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# Seeing the Kids – Seeing the Student Teachers; Dealing with Two Arenas the Whole Way

A Case Study of a Cooperating Teacher Mentoring First-year Student Teachers' Mathematics Teaching

Thesis for the degree philosophiae doctor

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Norwegian University of Science and Technology
Faculty of Social Sciences and Technology Management
Department of Education

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# Aknowledgements

The first time I heard about case studies and classroom research was when I, as a Master's or in Norwegian, a "hovedfag"s student attended a methodology course in qualitative research. As a teacher I immediately found this fascinating and this in turn amplified my nascent interest in research. Sigrun Gudmundsdottir introduced me to this way of doing research, and fortunately I came to know her both as my mentor and later as a collaborator in various projects. All through these years Sigrun encouraged me to continue my research interest and never doubted that I would undertake doctoral research. I asked Sigrun to be patient with me as I was waiting for the possibility of undertaking a really interesting project. This research text is the final result of such a research project, and even if I am responsible for it, there are many people to thank.

First of all I would like to thank Sigrun. When I finally began my research, she was able to follow my work for nearly one year as my mentor although she was seriously ill. But throughout the whole process I heard her voice and especially two sentences have guided me through the process; "remember to listen to your data" and "cut out the noise in your data". And in doing so I am glad to present the voice of a cooperating teacher, Sara. I am very thankful for the way she opened up her practice as both a teacher and a cooperating teacher in a way that hopefully will provide insight into the complex issue of mentoring student teachers' field experiences. I will give my thanks to Eric, Eli, Irene, Ina and Ian, the five student teachers. Without you I could not have carried out my research. I would also like to thank Arne and Gerd, two cooperating teachers, who also opened up their practice and took their time to collaborate with me. The insight I gained by working with them helped me to understand how to best carry out the collaboration with Sara and her student teachers.

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Trondheim, October 2006 Vivi Lisbeth Nilssen

# Contents

# Chapter 1
# Introduction

The heading of this research text, *Seeing the kids – Seeing the student teachers. Dealing with two arenas the whole way*, points back to how "Sara",[1] the research subject of this study, envisages her role as a cooperating teacher. As a classroom teacher for third graders Sara welcomes and opens her classroom to a group of five first-year student teachers. She expresses how she "in a way has two arenas the whole way" (int010303, p. 10). She explains this by pointing out that in mentoring the student teachers she has to be focused on the same things as them, namely the kids and their learning. At the same time she has to be focused on the student teachers' learning. Sara's understanding of her position contrasts with what Edwards and Collison (1996) report from a British study. They find that mentors do not regard their classroom to be a place where student teachers can learn by taking risks. Furthermore, student teachers rarely see themselves as learners in classrooms full of pupils. They are eager to be seen and act as competent practitioners. Mentors contribute to this view because they are eager to help student teachers deliver curriculum and carry out lessons smoothly. These mentors (or cooperating teachers) most probably coach by observing student teachers' performances, detecting errors and correcting them (Schön 1987).[2] Such coaching fits the student teachers' view of learning to teach; they need to train and get feedback from the cooperating teacher. Thus the practice field becomes an arena for training, and according to Edwards and Collison (1996), this preserves conservatism in schools. This study is one of several sources for my research interest.

The background for my study has developed from various sources; my occupational background, experiences and reading of literature. I am now employed in teacher education where I teach the subject of education.[3] As a former primary school teacher and cooperating teacher I have developed a growing interest in understanding more about the part of teacher education that deals with student teachers' field experiences. My experiences are that

[1] All the proper names in this study are pseudonyms.
[2] The use of the terms mentor, coach and cooperating teacher will be explained on page 6.
[3] The English word I use for the subject of "pedagogikk" in Norwegian teacher education. As will be seen throughout this research text, not all concepts can be translated literally. This is due to both cultural differences in the meaning of concepts and the fact that teacher education is organised differently throughout the world. When necessary I will explain how I have translated and used different concepts the first time they occur in the text. When I talk about teacher education I refer to the teacher education programme for primary and lower secondary schools in Norway. This programme is situated mainly at university colleges and the student teachers are awarded a teaching degree for teaching all subjects in grades 1-10 (age 6-16). In Chapter 4 I will explain how this teacher education programme is organised.

although first-year student teachers love their field experiences and regard them to be the most important part of their teacher education programme, they often complain that they are not "the real world". They find it unnatural to be accompanied by a cooperating teacher and three to four other student teachers in the classroom, complaining that they are left with little time to make experiences on their own; or to put it in another way, they have few chances to engage in real teaching. This is similar to the findings in the British study referred to above (Edwards & Collison 1996). The conclusion from this study is that there should be a greater focus on student teachers' learning; the practice field must be regarded as an arena for learning more than an arena for training. This is also emphasised in national documents on learning to teach mathematics in Norwegian teacher education.

Although the national curriculum for primary and lower secondary school (C-97)[4] emphasises a constructivist approach to teaching and learning, mathematics is still rather traditionally taught in schools, even by cooperating teachers (Alseth, Brekke & Breiteig 2003, Alseth 2004, Haug 2004, Sundli 2001, 2002). As a consequence, improving the competence of both experienced and future mathematics teachers has become an essential endeavour for the Ministry of Education (see for instance St.meld. [White paper] no. 12 1999-2000, St.meld. [White paper] no. 16 2001-2002, UFD 2005). Since 1990 preparation for teaching mathematics has been strengthened twice in the Norwegian teacher education programme by enhancing the credits. However, it is not enough to simply increase credits, it is also necessary to ensure a good connection to the practice field. A report to the Ministry of Education states: "In addition to increasing the credits in the mathematics and science subjects it is necessary that the content of the subjects is directed towards schools and that there is a good relation between the subject content, the education's pedagogical-'didaktiske'[5] content and the practice field" (Tveitereid 1997, p. 9, my translation). This has become an issue in the curriculum guidelines for teacher education (KUF 1999, UFD 2003). Thus the cooperating teacher plays an important role in the student teachers' process of learning mathematics for teaching. The aim of this study is to explore what this might mean; how can the cooperating teacher, through her[6] mentoring, facilitate the student teachers' learning of mathematics teaching through field experiences?

[4] This national curriculum was in force at the time I conducted this study. I will use terms and describe the structure of primary schools that were in charge when I conducted my fieldwork. From August 2006 a new reform entitled "Knowledge promotion" (KD 2006) is in force.

[5] Apostrophes set by me. See footnote 10 for an explanation of the term.

[6] I use the pronoun "her" when I talk about cooperating teachers. I will do so mostly because Sara is a female, but also because most of the cooperating teachers in primary schools in Norway are indeed females.

The quote from Tveitereid (1997) above, emphasising the connection between different areas of knowledge, is similar to Shulman's (1986, 1987) notion of pedagogical content knowledge.[7] This knowledge represents

> that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of understanding. (…) The blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction (1987, p. 8).

Shulman further states that this is the knowledge that "most likely distinguishes the understanding of the content specialist from that of the pedagogue" (1987, p. 8), or in other words distinguishes the mathematician from the teacher of mathematics. Thus we can claim this knowledge to be fundamental for the issue of learning to teach, and in the case of this study, learning to teach mathematics. As the concept takes into account how teachers use knowledge from different subject areas as well as context related knowledge, I find it to be useful in my research on how cooperating teachers assist student teachers in their process of learning to teach mathematics. However, over the years since the concept of pedagogical content knowledge emerged, other researchers have both expanded on and criticised Shulman's work. Thus I find it necessary to include a brief discussion of the term before I return to the presentation of my study.

In Norway, Slåtten (1998) finds the concept of pedagogical content knowledge to be somewhat unreflectively used as equivalent to the Norwegian concept "fagdidaktikk". [8] He argues that the Norwegian term entails more than Shulman's term, which in his view is mainly concerned with the content of teaching and the reflection teachers have on their work, teaching as it is performed in the classroom. Slåtten (1998) finds that the term "fagdidaktikk" includes, for example, knowledge about why the subject has a place in education and how the subject has developed through research. Slåtten's critique is reasonable. The term

[7] The term was first used in Shulman's 1985 presidential address to the American Educational Research Association, and was given more public exposure in seminal articles from 1986 and 1987. The concept grew out of a project called "Knowledge growth in teaching" at Stanford University. Shulman and his colleagues claimed that content was "a missing paradigm" in research on teaching and the concept developed as a result of research on what knowledge teachers had.

[8] The term "fagdidaktikk" first entered plans for Norwegian teacher education in the early 1970s. Strømnes (1994) states that with the overall plan for teacher education from 1992 finally "much work has been put into facilitating for a meaningful study of 'fagdidaktikk' in most of the subjects in teacher education. This is definitely praiseworthy" (p. 222, my translation, apostrophes set by me). He finds it more problematic that in this document the term "fagdidaktikk" is defined, and hence viewed differently, in various subject areas. He further points out that it seems to be a rather instrumental view. Slåtten (1998) claims that in approaching the term, there are "many individual prevailing understandings [of the term]" (p. 165). This is confirmed by an empirical study undertaken by Kvalbein (1999) and by evaluation reports (Harnæs 2002, Nokut 2006). As will be seen in Chapter 4, two overall curricula for teacher education from 1999 and 2003 strengthen "the 'fagdidaktiske' idea" in the study of subject matter.

"fagdidaktikk" in Norway is part of and connected to subject matter. Pedagogical content knowledge, by its very nature, contains elements of both subject matter knowledge and general pedagogical knowledge. Pedagogical content knowledge connects the two subjects of mathematics and education, as expressed by Løwing (2006). Moreover, the knowledge base included in pedagogical content knowledge inherits individual features as it develops through teaching over time (Gudmundsdottir 1995, Hasweh 2005). Gudmundsdottir (1995), for example, claims that "pedagogical content knowledge is mostly 'home made,' developed on the job by working with texts, subject matter, and students in different contexts year after year, and in the case of some experienced teachers, for decades" (p. 35). She further sees it as a practical way of knowing subject matter that is mostly learned from trying things out and observing, talking and working with other teachers.

To better catch the content of the term pedagogical content knowledge as used by Shulman, Slåtten (1998) proposes the Norwegian concept of "fagrelatert didaktisk kunnskap" (p. 167) or in his own English translation, "subject-related didactic knowledge" (p. 163). Even if I agree with Slåtten that it is probably not right to equate the two terms, I do not agree to the use of the term "didactic" in the English translation due to cultural differences in the understanding of the term.[9] In both the US and UK the term didactics is linked to traditional transmission forms of teaching, and is often used as the opposite of progressive education (see for instance Bruner 1996, Edwards & Ogden 1998, Rodd 1995, Tharp & Gallimore 1988).[10] Acknowledging the importance of Shulman's work on pedagogical content knowledge, without being satisfied with his definition or what knowledge should be included in the concept, others have, like Slåtten (1998), proposed other terms. Examples are subject-matter pedagogical knowledge (Hasweh 1987), content-specific pedagogical knowledge (Marks 1990) and subject-specific pedagogical knowledge (Edwards 1995). It is not difficult to recognise how the same two concepts are turned around and used differently; content and pedagogy.

Marks (1990) points out an important feature of pedagogical content knowledge that can explain the difficulties in arriving at a meaningful definition; as it derives from other types (or sources) of knowledge it can be difficult to determine where one ends and the other begins.

[9] I fail to understand why Slåtten (1998) first tries to create a Norwegian term for pedagogical content knowledge only to translate it back into English with another English term.

[10] This can be expressed as follows: "The concept *didaktik* is difficult to mediate across cultures, especially when the very language of explanation, English, seems almost alien to the term" (Ongstad, Hudson, Pepin, Imsen & Kansanen 2005, p. 2, italics in original). Ongstad et al. solve the problem by using what they call a German-Swedish-Danish spelling of the concept, "didaktik" when they refer to the concept as used in these countries. I will do the same, using the Norwegian words "didaktikk" and "fagdidaktikk"when necessary.

Classifying teachers' knowledge into categories can be problematic because of the ambiguous boundaries between the various types of knowledge and the fact that categories of knowledge do not develop in isolation. Finding the term "knowledge" too static and inconsistent with the constructivist perspective to teaching and learning, Cochran, DeRuiter and King (1993) propose the idea of pedagogical content knowing (PCKg). They define the term as "a teacher's integrated understanding of four components of pedagogy, subject matter content, student characteristics, and the environmental context of learning" (p. 266). They acknowledge that Shulman mentions both students' understanding as well as the context in his definition, but they maintain that it is veiled by his focus on "the transformation of subject matter for teaching" (p. 266).[11] Cochran et al. (1993) see knowing and understanding as active processes and emphasise that the four components are simultaneously and continually transformed and integrated to form what they call pedagogical content knowing. Bearing this view in mind, they emphasise that teacher preparation programs should promote integration of the four domains by having student teachers simultaneously experience the four components.

This way of organising teacher education seems to fit recommendations from a number of scholars (see for instance Ball 2000, Dewey 1904, Lowery 2002, Zeichner 1996). School experiences should be integrated into the education programme instead of being added at the end. Student teachers should meet pupils at the same time as they study subject matter and education. This is the case in the teacher education programme where my study is situated. In Chapter 4 I will describe the structure of this programme. For now I will emphasise what I find interesting to focus on in student teachers' field experiences; the role of the cooperating teacher and how she can assist student teachers in their process of integrating knowledge from different sources when they learn to teach mathematics. Focusing on cooperating teachers is important because they are the ones who have contact with the student teachers when they are engaged in teaching. Through the experience of teaching, pedagogical content knowledge develops and becomes visible. The practice field promises to be the optimal setting in which knowledge of subject matter and pedagogy come together in the making of a teacher (Blanton,

[11]Here I find it appropriate to provide the following quote from Shulman (1987): "My conception of teaching is not limited to direct instruction. Indeed, my affinity for discovery learning and inquiry teaching is both enthusiastic and ancient. (…) Nevertheless, at least at the secondary level, subject matter is a nearly universal vehicle for instruction, whatever the ultimate goal. (…) I do not mean to diminish the centrality of student learning for the process of education" (p. 7). Shulman then maintains that under some conditions teaching may begin with the pupils, stating that it is likely that in the early elementary grades "the starting point for reasoning about instruction may well be at the characteristics of the group itself. There are probably some days when a teacher necessarily uses the youngsters as a starting point" (p. 14). In Chapters 5, 6 and 7 I will show that teachers in primary schools often think like this. They often do as Hawkins (2000) argues to be necessary; they start by listening to the pupils.

Berenson & Norwood 2001). Moreover, the cooperating teachers are seen to have great influence on the development of student teachers' thinking, attitudes and teaching strategies. Because they act "in the real world" they are, from the student teachers' point of view seen as more credible than the teachers at the university college (see for instance Frykholm 1999, Shulman 1998, Zeichner & Gore 1990). As with the concept of pedagogical content knowledge I find it necessary to briefly discuss the term I will use to describe the role of the cooperating teacher in Norwegian teacher education.

The Norwegian term for cooperating teacher is "øvingslærer" which translated into English could be "training teacher", a word that in my opinion gives wrong connotations about the role. Indeed, the term has been debated and suggestions have been made to replace it with a term that points more in direction of "practice supervisor". Internationally, terms often used to describe the relationship between the cooperating teacher and student teachers are mentoring, supervising and coaching. The different terms or concepts can be connected to different models of supervision, or it may be that scholars define the concepts differently. An example is how Roberts (2000) mentions coaching as one element in the process of mentoring while Schön (1987) uses the term coach to mean almost the same as mentoring; a profession is learned from being together with a more experienced person. Moreover, each of the terms has different connotations in different countries although they all refer to persons that in one way or another guide other persons. For this study I prefer to use the term mentoring when I deal with the relationship between Sara and the student teachers. This is connected to my theoretical framework.

I situate my study within a socio-cultural approach to teaching, learning and mentoring as this is rooted in the work of Vygotsky and his collaborators. As will be seen in Chapter 2, where I present my theoretical framework, working together in joint activities is essential within this framework. I have found that researchers in the field of teacher education who situate their studies within the same framework often use the term mentor. Feiman-Nemser and Beasley (1997), for example, think of mentoring as helping someone learn to teach in the context of teaching and define it as: "Face-to face, close-to-the-classroom work on teaching undertaken by a more experienced and a less experienced teacher in order to help the latter develop his or her practice" (p. 108). Roberts (2000) explains or defines the term in similar ways: "A formalised process whereby a more knowledgeable and experienced person actuates a supportive role of overseeing and encouraging reflection and learning within a less experienced and knowledgeable person, so as to facilitate that person's career and personal development" (p. 162). In this research text I will use the terms mentor and mentoring

connected to the practice field of teacher education. The term supervisor and supervision will be used when referring to other settings. In direct quotations or referring to scholars I will use the terms they use.

As seen above, the concept of pedagogical content knowledge has proved to be difficult to pin down theoretically and different terms and definitions can be found. In a practical sense, however, it represents a class of knowledge that is central to teachers' work and that would not typically be held by non-teaching subject matter experts or by teachers who know little of the subject. Thus it is inevitably linked to learning to teach subjects, and that is the point for me in asking the research question; *how can the cooperating teacher's way of mentoring facilitate first-year student teachers' development of pedagogical content knowledge in mathematics?* This case study, telling the story about a cooperating teacher named Sara and her five student teachers, will hopefully make this important issue more visible. It shows how Sara, as she expresses in an interview, is "dealing with two arenas the whole way" meaning that she has to take care of both the kids'[12] and the student teachers' learning. Or expressed in another way; her role is to assist the student teachers to take care of the kids' learning while teaching and at the same time make it a learning venue for themselves. I gained insight into how Sara deals with this double role by being with her and the student teachers almost every day for six weeks.

Even if case studies can prove only that something is possible, not that it is probable, invoking possibility itself can be a virtue (Gage 1978). The story told from a case study can provoke, inspire and initiate discussions and dialogues, something which is crucial for reflection over practice and its development (Gudmundsdottir 2001). The story can provide a thinking tool for those who are occupied with teacher education on different levels, both to develop practice but hopefully also to lead to new research questions. An important reason for telling this story is to bring the voice of cooperating teachers into the debate on teacher education and how this education could best be organised. How does she perceive of her role and the possibilities undertaking it as it is expressed in national documents? How can she contribute to student teachers' learning of how to teach mathematics?

[12] As will be seen, Sara never uses the word pupils. She always talks about the kids. I asked her about this and the answer was that she does not like the word pupil, and she explains it like this: "I think I have this assumption, teacher–pupil, then it is subject-object, pupils don't – or more like, kids are more close to me (laughs). I may say his pupils, but my kids. (…) I will never could say that the pupils interplay, the word pupil connects to the teacher, it's the kids who interplay. It's probably because I love the word kids ['unga' in Norwegian]" (int032803, p. 8). I find it appropriate to use the word kids when I refer to Sara and her class. I could have used children ("barn" in Norwegian), but because of the way Sara personalises it I am convinced that kids is a better word. Elsewhere I will use the words children and pupils.

Although Sara's is the most important voice, we will see that other voices need to be heard as well if we are to understand her actions and the value they can have for the student teachers. Voices from the literature in this field, for example, theoretical concepts and research results, will be used to interpret, understand and mirror Sara's story. It is important to bear in mind that little research has been done within this field in Norway. Actually, in an evaluation of teacher education in Norway the lack of research on mentoring in the practice field was criticised (Harnæs 2002). I will therefore mostly refer to international studies. Due to differences of how both teacher education programmes and field experiences around the world are organised, it may be difficult to compare research results. For instance, I have found that mentoring most often occurs in dyads, one mentor and one student teacher. I have also found that different terms are used to express the student as a teacher, for example, in-service teacher, pre-service teacher, prospective teacher and student teacher. The various terms refer to differences in field experiences in the study. I will use the term student teachers, while I make exceptions in direct quotations. The voices of the five student teachers, "Eric", "Eli", "Ina", "Irene" and "Ian" are of course also important. Within a socio-cultural framework it is impossible to understand Sara without taking them into account. My voice will be heard in different ways, overtly in Chapter 3 when I describe the research process, and a more hidden voice; as the researcher I am the one who chooses which other voices should be heard.

