on how teachers describe the giving of feedback in mathematics.

4.2 Material acquisition methods

The decision to use interviews as the method of material acquisition came relatively early in the process of writing the thesis. It was a natural choice as capturing the unique perspective of teachers was the most important aspect of the plan. The plan became to interview four classroom teachers that teach in grades 1—6 in Swedish-speaking schools in Southern Finland. As before mentioned, the number of teachers chosen for this study ended up being a perfect amount to get a variety or answers, but still not so much that the essence of the study would get lost. Interviews also usually yield a lot of data, and four teachers would be more than enough, especially if the interview-questions were formulated in a way that invited longer answers.

The process of finding interview participants started with choosing the area and schools that would be involved. The broad area of "Southern Finland" was chosen, as that would be the most easily reached for in-person interviews. Southern Finland also has a larger amount of Swedish speaking schools, aside from the Westcoast, closer to Vaasa. Traveling up to Vaasa would however be unrealistic, and Southern Finland had enough schools to contact.

The search for interviewees started with an initial email to the principal where the thesis was pitched and a request for research approval was begun. This is the first real hurdle, as the approval from a principal is necessary before asking for a research permit from the municipality. Several municipalities had to be contacted, as it was difficult to get responses from possible participants. The sparce responses might partially be explained by the time of year the requests were sent out, as some teachers might have been too busy to answer emails.

After getting approval from the principal, the requests to the municipality were sent out. This often involved filling in a form and sending in material, like for example the interview guide and the research plan. Waiting for the permit often took longer than a week. The principles of the schools were contacted again after the permits from the municipality were received, and they got me in contact with the interested teachers. All contact after that happened between me as the interviewer and the teachers as the interviewees. All the interviews were voluntary, and the interviewees were made aware of this.

In the correspondence with the interviewees, I mentioned that the interviews could be conducted in person or via an online meeting service, like for example Microsoft Teams, Google Meet or Zoom. The interviews for this study were done in a couple of different methods, mostly online. Choosing to do the interview online makes it easy for both the interviewer and the interviewee. It requires less travel but can create problems if the internet isn’t working problems etc.

The form of interview I decided on ended up being a semi-structured interview (Cohen D & Crabtree B, 2006). Semi-structured interviews are formal and there is an interview guide that is used during the interview. The semi-structured part comes in when the discussion deviates from the guide. That is when the researcher can bring up follow-up question or more easily ask for elaboration. I chose this method as I wanted to get the interviews done in one interview and was not interested in trying to arrange follow-up interviews. It would also be more straining for the teachers, if they knew that they might need to participate several times. The fact that you can slightly stray away from the plan, when appropriate,

is also great when the interviewees have more to offer on the topic than you might have expected. (Cohen D & Crabtree B, 2006)

The interview guide had three distinct groups of questions. The first group were general questions. One of them was for example “How does a routine maths lesson look like in you class?”. The second group of questions was specifically about teacher feedback and the feedback process. The third group of questions was focused on more specific aspects of feedback, for example peer feedback and self-evaluation. The questions were primarily asked in order, but the order could change if the interviewee mentioned something that would come up in a later question. This was to make the interview more organized and flow better. It was also easier to ask the interviewee to elaborate in case they mentioned something interesting. A semi-structured interview style also provided the freedom to individualize the interview for the interviewee. If they mentioned that they have a different classroom setup for example, a follow-up question pertaining to the setup could be asked. (Cohen D & Crabtree B, 2006)

To save the interviews, a basic voice recorder application was used. The same application could be used for online interviews and for in-person interviews. The participants were made aware of the fact that the interview would be recorded, and the recording would be deleted after it was transcribed. The recordings ended up being anywhere from 20 minutes to 40 minutes.

The sound files were transcribed after each recording with a program within Microsoft word. The software did a decent job, but the program did not yield perfect transcriptions. This was partly due to the nature of the interview, and the fact that the transcription program wasn’t aware of how certain Finnish words are commonly used in conversation in Swedish. After the transcription was parsed through and fixed in places, the original sound files were deleted from the device. No names were attached to the transcriptions, only pseudonyms “Teacher A, B, C and D”. The letters after “Teacher” were given randomly because they are the start of the alphabet, and not in any specific order. No identifiable information was saved and used in this study. The name, gender, workplace and age of the interviewees are unknown. The only information that is known is that they work

as an elementary school teacher in a Swedish speaking school in Southern Finland.

4.3 Material analysis methods

As the method of analysis, I decided on an inductive thematic analysis. There are six phases when you do a thematic analysis (Braun & Clarke, 2006). As my material acquisition method was interviews, I needed to get them transcribed and onto a document where it was easier to connect with the data. There are no set rules as to how to conduct the transcript as it is a thematic analysis. It is however utterly important that the transcript doesn't lack information that is needed and that the meaning behind the words stay true. (Braun & Clarke, 2006, p.88)

The first phase of the process is about getting familiar with the data (Braun & Clarke, 2006). This phase is already started during the transcription process. Although transcribing can be tedious and time-consuming, it does give you some time to relive the data and get familiar with it. Familiarization continues when you re-read the data and reflect on it. I also started making some notes on interesting things that popped up in the data. This is the base work that will make the following steps easier. There is a risk of being overwhelmed with the amount of data that is created from the interviews (Braun & Clarke, 2006). I experienced some of that overwhelming feeling as well.

The next phase is about starting the coding process. This is when you sparse through the data and find meaningful words and ideas. (Braun & Clarke, 2006) Although a lot of researchers use software to do the coding, I did it manually as it was relatively easy. The sample size was small enough and the interviews were far enough apart for each other in terms of time, that I had time to familiarize myself with each transcription.

The third phase is searching for themes within the codes (Braun & Clarke, 2006). For this I made mind-maps to visualize the codes and themes. Clarke (2006) mentions that one of the difficulties can be making broad themes or too small

themes that technically should be labelled as subthemes. I also experienced some difficulties with this step. The sheer amount of data and codes often led to me feeling like some codes were left out, and having to fit them in existing themes just broadened the theme too much. But also creating a theme for just a couple of rogue codes was unnecessary because there wasn't enough to analyse. Therefore, some of the codes ended up being left out, which created a more cohesive analysis in the end.

Following the search for themes was reviewing themes (Braun & Clarke, 2006). This was something that I had almost started doing whilst finding them. I went through all my themes and evaluated how they looked and how they fit into each other and into my research question. Did they answer my research questions or create context for them? Clarke (2006) describes this phase as a time to make sure the themes are consistent and distinct. I put effort into making sure that I didn't have two themes that were too closely related, as I wasn't interested in repeating the same information several times during the writing of results.

The last step before starting the writing process was about naming the themes. I had already started giving the themes names from step 4, but I continued refining in this phase. After the refining was finished, it was time to continue to the next step and finally writing down the results. Before starting the writing process however, I needed to translate the themes, subthemes, codes and quotes into English. For this I used Google translate, Microsoft CoPilot as well as ChatGPT 4 and 5.5. All translations were checked, fixed and confirmed by the author before writing them down and submitting the thesis.

5 Research results and their interpretation

In this section of the thesis, the research results will be presented as well as the interpretation of them. As an inductive thematic analysis method was chosen, the focus has been on finding common themes within the transcripts of the interviews. The process was arduous and complicated in the beginning, but the work became easier as the material became more familiar. The themes that were found were “Purposes of feedback”, “Feedback in practice”, “Differentiation and interaction in feedback” and “Classroom culture”. These themes included in them subthemes that were more focused on a specific issue or topic.

Figure 3The themes, subthemes and code examples from the data gathered

Themes	Subthemes	Code examples
Purposes of feedback	Classroom goals	“Maintain a silent and calm working environment”
	Formative intentions	“You never have enough time…”
		“Is that reasonable?”
		“It’s support and it’s encouraging”
	Correction and mathematical accuracy	“I walk around, follow how they count...”
		“You may not be so quick to point out what’s wrong”
Feedback in practice	Oral feedback and instruction	“The logic behind it”
		“Focus on encouragement”
		“Traditional exams after each chapter”
	Tests, evaluation and assessment	“You can clearly see what is right and what is wrong”
		“It’s more for my sake that we have tests”
Differentiation and interaction in feedback	Feedback as dialogue	“Start from the student”
		“They sit in small groups”
		“It’s very rarely that I find that working alone works better”
	Adapting feedback to differences	

	Group work and interaction	
Classroom culture	Comparison and communication with the home Student responses and sensitivity to feedback	“Don’t directly give feedback” “They start comparing test results” “First and second graders think it’s fun to come to school” “I adapt a bit depending on the situation”

5.1 Purposes of feedback

There are several different purposes for feedback. They can range from correcting mistakes to creating goals and together with the student coming up with ways to reach those goals. In the interviews I conducted, I noticed a couple of reoccurring terms that I wanted to delve deeper into. These were “classroom goals”, “formative intentions” and “correction and mathematical accuracy”.