A case study report is something between story telling and a traditional research report (Stake 1995). Other features of this research tradition, explained further in Chapter 3, also guide the construction of this thesis. The research text consists of eight chapters. Following this introductory chapter I present the theoretical framework that frames and guides my research study in Chapter 2. I have already mentioned that I situate my study within a socio-cultural tradition of teaching, learning and mentoring. I present this tradition as it is outlined by Vygotsky and his successors. This framework also guides the research process, presented in Chapter 3. This chapter shows that the study is situated within a qualitative, interpretative tradition, so important features of this tradition are also presented. In the four chapters, 4, 5, 6, and 7 I present what happened during the six weeks of the student teachers' field experiences. I start with a presentation of the context of the study in Chapter 4. In the following three chapters I present each of the three themes that developed as an answer to my research question. Chapter 5 is entitled "Moving towards shared focus of attention by focusing on the kids", Chapter 6 is entitled "Making the invisible visible through guided planning", and Chapter 7 is entitled "Encouraging educative experiences by focusing on aims". A more thorough presentation of the content of these three chapters is presented in Chapter 3. The

research text ends with Chapter 8: Final reflections.

In Chapter 3 I will show how the use of theory plays an important role on different levels throughout the process of case study research. An example is how all studies are affected by a theoretical framework. According to Merriam (1998), such a framework is derived from the orientation or the stance the researcher brings to the research and it affects all aspects of the study. It is the lens through which the researcher views the world. The socio-cultural approach to teaching, learning and mentoring, my lens, will be presented in the next chapter.

# Chapter 2
# Theoretical framework

Research on learning throughout the last century can be categorised into three main perspectives or worldviews; behaviourist/empiricist, cognitive/rationalist and situative/pragmatist-/sosiohistoric (Greeno, Collins & Resnick 1996). Each of these three perspectives has contributed and continues to contribute important insights into scientific knowledge and understanding of cognition and learning, and each has influenced educational practices significantly. Even if they now "coexist side by side", the three perspectives each had their own period of prominence during the last century and thus they represent a historical line from behaviourism, a view strongly connected to external processes, to its counterpart, cognitivism, with its focus on internal processes and individuals' activities. The third perspective, which evolved during the last decades of the 20th century,[13] emphasises that learning is context bound and develops through interaction with other individuals. My study is situated within this last perspective, called situative/pragmatist-/sociohistoric by Greeno et al.

Over the last few decades there has been rapid growth in the number of theories and perspectives which attempt to investigate the development of cognition in context using non-deterministic, non-reductionist theories (Daniels 2001). Common to these approaches to learning and cognition is that they build upon the writings of the Russian L. S. Vygotsky, and use his theory as a valuable tool to understand the processes of social formation of mind. Daniels mentions four main approaches within this area. He refers to these as socio-cultural theory (Wertsch 1991, Wertsch, del Rió & Alvarez 1995), cultural-historical activity theory (Cole, Engeström & Vasquez 1997, Leontèv 1981), situated learning models (Lave 1996, Lave & Wenger 1991) and distributed cognition approaches (Salomon 1993). All approaches emphasise the significance of a contextual and social aspect of learning, claiming that people learn through participation in communicative and practical cooperation with others (Säljö 2001). Learning and development take place in socially and culturally shaped contexts (John-Steiner & Mahn 1996).

Daniels (2001) claims that a wide range of extensions and interpretations of socio-cultural theory create new and important possibilities for practices of teaching and learning and beyond. They provide us with theoretical constructs, insights and understandings which can be used to develop our own thinking about the practices of education. The development in

[13] First systematized and applied by Vygotsky and his collaborators in Russia in the 1920s and 1930s (John-Steiner & Mahn 1996).

research and theory in these different socio-cultural approaches mostly focuses on apprentices and children's learning either in schools or in informal settings (see for instance Lave & Wenger 1991, Rogoff 1990, Tharp & Gallimore 1988, Wertsch 1979). As pointed out in the introductory chapter, the student teachers gain work experience in school settings while they are studying education, mathematics and other subjects in the Norwegian teacher education programme. This means they have a learning venue that is situated in an authentic context where they are together with more experienced persons. These are important features of a socio-cultural perspective to learning. Thus I find theoretical constructs developed in this tradition to be useful devices for both understanding and developing the thinking about mentoring (and hence practice) in teacher education.[14]

For my theoretical framework I will first present the socio-cultural[15] approach as it is outlined by Vygotsky. I will mostly refer to his own work, but also show how his ideas have been understood and expanded by others. Furthermore, as I am most interested in how cooperating teachers may support student teachers' learning I will connect socio-cultural theory to mentoring by presenting the work of Tharp and Gallimore (1988). Building on Vygotsky's work, they present a theory of teaching as assisted performance. Although the theory is developed within school settings, they connect it to both supervision and teacher training.[16]

## *Vygotsky's socio-cultural theory*

According to Wertsch (1991) "a sociocultural approach to mind begins with the assumption that action is mediated and that it cannot be separated from the milieu in which it is carried out" (p. 18). The approach Wertsch outlines takes its basic framework from the writings of Vygotsky, where Wertsch identifies three basic themes which are closely intertwined. First, there is a reliance on genetic or developmental analysis. This means the focus is on the very

[14] Samaras and Gismondi (1998) and Hausfather (1996) call for further studies into how teacher education and field experiences could be understood within a socio-cultural frame of reference. In Norway, Klages (2000) has examined mentoring in pre-school teacher education and Mathisen (2000) has examined teacher education at the university by using situated learning theories.

[15] According to Wertsch et al. (1995) Vygotsky seldom, if ever, used the term "sociocultural". Both he and his followers usually spoke of a "sociohistorical" (Luria 1981) or "culturhistorical" approach (Smirnov 1975, cited from Wertsch et al. 1995. Original only in Russian). By doing so they wanted to emphasise the historical dimension. Wertsch et al. acknowledge that the latter terms are more appropriate when referring to the recognised heritage from Vygotsky, his collaborators and his successors. They find, however, that the term socio-cultural is a better term when one is dealing with the appropriation of heritage in the West.

[16] The concept "teacher training" is used by Tharp and Gallimore (1988). As seen in the introductory chapter I find that the term "training" incorporates features we would rather avoid. Bearing this in mind, I prefer to use the trem "teacher education". However, "training" is often used and I will also do so when I refer to others who have used the term.

process through which human consciousness is formed, and not only on the product of development. Second, Vygotsky (1978, 1981a) claims that higher mental functioning in the individual derives from social life, and third that tools and signs mediate human action on both the social and individual planes. The power of these three intertwined themes derives from the ways in which they presuppose one another; one must use a genetic analysis to understand how higher mental functions are the mediated, internalised results of social interaction (Wertsch 1981, 1991). Although Wertsch (1991) finds it somewhat artificial to isolate the three themes, I will do so in the next sections for "the sake of clarity" (p. 19) as Wertsch so aptly puts it.

## Genetic analysis

Vygotsky (1978, 1981a) found shortcomings in theories attempting to understand the nature of mental processes by only analysing the static products. He made genetic or developmental analysis the very foundation of the study of mind. The underlying assumption is that it is impossible to understand many aspects of mental functioning, such as thinking and reasoning, if one does not understand their origin and the transitions they have undergone. Analyses of "fossilized" (Vygotsky 1978, p. 63) or static products will often be misleading as they provide descriptions but not explanations of human mental development. Therefore, to explain human mental processes one needs to examine both their origins and development. According to Wertsch (1981) Vygotsky thus reflects ideas expressed by Marx who argued that an analysis of society must be based on knowledge of the socio-economic history of that society. Although a society may develop over long periods of time by making quantitative increments, fundamentally qualitative shifts will occasionally take place and will restructure the entire society. Bearing this in mind, Vygotsky maintains that along with the processes of organic growth and maturation, there are also fundamental shifts or changes in child development. He sees the introduction of cultural means of mediation[17] into what were formerly natural processes as the most important feature in these qualitative shifts. The use and mastery of cultural sign systems changes the nature of processes, such as memory and problem solving, and thus they play an important role in how the child functions in these areas (Vygotsky 1978, 1981a).

Even if in his empirical research Vygotsky focused mostly on the development of the individual, on ontogenesis, his analysis also applied to other "genetic domains", such as

[17] The term mediation will be dealt with below and in Chapter 6.

microgenesis, phylogenesis and socio-cultural history. All these domains require a genetic approach to provide an adequate account of human mental processes (Scribner 1985, Wells 1999, Wertsch 1985). In ontogenesis, Vygotsky (1978) argued, as seen above, that a cultural or social line of development involving mastery of culturally developed mediational means interacts with a natural line of development that involves growth and maturation. Microgenesis refers to development over the course of, and resulting from, particular interactions in specific cultural settings as part of ontogenesis. This means that the focus is placed on how mental processes develop in an individual over a relatively short period of time, and how various skills are gradually acquired during training

With respect to the genetic domains of phylogenesis and socio-cultural history, Vygotsky's work was primarily theoretical and relied on the work of others. In phylogenesis, development in the evolution of the human species, the main psychological phenomenon for him was that of problem solving. Accepting the Darwinian principle of evolution, he drew upon Köhler's ideas about tool-mediated practical action in gorillas and compared this with humans. He elaborated on the idea by claiming that tool use in gorillas is a necessary but not sufficient condition for higher mental functioning. It was a necessary evolutional step in the development of humans (Wertsch 1985, 1991). The last domain, socio-cultural history shows how humans have developed tools and signs over time in a particular culture. Compared to other species, what is special for humans is that we develop and use both psychological and technical tools to broaden our functioning (Säljö 2001). Vygotsky believed that each of these four domains is governed by a unique set of explanatory principles, but in any domain, the present state can be understood only by studying the stages of development that preceded it (Wells 1999).

## Social origins of mental functioning in the individual

The claim that higher mental functioning in the individual derives from social life is apparent from what Vygotsky (1981a) called "the general genetic law of cultural development" (p. 163). He explains the relationship between internal and external processes, the social origin of individual mental functioning as follows:

> An interpersonal process is transformed into an intrapersonal one. Every function in the child's cultural development appears twice: first on the social level, and later, on the individual level; first between people (interpsychological), and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts (Vygotsky 1978, p. 57).

In stating this, Vygotsky sees the development of higher psychological functions like

reasoning and problem solving as originating as actual relations between human individuals. He argues that an operation that initially represents an external activity is reconstructed and begins to occur internally. He calls the internal reconstruction of external processes internalisation, but "it goes without saying that internalisation transforms the process itself and changes its structure and functions" (Vygotsky 1981a, p. 163). Thus we can see that the process of internalisation is not a direct and simple copy of socially organized processes. Actually:

> *The transformation of an interpersonal process into an intrapersonal one is the result of a long series of developmental events.* The process being transformed continues to exist and to change as an external form of activity for a long time before turning inward (Vygotsky 1978, p. 57, italics in original).

Leontèv (1981), one of Vygotsky's collaborators explains that the process of internalisation does not entail the transference of an external activity to a pre-existing, internal "plane of consciousness" (p. 57). Rather, internalisation is the process in which this plane is formed. Even though, as we can see, both Vygotsky and Leontèv dismiss the idea that the process from external to intramental functioning is a kind of transmission, the term "internalisation" has been a frequent topic of debate among socio-cultural researchers (John-Steiner & Mahn 1996, Rogoff 1995, Wertsch 1998).

According to Wertsch (1998), "The construct of internalisation entails a kind of opposition between external and internal processes, that all too easily leads to the kind of mind – body dualism that has plagued philosophy and psychology for centuries" (p. 48). Nonetheless, he does not want to replace or avoid the term because it is so widely used both in everyday and professional discourse. Wertsch's view is that the debate is problematic, even fruitless because there are different phenomena in mind when different parties or disciplines, for example Piagetian or Freudian, use the term. He therefore finds it more appropriate to view it as a term whose definition is closely bound up with particular phenomena and examples, and thus a term that takes on a variety of definitions. Wertsch then focuses on what he sees as two viable meanings of the term "internalisation" when applied to mediated action: mastery and appropriation.

Wertsch (1998) finds that internalisation suggests an image in which processes that were carried out on an external plane come to be executed out of sight on an internal plane. However, what is striking in this regard is that many and perhaps most forms of action never progress to the internalisation stage. Many forms of action are and must be carried out externally, for instance pole vaulting or navigating a large naval vessel into a harbour. Even though an agent is involved, the mediational means also do a great deal of the job. In such

cases Wertsch finds it more appropriate to talk about "mastery", or building upon Ryle's (1949) concept, "knowing how" to use cultural tools. But, as Wertsch (1998) points out:

> This is not to say that there are not important internal dimensions or changes in internal dimensions in those carrying out these external processes, but it is to say that the metaphor of internalization is too strong in that it implies something that often does not happen (p. 50).

In addition to characterising the relationship of agents for mediational means according to levels of mastery, Wertsch (1998) also introduces the characteristic of "appropriation". In most cases the processes of mastering and appropriating cultural tools are thoroughly intertwined, but this need not to be the case. Wertsch understands appropriation to be the process of taking something that belongs to others and making it one's own. This way of understanding is based on the writings of Bakhtin (1981), where the notion of "one's own" is inherently related to that of others. Bakthin maintains that

> language, for the individual consciousness, lies on the borderline between oneself and the other. The word in language is half someone else's. It becomes "one's own" only when the speaker populates it with his own intention, his own accent, when he appropriates the word, adapting it to his own semantic and expressive intention (p. 293).

By making the distinction between mastery and appropriation of cultural tools, Wertsch (1998) recognises the fact that even if individuals master a tool, they can resist making it their own. Thus he acknowledges the individual as an active agent in the process of appropriation. While, as we have seen, Wertsch argues for and prefers to use the term internalisation, Rogoff (1995) chooses to use the term appropriation.

Rogoff (1995) finds the term internalisation to be about a transmission mode of thinking about cognition. Her use of the term appropriation (or participatory appropriation) refers to the process by which individuals transform their understanding of and responsibility for activities through their own participation: "By engagement in an activity, participating in its meaning, people necessarily make ongoing contributions (whether in concrete actions or in stretching to understand the actions and ideas of others)" (pp. 150-151). Thus, Rogoff sees participation itself as the process of appropriation, and she goes on to point out that individuals not only change through their involvement in one or another activity, but that in the process they are also prepared for subsequent involvement in related, similar activities. Rogoff acknowledges that her term appropriation resembles how Vygotsky uses the term internalisation. Nevertheless she finds that his characterisation of the process of internalisation involves a separation in time of social and individual aspects of the activity, while in her idea of appropriation a person's participation is at one and the same time a social

and an individual process. Using the term internalisation John-Steiner and Mahn (1996) express exactly the same thing: “In our view, internalization is simultaneously an individual and a social process” (p. 197). In spite of the debate, there is an acknowledgment of how higher mental functions originate in social processes. However, according to Wertsch (1991), one should bear in mind that Vygotsky’s definition of higher mental functions, such as thinking, voluntary attention and logical memory, is quite different from what psychologists usually have in mind when they speak of mental functions. Mind can be understood or defined “in terms of its inherently social and mediational properties” (p. 15).

Wertsch (1991) specifically draws attention to the fact that the notion of mental function as used by Vygotsky can properly be applied to social as well as individual forms of activity. Wertsch connects this to two ways in which mind “extends beyond the skin” (p. 14). Pointing to the first way, he draws attention to the fact that mental activities such as memory or reasoning can be socially distributed. He uses an example taken from Tharp and Gallimore (1988, p. 7) to illustrate what Vygotsky had in mind:

> A 6-year-old child has lost a toy and asks her father for help. The father asks where she last saw the toy; the child says ‘I can’t remember.’ He asks a series of questions – did you have it in your room? Outside? Next door? To each question, the child answers ‘no’. When he says ‘in the car?’, she says ‘I think so’ and goes to retrieve the toy (Wertsch 1991, p. 27).

The point is that in such cases the dyad serves as the system that has carried out the function of remembering on the intermental plane and thus one cannot tell if the father or the girl “did the remembering” (Wertsch 1991, p. 28). This is often the same in cases of problem solving (Wertsch 1979).

The second way in which “mind extends beyond the skin” is connected to the notion of mediation and mediational means: “Mental functioning is viewed as being shaped or even defined by the mediational means it employs to carry out a task” (Wertsch 1991, p. 15). Thus mediation is connected to the social plane of cognition. Mediation is also the third theme identified in Vygotsky’s writings; higher mental functioning and human action in general are mediated by tools and signs. Vygotsky’s accounts of the mechanisms of mediation provide the bridge that connects the external with the internal and thus the social with the individual (Wertsch & Stone 1985).

## Mediation

The idea of mediation, the claim that higher mental functioning and human action in general are mediated by tools and signs, is so central to Vygotsky’s writings that Wertsch (1985,

1991) claims it to be the key concept for understanding the whole theory. Every human action employs cultural tools or mediational means.[18] Vygotsky (1978) made a distinction between tools and signs as mediators, the former he named technical tools or only tools and the latter psychological tools or signs. He explained their different roles as follows:

> The tools' function is to serve as the conductor of human influence on the object of the activity; it is externally oriented; it must lead to changes in objects. It is a means by which human external activity is aimed at mastering, and triumphing over nature. The sign, on the other hand, changes nothing in the object of a psychological operation. It is a means of internal activity aimed at mastering oneself; the sign is internally oriented (p. 55).

As examples of signs or psychological tools Vygotsky (1981b) mentioned: "language, various systems for counting, mnemonic techniques, algebraic symbol systems, works of art, writing, schemes, diagrams, maps and mechanical drawings, all sorts of conventional signs" (p. 137). These psychological tools as well as such technical tools as calendars and computers are all products of human cultural historical activity, created and changed by societies over the course of human history and the level of its cultural development. Thus they are products of socio-cultural evolution. Individuals have access to the tools by being actively engaged in the practices of their communities (Daniels 2001, John-Steiner & Mahn 1996). Wertsch (1994) expresses it this way:

> Mediation is the key to understanding how human mental functioning is tied to cultural, institutional, and historical settings since these settings shape and provide the cultural tools that are mastered by individuals to form this functioning. In this approach, the mediational means are what might be termed the 'carriers' of socio-cultural patterns and knowledge (p. 204).

Even if Vygotsky, as we have seen, acknowledged both technical and psychological tools, he focused mainly on semiotic mediation, verbal and nonverbal signs and symbols of social origins as mediators of action. He viewed language to be the most important tool and preferred that verbal mediational means were used as widely and as often as possible. He probably did so for two reasons; first due to his background as a member of an intellectual Russian Jewish family where verbal formulation was highly valued and second, his interest in the formal instruction of literacy. He saw language not only as a mediator for social activity which enables participants to plan, coordinate and review their actions through external speech, but also as the tool that mediates the associated mental activities in the internal discourse of inner speech (Vygotsky 1986, 1987). Vygotsky approached language and other sign systems in terms of their mediational properties, how they are a part of and mediate human action rather than in terms of some kind of semantic analysis abstracted from the

[18] Wertsch (1991, 1998) uses these two terms interchangeably as I will also do throughout the research text.

context in which they are used (Wertsch 1991).[19]

In Vygotsky's (1981a) view, the key to understanding forms of semiotic mediation on the intramental plane is to analyse their intermental origins, a point that is reflected in his contention that "a sign is always originally a means used for social purposes, a means of influencing others, and only later becomes a means of influencing oneself" (p. 157). The action is fundamentally transformed by the inclusion of signs. It does not simply facilitate action that could have occurred without them. Comparing it to technical tools, Vygotsky (1981b) emphasises:

> By being included in the process of behaviour, the psychological tool alters the entire flow and structure of mental functions. It does this by determining the structure of a new instrumental act, just as a technical tool alters the process of a natural adaptation by determining the form of labour operations (p. 137).

As mentioned above, one sense of "mind extends beyond the skin" (p. 27) as expressed by Wertsch (1991) is connected to the use of mediational means: "The agent of mediated action is seen as the individual or individuals acting in conjunction with mediational means" (p. 33). As an example Wertsch mentions a blind man using his stick, tools can have their impact only when individuals use them; on their own they are powerless to do anything. In this way mediation is best thought of both as a process involving the potential of cultural tools to shape action and as the unique use of these tools (Wertsch et al. 1995).

## *Educational implications of Vygotsky's socio-cultural theory*

### The zone of proximal development[20]

Vygotsky (1978) claims quite strongly that "learning and development are interrelated from the child's very first day of life" (p. 84). Thus he rejects theoretical positions that either see the two processes as independent of each other or view them as equal. He goes on to maintain that there is a need to determine at least two developmental levels if we wish to discover the actual relations of the developmental process to the learning capabilities of a child. The first level, the actual developmental level, refers to the level of development of a child's mental functions that has been established as a result of already completed developmental cycles. Tests almost always deal with this level, and it defines functions that have already matured, that is, the end products of development. Vygotsky claims another level, the level of potential development, to be more important. He calls this level more precisely the zone between actual

[19] Rogoff (1990) finds that other mediational means than language play an important role in other socio-cultural settings than Western ones.

[20] I will use the abbreviations zpd and ZPD in the way they are used by scholars.

and potential development, and has also defined this zone as

> *the distance between the actual development level as determined by independent problem solving and potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.* (…) The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state (1978, p. 86, italics in original).

While the actual developmental level characterizes mental development retrospectively, the zone of proximal development characterizes mental development prospectively. What is in the zone today will be the actual developmental level tomorrow – that is, what a child can do with assistance today he or she will be able to do alone tomorrow. Emphasis is placed on a more dynamic assessment of children's intellectual abilities rather than more static measures (Daniels 2001).

Connected to the zone of proximal development, Vygotsky (1987) further claims that "*instruction is only useful when it moves ahead of development.* When it does, *it impels or wakens a whole series of functions that are in a stage of maturation lying in the zone of proximal development*" (p. 212, italics in original). Vygotsky finds this to be the major role of instruction in development, and is what distinguishes the instruction of the child from the training of animals. If the instruction merely utilises what has already matured in the developmental process it is completely unnecessary. The instruction must lead the child "to carry out activities that force him to rise above himself" (p. 213). Thus we can see that Vygotsky discussed the zone of proximal development both in terms of assessment and instruction. Within both frames of reference he discussed the relationship between an individual learner and a supportive other (or others) even if that other was not physically present in the context in which learning was taking place. Vygotsky's concept and account of the zone of proximal development is probably one of the most used terms in Western pedagogy over the most recent decades even if he himself did not use the term often and his account of the term emerged late in his writing. Although he claimed that the need for instruction had to be ahead of the child, Vygotsky himself gave little guidance in how the instruction should be carried out.

When Wood, Bruner and Ross (1976) introduced the term "scaffolding" to describe a form of adult assistance that enables the child to solve a problem or carry out a task, a task that was beyond his or her unassisted efforts, there were no references to the work of Vygotsky.[21] Later, the term scaffolding has been connected very closely to the zone of

[21] Later on they made this connection in Bruner (1986) and Wood (1998).

proximal development, and is used as a metaphor for the guidance provided by either adults or more capable peers, to use the words of Vygotsky (1978). The term "scaffolding", (as presented by Wood et al. 1976) could be taken to infer a "one-way" process wherein the "scaffolder" constructs the scaffold alone and presents it to the novice for use (Daniels 2001). More recently, however, the interaction between the scaffolder and the learner has been given more focus (Newman, Griffin & Cole 1989, Stone 1993, Wells 1999).

Newman et al. (1989) argue that rather than the donation of a scaffold as some kind of prefabricated climbing frame, the zone of proximal development is created through negotiation between the more mature partner and the learner. A similar emphasis on negotiation can be found in the writings of Tharp and Gallimore (1988). They discuss teaching as "assisted performance" in those stages of the zone of proximal development where assistance is required (this work will be presented in the last section of this chapter). The key question here seems to be whether "the hints", "supports", or "scaffolds" come from and are produced by "the more capable other" or if they are negotiated. Both Moll (1990) and Daniels (2001) claim that Vygotsky is unclear on this issue as he never specified the forms of social assistance to learners that constitute a zone of proximal development. Although he wrote about collaboration and direction there are only general descriptions like assisting children "through demonstration, leading questions, and by introducing the initial elements of the task's solution" (Vygotsky 1987, p. 209).

Wells (1999) recognises that guidance and instruction are most helpful when they are given in the context of a particular activity, in which teacher and pupil are engaged together:

> As teachers we can help learners by the questions we ask and the guidance we give. But we can ourselves also receive help and guidance from the questions and suggestions of learners – if only we are ready to accept them (p. 312).

He states that it seems "for learning to occur in the zpd, it is not so much a more capable other that is required as a willingness on the part of all participants to learn with and from each other" (p. 324). As with the concept of scaffolding, the "zone of proximal development" has itself been the subject of different interpretations and undergone considerable development (Lave & Wenger 1991, Wells 1999). Wells (1999) suggests that Vygotsky tended to characterize the zone of proximal development in terms of individual assessment and instruction, concerned chiefly with generalised intellectual development, and dependent upon face-to-face interaction. According to Wells, the concept has both been expanded in scope and been more fully integrated into Vygotsky's theory as a whole through subsequent discussion and use of the concept in the exploration of its applicability in a variety of settings. He asserts

that when it comes to the zone of proximal development today, there is more emphasis on the holistic nature of learning, more emphasis on other mediational means than language and more emphasis on collaborative communities of practice, and not only on dyads with face-to-face interaction.

When viewed from the perspective of education Wells (1999) finds four salient features of this expanded interpretation of the zone of proximal development. First, he finds that the zone constitutes a potential for learning that is created between participants as they engage in a particular activity together. He further maintains that the upper boundary, the potential development, is unknown and indeterminate because it also depends upon the manner of interaction that unfolds: "In this sense, the zpd emerges in the activity and, as participants jointly resolve problems and construct solutions, the potential for further learning is expanded as new possibilities open up that were initially unforeseen" (p. 331). Second, Wells states that as an opportunity for learning with and from others, the zpd applies potentially to all participants. Others can assist learning at all stages and in all areas. Each person can assist the others and each can learn from the contribution of others. Third, he pays attention to semiotic artefacts, such as books, maps, diagrams and works of art, as sources of guidance and assistance for learning, as well as guidance by human participants. Wells' fourth point is that learning in the zpd involves all aspects of the learner – acting, thinking, feeling and not cognition alone: "Because individuals and the social world are mutually constitutive of each other, transformation of the learner also involves transformation of the communities of which he or she is a member and of the joint activities in which they engage" (p. 331). Learning will be most successful when it is mediated by interaction that expresses mutual respect, trust and concern. Wells contends that this wider concept of the zpd has contributed significantly to the changing views both of the role of joint activity and interaction in the classroom and the changing role of the teacher. From being primarily a dispenser of knowledge and assigner of grades, the teacher sees him or herself as a fellow learner who acts as a leader of a community committed to the co-construction of knowledge. Wells (1999) further maintains that another major effect of continued exploration of the zpd has been to highlight its interdependence with all the main threads in Vygotsky's theory:

> The dialectical relationship between individual and society, each creating, and being created by the other; the mediation of action by material and semiotic tools and practices; the multiple levels on which previous development both enables and constrains current action and interaction; and activity as the site in which these threads are woven together as the resources of the past are deployed in the present to construct an envisaged future (p. 332).

In the last section of this chapter I turn more explicitly to how Vygotsky's ideas about guiding

in the zone of proximal development are developed and used in a model of teaching as assisted performance. This model also connects Vygotsky's theory to mentoring in teacher education.

## *Tharp and Gallimore's model of teaching as assisted performance*

Although Vygotsky's work principally discusses children, identical processes are found operating in the learning adult, and recognition of this fact opens for the creation of effective programmes for teacher training, according to Tharp and Gallimore (1988). They maintain that developmental processes, arising from assisted performance in the zpd, can be observed not only in the ontogenesis of the individual but also in the microgenesis of discrete skills as they develop throughout the life course. According to Wells (1999), Vygotsky states quite clearly that his thoughts on learning are equally applicable to almost every other form of cultural knowledge than the learning of language, which was his main focus. Cole (1985) also treats the idea of the zpd in terms of its general conception as the structure of joint activity in any context where there are participants who exercise differential responsibility by virtue of differential expertise. Thus, the work of Vygotsky, in my opinion, offers a frame of reference for understanding learning through field experiences.

Expanding on Vygotsky's writings, Tharp and Gallimore (1988) understand teaching as assisted performance of apprentices in joint activity with experts. Such teaching, they assert "becomes the vehicle through which the interactions of society are internalised and become mind" (p. 8). Assisted performance defines what a child can do with help and support from the environment, others and oneself. Thus they connect their definition of teaching to Vygotsky's notion of zpd, and in his and their own words they claim that teaching is good only when it "*awakens and arouses to life those functions which are in stage of maturing, which lie in the zone of proximal development*" (p. 31, italics in original). Tharp and Gallimore (1988) understand Vygotsky to mean that "*teaching consists in assisting performance through the zone of proximal development. Teaching can be said to occur when assistance is offered at point in the zone of proximal development at which performance requires assistance"* (p. 31, italics in original). They point out that the type of assistance given is less important than performance being achieved, which in turn means that development and learning proceed. To the extent that peers can assist performance, learning will also occur through that assistance. In pedagogy terms, assistance should be offered in those interactional contexts most likely to generate joint performances.

Tharp and Gallimore (1988) equate their definition of teaching to that of supervision;

"S*upervision should be defined – particularly in an institution devoted to teaching – as assisting performance in precisely the terms we used to define teaching*" (p. 25, italics in original). They point out that supervision is more than "directing and evaluating" (p. 24), and claim that there should be a chain of assistance in schools, including administrators, teachers and pupils. Each member of the supervisory chain assumes the responsibility of assisting, not controlling, the performance of the next member. The argument for the supervision chain refers to the failure of reform efforts in schools in the US. The recitation script is still the most prominent form of teaching. Tharp and Gallimore claim that "teachers themselves must have their performance assisted if they are to acquire the ability to assist the performance of their students" (p. 43).

Assistance and progress through the zpd and beyond is presented in a four-stage model:

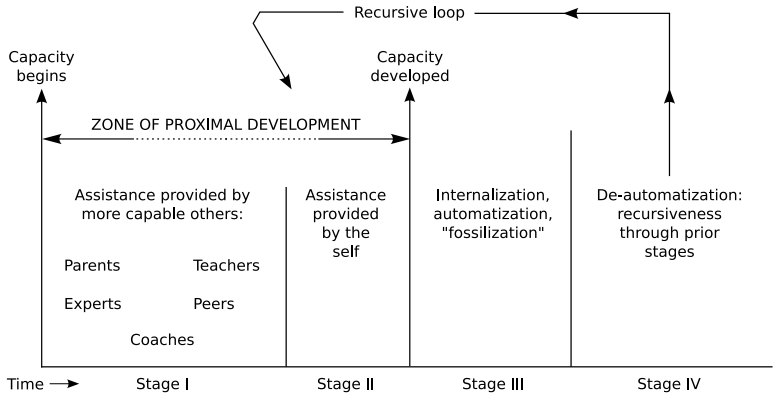


**Figure 1: Tharp and Gallimore's (1988) four stage model (p. 35)**

As the model shows, the two first stages are connected to the zpd. In stage one performance is assisted by more capable others whereas assistance is provided by the self in stage two. During stage one the learner gradually takes over the responsibility for the task and consequently the assistor's responsibility declines. This is accomplished through an interactive process where an emerging intersubjectivity of goals occurs. The developmental task of this stage is to move the learner from other-regulation to self-regulation. Development takes place, for instance, through questions asked by the learner, questions that assist the adult (or more capable other) to assist. As we already have seen emphasised by Wells (1999), the learners are never passive recipients of input from the more capable other. In stage two, the learner conducts tasks without assistance from others. It is strongly emphasised that this does not mean that the performance is fully developed or automatized. The point is that the learners can guide their actions with their own speech. Tharp and Gallimore (1988) put it as follows: "the transfer from external to internal control is accomplished by transfer of the manipulation

of the sign (e.g., language) from others to the self. The phenomenon of self-directed speech reflects a development of the most profound significance" (p. 37). An important transition stage of a skill through the zpd has been reached when the learners begin to direct or guide behaviour with their own speech, "what was guided by the other is now beginning to be guided and directed by the self" (p. 37). Throughout lifelong learning, talking to oneself as assisted performance can often be seen at the microgenetic level, the acquisition of some particular performance capacity.

Stage three is both beyond social and self control. Assistance is no longer needed; performance is developed and is described by Vygotsky (1978) as "the fruits" (p. 86) of development. He also described performance as "fossilized" (p. 63) meaning that it is both fixed and distanced from social and mental forces of change. Actually, instructions from others appear to be both irritating and disruptive at this stage. According to Tharp and Gallimore (1988), in the lifelong learning of any individual at any point in time there will be a mix of other-regulation, self-regulation and automatized processes. This is due to the fact that we have different proximal zones for different activities. The last stage, the fourth, is a phase where de-automatization of the performance leads to recursion back through the zpd. For various reasons, what is learnt may disappear or fade, and repetition may be required. Sometimes the restitution of other-regulation is required, but mostly, the recursive loop goes back to stage two, where self-regulation is provided. An effective self-control technique in this phase is remembering the voice of the teacher or the assistant.

As seen from the model, the first two stages are connected to the notion of the zpd, and hence to assistance from adults or more capable others. There are variations in both the means and patterns of the provided assistance. Taking disciplines and theories ranging from behaviourism and cognitive science to neo-Vygotskianism into consideration, Tharp and Gallimore (1988) have identified six ways of assisting in the first stage of the zpd. This is the stage where performance is assisted by more capable others and thus where the mentor plays an important role. Even if they agree with Vygotsky in that language is an important mediator, Tharp and Gallimore maintain that a full account of development must also include an understanding of non-linguistic means of assisting performance. Even if they use examples from a single third-grade reading lesson to illustrate the means employed in assisted performance, they stress that the examples could have been drawn from most joint-activity settings where the participants have both different skills and different levels of skills. They mention settings ranging from interactions on the playground to teacher pre-service training. Although they present each means of assistance in turn, as I will also do below, Tharp and

Gallimore claim that they have to be intertwined, occurring both simultaneously and in combination with each other.

## The means of assisting performance

Modelling is mentioned as the first means of assistance and is explained as the process of offering behaviour for imitation. Imitation of others is probably a fundamental way of learning that "begins a great distance below Homo sapiens in the phylogenetic scale" (Tharp & Gallimore 1988, p. 47). Rogoff (1990, 1995) shows how children take part in everyday activities through "guided participation" and thus gain opportunities to learn through modelling and imitation. In informal situations we learn a great deal from imitations, and according to Vygotsky (1978) "a full understanding of the concept of the zone of proximal development must result in re-evaluation of the role of imitation in learning" (p. 87). We have to reconsider imitation as a starting point for learning. It is a sign of development when one imitates and obtains help from others. Imitation can be understood as a constructive process because what is imitated is chosen by the individual; it is something the individual wants to do. A person can imitate only that which is within her developmental level (Vygotsky 1978, 1987). Building upon the work of Vygotsky and Bandura (1977), Tharp and Gallimore (1988) point out that the processes underlying the modelling-imitation connection are not the same as simple mimicry. They contend that imitation is an important part of assisted performance and recommend that it should be more appreciated in school settings. In both cognitive apprenticeship[22] (Collins, Brown & Newman 1989) and reciprocal teaching (Palincsar & Brown 1984), modelling is seen as an important feature of assisting cognitive performance, a point which Tharp and Gallimore (1988) find less well understood than modelling visible behaviour, like playing tennis or driving a tractor.

The two next means of assistance deal with following up behaviour. Contingency management follows an action and in effective teaching, the focus is on positive behaviour that will be followed up by praise and encouragement. Thus contingency management will function as reinforcement and give motivation for further work. It is a method of scaffolding which cannot improve or form new behaviour. Developmental advances are originated by other means of assistance. One of them is providing feedback. According to Tharp and Gallimore (1988) "for information to be considered feedback, it must be fed to a system that has a standard, as well as a mechanism for comparing a performance to a standard" (p. 55).

[22] This concept will be elaborated upon as it is used to discuss and interpret Theme two, "Making the invisible visible through guided planning" in Chapter 6.

The standard can be described by goals, but as modelling also provides standards, we become aware of the interdependence of the means of assisting performance. Video-tapes that can be studied in private are mentioned as an example of feedback, thus it is not solely a linguistic means.

The next three means of assistance are specifically linguistic and "a good mix of the three types of verbal assistance – instructing, questioning, and cognitive structuring – produces a lively and cooperative teacher – learner interaction" (Tharp & Gallimore 1988, p. 57). Instructing calls for specific action and is often used as a means of assistance rather than just giving the right answer. The learner is given instructions that make him capable of performing a task, for instance he is instructed to re-read a passage. Although there can be some similarities with instructing, questioning[23] calls specifically for linguistic response. Thus it is a central and valuable device because use of language in the response assists thinking. As pointed out by Tharp and Gallimore, questioning has been the most characteristic means of assistance in formal learning since the first Socratic seminars. Teachers still ask questions, but regrettably mostly embedded in the recitation script where assessment questions predominate. Such questions discover the level of the pupil's ability to perform without assistance. In mentoring, they capture the student teachers' actual developmental level. Assistance questions are needed to trigger mental activity that student teachers cannot produce alone.

The last means of assistance, cognitive structuring, does not call for a specific response; rather it provides a structure for organizing elements in relation to one another. It provides explanatory and belief structures that organize and justify. Examples can be as different as theory in science, theology in religion and rules in games. Some structures are universal while others are cultural. There are two types of cognitive structures which operate similarly; structures of explanation, where the teacher explains something, and structures for cognitive activity, where the child is given assistance to memorize or recall, generally referred to as "metacognition". As mentioned above, these six means of assistance are interrelated; they both can and must be regarded in connection with each other. Even more important, they are not prescriptions for teaching:

> This is because the responsiveness to the ZPD requires individualisation according to the exigencies of the moment and movement through the ZPD. The developmental level of the learner and the complexities of activities all require close accommodation. There is ample room for the personalities and proclivities of

[23] Sometimes instructions can be given in the form of questions. Tharp and Gallimore (1988) illustrate this approach as follows: "We may say to a child 'what flowers did you see yesterday?'Or we may say 'Tell me what flowers you saw yesterday.' These are functionally equivalent in assisting the child by requiring recall and categorisation" (p. 58).

> individual teachers. There is also an art of teaching. Teaching itself is the art of using the science (Tharp & Gallimore 1988, p. 70, capitals in original).

Through "being an eclectic pastiche" (p. 69), to use the words of Tharp and Gallimore, their purpose for drawing on research and concepts from theories of learning, cognition, linguistics and development, has been to develop a theory of teaching which can improve schools.