5.1.1 Classroom goals

There are many different goals that can exist in a classroom environment. In the interviews there were several larger goals that came up. The term “positive reinforcement” is commonly used when discussing teaching and learning. My interviews with the teachers weren’t an exception to this rule. All the teachers interviewed mentioned the importance in bringing in positive reinforcement, feedback and encouragement into the classroom. Teacher B mentions boosting self-confidence and morale:

> During the lesson it is largely about encouraging those that I know are having a hard time, and generally everyone. I want to acknowledge when they do well. (Teacher B)

This sentiment was paired with other similar ones from the other teachers. They seemed to value positive reinforcement and encouragement highly and seemed to emphasize the importance of it over many other forms of feedback. The teachers spoke passionately about it. Teacher D discussed how they have several goals:

> I have a couple of goals, I would say. Partly to give guiding feedback so that they (students) know that they are on the right track. Then also, if I notice that someone doesn't really believe in themselves, to encourage. And, to confirm how it's going. (Teacher D)

Teacher A didn't comment much on their goals for teaching and giving feedback. Teacher B did however describe their thought process when giving feedback:

> The goal is to name four different geometric shapes och your other goal is to maintain a silent and calm working environment (*arbetsro* in Swedish). So out goals are not only the mathematics, but maybe more about approach. (Teacher B)

In their explanation they seemed to express how important it is to combine different types of goals. Although there are important goals within mathematics itself, and the National Curriculum, there are also goals outside of it that are important. Many of those goals are not exclusively something that is practiced during mathematics class. An example would be giving other students a calm working environment, or what is called *arbestro* in Swedish. That is a skill and a goal that is applicable to almost all school subjects. The same goes for teamwork and generally working together with others. This is supported by Teacher B:

> You must be able to work with your partner. Yes, goals from mathematics (National curriculum) but not solely. (Teacher B)

5.1.2 Formative intentions

Formative feedback emerged as a prominent theme across the interviews, particularly how teachers used feedback to support students' learning during mathematics lessons. In the interviews the teachers described feedback as something that occurs continuously throughout the learning process. Teacher A gave an example of immediate feedback you might have to give a student to aid in understanding:

> Is that reasonable? Many (students) who have difficulty with mathematics just do and lose the thought behind it. If you had a hundred euros from the beginning when you went into the store, then it's probably a bit interesting that you come out with 370 euros. (Teacher A)

The question of "Is that reasonable?" might be needed in cases where a student is just going through the problems without understanding them fully. They might need someone to come up to them and ask them to explain their thought process. A teachers immediate questioning might be very helpful in such cases.

All four teachers emphasized that formative feedback in mathematics often takes place in the moment, while students are working on tasks. Teacher C explained that they regularly move around the classroom and provide brief comments or questions intended to guide students' thinking:

> I'm maybe not the teacher that goes during the lessons and says: "Hey, this is wrong, that is wrong". Instead, I tend to walk around and say something like: "Let's look at this problem a little bit. Is it as it should be?" (Teacher C)

The focus on the timing of feedback is seen in all interviews. Teacher B explained how they might give feedback in a moment when students are working independently during a mathematics class:

> If it's a situation where everyone is sitting and working, I can give such feedback that "now you're all sitting well". (Teacher B)

From these answers we can see that the feedback is often related to strategy and behaviour in the classroom. This is all feedback that strengthens understanding and helps learning. The learning environment is essential. Teacher B continues by saying that they focus on encouraging feedback in the moment:

> During the lesson, my feedback is often kind of encouraging. It's support and it's encouragement. (Teacher B)

Teacher C discussed how the formative feedback they give is focused on encouraging the students to come up with strategies and new ways of thinking about mathematics and the problems, without feeling shame or embarrassment:

> So that they themselves (students) then sort of count again and discover that, OK, it hadn't turned out right this first time, but now they succeeded that second time. (Teacher C)

They concluded by saying that:

> So maybe giving feedback is for them to try again without feeling that they have done wrong. (Teacher C)

Despite an emphasis on formative feedback, some of the interviewees described the lack of time as a limiting factor. Teacher A gave a complex answer on how they find the time to give feedback to students:

> You never have enough time, and you never invest enough time for it (feedback). It’s obvious that you sometimes hide behind not having time. You can arrange time for most things if it’s necessary. So, it’s probably more of a question of attitude. Maybe I don’t take enough time. (Teacher A)

In Teacher A:s answer we can see that there might be more time to give feedback, than expected. It is however important to understand that all teachers and classes are experiencing unique challenges and therefore Teacher A:s experience is not universal. Regardless, their perspective is important and sheds a light on how teachers decide to allocate their time during class. Teacher D also discussed the feeling of a lack of time:

> I don't have time to give feedback to everyone all the time, of course. No one has time but just walking around and showing that I've seen (them). (Teacher D)

Across the interviews, formative feedback was characterised as immediate and focused on strategies that help students learn. Feedback was also given on how students met other goals set by the teacher. Those include teamwork and general behaviour.

5.1.3 Correction and mathematical accuracy

It should come as no surprise that correction is a big part of the work that teachers do in mathematics class. By virtue of solving problems in class, there will be students that get the wrong answer occasionally. Every teacher mentioned correcting wrong answers as being one of the biggest forms of feedback that they give their students. How they approached correctness was similar as well. Teacher B described it as the following:

> In the meantime, I walk around, follow how they count, correct if I then go wrong, encourage and support and grab those who seem to be stuck a bit. (Teacher B)

Then I asked teacher A if she helps guide students forward when they get stuck on a problem or if they constantly get the wrong answer. To this they answered that they absolutely help guide students when they have a hard time with a specific problem. According to Teacher A, they help via a couple of different ways.

> It's often text-based problems that they (students) get stuck on. So sometimes it’s enough to read the question initially for the weaker readers, just because it might help it “click” better when they hear the problem out loud. I also like to emphasize the important terms and numbers they need to focus on. (Teacher B)

Text-based questions seemed, according to the interviewees, to be the types of problems that their students found the most difficult. They also required different types of guiding and correcting. Two of the teachers described how just reading the question out loud to their student or letting the student read the question out loud themselves, helped them understand it better. Telling the students which words to focus on also helped them understand how to move forward.

Some teachers also brought up the dilemma of constantly correcting the same student, when they are clearly struggling with mathematics. The teachers feel like they need to strike a fine balance between making sure that the student is learning the correct material whilst not discouraging trying again and maybe failing again. Teacher C mentioned how they try to approach the situation delicately, encouraging the student to figure it out themselves, instead of immediately labelling the work incorrect.

> That said, you may not be so quick to point out what is wrong. (Teacher C)

Teacher A also puts emphasis on the mathematical correctness, as they also feel it to be an extremely important part of mathematics teaching and learning. They also brought up differences in attitudes between students of different ages. According to them, the younger the student, the less they care about being corrected.

> I don't know, at the same time I feel that the younger students are happy to receive help. In lower classes, it may not be such a label. (Teacher A)

This is especially the case when a student already experiences difficulties in the subject. Because Teacher A also gives options for students to work together in pairs or groups, this effect seems to be lessened. Instead of one specific person getting “targeted”, instead they can learn from other students and get help before a teacher comes to see the progress. It also divides the attention if the teacher needs to correct anything.

> And then at the same time when they get to work in pairs and groups, so it may be that it is not so indicative for that one student. (Teacher A)

When asked about how Teacher B likes to check students work, they explain that aside from walking around the classroom, they also provide the answers by their desk. Students can go check the answers themselves, without involving the teacher. Teacher A also acknowledges the cons of such an approach.

> Right now, the students can go correct their own work. I have the results on my computer so that they can correct from there (…) because I simply do not have time to correct for all of them. It's not ultimate, because then I don't know if they understand what they're correcting and I don't even know if they're correcting correctly, but that at least they have some control/knowledge. It usually goes quite well. (Teacher B)

Teacher B:s approach brings more opportunities for mathematical correctness and accuracy, with the knowledge that it might lead to less mathematical understanding. A child might find the correct answers in the book but not understand how to get to the correct answer. The questions remain, is it that different from a busy teacher marking mathematics books?