## Activity setting

The social realities of human life seldom consist of dyadic interactions in formal learning, or as expressed by Tharp and Gallimore (1988): "It is a rare circumstance when only one person influences a learner" (p. 71). All teaching, including the teacher-child dyad is embedded in a broader socio-cultural context. Thus, they claim that "a theory of education not only must deal with the psychological aspects of teacher-student interaction but also must simultaneously address the social context of that interaction" (p. 71). The context must provide for joint activity by expert and apprentice, mentor and student teachers. Otherwise the ideal of assisted performance in the learner's zpd cannot be achieved. The nature of joint activity determines the quality of assistance rendered in the zone.

Tharp and Gallimore (1988) define contexts that have collaborative interaction, intersubjectivity and assisted performance as activity settings.[24] This includes cognitive and motoric components (activity) as well as external, environmental and objective features of the occasion (settings). Special attention must be paid to the meaning attached to the activity by the participants as this will influence important matters such as strategies applied or the manners in which the participants interact. According to Rogoff (1982) this will involve the integration of cognition and context. Activity settings are themselves both homely and familiar as they are the events and people of our work and relations to one another. According to Tharp and Gallimore (1988), "they [the activity settings] are the who, what, when, where and why, the small recurrent drama of everyday life, played on the stages of home, school, community and workplace" (p. 72). What is important is the reference to assisted performances as we saw in the example on page 17 where the father and daughter collaborated on finding her toy.

The persons present in activity settings, "the who", are not there by accident or selected at random. Which persons are involved depends upon the goal of the activity and where the activity takes place. Two dimensions are involved in "the what" of an activity setting. First

[24] The two concept of intersubjectivity and activity setting will be elaborated upon as they are used to discuss and interpret Theme one, "Moving towards shared focus of attention by focusing on the kids" in Chapter 5.

there is a description of the things that are undertaken, the operations themselves and second a description of how they are done, the scripts by which the operations are orchestrated. In the case of mentoring, the operation can be the conversation and the script can be the stable patterns of the behaviour in the conversation. Because activity settings are driven by productive activity, they occur as often and for as long as the product requires. They cannot exist without time; on the other hand they should occur when, and only when there is a product to drive it. When the product is produced or the goal achieved, the scheduled activity should be ended. This is referred to as "the when" of the activity settings. They must also have a place to exist, "the where". In ordinary life, this would be where the production can best occur – it is where the tools, the materials or the uses of the product determine the activity. Although Tharp and Gallimore emphasise that schools are "de-contextualised" activity settings for pupils, they will be the place where the "production" best occurs for student teachers.

The four dimensions of activity settings mentioned so far have been descriptive by nature. Additionally, there is the dimension of the "why" which can have substantial impact on the scripts that influence how the actors behave. Why an activity setting exists and functions can be described in terms of its motivation and its meaning. The first is usually provided by the goal of an activity setting. Even though motivations are not always identical for all members of the activity setting, they tend to create motivational homogeneity for members through the processes of emergent intermental subjectivity. The second facet of the "why" is meaning which provides part of the reason that activity settings exist and continue. However, as with the motivational stimulus, the meaning does not need to be the same for all participants. But there is a tendency that people in activity settings engaging in semiotically mediated interactions develop a mutual meaning structure, an evolving common understanding of the "why".

According to Tharp and Gallimore (1988), schools (at the time they developed their theory) do not inherit some essential features of activity settings, too seldom is there joint productive activity, too seldom meaningful productivity and the learning is de-contextualized. They propose that the solution is that activity settings in which assistance can occur must be created and supported at all levels of the school organisation: "A *primary operational principle for schools should be to assist the performance of all their members*, from kindergartners to superintendent" (p. 82, italics in original). They call this "the triadic model of assisted performance"; how can a person A help a person B, to assist person C. Translated to the case of mentoring in teacher education the question will be, how can the cooperating

teacher help the student teachers to assist the pupils in their learning? As already mentioned above, Tharp and Gallimore find it important that fledgling teachers experience how assisted performance is performed on two planes. They must have a chance to be part of and teach according to a philosophy where assisted performance is in focus and they need to experience it themselves as part of the supervision. The work of the mentor consists of assisting student teachers to develop the children by assisting them through their zones of proximal development.

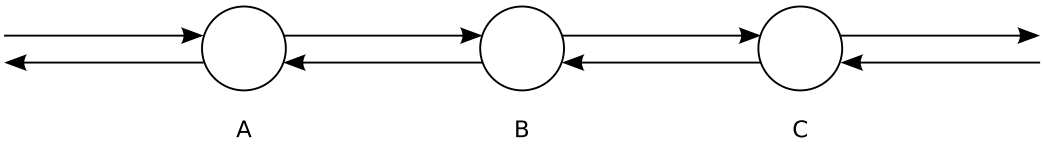


**Figure 2: Resiprocal assistance in the triadic model (Tharp & Gallimore 1988, p. 89)**

As the model above shows, assistance does not flow in one direction only – from the more skilled to the novice, the learner. This is almost never the case. In any interactions, influences are reciprocal in that pupils teach teachers, employees assist principals, pupils assist peers and student teachers assist cooperating teachers. However, assistance, needless to say, most often flows from the more competent other to the less competent participant – but influence, a more general concept, is inevitably reciprocal and shared. Through assisted performance the supervisor affects the cognitive structures of the learners and at the same time is affected by the contribution of the learners in the emerging group intersubjectivity. As seen above, assisted performance and intersubjectivity are important features of the definition of an activity setting. The third mentioned feature is joint activity, and as with other concepts within the socio-cultural tradition, the three features are intertwined: “The language that accompanies joint productive activity is the major vehicle for the development of intersubjectivity, the internalisation of concepts, the development of discourse meaning, and the development of higher cognitive processes” (Gallimore & Tharp 1990, pp. 196-197).

In settings defined as activity settings where assisted performance takes place, a fourth feature is relevant, the instructional conversation. It is through instructional conversations “that babies learn to speak, children to read, teachers to teach, researchers to discover, and all to become literate” (Tharp & Gallimore 1988, p. 111). Tharp and Gallimore (1988) emphasise that the concept of instructional conversation contains a paradox as “instruction” and “conversation” would appear to be contrary to each other. The former implies authority and planning while the latter implies equality and responsiveness. They claim the task of teaching

is to solve this paradox, “to most truly teach, one must converse; to truly converse is to teach” (p. 111). To converse is to assume that the learner has something to say beyond the “answers” already known by the teacher. According to Gallimore and Goldenberg (1992), an important part of how they define the term instructional conversation is to minimise “known-answer” questions and instead be responsive to student contributions in the course of the discussion. Although there is a thematic focus for the discussion there are multiple and interactive turns on the same topic. One of the aims is to activate, use or provide background knowledge and relevant schemata. If necessary, there is direct teaching. Another aim is to promote more complex language and expression and provide the basis for statements or propositions by pupils. The atmosphere is challenging but non-threatening and opens up for general participation, including self-selected turns. The instructional conversation stands in marked contrast to the recitation script, which may be miseducative simply because it does not set up the classroom as a community of discursive inquiry. Employing the instructional conversation instead of the recitation script is one element of instruction based on the socio-cultural perspective (Henderson & Cunningham 1994).

In this chapter I have presented the theoretical framework for my study. I have presented my worldview on how I believe people learn and how mentoring is connected to this. In the next chapter I will present how my study is situated within a qualitative, interpretative research tradition.

# Chapter 3
# Approaching the research field

School practice is seen as one of our culture's most important and complex mediation systems (Cole 1996, Doyle 1977). Mentoring student teachers during their practice in schools is both a part of this system and a complex system in itself. There are at least two reasons for this complexity. First, there are four to five student teachers interacting both with each other and with the cooperating teacher, and second, practice in teacher education serves many functions. As mentioned in the introduction chapter, one aim is to enhance the student teachers' understanding of the subject matter they are teaching, not only in mathematics but in all the subjects being studied. Another important function is learning to handle the role as a class teacher. Gudmundsdottir (2001) states that case studies capture the complexity of school practice and I would add that they are also suitable for catching the complexity of mentoring.

Yin (2003) suggests that case studies are the preferred strategy when asking "how" and "why"[25] questions, when the investigator has little control over events and when the focus is on a contemporary phenomenon within some real-life context. Merriam (1998) finds case studies to be a particularly suitable design if you are interested in process. All these attributes are relevant for my study and thus I find case study research to be the preferred method to explore my research question; how the cooperating teacher's way of mentoring can facilitate student teachers' development of pedagogical content knowledge in mathematics.

I will start this chapter by situating my case study within a qualitative, interpretative tradition where the aim is to highlight the research subject's voice. I will also reveal my own voice in presenting the story about the research process as one of the features of qualitative research is the intertwining of data collection and data analysis throughout the entire process. As the researcher, I am both the most important instrument for collecting data and the person who has to make decisions, choose from among alternatives and exercise judgements throughout the process (Merriam 1998). However, as will be seen, there are other voices, from literature, from my experiences and from the environment that help me.

## *Starting the study*

### Case study research

There is a lot of confusion surrounding the meaning of performing case study research. It can

[25] Not in the meaning of explaining cause and effect, but to understand why something is happening.

be understood in terms of process, unit of study and end product, where each of these approaches reveals something about case studies and contributes to a general understanding of the nature of this kind of research (Merriam 1998, Stake 1995, 2000, 2005, Yin 2003). Merriam (1998) finds that "the single most defining characteristic of case study research lies in delimiting the object of study, the case" (p. 27). Other scholars support this by claiming that case study research is an exploration of a system bounded in time and place (Bassey 2000, Cresswell 1998, Stake 1995). Miles and Huberman (1994) think of the case as "a phenomenon of some sort occurring in a bounded context" (p. 25). The phenomenon (or the case) can be an individual, a programme, a group, a community, an event, an activity and so on. For me, the case or phenomenon is chosen to provide insight into a greater issue, namely mentoring in the practice field of teacher education. Stake (2005) calls this approach an instrumental case study.

Defining the boundaries can be a challenge in case study research. In my study, the boundaries both in time and place were given. At the time I conducted the study the student teachers' field practice occurred during three weeks in the autumn and three weeks in the spring during the same academic year. The field experience is situated in the same school with the same cooperating teacher or mentor all these weeks. In other years the mentor will meet other student teachers and the student teachers will meet other mentors, but the meeting and the collaboration on mentoring in the first year of teacher education is situated only within these weeks.[26] There are limits both on the number of persons and the amount of time for observations, and thus the criteria for being a case are met (Merriam 1998).

In making the design of the study, researchers in this tradition have to make some choices as to which sort of case study they will employ. The reason for undertaking this type of research is to gain more understanding of how all the parts work together to form a whole. Researchers within the qualitative tradition recommend single-case studies, and Stake (2005) explains it like this: "The name 'case study' is emphasized by some of us because it draws attention to the question of what can be learned from the single case" (p. 443). I have decided to undertake a single-case study so I can perform the in-depth analysis I find necessary to capture the complexity. Another choice concerns the question of whether to carry out a holistic analysis of the entire case or an embedded analysis of a specific aspect of the case (Yin 2003). As mentioned above, mentoring is a complex activity and can be viewed from different perspectives and hence it can focus on different aspects, for instance relational or

[26] From the academic year of 2003/2004 a new overall plan for teacher education (UFD 2003) allow for more flexible use of these six weeks.

dialogical perspectives. My perspective focuses on the issue of learning, especially learning to teach mathematics. According to Yin this is called an embedded analysis. This does not mean I will take the phenomenon of mentoring completely apart. Even though I will employ an embedded analysis of a specific aspect of the mentoring practice, my intent is to explore how this connects to the whole situation. Therefore, my idea is that I need to be with my research subjects throughout the entire period if I am to see the big picture.

My final choice before entering the field concerns the data collection. As the purpose of my study is to provide a holistic, in-depth account of the case, extensive, multiple sources of information, or data, are needed (Erickson 1986). Case studies can be quantitative or qualitative or a combination of the two (Yin 2003). My study is located within the interpretative, qualitative tradition. I find that the assumptions underlying this type of research fit my worldview and are suitable when performing research where the aim is understanding and meaning. I will explain this further in the next section.

## Qualitative research

The interest of qualitative researchers is to understand the meaning people have constructed, that is, how their research subjects make sense of their world and the experiences they have in the world. The main concern is to understand the phenomenon of interest from the participant's[27] perspectives, not the researcher's. This is sometimes referred to as the *emic*, or insider's perspective, versus the *etic*, the outsider's view (Erickson 1986, Merriam 1998). Qualitative research rests upon certain philosophical assumptions. Thus researchers in this tradition approach their studies with a certain paradigm or worldview, a basic set of beliefs or assumptions that guide their inquiry. These assumptions are issues related to ontology, epistemology, axiology, rhetoric and methodology (Creswell 1998).

The ontological assumption addresses the nature of reality. Reality is seen as complex and ever-changing and constructed by individuals involved in the research situation (Glesne & Peshkin 1992). Thus qualitative researchers acknowledge that multiple realities exist, such as the reality of the researcher and the realities of the research subjects. The qualitative researcher reports these realities by relying on the voices and interpretations of research subjects through use of extensive quotes and presenting themes that reflect words used by the

[27] The literature on qualitative research uses various terms, such as participants (Erickson 1986, Glesne & Peshkin 1992), informants (Merriam 1998), actors (Stake 1995) and research subjects (Moen 2004) when talking about the individuals who are the focus of the study. Considering the assumptions underlying qualitative research I prefer to use the terms research subjects and participants interchangeably. Other terms may be used in direct quotes.

research subjects. On the epistemological assumption, the relationship of the researcher to the participants in the study, qualitative researchers interact with the participants, whether this interaction takes place as extensive fieldwork, as in my case, or as interviews. Actually, the researcher tries to minimize the "distance" or "objective separateness" (Guba & Lincoln 1988, p. 94) between herself[28] and the research participants.

This close relationship has implications for the axiological assumption, the role of values in the study. The qualitative researcher acknowledges and should be aware of her subjectivity and of the fact that she brings prejudices to the study. Experiences as well as choice of theoretical framework guide the process in trying to understand and create meaning out of the data. In my study, other researchers, for instance a mathematics educator not preoccupied with mentoring as I am would have seen something else.[29] Because the researcher admits to the value-laden nature of the study, she actively reports her values and biases as well as the value-laden nature of information gathered from the field. A qualitative researcher sees that her research never can be objective or devoid of values (Creswell 1998).

Basing research on the rhetorical assumption means that in the research report the researcher uses literary forms of writing, such as the use of metaphors, the use of the first person "I" and a focus on stories. Terms like understanding, discovering and meaning are frequently used and function as important rhetorical markers. Additionally, the researcher uses specific terms, such as credibility, transferability and dependability to verify a case study (Lincoln & Guba 1985).[30] Moreover, the language of the qualitative researcher becomes personal, literary and more based on definitions that evolve during the study rather than on definitions pre-set by the researcher from the start (Creswell 1998).

The methodological assumption emerges from the above assumptions. The researcher starts and continues to work inductively. She develops categories from research participants

[28] Because I am a woman I will use the personal pronoun she when I talk about the researcher.

[29] This point can be illustrated by two stories about the empirical work of the two researchers Grant (1991) and Gudmundsdottir (1991). They were doing fieldwork with the same teacher but at different times. At the time they conducted the studies they did not know about each other. Both researchers wrote case descriptions of the way Susan Hall, the teacher, organised the teaching and learning of literature. But they infused their stories with different meaning because they were working from different theoretical perspectives. While Grant told a narrative about Susan Hall as a teacher of critical thinking, Gudmundsdottir developed a narrative about Susan Hall as a teacher displaying impressive pedagogical content knowledge. According to Susan Hall, both narratives about her are true even if the narrative descriptions of her are so different that a stranger reading them would think that they refer to two different teachers. Clark (2005) points to how we should not be surprised by, or alarmed about the differences in these two portrayals. This is an example of how Susan Hall, and every teacher we study, is complex and multi-faced. He wonders if we should not do intentionally what here happened accidentally; undertake two successive qualitative studies of one teacher to gain more knowledge about the developmental and situational dynamics of expertise in teaching (or mentoring, my comment).

[30] I will come back to the issue of verification procedures at the end of this chapter.

rather than specifying them in advance. In case studies, for example, the researcher details a description of the case and its setting or context before mentioning the more abstract themes. The investigator may "layer the analysis" (Creswell 1998, p. 77), presenting numerous themes initially, followed by grouping these themes into broader and more abstract categories later. A researcher begins a qualitative study with general questions and refines them as the study proceeds; the process is one of an emergent design.

Because qualitative research is designed inductively with an emergent design, many believe mistakenly that theory has no place in such studies (Gudmundsdottir 1992, 2004, Merriam 1998). Actually, in doing a case study, theories play an important role on different levels throughout the entire research process. In Chapter 2 I already presented my theoretical framework[31] for the study. Such a framework is derived from the orientation or stance the researcher brings to the study, and according to Merriam (1998) every study has one and all aspects of the research are affected by it. She further states that the framework can be identified through our vocabulary, concepts and theories. She calls this discipline orientation and defines it as follows: "The disciplinary orientation is the lens through which you view the world. It determines what you are curious about, what puzzles you, and hence, what questions you ask that in turn begin to form your investigation" (p. 45).

In addition to the socio-cultural approach within which my study is situated, other theories on mentoring, learning to teach and pedagogical content knowledge will of course influence my analysis and interpretation. Without all these theories I would not have been able to see anything beyond commonplace descriptions (Gudmundsdottir 1992, 2004). Theories help the researcher to understand the meaning of actions and thus "make the familiar strange", as expressed by Erickson (1986, p. 12). However, as the researcher begins to understand more about the meaning, she lets go of the theories for a while. Then, in the last phase of the research new theories emerge depending on what the data have told her. Glesne and Peshkin (1992) describe the role of theory throughout the research process as follows:

> Preexisting theory may aid in question development - not to shape the study design, but to extend the range of your own thinking. In the early stages of data analysis, you begin developing your own substantive theories about the social phenomenon you are studying. After the data have been collected and analysed you may return to the literature to juxtapose your findings and substantive theories with grand theory in order to discuss the contributions that your study provides (p. xiii).

In other words: in contrast to deductive researchers who in a sense "hope to find data to match

[31] Merriam (1998) uses "theoretical framework" while Glesne and Peshkin (1992) use the term "conceptual framework". In my opinion they are talking about the same thing. They refer to the framework surrounding the study, but not necessarily the theories used to explain the findings.

a theory, inductive researchers hope to find a theory that explains their data" (Goetz & LeCompte 1984, p. 4). As will be seen at the end of this chapter, theories give meaning to qualitative case studies. The job of the qualitative researcher is to go beyond behaviour by giving meaning to what is observed and analysed through interpretation. One way of doing this is to explain the findings through use of theories (Erickson 1986, Geertz 1973, Gudmundsdottir 1992, 2004).

To summarise, the assumptions underlying qualitative research lead to the following definition of it:

> Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos to the self. At this level, qualitative research involves an interpretive naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them (Denzin & Lincoln 2005, p. 3).

My case study is now located within the qualitative, interpretative tradition, and I turn my attention to the selection of research subjects.

### *The choice of research subjects*

Research subjects or research participants can be selected at random or on the basis of particular preferences. Selecting research subjects for the purpose at hand is the most suitable approach (Miles & Huberman 1994). Purposeful sampling is based on the assumption that the investigator wants to discover, understand and gain insight, and therefore must select a sample from which the most can be learned. Patton (2002) argues that

> the logic and power of purposeful sampling lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research, thus the term purposeful sampling (p. 230).

LeCompte, Preissle and Tesch (1993) prefer the term criteria-based selection to the terms purposive or purposeful sampling. In criterion-based selection you create a list of the attributes you find essential to your study and then proceed to find or locate a unit matching the list. You not only spell out the criteria you will use, but you say why the criteria are important.

I had three things in my mind when I decided to use Sara as my research subject. First, I had reason to believe that student teachers would experience pupils doing mathematics the way the national curriculum (C-97) emphasises. I find learning to teach in a way that is emphasized in the national curriculum to be important because the overall plan for teacher

education states that student teachers' competence in mathematics teaching should be directed towards the prevailing curriculum for schools (KUF 1999). However, I could not be sure if the student teachers would do this in their own teaching. Second, Sara has a reputation of being "a good cooperating teacher" from the evaluation reports delivered by former student teachers. Third, I knew Sara was open to being audio- and videotaped, and capable of looking at episodes from the mentoring conversations and discussing them. She would be able to give me rich information. I knew this because before commencing my study I conducted some pre-studies to see if my method of discussing video-taped mentoring conversations with the cooperating teacher was feasible. The aim of this method was to gain better understanding of the actions performed by the mentors. Sara was one of three cooperating teachers I asked to explore if it would be easy to discuss episodes from the mentoring the way I was planning. During that process I became familiar with Sara as a teacher, and as a cooperating teacher who loves her work and is both capable of and likes to talk about her profession.

My focus is on Sara. It is her thoughts and actions, her story I would like to hear and understand. It is her voice I regard as the most important one in answering my research question. However, in a socio-cultural perspective it is impossible to regard her in isolation and apart from the context and the interactions with the student teachers. Thus, the student teachers are of course also important research participants, and their voices will be heard as well.[32] After all, the intent is to explore how Sara through her way of mentoring may facilitate their development of pedagogical content knowledge of mathematics. While I deliberately chose Sara, the fact is I did not have a chance to choose the five student teachers, Eli, Eric, Ina, Ian and Irene. Before I contacted Sara it was decided that these five student teachers would be with her and her class of third graders for six weeks.[33] Luckily all five agreed to participate in the study when I told them about my research plan. Thus I gained entrance to the field and could begin my data collection through six weeks of extensive field work. Before I examine this further it is important to explain what I see as my unit of analysis.

According to Merriam (1998) "once the general problem has been identified, the task becomes to select the unit of analysis, the sample" (p. 60). Thus she equates the sample with the unit of analysis. However, building upon a socio-cultural framework I understand mentoring in terms of mediated activity where the cooperating teacher employs mediational means, mostly language, to assist the student teachers in their learning process. Mediated

[32] I will give a presentation of Sara and the five student teachers in Chapter 4.

[33] How the practice in teacher education in Norway was organised by the time I conducted the study is explained in Chapter 4.

action as the unit of analysis within a socio-cultural framework will be dealt with below.

### *Mediated action as a unit of analysis*

As we have already seen in Chapter 2, according to Vygotsky (1978), human learning and development occur in socially and culturally shaped contexts. He focuses on the relationship between human beings and the context, and claims that higher mental functioning in the individual derives from social life. To understand the individual it is necessary to understand the social relations in which the individual exists. The challenge within a socio-cultural perspective is therefore to examine and understand how human actions are related to the social context in which they take place. A central concept for understanding how human mental functions are connected to external social settings is mediation, "human thinking develops through the mediation of others" (Moll 2001, p. 113). Kozulin (1995) argues that Vygotsky's notion of mediation includes three large classes of mediators: signs and symbols, interpersonal relations and individual activities. As a consequence of this, Wertsch (1991) claims that a fundamental assumption of a socio-cultural approach to the mind is that human action is what should be described and explained. The unit of analysis will be grounded on action. Wertsch puts it this way:

> When action is given analytic priority, human beings are viewed as coming into contact with, and creating their surroundings as well as themselves through the actions in which they engage. Thus action, rather than the human being or the environment considered in isolation, provides the entry point into the analysis (p. 8).

Wertsch also connects mediation and hence the use of mediational means to this form of action by claiming the relationship to be so fundamental that we can talk about "individual(s)-acting-with-mediational-means" rather than "individual(s)" (p. 12). Though there are no direct indications in Vygotsky's work that tool-mediated action can function as a unit of analysis, other scholars support Wertsch's ideas (Moll 2001). Zinchenko (1985) even states that the proposal of tool-mediated action does not contradict any of the ideas relating to unit that are found in Vygotsky's writings. While Vygotsky did not offer any well-developed account of his ideas on the unit of analysis, he did discuss the notion and it was of great significance to him.

Vygotsky's (1986) main approach to the unit was that of a living part of the whole, and he warned against breaking down the complex whole into elements. He employed an analogy from chemistry about the relationship between water, on the one hand, and the elements of oxygen and hydrogen on the other to explain his point:

> It may be compared to the chemical analysis of water into hydrogen and oxygen, neither of which possesses

> the properties of the whole and each of which possesses properties not present in the whole. The student applying this method in looking for the explanation of some property of water – why it extinguishes fire, for example – will find to his surprise that hydrogen burns and oxygen sustains fire. These discoveries will not help him much in solving the problem. (…) Nothing is left to the investigator but to search out the mechanical interaction of the two elements in the hope of reconstructing, in a purely speculative way, the vanished properties of the whole (p. 4).

When action is given analytic priority neither human beings nor the environment can be considered in isolation. Human beings are viewed as coming into contact with and creating their surroundings, as well as themselves, through the actions in which they engage (Wertsch 1991). To understand both the activity and the forms of mediation involved I decided to analyse and interpret the mediated activity as it emerges in the mentoring sessions. The sessions will of course consist of conversations and discussions and in this way all the parts of mediators mentioned by Kouzulin (1995) will be present; signs and symbols, interpersonal relations and individual activity. In the next section I turn to the process of data collection in the field. I will show how action connects to texts and thus how it can be analysed through a hermeneutical process. Further, I will show how this affects the texts which form my data collection, and hence the data material.

## *Entering the field, the process of data collection*

### Action considered as a text

According to Bakhtin, "where there is no text, there is no object of study, and no object of thought either" (1986, p. 103). He points out that man always expresses himself, that is, he creates a text. Ideas, thoughts and meanings are realized and made available to the researcher only in the form of a text. A human act is a potential text and can be understood (as a human act and not a physical action) only in the dialogic context of its time. Bakhtin says:

> When studying man, we search for and find signs everywhere and we try to grasp their meaning. We are interested primarily in concrete forms of texts and concrete conditions of the life of texts, their interrelations, and their interactions (p. 114).

The systematic use of hermeneutic interpretation as a research philosophy to approach participants' meanings in a given social interaction is called "the strong hermeneutic program"[34] by Phillips (1992). He thus connects social activity to hermeneutics and according to Ricoeur (1971) social actions can be regarded as texts. They become text (or data, to be interpreted like text) for several reasons. By writing down a description of the action, the

[34] "The weak hermeneutic program" involves general understanding through the use of symbolic systems where every act of comprehension is by nature hermeneutic (Phillips 1992).

action becomes fixed, and it will no longer be tied to the moment it occurred. By "fixing" it the action and the meaning have been detached from the moment, event and persons and is independent of the original participants. An action can acquire greater meaning than the participants could imagine, an event can go beyond the original social situation and become recreated in other social contexts. The social events should be perceived as an "open work" where meaning can be added from the reader or listener (Ricoeur & Thompson 1981).

Being with Sara and the student teachers for six weeks provided me with many texts. Some of them, for example individual log books written both by Sara and the student teachers, were forms of written texts. Oral texts during the mentoring sessions were audio- or videotaped and transcribed into lasting text by me. I was interested in the videotaping for two reasons. First, to understand Sara's responses and actions during the conversations I wanted to know more precisely than I could observe who did the talking, what was said and how it was said. Second, the videotapes were used as a means to recall episodes which Sara and I could discuss later. Through the pre-study I experienced that it was difficult to know which issues were discussed at what time during the mentoring conversations. Therefore, I decided to tape all the conversations either by audio- or videotape. However, I did not transcribe all of them. Those dealing with mathematics were transcribed while I made "write ups" of the rest, meaning that I summarised both the content and patterns regarding, for instance, who was talking. Thus the actions from the mentoring conversations were fixed into texts in two ways, transcription "word by word" and as "write ups".

All interviews with Sara and the student teachers were taped and transcribed. Some of the interviews with Sara were conducted to key into her thoughts on her role while others were more like conversations (or discussions) on what had happened during the mentoring. In some of them we just tried to remember what had happened while in others we watched sequences on video[35] and discussed Sara's actions and intentions. Although I either audio- or videotaped the mentoring conversations I also were present and wrote down observations of almost all of them. Listening to a tape or looking at a film can never grasp the whole situation. Thus my observation journal also became an important text. On the right hand side of the page I wrote down what Sara and the student teachers talked about (this made it easy to find the text about mathematics on the tapes) and some of the behaviour I found interesting. On the left hand side I wrote down some thoughts and reflections that came to me as I was listening and watching.

[35] My intention was to videotape all the mentoring conversations but because one of the student teachers did not want me to do so, I decided to only audiotape in the autumn period. In agreement with the student teachers all the conversations were videotaped in the spring period.

These thoughts often took the form of questions like "is it so that?" or "could it be that?" In the observation journal I also wrote down my observations in the classroom. Although my interest primarily was in the mentoring conversations and the actions performed there, observations made in the classroom were necessary to better understand the focus of the mentoring. Writing down observations is an example of a social action that is fixed into lasting text.

All the texts mentioned here comprise the data material for my research, multiple sources, as is one of the claims of case study research.[36] Although I have defined my unit of analysis to be the mediated activity as it takes place during the mentoring conversations, the other texts, or material are necessary both to catch the complexity and to verify the study, a theme I will return to at the end of this chapter. As stated above, hermeneutics is strongly connected to interpretations of texts and below I will explore the idea of hermeneutics in the human sciences.

## Hermeneutics

The word hermeneutics has three different meanings; expression, interpretation and translation. Together these words reflect what we can call the hermeneutic operation, that is work with the aim of understanding (Lægreid & Skorgen 2001).[37] To understand we need to interpret. What is to be interpreted are texts of different kinds, utterances, art, people's experiences, human actions and other things regarded to have "a meaning". Hermeneutics inherits a dialogical nature as both the interpretation and the understanding are to be comprehended as a process of knowledge regarded as a "conversation" between the interpreter and what is to be interpreted. The process is a dialogue through which a question leads to an answer and in turn leads to another question. In this way both the subject and the object participate in the process of generating knowledge (Marc-Wogau 1981).

According to Taylor (1985) there is an inevitable hermeneutic component in human science; we try to interpret that which we do not understand. Taylor maintains that interpretation is an attempt to clarify or give meaning to an object of study that superficially is seen as unclear, chaotic, incomprehensible and even self-contradictory. Interpretation is an attempt to find an underlying meaning or express something that seems unclear in a clearer

[36] See Appendix 1 for a more thorough description of the data material and how the different texts are marked in the research text.

[37] Historically hermeneutics has developed from a discipline or method to understand ancient texts (for instance the Bible and the old Greek texts) to a philosophy of hermeneutics as presented by Heidegger and Gadamer. Here I regard hermeneutics as a theory on (or frame of) understanding (Lægreid & Skorgen 2001).

way. The phenomena that can be the focus of the hermeneutic inquiry are characterized by certain conditions. The object of the study must be of a kind that can give meaning. Interpreting is trying to express the meaning by means of other and new expressions. Therefore we must also be able to distinguish between meaning and expression. The meaning of the object of study must also be the meaning for the social actors. Meaning is always meaning for someone (Taylor 1985).

As we can see, hermeneutics is highly relevant for my research, as it is for all social studies. Interpretation and understanding are important to any researcher in these sciences as the data material often comprises phenomena with meaning, such as actions, utterances and texts. Social studies also try to explain phenomena embedded with meaning, in my case mentoring. Interpretation and understanding are fundamental to this type of study. An assumption in hermeneutics is that we always meet the world with suppositions which decide what we understand or do not understand. When we approach something (text, behaviour, art) that we do not understand, we do so in light of what we bring to the situation (Gilje & Grimen 1993). Gadamer (1989) calls the suppositions we bring to the situation prejudices. He contends that prejudices are necessary to understanding because we have to start with some ideas about what we are looking for. Without them we have no direction.

Gilje and Grimen (1993) point out three different kinds of prejudices. The first concerns language and conceptions, “The researcher sees the world through the conceptions her language offers. (…) These conceptions make it possible to see something as something” (p. 148, my translation). Different researchers therefore might have different horizons of understanding when in another sense they are looking at the same thing. Another kind of prejudice is connected to beliefs and ideas. This means what the researcher holds as being true about the world, nature, society, and not least about others and herself. These prejudices are important because they decide what the researcher will experience as problems and thereby define research problems. The last prejudice mentioned by Gilje and Grimen is personal experience which will of course differ from researcher to researcher according to the environment they have lived their lives in. People interpret the world in light of their experiences which often function in the researcher's mind as examples of how things are or the way things work.

The researcher brings all these prejudices to the situations she is supposed to interpret to gain understanding. There are some reminders of these prejudices. First, there is what Polanyi (1973) calls tacit knowledge, where the researcher is not aware of the prejudices which may then guide the interpretations unconsciously. As will be seen below, to ensure the credibility

of the study the researcher needs to expose her prejudices. Second, we find the holistic view, which means that things are connected to each other in a more or less structured way. If the prejudices of a researcher are not connected in such a loose way the world will presumably be so fragmentary and chaotic that meaningful action will be impossible. In my case, a socio-cultural framework fits well with the assumptions underlying qualitative research. Both inherit a constructivist world view; reality is seen as complex and ever-changing and knowledge develops through interactional processes. Third, the prejudices are changeable through new experiences; if this were not the case, intersubjectivity between people would be impossible. All people would be in their own world. Changes in parts of the system can affect other parts due to the holistic view (Gilje & Grimen 1993).

My prejudices concerning the structure of mentoring conversations are based on the experience that the cooperating teachers usually use a strategy designed by Handal and Lauvås (1983). This strategy has three phases: pre-teaching conversations, teaching and post-teaching conversations. My experience is that pre-teaching conversations are not seen to be common planning. The student teachers usually plan their lessons and produce documents showing the cooperating teacher their thoughts. These documents are often referred to as planning documents and as will be seen in Chapter 4, student teachers are told to use such documents while teaching. Both by observing these pre- and post-teaching conversations and audio- or videotaping them I am supposed to see how this relates to how the cooperating teacher supports or assists the student teachers' teaching. I have some ideas about use of language as mediated action, and the importance of posing good questions to make the student teachers reflect both on their planning and teaching. As already mentioned, these prejudices stem from theory, but also from personal experiences as a cooperating teacher and as a teacher in education at the university college. I had both been a part of and watched many such conversations for a long period of time before I started the research. I also have prejudices concerning student teachers and their images of and ability to teach mathematics. As mentioned in the introduction, I know that student teachers have problems handling the interactivity that occurs when pupils discuss mathematical problem solving with peers and with the teacher. Research reports have even told me about student teachers trying to avoid interactive teaching and mentors contributing to this. The problem seems to be a lack of both subject-matter knowledge and pedagogical content knowledge (Ball 1988, 1991, Calderhead & Robson 1991, Edwards 1998, Nilssen, Wangsmo-Cappelen & Gudmundsdottir 1996).

Even if prejudices decide what we understand, perhaps their most important role is when they fail, when we experience that the world is not what we expected it to be. Gadamer (2001)

points out that the Greeks have a wonderful word for what leads to the failure of prejudices – *atopon.* Actually it means what is not in the system of our prejudices and therefore makes us wonder. He further reminds us of the Platonian thesis "the undertaking of philosophy starts with wondering" (p. 148, my translation). We cannot progress by means of the prejudices we brought with us into the research. Gadamer also reminds us of Aristotle's belief that what we anticipate relies on how deep the insight is. This means that *atopon* is relative because it is so related to knowledge and experience. All this wondering and these pauses in understanding are obviously always open for progression and deeper understanding.

The researcher seeking understanding runs the risk of going astray due to prejudices which are not confirmed by the cases themselves. But as Gadamer (1989) says:

> A person trying to understand something will not resign himself from the start to relying on his own accidental fore-meanings, ignoring as consistently and stubbornly as possible actual meaning of the text until the latter becomes so persistently audible that it breaks through what the interpreter imagines it to be. Rather, a person trying to understand a text is prepared for it to tell him something. That is why a hermeneutically trained consciousness must be, from the start, sensitive to the text's alterity (p. 269).

Such receptiveness presupposes neither being neutral about the case nor the extinction of oneself. It implies adjusting one's own fore-meanings and prejudices to the case. It is important for the researcher to be aware of one's own bias and to give the text the possibility of presenting itself and thus compare the text's truth against one's own fore-meanings. These ideas became important to me. In the beginning I was not good enough at letting the text open itself. I could see from my observation journal or memos that I was mostly focused on what did not happen; the student teachers did not perform whole-class teaching, there were no planning documents and other written plans for the first week. Actually, I was surprised to see how much Sara both was the leader of the class this first week and how during the next week she took part in the student teachers' planning; and they planned for interactive teaching. This challenged my experience and hence my prejudices. I had to find the meaning, what is this about? Why is it that the student teachers in my study behave differently than the ones in other similar studies?

My next thought was that context is important. The context of my study is quite different from some of the other studies mentioned above. The most important difference is perhaps differences in nationality and different kinds of teacher education programmes. In Norway the student teachers are to be together with their cooperating teachers in all subjects for five to six weeks divided in two periods. One of the studies I refer to above is from England (Edwards & Collison 1996) and the student teachers in this study are just observing and teaching the mathematics lessons. Perhaps they lack the security they need to try new forms of teaching?

And perhaps they have not seen other ways of teaching? I began to understand more fully that the support would be connected to the whole context of both practice and mentoring, and that mediated activity for this special cooperating teacher consists of more than the use of oral language. I realised that the mentoring conversations did not constitute a complete unit of meaning for me. To capture the whole meaning I realised I had to look at the whole context. By doing so I developed thoughts about the cooperating teacher as a model. The student teachers had gained access to both the planning and the teaching of the cooperating teacher. This was a new surprise because there has not been a receptive attitude to this over the last two decades in Norway. Importance has been attached to having the student teachers teach alone from the beginning and not connecting the mentoring to the apprenticeship model (Skagen 2000).

Thus I began to develop some ideas on possible categories or themes, while being well aware of the fact that they would change during the process. Data analysis is an ongoing process in qualitative research. We are constantly theorising and trying to make sense of our data through what can be called an intuitive and inductive process, a dynamic and creative process. Throughout the analysis, researchers attempt to gain a deeper understanding of what they have studied, keep track of emerging themes and continually refine both the analysis and the interpretations (Taylor & Bogdan 1998). As the study progresses, we begin to focus the research interest, ask directive questions, check out research subjects' stories and follow up on leads and hunches. At this point in the process there were many new thoughts swirling in my head, and I had to go back and forth, like the movements in a hermeneutic circle.

### *The hermeneutic circle*

The hermeneutic circle points to the relations between what we are going to interpret, the prejudices, and the connection or context where it is to be interpreted. The conception indicates that all interpretation consists of constant movements between wholes and parts, between what is interpreted and the context, and between what is interpreted and our prejudices. How the part is to be interpreted relies on how the whole is to be interpreted and vice versa. How the whole phenomenon is to be interpreted depends on how the context is interpreted and vice versa. If we understand the hermeneutic circle this way it will refer to grounds of connection. It tells us something about how the interpretation of phenomena with meanings can and must be given reasons. Thus the hermeneutic circle says something about what the reasons for interpretations are like, what structures they entail or what they are based on (Gilje & Grimen 1993). As Gadamer (1989) points out

> We recall the hermeneutical rule that we must understand the whole in terms of the detail and the detail in terms of the whole. This principle stems from ancient rhetoric, and modern hermeneutics has transferred it to the art of understanding. It is a circular relationship in both cases. The anticipation of meaning in which the whole is envisaged becomes actual understanding when the parts that are determined by the whole themselves also determine this whole. (…) The harmony of all the details with the whole is the criterion of correct understanding. The failure to achieve this harmony means that understanding has failed (p. 291).[38]

The researcher is an important part of the conception of the hermeneutic circle, and the dialectic process between the researcher and the text is an important feature of hermeneutics. Truth and understanding evolve in a process between the interpreter and the text. They are not something that can be studied or found from the outside with help from rules of methods or techniques of interpretation.