5.2 Feedback in practice

Delivery is an important factor to think about when giving feedback. It is not always just about what feedback you give, but also how you go about giving it.

During my analysis I found a couple of different methods of delivery that I want to focus on. Those include the most common oral feedback and instruction, as well as tests, evaluations and assessments.

5.2.1 Oral feedback and instruction

The importance of verbal feedback was brought up numerous times during the interviews. Some of the interviewees brought verbal feedback up explicitly, whilst others seemed to see it as a natural and obvious part of the work they do. Verbal feedback seemed to be, according to these interviews, the most common form of feedback and instruction they gave. Teacher C described it as the following:

> Yes, as a primary school teacher you need to learn that you can't just explain a task in one way. You can't explain it in two ways, so maybe I have three different ways. (Teacher C)

They emphasize the need of explaining concepts and tasks several times in different ways to the students. When asked if this also applied to how formative feedback also had to be given repeatedly, they answered agreeing. When Teacher D was asked if they also provided feedback and instruction verbally, they said:

> It ends up being more verbal, I would say. (Teacher D)

Some of the teachers mentioned verbal feedback when talking to the class or when addressing an individual student in front of the rest of the class. All the teachers mentioned giving individual and personal verbal feedback. Teacher A described the dilemma of not always having enough time to give feedback individually, and that's when more general feedback is convenient.

> One doesn't do it enough individually. It's more about one's own attitude to taking the time and actually investing in it. And then there's the fact that you easily bring up the tests, everyone has the same test, and they you go through it and that's how it ends up being. (Teacher A)

When asked if they pair the verbal instruction and formative feedback with anything specific, teacher B says:

> Usually, if it's something completely new, it starts with looking at the book together. We go through whether there are new measurements or new calculation methods. The logic behind it. I can write pictures on the board to clarify something, ask for examples. (Teacher B)

Teacher B introduces topics and new concepts by using verbal instructions as well as pairing it with different visuals. When asked if they use this verbal instructional method when giving feedback, Teacher B responded by saying:

> I usually don't talk about how it's going during the lesson. Instead, there is a lot of focus on encouragement and on the fact that they should keep practising and so on. (Teacher B)

This seems to indicate that there is a focus on keeping the verbal feedback slightly more surface-level instead of giving complex critique in the moment. It is however interesting if feedback comes forward more strongly in tests or assessments.

5.2.2 Tests, evaluations and assessments

The method of delivery that the teachers mentioned the most after oral feedback was feedback that was given in the form of tests and evaluations. When a student gets a good score in a test, that is in and of itself feedback on how well they did. It is feedback that the teachers can give more easily and conveys an objective score to the students. Tests are also a good way for teachers to get feedback on their teaching. Both views were represented by the interviewees.

Teacher B explains tests as a self-evaluation tool for students in the following way:

> Tests are more about students themselves seeing how they're doing (in mathematics). So that form of feedback is for them to see what they are capable of, as they cannot get outside help during a test. (Teacher B)

This emphasis of students not getting help during the test and therefore getting a clearer understanding of how well they are doing in class is not mentioned by the other interviewees. They do however explain that tests often give a simple objective measurement of student's knowledge. Teacher C explains:

> In mathematics tests you can clearly see what is right and what is wrong. That type of feedback is already different (from other forms of feedback) during mathematics, so to say. (Teacher C)

Several of the teachers mentioned frequent tests after each chapter in their mathematics books. Teacher A explains putting more emphasis on tests than homework for example:

> We have traditional exams after each chapter. I don't usually spend time on going through the homework. Instead, they (students) report to me if they didn't do their homework. They can absolutely ask if they have any questions! (Teacher A)

They continue by explaining that the exams are a way for the teacher to evaluate themselves and their own teaching. They are not there to necessarily evaluate the students. They also make sure to tell their students that:

> We instead have tests very often, and the students know that. They (tests) are not to check them, but instead to check me. I'm checking my teaching. Is there something we need to go over again? (Teacher A)

This was a sentiment shared by several teachers. Teacher C also pointed out the importance of tests to help self-evaluation of both students and teachers. They also expressed the importance of frequent tests:

> But just when we have mathematics tests, it's nothing we practice for, but we take them after each chapter. I always tend to explain to the students that the test is not so that I can see how many (answers) you got wrong or right. Instead, it's so that I can see "Ok, so now many students got this problem wrong", then it's something that I was not able to teach properly. (Teacher C)

They also reinforced this view later when they repeated:

> It's more for my sake that we have tests. (Teacher C)

Teacher D expressed that they had tests with the older students, but the younger ones not so much. In answering a question about communication with parents, Teacher D said the following:

> With the older ones (students) who have tests and such, they for example get their test scores written in Wilma. But the younger ones don't have tests and instead we work on what we work on at school, and then they have some homework and things like that. (Teacher D)

Grades as a form of feedback is not an unprecedented idea, as some of the other teachers expressed similar opinions. They did however note that just grades are not enough feedback. The grades should reflect all the other feedback that the student has received during the class. The importance that is placed on it does however have a different effect on the student, than just regular verbal feedback during a lesson.

Evaluation is an inevitable part of teaching and learning in a school environment. This was also something that was brought up a lot in interviews. Mathematics especially is seen as a subject that is very often evaluated with numbers and scores. Some of the teachers mentioned evaluations at the end of the semester or year, as a decent version of feedback. It seems like grades are a powerful

version of feedback and pressure for students to improve. Teacher B concludes with how tests are useful when giving students their final grades:

> They (tests) are also for the final evaluations. They are connected. (Teacher B)

5.3 Differentiation and interactions in feedback

Now that the purposes of feedback have been discussed, there are some other interesting themes that emerged from the data. One of them was how teacher differentiate when giving feedback in mathematics. Another is how teachers structure lessons to include group work or peer-feedback.

5.3.1 Adapting feedback to differences

Several of the teachers mentioned how important it is to adapt the type of feedback they give, depending on the students. These differences might be the age of the student, skill level or self-confidence level. In this chapter I will analyse how teachers work with differentiation. The students' emotional reactions will be analysed in a later chapter.

One difference that was widely mentioned by several teachers was age. It seems the consensus that it is easier to give younger students feedback. The students like mathematics as a subject and find it more interesting. That is why giving feedback is seen as easier. There is a sense that the feedback can be more straightforward. To a question pertaining to how the individualize feedback, Teacher A says the following:

> I feel that in the lower grades, most students still find mathematics to be one of the most fun subjects, and I think that largely has to do with the fact that it is still relatively easy for many. There are fewer students who find it difficult. However, the differences become greater and greater. (Teacher A)

This indicates that in the older grades, the skill differences between students are larger and therefore the way teachers give feedback must be more tailored to fit the individual student's needs. This is what the differentiation is largely about. Teacher B also emphasizes the importance of seeing the student and working from that perspective.

> Start from the student. (Teacher B)

To know how to adapt the type of feedback and how the feedback is given, you need to first figure out what the need of the student are. Teacher C expresses the difference in giving feedback and instruction to weaker students as opposed to stronger students:

> For stronger students, you should tell them to think more about that task, whilst for a weaker student you might have to sit next to them and say "Hey, that answer (box) looks a bit silly, shall we think about it together?" (Teacher C)

When asked to elaborate, teacher C continues by saying:

> You maybe do a bit more together with a weak student, whilst you know a stronger student will notice it themselves. (Teacher C)

This answer seems to indicate that when advising students of different ability- or skill-levels, the type of intervention must differ. Students that are stronger in mathematics will have an easier time figuring out where they went wrong in a calculation, whilst a weaker student might struggle. This is why simple prompting by the teacher could be enough for a stronger student, but not enough for a weaker student.

School mathematics books are widely used for good reason. They provide a simple roadmap that allows students to learn at the same pace as other students. It also is helpful for the teacher when creating lesson plans. When discussing

how Teacher A uses the exercises in the books as a differential tool, they gave a very clear example:

> There are often four tasks, and you (students) must always choose at least two. I often present them by saying that ‘this one is difficult’ and ‘this one is easy’. Then they choose for themselves if they want the difficult tasks. ‘And this is one that develops your thinking’ and so on, I usually kind of advertise these tasks. (Teacher A)

This gives the students the possibility to choose for themselves what tasks to try out. It also gives them the possibility to try one easy task and one difficult. This prompted a follow-up question on how well Teacher A thinks this method has worked in their classroom to aid differentiation.

> I feel that this system of them choosing for themselves, more students choose difficult tasks and they choose more (tasks). (Teacher A)

This indicates that the method of letting the students choose for themselves promotes more learning and academic risk taking. Not only are the difficulty-levels of the chose tasks higher than normal, but also the number of tasks completed is increased. It is however unknown if this is just stronger students choosing to do more, or also weaker students participating.