Søndenå (2002) compares her research with the story of Espen Askeladd, a character from Norwegian fairytales. He is interested in everything that he comes across; he is curious and collects things even though he does not immediately know what he will use them for. Liedman (2001) has similar ideas and maintains that to gain new insight one must dare to make detours by taking into consideration things you did not search for in the beginning; the roads to knowledge are detours. Both Søndenå and Liedman point to a feature often connected to the hermeneutic circle. It is often understood as going back and forth and many scholars prefer to use the term spiral rather than circle (Gudmundsdottir 2001). However, the term circle is not used to point to something closed; it is used to point out that interpretation is not a linear process. There are many parts (or details) brought together to understand the whole.

To avoid the impression of the circle as something closed, where the meaning of the whole is constituted from the beginning, I turn to Gadamer (2000) and his concept of concentric circles. He maintains that our expectations of meaning have to be changed if the text demands this. The movement of understanding will continue steadily from the whole to the parts and back to the whole, "the task is to expand the understood unit of meaning in concentric circles" (p. 326, my translation). That all the details fit together into a whole is always the criterion for "correct" understanding. If there is no such harmony, there will be a breakdown in understanding. I see talking about the hermeneutic circle in terms of concentric circles as a useful approach in connecting the notion of the hermeneutic circle to Rogoff's (1995) notion of different planes in the analysis.

In her research on children's development, Rogoff claims that there are three planes of analysis which she refers to as the community, interpersonal and personal planes. She claims that "these are inseparable, mutually constituting planes comprising activities that can become

[38] This reminds us of Vygotsky's ideas presented in the analogy of hydrogen and oxygen, pages 40-41.

the focus of analysis at different times, but with the others necessarily remaining in the background of the analysis" (p. 139). The active and dynamic contributions from individuals, their social partners, historical traditions and materials, and their transformations, are connected through the use of "activity" or "event" as the unit of analysis. Thus she draws attention to the details of the unit of analysis. Each detail can become the focus of the analysis with the other details in the background. But each detail cannot explain the case if not seen together with the others as a whole. I like to think of the notions of foreground and background as concentric circles where the details change place during the analysis. As interpretive researchers we must be prepared to redefine the text providing us with data. We have to understand many texts that can be put together to create meaning. As we allow the text to open up to our questions and we listen to the answers we will be able to create meaning. The important thing is to remember the first of the hermeneutics conditions, to understand the case; you have to deal with the same case (Gadamer 2000). For me, the unit of analysis is still mediated activity as it emerges in the mentoring of mathematics, but to understand the activities there will be context and history in the background helping me to develop the categories which offer the whole meaning. Creswell (1998) recognises the highly interrelated set of activities of data collection, analysis and report writing, and claims that qualitative researchers do not always clearly know what stage they are in. However, there will always be a time for intensive analysis and interpretation. This will be the theme of the next section.

## *Leaving the field*

### Final analysis

I have shown how during my fieldwork I have been constantly looking for patterns and themes, noticing key words and phrases and trying to understand what they mean. So by the time I left the field I had a great number of texts to be thoroughly analysed, as well as ideas and thoughts on what I could be looking for in order to understand. Bogdan and Biklen (2003) explain the difference between analysis and interpretation as follows:

> By data analysis we mean the process of systematically searching and arranging the interview transcript, field notes, and other materials that you accumulate to enable you to come up with findings. Data interpretation refers to developing ideas about your findings and relating them to the literature and to broader concerns and concepts (p. 147).

The analytical task enables you to arrive at findings while the interpretive task helps you make sense out of the findings. However, Bogdan and Biklen admit that while it is relatively

easy to come up with an explanation of the difference between the two tasks, it is much more difficult to separate the two in the process of doing qualitative research. Findings and ideas about findings will clearly emerge together.

Taylor and Bogdan (1998) suggest that qualitative research is a craft while Stake (1995) talks about the art of case study research. They point to the fact that researchers develop their own way of analysing qualitative data. There are guidelines to follow, but never recipes or rules. Rather than being a mechanical or technical process it is a process of reasoning and thinking (Taylor & Bogdan 1998), and, I would like to add, a process of writing. You write down your reasoning and thinking in different ways from the first tentative questions written in the field notes to the drawing of figures and tables when trying to make connections. The aim is to reduce large amounts of data to a few themes, dimensions, codes or categories (See for example Creswell 1998, LeCompte & Schensul 1999, Miles & Huberman 1994, Patton 2002). This is a complex and time-consuming process going back and forth between the data material, ideas and theories. In Appendix 2 I explain how I performed this process by means of analytical tools. Strauss and Corbin (1998) define such tools as "devices and techniques used by analysts to facilitate the coding process" (p. 87). Analytical tools are used to increase sensitivity, stimulate the inductive process, raise awareness of biases and overcome analytical barriers. Analytical tools have an individual nature; they should be used flexibly and as extensions of the researcher's own abilities. Procedures and techniques should not be used in a routine manner, but as helpful devices to open up the data material. As a good craftsperson each researcher must find the system that works best for her to understand "what is going on here" (p. 114) or to understand what this is a case of (Gudmundsdottir 2004). Below I will describe steps I took to understand how Sara deals with her role connected to the student teachers' processes of learning to teach mathematics.

### *Figuring out what this is about*

Inspired by Rogoff's (1995) three planes of analysis and Gadamer's (2000) concentric circles I began to think about my meaning making in terms of steps, phases or perhaps stages. First I had to understand what I was dealing with, what were Sara and her student teachers involved in? Early in the analysis I realised there was a parallelism in both Sara's talk and actions. When I interviewed her she often answered my questions on the student teachers by saying "it's just like the kids" before she gave me examples. I also could see a parallelism in her talking to the student teachers about the kids and her talking about the student teachers to me. Realising this in her talk I began to look for evidence in her actions as well. Could I

understand her interactions with the student teachers in light of how she wanted the student teachers to interact with the pupils? Through the more thorough analysis, identifying recurring words and patterns I could see that in the same way Sara believes kids learn mathematics she also believes that student teachers learn to teach mathematics; through experiences and collaboration.[39] Thus I found that in both her teaching and in her mentoring Sara bases her approach on a philosophy of education as learning through experience and collaboration. She wants the student teachers to understand how she believes children learn and understand mathematics and how teaching relates to this, and the way they are going to understand this is through experiences and collaboration. This is Sara's guiding principle and long-term aim for mentoring mathematics teaching.

Having realised this, my next step was to understand how Sara connects her role as a cooperating teacher to how she believes student teachers learn to teach mathematics. If they learn through experience and collaboration I had to find out more about her role in that process. These two concepts became important for understanding her actions and hence her assistance. How will the mentoring be when you believe student teachers learn through experience and collaboration? When I became aware of this trait of Sara's mentoring I found I had to read more theory, and as the word experience was constantly appearing in the material I turned my attention to the work of Dewey (1938).[40] His late work on the concept of educative experience helped me to see that Sara's assistance to and support of the student teachers could be understood in terms of making experiences educative. Through my analysis I could see that her main focus in discussing experiences on different levels, both in the pre- and post-teaching conversations was to turn the student teachers' attention on to the kids. "Making visible" and "helps to see" emerged as important features of Sara's support to make the student teachers' experiences educative. I could see more clearly what it was Sara wanted

[39] As will be seen in Chapter 4, Sara's way of thinking about the learning of mathematics is well attuned to the national curriculum, C-97.

[40] Taylor and Bogdan (1998) emphasise how qualitative researchers should go beyond their theoretical framework if their data tell them to do so; "Although most researchers align themselves with a special theoretical framework, it is standard to borrow from diverse frameworks to make sense of data" (p. 148). If concepts fit your data you should not be afraid to borrow them. This time, however, the concept "borrowed" from Dewey is acknowledged to be consistent with socio-cultural theory. In reading the work of Dewey (1916, 1933, 1938) I was struck by similarities with my theoretical framework as presented in Chapter 2. This is sustained by Rogoff (1995) who states that "Vygotsky's and Dewey's theories focus on children participating with other people in a social order with a seamless involvement of individuals in sociocultural activity" (p. 141). Wertsch (1998) points out that Dewey had great influence on socio-cultural studies. Dysthe (2001) argues that socio-cultural perspectives have roots back to Dewey and Mead on the one hand and Vygotsky and Bakhtin on the other. Interesting to note is that in his book "Mind in Society" (1978), Vygotsky points back to Dewey; "This is the position adopted by Dewey, one of pragmatism's representatives. He defines the tongue as the tool of the tools, transposing Aristotle' definition of the human hand to speech" (p. 53). According to Cole (1996), Dewey's work was well known among Russian educators and psychologists.

the student teachers to learn through their experiences, and why and how she collaborated with them in the process; she does not believe in a "pedagogy of telling", nor that you can learn from experiences alone.

I find Sara's primary concern to be "how are the student teachers going to learn about kids and mathematics so they can learn to teach mathematics?" Turning this issue around I could see that the way to learn about kids and mathematics is to learn through the experiences of teaching mathematics. Thus attitudes towards learning from experiences become an important part of learning to teach. But these student teachers need help to see both what and how they can learn from experiences. I find an important feature of Sara's role to be about inspiring and assisting the student teachers "to teach mathematics in a way they can learn from". I had finally found the meaning of what was going on, or what this could be a case of. I had captured Sara's voice, and identified aspects of her mentoring. My next and last step was to identify how Sara's way of mentoring relates to the student teachers' development of pedagogical content knowledge in mathematics.

In doing so I ended up with three important themes that will be discussed and elaborated on.[41] The heading of the themes address how I, through use of theoretical concepts have interpreted Sara's reflections and actions. Two of the themes are strongly connected to how Sara deals with the mentoring in pre- and post-teaching phases throughout all six weeks. The first theme is different. It is named "Moving towards shared focus of attention by focusing on the kids". It shows how Sara deals with the very first days of the student teachers' field experiences. Even if I became aware of the trait of "seeing the kids" early on, I did not understand the importance of the activities this first week before I began my final analysis. I identify what happens the first week as a critical incident that contributes to an understanding of what happens the other five weeks of the collaboration between Sara and the student teachers. The theme focuses on how Sara, through designed activities clarifies her vision of how she believes kids learn mathematics and how her teaching relates to this. I argue that due to her collaborative way of mentoring her intention is to move the student teachers' towards a shared focus of attention. I build my argument upon Wertsch's (1984, 1985) use of the concept of *intersubjectivity*.

The second theme, "Making the invisible visible through guided planning", mostly includes data connected to the pre-teaching phase of Sara's mentoring. The theme focuses on how Sara, takes on a rather active part in the student teachers' planning sessions. Sara assists

[41] Once more I want to direct the reader's attention to Appendix 2 for an explanation of how I arrived at these three themes.

the student teachers to focus their attention on the kids and their learning. Using Collins et al.'s (1989) concept of *cognitive apprenticeship* I argue that Sara assists the student teachers by making her own thinking visible. This trait of Sara's mentoring made me understand why she moved the student teachers' attention towards the kids as argued in theme one. Moreover, her guiding planning points towards theme three as it takes into account how she encourages the student teachers to learn from their teaching.

The third theme, "Encouraging educative experiences by focusing on aims" is strongly connected to the student teachers' teaching and the post-teaching conversations. The theme focuses on how Sara encourages the student teachers to, while teaching learn about how all kids learn and develop mathematics in various ways. Moreover, as with the kids, the student teachers also perceive their experiences differently. Therefore, this theme also includes data that show how Sara deals differently with the student teachers in post-teaching conversations. To interpret this third theme I use Dewey's (1938) concept *educative experiences*. Even though I am doing an embedded analysis of some parts of Sara's mentoring, I cannot even claim to have that whole story. However, as I have shown, I have identified details or themes that taken together provide an account of how Sara assists the student teachers to teach mathematics in a way that encourages educative experiences, experiences they can learn or develop pedagogical content knowledge from.

## Have I got it right?

As I proceed through the process of doing case study research, Stake (1995) reminds me that I must ask myself the important question "do I have it right?" (p. 107). He maintains that "though it is true that we deal with many complex phenomena and issues for which no consensus can be found as to what really exists – yet we have ethical obligations to minimise misrepresentations and misunderstanding" (p. 109). Creswell (1998) addresses the same issue by asking "how do we know that the qualitative study is believable, accurate and 'right'?" (p. 193), or to use Lincoln and Guba's term (1985) how can we secure the "thrustworthiness" (p. 290) of a study? Works focusing on how to ensure the quality of the study, and hence its thrustworthiness, propose several verification procedures. As pointed out by Glesne and Peshkin (1992): "Without such tactics [verification procedures], it is sometimes difficult to know how much of what researchers see is a product of their earnest but unconscious wish to see it so" (p. 147). The terms credibility, transferability and dependability are used to identify verification processes consistent with the nature of, and axioms underlying qualitative research.

Credible findings, or how the findings match reality, are more likely to be produced through prolonged engagement, persistent observation, triangulation and member checking (Lincoln & Guba 1985). According to Glesne and Peshkin (1992) time is a major factor in the acquisition of trustworthy data. As I have mentioned, I spent a considerable amount of time with Sara and her student teachers, being with them virtually on a daily basis for the entire six weeks they were together. Lincoln and Guba (1985) refer to this long-term observation as prolonged engagement. It is about spending enough time with the research participants to build trust, learn the culture and test for misinformation introduced by distortion either of the self or of the research participants. While prolonged engagement provides scope, persistent observation provides depth. The purpose of the latter is to identify those characteristics and elements in the situation that are salient to the study, relevant to the purpose of the study, and of interest for the focus (Glesne & Peshkin 1992, Lincoln & Guba 1985, Merriam 1998).

A third way of making the findings credible is through triangulation. This can be done in different ways. The triangulation I have employed uses different sources as well as different methods. A multi-method approach is a significant feature of case study research, and presupposes that in searching for significant features of the case, the researcher seeks out corroborating evidence from different sources to shed light on a theme or perspective. This helps to reinforce confidence in a statement (see for instance Denzin 1989, Lincoln & Guba 1985, Merriam 1998, Miles & Huberman 1994, Stake 1995, Patton 2002). As shown above, my triangulation procedure concerns first and foremost different data sources, using interviews, observations and different types of document from both Sara and the student teachers. The data sources were sorted in different ways as I proceeded through the research; on four mathematical teaching periods and in pre- and post-teaching conversations (see Appendix 2). Thus I "cross analysed" the data, a way of triangulating.

Another way of enhancing the credibility of the study is to take the findings back to the source, called member checking by Lincoln and Guba (1985). This involves taking data, analysis and interpretations back to the participants so they can judge the accuracy and credibility of the account. This technique is considered to be "the most critical technique for establishing credibility" (p. 314). Participants play a major role directing as well as acting in case study research. They should be asked to examine rough drafts of the researcher's work and to provide alternative language, critical observations or interpretations (Stake 1995). I "member checked" with Sara both during the field work and over the years while I have worked on this research text. We have discussed salient issues and she has also read drafts of this case report. I have decided to use two words often used by Sara in this research text; kids

and see. From my point of view they can not be replaced by the terms children and observing.

As mentioned above, I entered the field with prejudices. Being continually aware of my own biases, my own subjectivity, as well as communicating them to the reader, is my last point in producing trustworthy interpretations (Glesne & Peshkin 1992). In qualitative research each researcher is her own best data collection instrument. Delamont (1992) claims that this is only the case "as long as she [the researcher] is constantly self-conscious about her role, her interactions, and her theoretical and empirical material as it accumulates" (p. 9). It is a waste of time trying to eliminate "investigator effects" (p. 8). The researcher ought to concentrate on understanding these effects (Delamont 1992). Clarifying researcher bias from the outset of the study is important so that the reader understands the researcher's position and any biases or assumptions that impact the inquiry (Merriam 1998). I have done so by commenting on past experiences, biases, prejudices and orientations that have likely shaped the interpretation and approach to the study. In Glesne and Peshkin (1992), Peshkin provides this personal account:

> My subjectivity is the basis for the story that I am able to tell. It is a strength on which I build. It makes me who I am as a person and as a researcher, equipping me with the perspectives and insights that shape all that I do as researcher, from the selection of topic clear through the emphases I make in my writing. Seen as virtuous, subjectivity is something to capitalize on rather than to exorcise (p. 104).

The term subjectivity used in this way encompasses the personal orientations and complex combination of values, attitudes, beliefs, interests and needs. They derive from life history and operate sometimes dispositionally, sometimes deterministically; and sometimes consciously, sometimes unconsciously. What is important is being aware of one's own subjectivity, and what it both enables and disables you to see.

Employing the verification procedures mentioned so far, my aim is to persuade the reader that the findings are credible and consistent with the data collected during these special weeks I spent together with Sara and her student teachers. I can never repeat the study exactly the way I did. Even if I follow Sara with another group of first-year student teachers another year I will probably not find the same findings simply because humans will behave differently in interaction with other individuals. Lincoln and Guba (1985) refer to this issue as dependability. The question is whether the results are consistent with the data collected, that the results make sense given the collected data and not whether the findings can be repeated. In addition to the aforementioned process of triangulation and the description of my own subjectivity, using the audit trail is a way of guaranteeing what Lincoln and Guba call dependable data. Merriam (1998) states that "in order for an audit trail to take place, the

investigator must describe in detail how data were collected, how categories were derived, and how decisions were made throughout the inquiry" (p. 207). My descriptions in this chapter together with Appendices 1 and 2 should enable the reader to conduct the audit trail procedure.

The last point I will make in this section is to discuss how my findings can apply to other settings or situations. Single, qualitative case studies are selected because the researcher wishes to understand the particular in depth, not to find out what is generally true of the many (Merriam 1998, Stake 1995, 2005). Even when this is the aim, the question of generalisation often arises in discussing the single case study. Well known scholars in the area of case study research propose different approaches to this issue, approaches that reflect the assumptions underlying qualitative inquiry. Instead of talking about generalisation, both Stake (2000) and Eisner (1991) ask the question of what can be learnt from the single case study. Patton (2002) supports the learning issue, and adds that single case studies often open up new territory for further research. Yin (2003) uses the term "analytic generalisation" and claims that case studies are generalisable to theoretical propositions and not to populations or universes. The goal is to expand and generalize theories.

Bassey (2000) proposes the term "fuzzy generalisation", and explains:

> In the use of the adjective 'fuzzy' the likelihood of there being exceptions is clearly recognised and this seems an appropriate concept for research in areas like education where human complexity is paramount. (…) A fuzzy generalisation carries an element of uncertainty. It reports that something has happened in one place and that it may also happen elsewhere. There is a possibility but no surety. There is an invitation to 'try it and see if the same happens for you' (p. 52).

Bassey then goes on to stress the importance of the relationship between a fuzzy generalisation and the written report which supports it. Even if it may be memorable, he claims that the fuzzy generalisation on its own has little credence and needs to be read in conjunction with the research report. The consequence can be that it encourages others to act on it in their own school and circumstances. When Lincoln and Guba (1985) talk about possibilities of "transfer" (p. 297) from one setting to another they are pointing to the same issue.

To ensure that the findings are transferable, qualitative researchers need to give detailed descriptions; called "thick descriptions" by Geertz (1973). I will elaborate more on the issue below under the heading "writing up the study". By now I will point out how a rich, thick description allows the reader to make decisions on transferability because the writer offers detailed information about the participants and setting under study. Every case study researcher must work hard to report all evidence fairly (Yin 2003). I report my evidence in

two ways. First I offer the readers a possibility of "being there" through both my description of the context and my presentation of the three themes I have found as answers to my research question (chapters 4 to 7). Second, in Appendix 1 I present the data collected and details about the data material. According to Bassey (2000) "what is important is that the process is conducted in a sufficiently systematic way to ensure that the researcher can work effectively within the ethic of thrustworthiness and the ethic of respect for persons" (p. 80). In the above section I discussed the trustworthiness of my study. Below I discuss respect for the persons involved.

## Ethical considerations

Two basic ethical principles become important when the perspective of research subjects is the aim of the research; informed consent and the protection of subjects from harm or risk (Bogdan & Biklen 2003). First, informed consent attempts to ensure that research participants enter the research voluntarily, understand the nature of the study and are as well informed as possible of the purposes and activities of the research that will occur, and of any burdens (for instance additional work load), dangers and obligations that are involved. Often this will be done by providing information from the beginning and asking the participants to sign a form. The formality of providing information about the project and signing a form regarding informed consent was addressed by me. All participants allowed me to be with them as much as I wanted, both in the classroom and in the mentoring conversations. They also gave me permission to use quotes from interviews, mentoring conversations and log books in my final report (see Appendix 4).

The second principle is less formalistic, but surely no less important, the research participants need to be protected as much as possible from harm or risks. As with other aspects of performing qualitative research, ethical considerations are ongoing processes throughout the study. It is necessary to establish trust through informed consent, but the second principle reminds us of bearing this in mind the whole way through. Stake (2000) puts it this way: "Qualitative researchers are guests in the private spaces of the world. Their manner should be good and their code of ethics strict" (p. 447). Although I never felt that anyone was put at risk, I did have some considerations throughout the study that can be discussed under the heading of ethics. My concern regarding Sara's participation was about time pressure. Although she knew there would be interviews coming up in an already stressful period, I sometimes felt a bit uncomfortable by asking her to do so. The important thing for me was to let her decide the time. That is why the very first interview in the autumn, as well

as the video interviews in the spring, were conducted after the periods with the student teachers were over.

I was even more concerned about the student teachers. Although I felt they were interested and saw some signs of this, one of them even expressed great pleasure in having the chance to be a participant, I had some thoughts on their opportunity to say no. Although they were willing to participate, they may have felt they did not really have the opportunity to say no. After all, a lot had already been arranged when they first met me. I tried to address this issue by asking them now and then if I could still stay. I also asked if it made any difference to their teaching practice, after all their well-being in their first practice experience was more important than my research. The nice answer to this was, “we don't know how it would have been if you weren't here”, as it was their first year. I also told them to talk to Sara if they would not tell me directly. As mentioned above in footnote 35, even though all five student teachers agreed to participate, one of them did not want to be filmed during the first period. This changed my plan, but I do not think it affected the study in any way. Ethical concerns about the student teachers also arouse when writing up the study in this research text. First, as will be seen in Chapter 4, all five have different strengths in different subjects, a fact which is also reflected in my data. As I pay special attention to Sara and mentoring mathematics, the picture that is provided of each of the student teachers is probably not the most accurate one with respect to their experiences from the practice field. Second, the illustrations I use to exemplify Sara’s reflections and actions are chosen as the best ones with her perspective in mind. This may also be an injustice with respect to the student teachers.

The last ethical concern I would like to mention is the issue of anonymity. As told in footnote 1 I use pseudonyms for Sara and the student teachers, and I do not use the school's real name. However, at the local level it is impossible to protect identities. For six weeks I went to the school carrying my tape recorder or my camera. Every employee at that school as well as another group of student teachers (who were interested) knew that I was with Sara and the student teachers. Even the parents in the class were informed about my presence, first by Sara on my arrival and later through an information letter I sent them (Appendix 3). Even though the kids in the class were not part of my study, I found it necessary to obtain the parents’ permission to use quotes from the student teachers referring to the pupils.

### Writing up the study

The literature on performing qualitative research has some recurring statements. One of them is, as we have already seen, that analysis is an ongoing process starting the first day and

ending when you have finished the report. Another is that there is no recipe, only guidelines for important issues such as how to analyse the data and how to report the findings. The same can be said about writing up the study (see for instance Merriam 1998, Patton 2002, Stake 1995, Wolcott 1990). However, as we saw from the discussion on the thrustworthiness of the study, some important issues must be addressed. The case study report must allow readers to experience vicariously the described setting as well as provide them with the opportunity to understand the case and to judge the credibility of the author's interpretive analysis (Erickson 1986). So far in my report I have told the reader how I conducted the study and what my prejudices and theoretical stance are. I have also shown how I arrived at what I will call findings, how I found the three themes or issues I regard as important and find necessary to tell in order to understand what happened as an answer to my research question.

In the next four chapters, Chapters 4 to 7, I will provide information that hopefully will allow the reader to experience the setting of my research study vicariously. Providing this information is a balancing act between description and interpretation; both are essential in reporting case studies (see for instance Erickson 1986, Merriam 1998, Patton 2002, Stake 1995). To develop the recommended vicarious experiences for the reader, to give him or her the sense of being there, the context or the "physical situation" as Stake puts it (1995, p. 63), must be well described because it is fundamental to meanings for both researchers and readers. In Chapter 4 I describe the context and the research subjects, and the processes I find necessary to tell if the reader is to understand my findings. Thus, because I have chosen what to tell, the description will not be without interpretation (Erickson 1986, Patton 2002). Taken together Chapters 4 to 7 provide the reader with the thick description that is seen to be so important in reporting case studies.

Building upon the work of Geertz (1973),[42] scholars in the qualitative research area emphasise that the provided thick descriptions are not long, detailed and commonplace descriptions. Thick descriptions go beyond the mere reporting of what a person is doing, the so called "thin description", and come rather to the meaning and intentions behind it. They present the context and meanings of events that are relevant to those involved (Denzin 1989,

[42] Geertz (1973) has borrowed the term "thick description" from the work of Gilbert Ryle (1971a, 1971b) and uses it to explain what ethnography is. He claims that an ethnographic account does not rest on the author's ability to capture primitive facts or episodes and bring them home like a mask or a carving. The account rests on the degree to which the author is able to clarify, or describe and explain what goes on in the studied place. Between a "thin description", just pointing to what a person is doing, and the "thick description", pointing to the meaning of what he is doing, we find the object of ethnography. Since the time when Geertz introduced the concept virtually every book on case study research as well as qualitative research has passages on the importance of thick descriptions. However, not all of them credit the term back to Geertz (for instance Merriam 1998 does not).

Lincoln & Guba 2002, Stake 1985). Stake (1985) claims that "thick description" is the term Geertz used for *emic* interpretations, what meaning is attached to happenings by participants, "thick descriptions are not complexities objectively described; they are the particular perceptions of the actors" (p. 42). The voices, feelings, actions and meanings of interactional individuals are heard, and the thick description establishes the significance of an experience for the persons in question (Denzin 1983, 1989).

Above we saw how Bogdan and Biklen (2003) defined the two tasks of analysis and interpretation. In the analytic task I wanted to come up with Sara's meaning of the actions. Thus my findings can be given as part of a "thick description" even if Lincoln and Guba (1985) argue that findings are not part of the "thick description".[43] Denzin (1989), however, claims that a thick description sets up and makes interpretation possible, "it creates the conditions for thick interpretation" (p. 159). By thick interpretation, Denzin means in part connecting individual cases to larger public issues. In Chapters 5 to 7 I examine the interpretive task, explaining and framing my ideas (or findings) in relation to theory, others work and making them understandable.

Writing up qualitative studies, and especially case studies will, according to Stake (1995), fall somewhere between storytelling and what he calls the traditional research report. The report is the publishing act of how I have moved from the first curiosity manifested in the research question through "mountains of data" (Strauss & Corbin 1998, p. 7) gathered through extensive field work to being able to tell the three stories that make up the account of Sara and the student teachers. Taken together they make up my findings. I asked myself a lot of questions. How should I manage to create stories that take into account Sara's processes and aims; how and why Sara acts the way she does? How should the voices from the student teachers best be presented? Hence, at the same time that I was reading and analysing, I started to produce what in the end became this text. Texts have been turned around, moved and, not least, deleted until I arrived at the structure I present in the next four chapters of this research report. They deal with what happened between Sara and the student teachers. I will start by presenting the context of the study in the next chapter.

[43] In 1985 Lincoln and Guba made what they called "one primitive attempt" to define what should be in a thick description, and claimed that "the questions of what constitutes 'proper' thick description is, at this stage in the development of naturalist theory, still not completely resolved. Clearly, not just any descriptive data will do, but the criteria that separate relevant from irrelevant descriptors are still largely undefined" (p. 316).

# Chapter 4
# The context of the study

As mentioned in the previous chapter the case study report should allow readers to experience vicariously the setting in which the research is carried out; giving them a sense of being there. Such a thick description (Geertz 1973) should provide the readers with the opportunity to understand the case and to decide if the reported findings are indeed reasonable (Erickson 1986). This gives the readers the possibility to decide if the findings can be transferred to other settings (Lincoln & Guba 1985). One way of addressing this is to provide information about the context in which the inquiry is carried out. This includes a description of both the physical surroundings and the activities and processes the research subjects are engaged in. The intention is not to attempt to achieve the impossible; reproducing the field completely. The information provided is chosen from the focus of inquiry. In this chapter I will present salient features of the context so that the reader can understand my findings as answers to my research question; how Sara's mentoring may facilitate first-year student teachers' development of pedagogical content knowledge in mathematics. Certain features of social action and meaning are highlighted; others are presented less prominently or not mentioned at all (Erickson 1986).

This chapter is not totally devoid of analysis and interpretations. I could not have presented the content and patterns of the mentoring conversations without having analysed them. The way I present Sara and the student teachers is also based upon how they act during these six weeks of collaboration, what they say and what they write. Moreover, I have chosen quotations to illustrate the actions from a vast amount of data. I have also selected what to tell from various types of official documents. Even the way I describe the physical environment is through my interpretation of what the reader may need to know from the point of view of my research question.

The chapter has three sections. First I start with a sketch of the teacher education programme for primary (and lower secondary schools) in Norway. A brief historical overview emphasising the practice field and the role of the cooperating teacher opens this first section. Within a socio-cultural framework I find this to be important to understand the wider context of the practice field today. In the second section I present “Seaside School”, Sara and her class. I also present what Sara thinks about mathematics teaching. The third section deals with the mentoring. Here I present Sara as a cooperating teacher and the five student teachers she is mentoring before I turn to features of the mentoring conversations. I end the section with a

presentation of how the student teachers in their first year of teacher education experience teaching mathematics with Sara and her class of third graders.

## *The teacher education programme*

More than twenty years ago Strømnes (1983) claimed that the lack of knowledge on the practice field of teacher education in Norway was due to the low status this part of the education had; the voices of cooperating teachers are soft and few and far between in the historical documents. This is the case even though the provisions governing the first organised teacher education seminars in Norway from 1826 ascertained that student teachers should have practical teacher training[44] in local schools as part of their education (Strømnes 1999). Thus we can see how teacher education for primary schools in Norway from the start was divided into practical training and theoretical studies. My study examines the practice field and below I will present Strømnes' (1999) analysis of how the years from 1826 to 1995 can be divided into four development periods for this part of teacher education.

Strømnes (1999) maintains that during the first period of his analysis, lasting throughout the 19th century, "the exercise of authority and contradictions" were prominent (p. 7, my translation). The contradictions in this period mainly came from the means and responsibility and not so much from the aims of field experience and student teachers' learning. A contradiction also arose from the question of whether practice experiences or courses should be an integrated part of the education or be taken when the theoretical studies had been completed. Even if the aim was to relate the two parts to each other, the teachers at the seminars were often also in charge of the practice field; they demonstrated teaching in schools and they supervised the student teachers' teaching. Throughout the century propositions were made to empower the actors in the practice field, but, according to Strømnes, the losers in what can be called "the battle of practice" were the cooperating teachers and the local authorities, whereas the central authorities and the seminar teachers were in charge.

The second period called "reinforcement and consolidation" (Strømnes 1999, p. 14, my translation) started with the Teacher Education Act of 1902. Sections in the Act called for the integration between theory and practice to be reinforced, and throughout the period many propositions were made both on the national and the local level to improve this integration. One example of a suggested improvement, made in 1923 by Erling Kristvik, headmaster at

[44] I stated in the introductory chapter that I want to avoid the phrase "teacher training". The Norwegian word "øving" is used by Strømnes (1999) and I have translated it to "training". When I refer to Strømnes' work I will thus use this term.

Tromsø College for Teacher education, was that he should observe and follow the teaching of first graders in a primary school six to eight hours a week. The teacher of this class of first graders should use one to two hours a week to collaborate with Kristvik and attend his teaching of education at the college. According to Strømnes, this proposal would probably have improved the practice field of teacher education but amongst other proposals it was turned down for financial reasons. Strømnes summarises this period, lasting to 1938, by concluding that despite the intention of improving field experiences in teacher education, the new Act from 1902 did not in fact change practice.

The third period, lasting from 1938 to 1973 is, according to Strømnes (1999), “a period of professionalisation and go-getter spirit” (p. 21, my translation) for the cooperating teachers and hence the practice field of teacher education. This is due to three incidents that occurred within a few years of each other. First, joint national directives on how teacher education colleges should use the training school[45] were introduced in 1939. Until then decisions had been made on the local level, often based on personal ideas and considerations. From now on the schools should be research fields and through collaboration, teachers from both parts of teacher education should contribute to improving the relations between them. The second incident occurred the same year when the cooperating teachers professionalised their field by establishing the "Norwegian Union for Cooperating Teachers", which made them more visible in the public room and gave them a better opportunity to be heard. In the years after World War II the cooperating teachers were the architects behind many requests to the authorities that focused on ways of improving student teachers' field experiences. Two cases appeared to be of special interest; the central authorities should take the responsibility for the training schools to secure their standard and the student teachers should gain experiences with schools with classes combining more than one age group. Through the union, the cooperating teachers also focused on their own need to be educated as mentors for student teachers. This developed throughout the 1970s and today cooperating teachers can attend voluntary courses or studies in "pedagogical supervising".

The third incident was a book published in 1941 entitled "The Teacher Profession. Introduction to Education" written by Erling Kristvik (1941).[46] The aim of this book,

[45] My translation of the Norwegian word "øvingsskole"; a school which were tightly connected to a teacher college, and the place where the student teachers had their field experiences. Throughout the history of teacher education it has been debated as to whether these schools should be the responsibility of the central or the local authorities. These schools existed until the 1990s.

[46] The book was first published in 1925 but according to Kristvik it was "too comprehensive to be used as a textbook in teachers' college" (1941, foreword, not paginated, my translation). The book was re-issued in 1946

according to Kristvik, was "to pinpoint bridges from abstract formulas to practical work in schools" (1941, foreword, not paginated, my translation). According to Strømnes (1999), this book gave the cooperating teachers and the teachers at the teaching colleges a foundation for collaboration and for making connections between theory and practice. This was then followed by a period where the focus in discussions, proposals and inquiries was on better conditions for the cooperating teachers and improved quality of student teachers' field experiences. An Act from 1954 paved the way for experimentation in schools on all levels, from primary schools to the teacher education colleges. The idea was to allow pedagogically well substantiated experiments without changing the rules and regulations in force. Experimentation with new models of organising field experiences in teacher education led to some changes; more continuous practice, observational practice and organisational meetings between cooperating teachers and teachers of education.

In 1973 both the name and the status of teacher education colleges were changed; from now on they became "Pedagogical University Colleges".[47] New framework or overall plans for teacher education emerged every six years in this fourth and last period of Strømnes' (1999) analysis; in 1974, 1980, 1986 and 1992. Due to some inconsistencies and changes from one plan to the next, Strømnes (1999) calls this period "wobbling walk" (p. 37, my translation) regarding the practice field. Even if we have to take into account strong changes in general society during this period Strømnes finds this frequent occurrence of new plans to be due to "strong internal academic and political tensions and conflicts of interest" (p. 37, my translation). With the plan from 1974 educational theory and practice became one study unit lasting for one out of the three years of study. A broader concept of what field experiences mean emerged with this plan; experiences from practice could be gained not only in schools but also in other educational environments. It was further emphasised that "the practice component should also be coordinated with the subjects and topic studies that are also part of the education [programme]" (NOU 1974: 58, p. 128, my translation). As a consequence there should be collaboration between the teachers of education, the teachers of other subjects and the cooperating teachers. From 1980 student teachers are also mentioned as part of this collaboration. In 1992 teacher education became a four-year study but the amount of time

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and 1953, each time being both "revised" and "expanded". The last edition from 1953 also includes tasks to use in teacher education. But Kristvik (1953) emphasises that "written and other printed sources are only part of the scope of what the discussions should be based on. Equally important is that learning and experiences from field experiences should be used, as well as children's lives outside school and personal memories from one's own time in primary school" (p. 373).

[47] In the 1990s these colleges became part of a more comprehensive university college system. Today teacher education is given in faculties within this system of education for different professions.

allotted for educational theory and practice remained the same – one year. Now it was emphasised that at least 12 out of 16 to 18 weeks of field experience should be in schools. The student teachers should again have a grade in practice and the cooperating teachers were given the responsibility for setting this grade. While we saw how the cooperating teachers in the third period were the architects behind the changes and proposals, Strømnes (1999) asserts that the teachers of education had strong impact on student teachers' field experiences during this fourth period.

This brief historical overview shows how through different Acts and plans the authorities continuously tried to establish the intention of teacher education right from the first public provisions on education in 1826; to create a relation between the theoretical and practical part of teacher education. Recurring traits are the power struggles and cooperation problems between the two parties, mostly concerning organisational and economic issues but also concerning which knowledge should be given prominence. Strømnes (1999) ends his analysis with the plan from 1992. Since then two new plans have emerged, in 1999 and 2003. At the time I conducted the fieldwork for my study, the 2002/2003 academic year, the plan from 1999 was in force. With this plan the subject of education and practice were again separated and field experience was treated as a study unit with its own syllabus. Through integrated studies of education, central school subjects and field experiences student teachers should develop five areas of competence; academic, "didaktisk",[48] social, professional ethics, and change and development competence. Each of the first three years was profiled by overarching themes that should guide all the subjects and all field experiences. The profile of the first year of study was "pupil, teacher, learning environment" and for the second year "pupil, class, school". The third year was profiled by "pupil, school, society". The model below shows the obligatory subjects (including "fagdidaktikk") and how it is weighted in the overall, national plan for teacher education from 1999. Additionally there was an obligatory 30-hour course in drama the first year.[49]

[48] See footnote 10 for an explanation on the use of this Norwegian word. "Didaktisk" competence comprises "ability to analyse curricula and reflect over content and working methods and make provisions for learning and developmental processes for all pupils" (UFD 2003, p. 12).

[49] In the historical overview I focused on field experiences and the cooperating teachers. Other changes throughout history have been the length of the teacher education programme and admission requirements for the studies. A recurring trait of the new plans has also been that obligatory subjects in the theoretical part of the study have changed. Another recurring discussion has been the relationship between the subject of education and the central school subjects. Throughout the last decades of the previous century the subject of education has been reduced (fewer credits) in favour of a "fagdidaktisk" (see the introductory chapter for a discussion of the term) dimension in the school subjects.