5.3.2 Group work and interaction

While several teachers mentioned group and pair work, it is not described as a form of feedback. The students were not instructed to explicitly give feedback to each other. It is however clear that natural feedback is given to each other when working together. When asked about how much working together is emphasized in their classroom, teacher A answered as follows:

> In math, you can always work in pairs or groups. I encourage them to always work together, and we talk about how you tend to get much further

> when you discuss mathematics. It's very rarely that I find that working alone works better. (Teacher A)

This discussion-element of mathematics is an important aspect according to the interviewed teachers. It is an opportunity to figure things out together and help each other. When students work together, it often leaves more time for the teacher to help, because they don't have to come up to each individual student that is stuck on a task. Teacher D also mentions this:

> And, that they sit in small groups and in a way take responsibility to help each other. (Teacher D)

After a follow-up question regarding the time-saving aspect of letting students work together, Teacher D elaborated by saying that:

> In a way, children are often very good at explaining things to each other, and they might be able to explain in a way that their friend understands more quickly than if I were the one to explain. Then they also don't need to wait so long for help, when they already get help from their partner. (Teacher D)

Similar thoughts were expressed by the other teachers. Giving some of the responsibility to correct each other and find solutions, away to students, can be a positive for the teacher. They can give feedback to groups of students, instead of individual students. The feedback they provide feel less directed at one specific person. It gives an opportunity for students to hold each other accountable. Teacher C explains it by saying:

> I have certain situations where they're supposed to work in pairs, or sometimes the textbook specifies that they should work in pairs. In those cases, they're not allowed to move to the next step before they agree on an answer. (Teacher C)

Teacher C does however further explain that how the pair- or group-work works depends on the age of the students. Younger students might not be given the opportunity or responsibility to correct other students. This seems to imply that older students can be given more responsibilities when it comes with correcting or giving feedback.

> Maybe they work together to come to the correct answer. But with younger students, I don't really have them correcting each other. (Teacher C)

Where the line of "too young" to correct a peer's work lies, remains unclear. It is also not something that every one of the interviewed teachers agreed on. Teacher D expressed in their interview that they like it when even first-graders are involved in correcting each other's work. They described it as the following:

> Well, with the first graders, they sit in groups of three and when they have homework, I tell them to put their books together and compare how they have solved the tasks. And then if they notice that they have different answers, they should ponder together to see what it should be. And how can they figure out what the right answer is? (Teacher D)

This suggests that there is a certain amount of variability within the teacher-community on how to handle peer-to-peer feedback.

5.4 Classroom culture

Something that is all-encompassing in school is classroom culture. The angle that is analysed in this thesis is how students compare themselves in the classroom, respond to feedback and how the teachers convey feedback to the students' parents or guardians.

5.4.1 Comparison and communication with the home

Comparison is an unavoidable part of life and possibly nowhere is it more prevalent than at school. As the teacher is the authority figure in the classroom,

most students want to get praise and good feedback. When they notice differences in how and who the teacher is giving feedback to, they might start even subconsciously analysing the reasons for it. Some teachers decide to use online platforms to communicate feedback to the students. This feedback is also seen by the students' parents or guardians, which adds a separate layer to feedback. Teacher B emphasizes how some students are more prone to comparing their own results with other students results:

> They shouldn't compare themselves with others, because that is something that happens quite easily with certain students. (Teacher B)

This comparing behaviour is something that comes up in different ways during the interviews. When asked what the students tend to compare with each other, Teacher B clarifies:

> They start comparing test results, and when working during the lesson, it can easily become like 'I finished these pages before you'. You try to avoid that. (Teacher B)

This answer indicates that some students can get competitive during the lessons. Not only are objective test results a target for comparison, but also the speed at which work is finished in the classroom setting. Some of the teachers focus on giving test results to students to bring home, instead of focusing on them too much in the classroom. This gives the students less of a chance of comparing results with each other.

> It's also that they are sent home, the tests, so it's also a type of communication with the home. Here is where the (students) skills/knowledge is now. (Teacher B)

When asked about how they tend to communicate with the home, Teacher D explains that there are several ways in which they let students' parents and guardians know what's going on in the classroom.

> We have a weekly newsletter and where I can write, not necessarily every week, about what we have worked on and which strengths/skills we have worked on, and how the work has been going in class. (Teacher D)

A follow-up question pertaining to how they deal with situations where a specific student has a more immediate problem or need, Teacher D clarified:

> If there were something, especially about a specific student, that I became really concerned about, then of course I would call home. (Teacher D)

Teacher D seems to want to contact the home to both bring them up to speed with something concerning the student, but also to keep such issues more private. When asked about how often they contact the home, or make calls regarding students' progress or behaviour, Teacher D said that it's not very frequently.

> If everything is going well, then you don't hear much from school. (Teacher D)

As the teachers discussed how students compare their results and successes with each other, a new question popped up. The questions posed was if the students were ever given an opportunity to give each other feedback. Teacher A answered as follows:

> One helps the other and explains something. (They) don't directly give feedback. (Teacher A)

Teacher A talks about how students can work together during the lessons, but that peer-feedback is not something that is commonly done. Teacher C also had a similar response to the question of students giving feedback to each other. They however emphasized the age of the students in their answer:

> Not really with the younger students. (Teacher C)

This implies that peer-feedback is something that feels more realistic with older students. Teacher B continues by explaining how they communicate with students about some more sensitive topics that could generate negative interactions in the classroom.

> Then if there has been a big drop, I can sometimes take the students to the side and discuss. Did this topic feel very difficult, where you having a tough day, or what are you thinking about regarding the test? How did it feel? (Teacher B)

By having difficult discussions privately, teacher B gives the student a moment to reflect without other curious students listening in. Especially when a student receives negative feedback, can they feel ashamed if others in the classroom also hear about it.

5.4.2 Student responses and sensitivity to feedback

All students are individuals, as are the teachers teaching them. This leads to the topic of how different students act and react in class. How teachers adapt their feedback to different students was already discussed, but that leaves the question of how students react to feedback. There is a lot of differences between students. The same student might also differ between teachers and days. The bigger changes tend to happen from year to year, as children grow older and their sense of self develops. The topic of age was already briefly mentioned, but Teacher C brings it back up when saying that:

> The younger they (the students) are, the better they may receive that feedback because it is not like they have done anything wrong. (Teacher C)

An incorrect answer does not automatically define the student or their knowledge. Getting things wrong are a normal, and even essential part of learning. This indicated that when students get older, they get more self-conscious and might

take feedback more personally. To clarify what Teacher C meant by their statement, a follow-up question was posed. Teacher C clarified by saying that:

> I almost think they are easier because they are more receptive. First and second graders think it's fun to come to school. The first graders' favourite subject is math and PE. (Teacher C)

This indicated that the excitement that some younger students seem to have towards school lessens with the years. This difficulty and insecurity that older students often exhibit is not solely due to their age. Because mathematics in fun, they are more eager to receive feedback and learn. Teacher C mentions the students' knowledge and perceived skills as another factor in how they receive feedback.

> But then you might notice if it's a student who is weak in that subject, they can become very insecure and not understand what they are supposed to do. Whereas a student who is strong in the subject might receive the feedback a bit better. (Teacher C)

Comparison might be one of the reasons students become insecure about feedback. Teacher B brings up this as a reason for why they in specific circumstances try to refrain from giving verbal feedback, so that others in the classroom don't hear it. They say:

> If there is any student who has big differences, e.g. if there are any students who have been really good, usually I don't usually say it in the Class. (Teacher B)

Hearing others get praise from the teacher, whilst themselves struggling, can be a difficult experience. It can prevent the student from asking for advice or help, as that exposes them as someone who doesn't know, or isn't worthy of praise. That is a painful feeling that can accumulate throughout the years, leading to uninterest in mathematics as a subject.

Another subject that was brought up during the interviews was the other end of students that find mathematics easy and/or fun. They might get their work done faster than others and find less challenge in the books provided. Interestingly these discussions often circled back to being conscious of the students that struggle more. Teacher A put it as follows:

> There are students who you know feel good when they are challenged. They are pushed by it. And then there are those that you need to encourage/bring up instead. (Teacher A)

Teacher A was not the only one who brought up this other end of the spectrum. Teacher D also brings up how wide the differences between student can be.

> I adapt a bit depending on the situation, and that some students may need more encouragement, while others are constantly super motivated and just want to keep doing more and more and more. (Teacher D)

Several teachers mentioned extra pages in the books that are meant to challenge, and that those are popular with the stronger students. This does however bring up how often good work is rewarded with more work. In the instance where a student loves mathematics and wants to be do more, this is a fantastic way of giving them something to do and try out. A good attitude and interest in learning indicate that the teacher can ramp up the difficulty and provide the student with new, engaging work. There is also the fact that the extra problems on the extra pages might be more interesting than the main work. Somebody who struggles more, or is a slower solver, might never get to try those exercises. Not getting to do extra work also indicated to the student that they are slower or worse at the subject, which can lead to different emotional reactions. Finding a balance seems to be most important.

When asked about how students outwardly express their opinions in class on how they are doing and how they find their work to go, Teacher C said the following, whilst smiling:

> If you were to ask them how good they are at mathematics, everyone would answer ‘I’m very good’, and that’s that. And I think that’s great and they’re allowed to think that. (Teacher C)

Teacher C was not the only one who expressed similar thoughts in response to questions on self-assessment. It is not possible to be sure of if the student’s expressed thoughts are their actual beliefs or a way for them to not critically reflect on their own beliefs. The latter might indicate that they are uncomfortable communicating how they are feeling in the classroom. Teacher C:s demeanour does however indicate that the students are feeling positive about their learning.

6 Validity

This research was done in accordance with TENK: s (2023) research integrity guidelines. It has been conducted with diligence and accuracy in every step of the research process. All articles and material read and used in the thesis were correctly referenced.

6.1 General research ethics

For the interviews to be possible, research permits were necessary. The permits were provided by the municipalities that had the schools that were agreeing to participate. Both the headmaster and teachers were informed of the study and the voluntary nature of it. Each interviewee also got reminded of the purpose of the study before the interview, as well as their right to back out of the study at any moment.

The names of the participants were anonymised to make it as hard as possible for anybody to recognise the person in question. The participants were given the names Teacher A, B, C and D. The letter behind the word Teacher was given randomly, without a clear pattern or reason.

Extra care was put into the security and sensitivity of the material and personal information collected during the study. The personal data collected during the making of this thesis was stored securely on devices locked with passwords. Nobody but the author of the thesis had access to sensitive information regarding the interview participants. All personal information pertaining to the interviewees was deleted from the devices as soon as the interview was transcribed and analysed. The quotes used in this study were directly from the interviewees and accurately translated into English from Swedish. The original Swedish quotes are saved as an appendix to further bring trustworthiness to this thesis.

The validity of this study is strengthened by following the guidelines for research integrity (TENK, 2023).

6.2 Research ethics and AI use

Artificial intelligence (AI) was used as a support tool during the thesis writing process in accordance with the university of Helsinki's guidelines (University of Helsinki, 2025). AI was used as a brainstorming tool when trying to come up with good ideas for the theoretical background as well as a support when restructuring the thesis outline. ChatGPT 5.5 was used for brainstorming and for structural support from March to May of 2026. Microsoft Copilot and ChatGPT were also used as a helpful tool when translating the original Swedish quotes into English, although the final translation was always checked, finished and/or corrected by the author. ChatGPT version 5.5, 4 and the step-down lighter version were used in Spring 2026 for translating. No sensitive or confidential information was fed into the tool, and no part of the thesis was ever submitted to an AI-tool. AI did not replace the authors writing or analysis and the final content of the thesis is the work of the author.

6.3 Research limitations

There are limitations to this study due to a few different factors. One of the factors is the small sample size of interviewees. A sample of four teachers were chosen to be interviewed. A larger sample size could provide a wider and more generalised view on how teachers provide feedback to their students.

Another limiting factor is the location and language of the teachers/schools. This research uncovered something about teachers in Swedish speaking schools in Southern Finland. The results can however not be generalized for all teachers in Finland, let alone outside of Finland. This thesis focused solely on the teacher's perspective, but it could be widened to include other staff, students and parents.

7 Discussion

The purpose of the study was to find out how primary school teachers teaching in Swedish speaking schools in Southern Finland give feedback to their students in mathematics. The first research question focused on how the teachers provided feedback to their students. The other research question focused on how they involved their students in the feedback process. In the theoretical background I focused on describing what feedback is and how it's utilized in the school environment. The theoretical background also delved into some mathematical theories that were found to be relevant to the nature of this study.

The study involved interviewing four teachers and getting their perspective on the topic. The transcribed interviews got analysed thematically, resulting in four main themes and ten subthemes. Within the themes there were codes that build up the subthemes and larger themes. In this chapter I will discuss the conclusions of the analysis as well as how it relates to the larger question of feedback in school. Finally, some suggestions for future research will be made.

This discussion doesn't use the analysed themes as headings, instead they were combined into three main points that describe the results well. This was done to better understand how the results reflect what previous theory has said about the subjects, as well as how the results might be implemented in real life. The headings used are "Feedback and it's close connection to tasks", "How teachers use their judgement" and "Fostering mathematical understanding".

7.1 Feedback and it's close connection to tasks

The analysis of the results seems to suggest that a lot of the feedback given by teachers is task-dependent and focused on specific exercises. A part of this process was guiding students to the correct answer. This connects to Hattie and Timperley's (2007) levels of focus of feedback. The feedback focuses on how well students solve problems and complete tasks.

It is also imperative to remember that task-oriented feedback has limitations and that it's also important to provide feedback on strategy (Fyfe et al., 2014). Students, especially in mathematics, can easily arrive at the right answer using the wrong strategy. Giving feedback on strategies hopefully helps with this aspect and provides deeper understanding.

The result of my analysis seems to suggest that task-oriented feedback was a common method of providing feedback in the classrooms of the teachers interviewed. Its value was however dependent on how it impacted the students. Did it only correct their answer or also provide deeper understanding on the problem? The teachers emphasized how encouraging the students was important. It would be interesting to see how much the need to give positive feedback impacted the amount of other type of feedback the students received.

7.2 How teachers use their judgement

The interviewed teachers participated in this study described several ways in which they provide feedback to their students as well as different forms of feedback. They were aware of how feedback had to be adapted to the individual students' needs and situations. This suggests that an important part of giving feedback to students is the teachers professional judgement. It is ultimately up to the teacher how feedback is given and why.

Hattie and Timperley's (2007) study on the levels of feedback can be related to the results of the analysis. Although the four levels of focus are quite clearly defined and serve different purposes, the reality can be different. The results seem to suggest that a teacher can both correct a student's work and give suggestions on strategy whilst still providing encouragement. In this situation, the teacher is touching upon several of the levels of feedback.

Even in instances of praise, they were often connected with feedback that was constructive. The praise could for example focus on the student's strategy or behaviour in the classroom. As Hattie and Timperley (2007) described feedback

on the self-level as less effective, the thought could be that praise is less important than other types of feedback. The results however seem to indicate that teachers found praise to be one of the most important types of feedback. They saw it as a prerequisite of building confidence and self-assuredness. The results reflect the goals set up in the national core curriculum (Finnish National Agency for Education, 2014) as well.

In their judgement, the teachers seemed to agree that peer-to-peer feedback wasn't as important as other types of feedback. The age of the students was mentioned as a limiting factor. They also didn't deeply mention much about self-evaluation. This indicates that the feedback process doesn't involve the students very much in an active way. They are more the passive recipient of feedback.

7.3 Fostering mathematical understanding

One of the interesting things to consider is if the feedback provided by the teachers supported only instrumental understanding, or if it also provided relational understanding (Skemp, 1978). Instrumental understanding refers to the understanding of knowing the rules and formulas, whereas relational understanding means that you understand the mechanics and connections of different mathematical ideas.

Teacher A mentioned in their interview how some students that have a harder time with mathematics, might do some strange accidental miscalculations. They said the following:

> Is that reasonable? Many (students) who have difficulty with mathematics just do and lose the thought behind it. If you had a hundred euros from the beginning when you went into the store, then it's probably a bit interesting that you come out with 370 euros. (Teacher A)

This could tie in quite cleanly with the theory of relational versus instructive understanding (Kemp, 1978). The student might have some sort of formula or

calculation that they used. There is however a large misunderstanding on why one should apply the formula or why that might not be the correct formula to use. If the student understood the mechanics behind the mathematics, they might have been able to catch the mistake earlier.

Some of the feedback provided by the interviewees seemed instrumental in nature. This was a natural result, in my opinion. A large part of mathematics is about correct answers, so it seems obvious that a lot of the feedback would be geared towards it. It also serves its purpose, as it's fast and easy to do. It is also a way for teachers to give feedback to more students during lesson-time, as this form of feedback can be given quickly to many students at a time. There was however also relational feedback given when teachers asked the students clarifying questions or asked them to elaborate on their strategy. This indicates that teachers utilize both instrumental and relational feedback and understanding in their teaching.

Fostering mathematical understanding is also connected to the national core curriculum (Finnish National Agency for Education, 2014) as it frequently mentions the importance of problem-solving skills and mathematical confidence. We can therefore conclude that mathematical understanding is at least as importance as task completion.

7.4 Future research

This thesis has focused on teachers' perspectives on how they provide feedback to students in the classroom. Because of the smaller sample size and the nature of the study, there is a lot of opportunity to do continued research.

One aspect that was mentioned but not delved too deeply into was how feedback methods etc change with experience. A quantitative study using forms sent to several schools could yield an interesting array of answers. One variable that would need to be controlled for would be how many years a teacher has been teaching, and previous job experience. Somebody might have worked as a

teacher in elementary school for two years but worked teaching adults for a decade before that. Seeing how teachers' previous experiences shape their teaching and how they give feedback could provide a new perspective to the field of teaching and feedback.

Continued research could also be done from the student's perspective. It could be done as an observation where the researcher is in the classroom, observing the interaction between students and the teacher. Another method would be to interview students directly. This would broaden the field of research and bring a new perspective to what has already been analysed in this thesis.

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Appendices

APPENDIX 1 An email that was sent to a headteachers of a school. The same or similar mails were sent to other cities in Southern Finland.

Hej,

Jag heter Sabina Siren och är sista årets klasslärarstuderande på Helsingfors universitet. Jag håller på med min pro-gradu som handlar om hur klasslärare ger respons till elever i matematik. Min insamlingsmetod är intervjuer och jag hoppas att intervjua 4-6 klasslärare som jobbar i svenskspråkiga skolor i

Jag skulle gärna intervjua en eller ett par klasslärare från din skola och jag kommer gärna på plats till skolan eller istället kan vi mötas via teams/zoom eller dylikt. Studien kommer att genomföras med respekt för lärarnas integritet och tidsbegränsningar. Intervjuerna hålls förhoppningsvis i Februari.

Forskningslovet ska skickas in så snabbt som möjligt och jag måste därför fråga såhär preliminärt om ni möjligtvis skulle vara intresserade. Då kan jag skriva in er skola som en forskningsenhet och skicka in forskningslovet. Vi kan sen efter det göra tydligare planer gällande vilka klasslärare som vill ställa upp, och de har såklart då rätten att ändra åsikt gällande deltagandet! Jag skickar då även en mera genomgående förklaring på forskningen som kan skickas vidare till alla klasslärare eller enbart de som är möjligtvis intresserade.

Om du behöver ytterligare information eller vill diskutera detta närmare, är du välkommen att kontakta mig via epost eller telefon. Tack för din uppmärksamhet i denna fråga, och jag ser fram emot att höra från dig! ☺

Mvh,
Sabina Siren

APPENDIX 2 The original transcribed Swedish quotes as well as the English translations

Subtheme	Original Swedish quote	English translation
5.1.1 Classroom goals	Under lektionen handlar det mycket om att jag vill uppmuntra dem som jag vet att har det tungt och nog allmänt alla. Jag vill uppmärksamma när de gör bra ifrån sig.	During the lesson it is largely about encouraging those that I know are having a hard time, and generally everyone. I want to acknowledge when they do well.
5.1.1 Classroom goals	Målet är att du ska nämna fyra olika geometriska figurer och ditt andra mål är att du ska kunna ge arbetsro. Så våra mål är inte enbart det där som är på själva matten, utan kanske mera förhållningsätt.	The goal is to name four different geometric shapes och your other goal is to maintain a silent and calm working environment (*arbetsro* in Swedish). So out goals are not only the mathematics, but maybe more about approach.
5.1.1 Classroom goals	Du ska kunna samarbeta med ditt par. Jo, mål från matten (läroplan) men inte bara.	You must be able to work with your partner. Yes, goals from mathematics (National curriculum) but not solely.
5.1.1 Classroom goals	Jag har några mål skulle jag säga. Dels liksom handledande respons så att de vet liksom att de är på rätt väg sedan. Sen också det där, att om jag ser att någon inte riktigt tror på sig själv, så då liksom att att uppmuntra. Ja, och sen bekräfta att hur det går liksom.	I have a couple of goals, I would say. Partly to give guiding feedback so that they (students) know that they are on the right track. Then also, if I notice that someone doesn't really believe in themselves, to encourage. And, to confirm how it's going.
5.1.2 Formative intentions	Aldrig har man tillräckligt med tid och aldrig satsar man tillräckligt på det. Det är helt klart att ibland gömmer man sig också bakom att man inte har tid. De flesta saker kan man arrangera tid för om det är så att man behöver. Så det är säkert mera en attitydfråga. Jag kanske inte tar tillräckligt med tid.	You never have enough time, and you never invest enough time for it (feedback). It's obvious that you sometimes hide behind not having time. You can arrange time for most things if it's necessary. So, it's probably more of a question of attitude. Maybe I don't take enough time.
5.1.2 Formative intentions	Är det rimligt? Många som har svårt för matematik tappar det där att dåm bara gör och tappar tanken bakom det. Om du hade hundra euro från början när du gick in i butiken, så nog är det ju lite spännande att du kommer ut med 370 euro.	Is that reasonable? Many (students) who have difficulty with mathematics just do and lose the thought behind it. If you had a hundred euros from the beginning when you went into the store, then it's probably a bit interesting that you come out with 370 euros.

5.1.2 Formative intentions	Om det är en situation där alla sitter och jobbar så kan jag ge sådan feedback att “nu sitter ni alla duktigt”.	If it's a situation where everyone is sitting and working, I can give such feedback that "now you're all sitting well".
5.1.2 Formative intentions	Under lektionen är min feedback ofta liksom uppmuntrande. Det är stöd och det är uppmuntring.	During the lesson, my feedback is often kind of encouraging. It's support and it's encouragement.
5.1.2 Formative intentions	Jag är Kanske inte den läraren som under lektionerna sager att ‘Hej, det där är fel. Det där är fel’, utan jag brukar gå runt och säga mera att ‘Vi tittar lite på den här uppgiften. Är den som de ska?’	I’m maybe not the teacher that goes during the lessons and says: “Hey, this is wrong, that is wrong”. Instead, I tend to walk around and say something like: “Let’s look at this problem a little bit. Is it as it should be?”
5.1.2 Formative intentions	Så att de själva sedan räknar liksom på nytt och upptäcker att, OK, det hade inte blivit rätt den här första gången, men nu lyckades de den där andra gången.	So that they themselves (students) then sort of count again and discover that, OK, it hadn't turned out right this first time, but now they succeeded that second time.
5.1.2 Formative intentions	Så kanske att ge feedback är att de själva ska försöka på nytt utan att känna att de har gjort fel.	So maybe giving feedback is for them to try again without feeling that they have done wrong.
5.1.2 Formative intentions	Jag hinner ju inte liksom ge hela tiden en respons till alla såklart. Det hinner ingen, men just att man går runt och visar att man har sett.	I don't have time to give feedback to everyone all the time, of course. No one has time but just walking around and showing that I’ve seen (them).
5.1.3 Correction and mathematical accuracy	Jag vet inte, samtidigt så upplever jag att de yngre eleverna tar ju gärna hjälp. I lägre klasser är det kanske inte en sådan stämpel.	I don't know, at the same time I feel that the younger students are happy to receive help. In lower classes, it may not be such a label.
5.1.3 Correction and mathematical accuracy	Och sen samtidigt när de får jobba i par och grupp, så det kan vara att det inte blir så utpekande för den där ena.	And then at the same time when they get to work in pairs and groups, so it may be that it is not so indicative for that one student.
5.1.3 Correction and mathematical accuracy	För tillfället så har jag så att eleverna får gå rätta, jag har liksom facit på min dator så de får rätta därifrån så att de ska kunna se att det är rätt för att jag helt enkelt inte hinner rätta för dem alla. Det är inte ultimat, för sen vet jag inte om de förstår det som de rättar och jag vet inte ens om de rättar rätt, men att I	Right now, the students can go correct their own work. I have the results on my computer so that they can correct from there (…) because I simply do not have time to correct for all of them. It's not ultimate, because then I don't know if they understand what they're correcting and I don't even know if they're correcting correctly, but that at least they

	alla fall så har de någon koll. Det brukar gå helt bra.	have some control/knowledge. It usually goes quite well.
5.1.3 Correction and mathematical accuracy	Ja, det är oftast textuppgifter som de fastnar på. Så ibland kan det riktigt bara räkna med att man läser uppgiften inledningsvis för att de är svaga läsare, men bara för att det klickar på ett annat sätt när de får höra den där uppgiften. Och sen brukar jag betona de där liksom viktiga orden i textuppgifterna och vilka tal de ska ta tag i.	It's often text-based problems that they (students) get stuck on. So sometimes it's enough to read the question initially for the weaker readers, just because it might help it "click" better when they hear the problem out loud. I also like to emphasize the important terms and numbers they need to focus on.
5.1.3 Correction and mathematical accuracy	Under tiden så går jag omkring, följer med hur de räknar, rättar om jag sen går fel uppmuntrar och och stödjer och tar tag i såna som verkar ha fastnat lite.	In the meantime, I walk around, follow how they count, correct if I then go wrong, encourage and support and grab those who seem to be stuck a bit.
5.1.3 Correction and mathematical accuracy	Som sagt då är du kanske inte så snabb på att peka vad som är fel.	That said, you may not be so quick to point out what is wrong.
5.2.1 Oral feedback and instruction	Man inte gör det tillräckligt individuellt. Det handlar mera om sin egna inställning och ta den där tiden och verkligen satsa på det. Sen blir det ju det där att man lätt tar det där provena, alla har samma prov, så går man igenom och så blir det där.	One doesn't do it enough individually. It's more about one's own attitude to taking the time and actually investing in it. And then there's the fact that you easily bring up the tests, everyone has the same test, and they you go through it and that's how it ends up being.
5.2.1 Oral feedback and instruction	brukar jag inte under lektionstid prata att att liksom hur det går utan det är mycket fokus på den där uppmuntran och det där att att de ska fortsätta öva och sådär	I usually don't talk about how it's going during the lesson. Instead, there is a lot of focus on encouragement and on the fact that they should keep practising and so on.
5.2.1 Oral feedback and instruction	Oftast brukar det börja, om det är liksom något riktigt nytt, med att titta på boken tillsammans. Vi går igenom, är det nya mått, är det någo nya räknesätt? Liksom logiken bakom det. Jag kan rita bilder på tavlan för att förtydliga någonting, fråga exempel.	Usually, if it's something completely new, it starts with looking at the book together. Vi go through whether there are new measurements or new calculation methods. The logic behind it. I can write pictures on the board to clarify something, ask for examples.
5.2.1 Oral feedback and instruction	Det blir nog mera muntligt, skulle jag säga.	It ends up being more verbal, I would say.

5.2.1 Oral feedback and instruction	Ja som lågstadielärare så måste du kanske lära dig att du kan inte bara förklara en uppgift på ett sätt. Du kan inte förklara en uppgift på två sätt och så kanske jag har tre olika sätt.	Yes, as a primary school teacher you need to learn that you can't just explain a task in one way. You can't explain it in two ways, so maybe I have three different ways.
5.2.2 Tests, evaluations and assessments	Vi har nog traditionella prov efter varje kapitel. Jag brukar inte sätta tid på att gå igenom läxor, utan dom anmäler åt mig om de inte har gjort det, om det finns någonting de vill fråga, absolut fråga!	We have traditional exams after each chapter. I don't usually spend time on going through the homework. Instead, they (students) report to me if they didn't do their homework. They can absolutely ask if they have any questions!
5.2.2 Tests, evaluations and assessments	Och så har vi jätte tätt i stället proven. Och det vet eleverna, dom är inte för att jag kollar de, utan det är för att jag kollar mig. Jag kollar min undervisning. Är det någonting som vi behöver ta på nytt?	We instead have tests very often, and the students know that. They (tests) are not to check them, but instead to check me. I'm checking my teaching. Is there something we need to go over again?
5.2.2 Tests, evaluations and assessments	Prov handlar ju mera sen om eleverna själva ska få se hur de klara av, så den sortens feedback är för de matt se vad de kan göra, I och med att de inte får hjälp under provet.	Tests are more about students themselves seeing how they're doing (in mathematics). So that form of feedback is for them to see what they are capable of, as they cannot get outside help during a test.
5.2.2 Tests, evaluations and assessments	(Proven) är också för bedömningen för slutåret. De hänger liksom ihop.	They (tests) are also for the final evaluations. They are connected.
5.2.2 Tests, evaluations and assessments	I matteprovet, så då ser du tydligt vad som är rätt och vad som är fel. Redan den feedbacken under matten är ju annorlunda, så att säga.	In mathematics tests you can clearly see what is right and what is wrong. That type of feedback is already different (from other forms of feedback) during mathematics, so to say.
5.2.2 Tests, evaluations and assessments	Men just när vi har matteprov så är det ingenting vi övar till, utan vi tar det efter varje kapite. Jag brukar alltid förklara för eleverna att provet är inte för att jag ska se hur manga fel eller rätt du hade, utan det är för att jag ska kunna se att "ok, nu hade jättemånga fel på den här uppgiften", då är det någonting som jag inte har kunnat lära ut.	But just when we have mathematics tests, it's nothing we practice for, but we take them after each chapter. I always tend to explain to the students that the test is not so that I can see how many (answers) you got wrong or right. Instead, it's so that I can see "Ok, so now many students got this problem wrong", then it's something that I was not able to teach properly.

5.2.2 Tests, evaluations and assessments	Det är mera för min skull som vi har proven.	It's more for my sake that we have tests.
5.2.2 Tests, evaluations and assessments	Med de äldre som har prov och så där så de liksom får ju provvitsord på Wilma så här, men med de här yngre så när de nu inte ännu har liksom prov och sådant. Att vi jobbar med vad vi jobbar i skolan och sen har de lite hemuppgifter och sådant.	With the older ones (students) who have tests and such, they for example get their test scores written in Wilma. But the younger ones don't have tests and instead we work on what we work on at school, and then they have some homework and things like that.
5.3.1 Adapting feedback to differences	Jag upplever att ännu i de lägsta klasserna tycker de flesta att matte är ett av de roligaste ämnena som finns och jag tror det handlar mycket om det där att det är ganska lätt för många ännu. Det är färre som det är svårt för. Skillnaderna blir större och större.	I feel that in the lower grades, most students still find mathematics to be one of the most fun subjects, and I think that largely has to do with the fact that it is still relatively easy for many. There are fewer students who find it difficult. However, the differences become greater and greater.
5.3.1 Adapting feedback to differences	Ofta fyra uppgifter, och man måste välja alltid minst två. Jag brukar ofta presentera liksom att den här är svår och den här är lätt. Och då väljer de själva att vill de ha svåra uppgifter. Och det här är en som utvecklar ditt tänkande och så brukar jag liksom göra reklam för de här uppgifterna.	There are often four tasks, and you (students) must always choose at least two. I often present them by saying that 'this one is difficult' and 'this one is easy'. Then they choose for themselves if they want the difficult tasks. 'And this is one that develops your thinking' and so on, I usually kind of advertise these tasks.
5.3.1 Adapting feedback to differences	Jag upplever att det här systemet med att de väljer själv så, fler elever väljer svåra uppgifter och de väljer fler.	I feel that this system of them choosing for themselves, more students choose difficult tasks and they choose more.
5.3.1 Adapting feedback to differences	Utgå från eleven.	Start from the student.
5.3.1 Adapting feedback to differences	För starka elever ska man säga att fundera lite mera på den där uppgiften, medan en svag elev så kanske du måste sätta dig bredvid den, att 'hej, det här fältet ser lite tokigt ut här, ska vi fundera lite tillsammans'.	For stronger students, you should tell them to think more about that task, whilst for a weaker student you might have to sit next to them and say "Hey, that answer box looks a bit silly, shall we think about it together?"

5.3.1 Adapting feedback to differences	Man gör kanske lite mera tillsammans med en svag elev, medan en stark elev så vet man att den kommer att märka det själv.	You maybe do a bit more together with a weak student, whilst you know a stronger student will notice it themselves.
5.3.2 Group work and interaction	Matte får man alltid jobba i par eller grupp. Jag uppmuntrar att hellre jobba tillsammans alltid, och vi pratar om det där att när man pratar matematik så kommer man ofta mycket längre. Ytters få gånger jag upplever att det blir bättre på att sitta för sig själva.	In math, you can always work in pairs or groups. I encourage them to always work together, and we talk about how you tend to get much further when you discuss mathematics. It's very rarely that I find that working alone works better.
5.3.2 Group work and interaction	Jag har visa tillfällen när man ska jobba I par, eller jag har ibland I böckerna, att I boken ska man jobba tillsammans med sitt par. Där får man inte gå vidare före man är översens om svaret.	I have certain situations where they're supposed to work in pairs, or sometimes the textbook specifies that they should work in pairs. In those cases, they're not allowed to move to the next step before they agree on an answer.
5.3.2 Group work and interaction	Kanske de jobbar liksom tillsammans och jobbar tillsammans för att komma fram till rätt svar. Men med de här yngre har jag nog inte så mycket att de rättar och varandra.	Maybe they work together to come to the correct answer. But with younger students, I don't really have them correcting each other.
5.3.2 Group work and interaction	Men med ettorna och så har vi också så att de sitter då i tre personers grupper och sedan när de har haft en hemuppgift så då liksom säger jag att böckerna ihop och så jämför ni liksom att hur har ni löst uppgifterna och sedan att om ni ser att ni har lite olika svar så fundera tillsammans så att vad vad ska det få det vara? Och hur kan man liksom ta reda på att vad svaret är?	Well, with the first graders, they sit in groups of three and when they have homework, I tell them to put their books together and compare how they have solved the tasks. And then if they notice that they have different answers, they should ponder together to see what it should be. And how can they figure out what the right answer is?
5.3.2 Group work and interaction	Och så här att de sitter i små grupper och liksom de har som ansvar att hjälpa varandra.	And, that they sit in small groups and in a way take responsibility to help each other.
5.3.2 Group work and interaction	På något sätt så är barn jätteskickliga att förklara saker för varandra ofta och de kanske förklarar på ett sådant sätt att att kompisen fattar snabbare än om jag förklarade. Då behöver de ju inte heller vänta så länge på hjälp när de får hjälpren liksom av av sitt par.	In a way, children are often very good at explaining things to each other, and they might be able to explain in a way that their friend understands more quickly than if I were the one to explain. Then they also don't need to wait so long for help, when they already get help from their partner.

5.4.1 Comparison and communication with the home	Nån hjälper den ena och förklarar nånting. Att inte kanske direkt ger respons. (I respons till fråga om elever ger respons till varandra)	One helps the other and explains something. (They) don't directly give feedback.
5.4.1 Comparison and communication with the home	De ska inte jämföra sig med varandra, för det är sånt som händer ganska lätt med visa elever.	They shouldn't compare themselves with others, because that is something that happens quite easily with certain students.
5.4.1 Comparison and communication with the home	Att dåm börjar jämföra provresultat, och också när de räknar under lektionstid, så är det lätt sådär att 'jag räkna de här sidorna snabbare än du', man försöker undvika sånt.	They start comparing test results, and when working during the lesson, it can easily become like 'I finished these pages before you'. You try to avoid that.
5.4.1 Comparison and communication with the home	Det är ju också nog att de skickas hem, de där proven, så det är också en kommunikation med hemmet. Här är kunskapen nu.	It's also that they are sent home, the tests, so it's also a type of communication with the home. Here is where the (students) skills/knowledge is now.
5.4.1 Comparison and communication with the home	Sen om det har varit ett stort nedhopp så kan jag ibland ta eleverna till sidan och diskutera, att kändes just det här temat jätte svårt, hade du en tung dag då, eller vad funderar du kring provet. Att hur kändes det?	Then if there has been a big drop, I can sometimes take the students to the side and discuss. Did this topic feel very difficult, where you having a though day, or what are you thinking about regarding the test? How did it feel?
5.4.1 Comparison and communication with the home	Inte egentligen med de yngre eleverna.	Not really with the younger students.
5.4.1 Comparison and communication with the home	Vi har då veckobrev och där kan jag skriva så det allmänt inte varje vecka, men alltså där att att jag kan skriva liksom just att att vad vi har jobbat med och vilken styrka vi har jobbat med och och hur liksom arbete har har liksom fungerat i klassen.	We have a weekly newsletter and there I can write, not necessarily every week, about what we have worked on and which strengths/skills we have worked on, and how the work has be going in class.
5.4.1 Comparison and communication with the home	Om det skulle vara någonting, särskilt med någon viss elev så där att jag skulle bli jätte sådär fundersam så då ska jag såklart ringa hem	If there were something, especially about a specific student, that I became really concerned about, then of course I would call home.
5.4.1 Comparison and	Om allt flyter bra så hörs det inte så mycket från skolan.	If everything is going well, then you don't hear much from school.

communication with the home		
5.4.2 Students responses and sensitivity to feedback	Det finns ju elever som man vet att mår bra när de utmanas. De pushas av det. Och sen finns det dihär som man faktiskt behöver istället lyfta.	There are students who you know feel good when they are challenged. They are pushed by it. And then there are those that you need to encourage/bring up instead.
5.4.2 Students responses and sensitivity to feedback	Om det är någon elev som har stora skillnader, t.ex. om det är någa elever som har varit jätteduktiga så oftast brukar jag inte I Klassen kanske säga det.	If there is any student who has big differences, e.g. if there are any students who have been really good, usually I don't usually say it in the Class.
5.4.2 Students responses and sensitivity to feedback	Om du skulle fråga dem hur bra de är på matte så skulle varenda en svara att 'jag är jättebra', och det var det. Och det tycker jag är jättebra och det får de tycka. (med leende) (I respons till om eleverna gör självbedömning)	If you were to ask them how good they are at mathematics, everyone would answer 'I'm very good', and that's that. And I think that's great and they're allowed to think that.
5.4.2 Students responses and sensitivity to feedback	Ju yngre de (eleverna) är, desto bättre kanske tar de emot den där feedbacken för att det inte so att de har gjort någonting fel.	The younger they (the students) are, the better they may receive that feedback because it is not like they have done anything wrong.
5.4.2 Students responses and sensitivity to feedback	Men sen märker man kanske om det är en elev som är svag i det ämnet, så den kan ju bli jätte osäker och inte förstå vad den ska göra. Medan en elev som kanske är stark I ämnet, så den kanske tar emot feedbacken lite bättre.	But then you might notice if it's a student who is weak in that subject, they can become very insecure and not understand what they are supposed to do. Whereas a student who is strong in the subject might receive the feedback a bit better.
5.4.2 Students responses and sensitivity to feedback	Ja, jag tycker nästan att de är lättare för att de är mera mottagliga. Ettor och tvår tycker det är roligt att komma till skolan. Ettornas favoritämne är ju matte och jumppa.	I almost think they are easier because they are more receptive. First and second graders think it's fun to come to school. The first graders' favourite subject is math and PE.
5.4.2 Students responses and sensitivity to feedback	Jag anpassar lite beroende på, och sen just att någon kanske behöver mera uppmuntran medan någon är helt supertaggad hela tiden och liksom vill bara göra mer och mer och mer.	I adapt a bit depending on the situation, and that some students may need more encouragement, while others are constantly super motivated and just want to keep doing more and more and more.

APPENDIX 3 The original interview guide in Swedish

1. Hur ser en vanlig lektion ut i din matematikundervisning?
2. På vilka sätt integrerar du problemlösning och kritiskt tänkande i din matematikundervisning?
3. Vad är ditt mål med att ge feedback till elever i matematik?

4. Känner du att det finns en skillnad i sättet du ger feedback till elever i matematik versus något annat ämne?
5. Ger du mera feedback på elevens strategi eller resultat?
6. På vilka sätt brukar du informera eleverna om hur de klarar sig i matematik?
7. Hur hjälper du elever som fastnar på någon viss uppgift?

8. Hur balanserar du att berätta för eleven vad hen gjorde bra, men samtidigt hjälpa dem förbättra sig i matematik?
9. Vad har varit utmanande med att ge feedback till eleverna i matematik?
10. Hur hittar du tiden för att ge elever feedback?
11. Anpassar du feedbacken beroende på behoven hos individuella eleven?
12. Har du justerat hurdan/hur du ger respons beroende på elevernas ålder?
13. Har dina metoder ändrat under den tiden du har jobbat som lärare?

14. Finns det specifika verktyg eller metoder som du använder för att ge feedback till eleverna?
15. Vilka metoder har fungerat bra, vilka har fungerat mindre bra?
16. Hur avgör du om den feedback du ger hjälper eleverna nå de mål som du och de satt?
17. Involverar du eleverna i att bedöma hur de ligger till i matematik? Hur?
18. Har du eleverna ge varandra feedback? Hur i så fall?
19. Vilka faktorer har du upplevt påverkar hur eleverna tar emot och använder feedback?