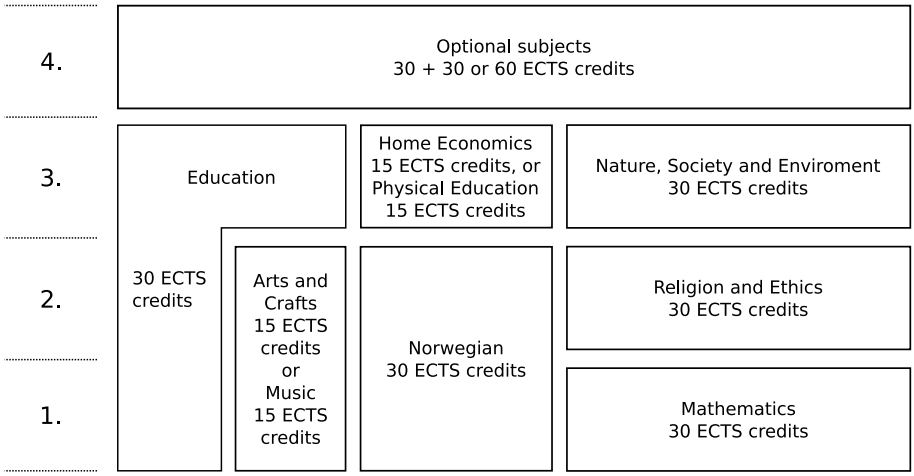


**Figure 3: Illustration of the teacher education programme**

The main objective is to educate classroom teachers and field experiences are connected to and integrated with all subjects.[50] All study units in this teacher-education programme thus comprise subject content, "didaktikk" and field experience. The overall plan for teacher education states that there should be 18 weeks of field experience during the first three years. As education, as seen in Figure 3, is the only subject that runs all three years the teachers of this subject are seen to have a special responsibility for progression and continuity in student teachers' field experiences. Below I will present traits from the syllabus for field experiences developed at the university college where I conducted my fieldwork. This plan is based upon the objectives in the overriding national plan for the 2002/2003 academic year and is designed to attain the objectives in the plan.

After about two months of their teacher education programme the student teachers enter the practice field for the first time. Thus they start their field experience with only two months of studies. In the practice field a group of four to five student teachers stay with one cooperating teacher and her class three full weeks in the autumn, and then return to the same site in the spring for another three weeks. Each year both the groups and the sites are changed. Thus the student teachers obtain experience from different schools and cooperating teachers and from pupils at different age levels throughout their teacher education programme. Traditionally the teachers[51] at the university college have little contact with the student

[50] Above we saw how the teacher of education and the cooperating teachers in a way have been in charge of student teachers' field experience throughout the history of teacher education. During the 1990s other subjects became more visible. The plan from 2003 states that field experience should be organised so student teachers "encounter the practice field as an arena for study activities in the subjects. (…) [And] reflect upon and expand their 'didaktiske' knowledge in the subjects and across the subjects" (UFD 2003, p. 15, my translation and apostrophes set by me to mark the Norwegian word as explained in footnote 10).

[51] Teachers at the university college have different titles, e.g. professor, associate professor, university college teachers. As I am not talking about individuals I refer to them all as university college teachers.

teachers during these periods; there are no courses or plenum sessions on campus. However, each student-teacher group is connected to one of the teachers at the college; a "follow-up teacher" who is recruited from all the compulsory subjects in the first year of study. In footnote 50 I have already mentioned how this has changed recently; the teachers of education are now not the only ones responsible for student teachers' field experience. The "follow-up teacher" spends time with the cooperating teacher and the student-teacher group, at least one whole day each period. Formally these teachers act neither as supervisors nor as evaluators as the cooperating teacher holds the double role of mentor and evaluator. She decides if the student teacher should pass his or her first year of student teaching. However, when in doubt she confers with "the follow-up teacher" and other officials at the university college.

For each student teaching period the local syllabus lays down some requirements or demands so that the objectives of the overall national curriculum can be achieved. Both in the autumn and the spring period first-year student teachers should plan, give reasons for, carry out and assess teaching in sessions, mainly in the subjects of mathematics, Norwegian and their aesthetics subject. In this process they are supposed to use a planning document as the basis for mentoring (I will return to this issue in Chapter 6). In the autumn period the student teachers are also instructed to observe the pupils' communication and relationship and use log books to reflect upon the learning environment. In the spring period they should be acquainted with and in their log books reflect upon their own role as teachers and the responsibility of the classroom teacher. Throughout their four years of study the student teachers must carry out minor projects in different subject areas while undertaking their student teaching sessions. In their first year of study this project is connected to mathematics.

The student teachers follow the cooperating teacher in all her work. In addition to the teaching and the work with the class this also entails collaborating with colleagues and attending staff meetings or courses. The cooperating teacher is allotted time, paid by the university college, to mentor the student teachers about two hours each day. By the time this study was conducted, the university college hired cooperating teachers on an individual basis.[52] One of them was Sara, the research subject of my study.

## *Sara and the context of teaching*

Sara works as a teacher at Seaside primary school (grades 1-7, the pupils are from 6-13 years

[52] Now whole schools are involved through partnership models. Bearing my historical overview in mind, this is seen as an attempt to achieve the objective of better connection between theory and practice in teacher education (st.meld. [white paper] no 16. 2001-2002).

of age). The school is situated in a rural area mostly consisting of one family houses and is close to both the sea and woods, both of which are often used by all classes during their outdoor days and other excursions. There are also playgrounds near by for ball sports like football and handball. Every morning the student teachers meet with Sara in the staff room for a morning cup of coffee, and they also meet some of the other thirty teachers and staff members here. There is a friendly atmosphere welcoming both this group of student teachers and another group staying with another cooperating teacher. The headmaster appreciates that teachers in her staff are cooperating with the employees at the university college in various ways. The year I conducted my fieldwork there were two cooperating teachers at Seaside and other teachers at the school were involved in collaborative projects with teachers at the university college. These projects did not include student teachers.

Sara has been a teacher since 1990 and a cooperating teacher since 1997. Before she started her teacher education Sara worked in a kindergarten one year and studied education science at the university for one and a half years. After she completed her teacher education Sara continued to study at the university college while she was working full time as a teacher.[53] She studied pedagogical supervision and pedagogical administration, and thus Sara is well educated in pedagogical topics. In addition to her work as a teacher and a cooperating teacher, Sara is the team leader for grades 1-4 (ages 6-10) and thus is part of the Seaside School administration.

In an interview Sara tells me that if she has the opportunity she may want to study mathematics. As a pupil she always liked doing mathematics and she received good response to her work. Sara was awarded her teaching degree before mathematics became a compulsory subject in teacher education (from 1990), but it was one of her chosen subjects as part of her education. Although, as she puts it, her heart is burning for the subjects of mathematics and Norwegian, she highly appreciates the opportunity to be a classroom teacher. It gives her the chance to make connections between different subject areas and perhaps more importantly, work with the learning environment and the interplay between the kids. For Sara this means both well-being and the urge to learn. She explains it in this way:

> This here [in primary school] is where you can really work on getting the kids to enjoy themselves and have them join in what we're doing - that's to say have them retain the urge to learn they hopefully have when they start school (p. 1). (…) Because I believe that if kids sense that other kids see me, speak to me, I play on the same team as other kids and also the adults - (...) They really have incredibly much growth in them – to have this genuine drive – I have never experienced a kid who has not had this urge to learn and to be part of things

[53] The way the study was organised made this possible. There were weekend sessions and the length of the study was stretched, using one year for the usual half-year studies.

> and be allowed to keep doing this (p. 3). How do kids grow, how should we facilitate for kids to – flourish or – that is – what can we do in the wings, so to speak? I think that's where it is (p. 2) (int010303, pp. 1, 2, 3).

Sara finds great pleasure in collaborating with both the kids and their parents. She expresses it like this: "After I had worked for some years I also grew increasingly more focused on cooperation with the kids' homes − that's to say having a holistic view. Thus I believe that I extend my horizon all the time, when it comes to how many different factors are involved" (int010303, p. 5). This can be connected to how she finds that her workload as a teacher has grown in a short period of time. Sara is not sure that this is only due to changes introduced by the authorities, for instance more compulsory time to be used on collaborating with colleagues. She reflects: "I don't know whether it's because we're getting better at our job and see even more things we should have addressed – I have ideas, I have thoughts about it, I have some visions I would like to realize – thus I believe that we raise the demands all the time" (int010303, p. 4).

When I conducted my fieldwork, Sara was the class teacher for twenty-four third graders (8-9 years of age) in the autumn and three more in the spring. She teaches all subjects except physical education. One of the girls has special needs. Sara describes the kids as follows in a booklet she has made for the student teachers:

> In 3A, as in every group of kids, the maturity and interests of the kids vary. Some read well while others have to spell out the words. Some can concentrate for long periods, others cannot. Some have learned addition and subtraction almost up to a hundred while others hardly can do it up to ten without using concretes. We attach importance to the development of each kid, what are YOU working on? What do YOU think you have to do in your work? What have YOU been learning? (infb, p. 13, my translation, capitals in original).

In one corner of the classroom there is a "class circle" consisting of chairs and benches placed in a half circle in front of a board and a flip over. This is where the class meets for common activities, ranging from the morning assembly to the introduction of new topics and the sharing of their solutions to tasks, for example mathematics problems. In one corner of the room there are three computers often used by the kids as part of lesson work and as part of supplementary work. In the middle of the classroom there is a big round table surrounded by chairs. Sara explains one of the ways she uses this table:

> Often when we have done exercises in the class circle and we are going to work some more on the topic, I know I'm not doing that many exercises so that everybody understand. Some of the kids catch what I'm teaching at once while others need more time. What I do then is tell them that if they want to work with me they can come to the round table. (…) And then [after a while] some of the kids will say, now I'll go to my seat – so there is something about walking the path together with them until they are steady enough to walk it alone (mc111202, p. 7).

The kids' work areas are arranged with tables in groups of five although the kids are grouped in sixes (changed in the spring period when new kids arrived) because each of the kids

belongs to one of four regular groups called Donald Duck, Panda, Seal and Dolphin. But for three weeks at a time one kid from each of these groups of six makes up the environment group. They are responsible for looking after practical things like setting out books, getting milk for lunch and opening the windows to air out the classroom. They also make plans together with Sara and work on the class atmosphere.

Sara collaborates closely with the other teachers working on the same grade level. The class teacher of the other third grade class, 3B, teaches physical education in Sara's class. There are three other teachers on the team; one of them has the responsibility for the girl with special needs. The two classes thus share teachers and are closely connected to each other. They often have joint activities, both regularly throughout the year and ad-hoc in connection with such events as excursions and celebrations. The two classes usually spend their Monday periods outdoors. As the school is situated near both the woods and the sea opportunities abound for learning experiences in the various subjects. Fridays the two classes are regrouped to make four new groups consisting of six to seven kids from each class. They move around from station to station creating artistic expressions through drama, dancing, music and arts; one activity each week. Every Thursday in the student teachers' first period of teaching the two classes of third graders are grouped together with the two classes of seventh graders in what is called mixed-age groups. They worked on practical mathematics by going from station to station. I will return to this issue below when I present how the student teachers experienced the teaching of mathematics.

As mentioned above, each of the student teachers received a booklet from Sara in which she welcomes them to the school and presents important information.[54] The front page has a nice drawing of kids doing an activity together. Inside the booklet the student teachers can read about the aims Sara and the other teachers responsible for the third graders are trying to achieve. By continually working on the class environment and social learning they intend to develop independent, accountable and collaborating kids. To achieve this, the kids must learn to make choices and the role of all the adults at Seaside, not only the teachers, is to help the kids to foresee alternatives and to assess their choices afterwards. The kids should be empowered, and should also set their own objectives when working individually; usually each of the kids has their own individual plan covering two-week periods. The student teachers can

[54] In addition to information about the class and how they work, the booklet includes a map of the school area, a confidentiality contract to sign and a letter from the headmaster. There is also information from the university college on the criteria for evaluating student teachers. As mentioned above, the student teachers are supposed to use planning documents when they plan teaching, and the booklet also provides such forms.

readily understand what these teachers of kids in the third grade see is a safe learning environment: structure, limits and clear agreements. The kids are familiar with various ways of working, such as individual work plans, co-operative learning, outdoor school, storyline and being in mixed-age groups.

In the booklet, the student teachers can also read that the teacher's role in mathematics teaching is based on such principles as asking questions, stimulating the sense of wonder and providing kids with opportunities to communicate with each other. Sara writes in the booklet that mathematics is much more than simply writing down numbers where the primary focus is on getting the answer right. There should be room for the imagination, guessing and other ideas so the kids can discover, see structures and make connections between different areas. The use of language is important. Below I will show how Sara's way of thinking about and teaching mathematics is well attuned with the ideas and ideology in the mathematics syllabus in the national curriculum, C-97 (KUF 1997).

Throughout my collaboration with Sara she talks about teaching mathematics in terms of making arrangements for the kids' experiences. This can be exemplified through two quotes: "How do we manage to take care of the kids who need even more experience?" (mc111202, p. 15) and "He [a kid] is probably in a phase where he continues to need experience with this" (mc112002, p. 4). Sara is convinced that kids learn and gradually build competence and understanding by being involved in practical experiences, for instance through play, games, building models or performing measuring activities. Sara's ideas here are in accordance with the national curriculum's syllabus for mathematics (part of C-97, KUF 1997) where we find this expression: "Day-to-day experience, play and experimenting help to build mathematical concepts and terminology" (p. 153, my translation). The consequence is that "at the primary stage, pupils' own experience plays a particularly important role. Play figures prominently (p. 155). (…) Pupils' own activities – carrying out practical work and gaining concrete experience – are of the greatest importance in studying mathematics (p.156)" (KUF 1997, pp. 155, 156, my translation).

As will be seen throughout this research text, Sara strongly believes that individuals learn through collaboration with others. Even if she has social objectives behind her emphasis on cooperation, this is also strongly connected to the importance she attaches to academic learning through active participation and use of language. The quote below shows how these thoughts have developed:

> From when I started as a teacher and until now, I have acquired a broader perspective on being a teacher – I mean before I got my teaching degree I had thoughts about myself as a teacher and the subject content, what

> the kids should learn, and I should be good at transforming it (she laughs a bit) – I think that during the years I have worked as a teacher, focus has been moved from me and the textbook to inside every kid – and to the interplay between them [the kids]. I am more and more convinced that there is where it [the learning] happens (int010303, p. 5).

Sara is convinced that discussing, arguing and joint problem solving help kids in their process of learning mathematics. In C-97 we find that third graders should "cooperate in assessing various possibilities and solutions, in play, games and practical tasks" (KUF 1997, p. 160, my translation). It also points out that this is something that needs to be learned; "They [the pupils] should learn to cooperate in describing and resolving situations and problems, to talk about and explain their thinking, and develop confidence in their own abilities" (KUF 1997, p. 158, my translation). This brings us to another trait of Sara's mathematics teaching; the kids should find their own way of calculating and use the devices best suited for them to accomplish their tasks. As a consequence, the kids are allowed to develop their own algorithms. Additionally, as emphasised in C-97, the kids should acquire training through collaboration "in explaining their thoughts" (KUF 1997, p. 158, my translation). Sara finds that "my best moments as a teacher are when I am in a real dialogue with the kids and listen to what they think and – learn from them" (int010303, p. 5). However, she is quick to point out that she is not the only one who should listen to the kids and learn from them. Sara strongly believes that the kids develop both their understanding and ways of accomplishing tasks through experiences and cooperation with others. She finds it important to inspire the kids to ask each other questions about what they see, do and think. This is in accordance with C-97 where we can read this: “The pupils construct their own mathematical concepts. To achieve this construction of concepts it is necessary to emphasise conversation and reflection. (…) The pupils may have unfinished concepts, sometimes they make mistakes and show misunderstandings. In a confident and edifying this should be used as a starting point for further learning and insight” (KUF 1997, p. 155, my translation).

## *Sara and the context of mentoring*

### *Sara as a cooperating teacher*

Sara was asked to be a cooperating teacher by her headmaster and saw this as a way of keeping abreast of what is going on in this field and staying alert as a teacher. Although she saw this engagement an exciting challenge, she felt a bit anxious about what she actually had to offer the student teachers. However, throughout her years working as a cooperating teacher Sara feels she has developed in the job. She puts it this way:

> In my first year as a cooperating teacher I was not the same as I am now. Then everything was much more according to my premises, I think, rather than the student teachers' premises – Then I thought I had the key– I was not that concerned about how the student teachers learn – but ten years ago I maybe was not so concerned about how kids learn either, I mean I thought more about what they should learn and how I could deliver it in a good way. (…) I had more of a traditional teaching style. (…) But now – now I think I am more focused on – now I think it's best if both the student teachers and the kids develop and learn – if I only help this happen, facilitate the surrounding conditions, so they can experience that here, here I can find out things on my own, then that's the best (int041103, p. 4).

Sara remembers how in mentoring the first student-teacher group she thought that this was easy, things were straightforward. Now she thinks:

> What is the greatest fun about this, I think, about my role, I think it's becoming – I don't think that I should call it more difficult – every time, but I think there's so much surfacing I might have addressed. (...) That I could have – that's everything you might follow – so it's definitely not boring around here (int032803, pp. 9-10).

Even if Sara no longer believes she has the recipe telling the student teachers the best way of doing things, she states clearly that she wants them to understand that being a teacher is an important and wonderful job that centres on letting each kid flourish, as expressed on page 69.

Sara tells me that her style of both teaching and mentoring can be compared to the constant drip of water that can form a stone over time. She uses this metaphor to illustrate that it is not power that forms the stone, it is the water, over time. She explains it like this:

> I'm probably more the type of person who drips several times than goes hard at it at once and says [and so be it] – it's perhaps not so good when you don't have much time at your disposal, no (laughs a bit) – when I can't drip every day for two years – but all the time it is a challenge to know – how hard should you go at it? (int041103, pp. 9-10).

Sara believes that the more often you have focused on things, discussed issues, arranged and connected experiences, then the more the student teachers (and the kids) will understand and see in the end.[55] As an example she mentions:

> I believe that the more often I have said the word relations – the more often I have said the word communication, the more often I have said the word interplay. (…) I believe that little by little it will be like – when they think about the role of the teacher and kids' learning – maybe not now, but maybe later on it'll surface. Yes, interplay. Yes, relations. Yes, pupil activity. I believe that they need it, the dripping. The more times you've heard it the better – and especially if you mange to connect it to your own experiences and field experiences. But I believe we can say drips. I don't think there is a danger of it being repeated too often to my student teachers either (int041103, p. 4).

As mentioned above, cooperating teachers decide if student teachers have passed their student teaching. Sara acknowledges that student teachers probably look upon her as an evaluator, but she wants and hopes that they will use her as a resource person in their process of learning. At the same time she wants them to be conscious of and responsible for their own

[55] In Appendix 2 I show how Sara's use of the word "see" is a recurring trait in my data material. In Chapter 7 I elaborate on this as part of my findings.

learning. She finds it important to emphasise that their development is important:

> So I try to emphasize, heavily, I think, to them that what's most important is that you're seeing development, not which point you're at when you finish your field experience here. Rather that something has happened from when you arrived, that you've made an effort to – get something out of your field experience. (...) And then it might happen that I – that we assess just as positively someone who might have started on a – well, it's probably not right to say low level – but who started quite modestly, rather than someone who came here and was already a master, like, and who didn't – put in so much effort into developing (int010303, p. 11).

Sara compares student teachers' learning with kids' learning. As they are all different people they all learn differently. They need to use their language, discuss, make and share experiences and carry out tasks by trial and error. Sara also believes that writing is essential to learning, and as mentioned above, writing log books is an obligatory part of student teaching. Sara encourages the student teachers to write interactive log books; the student teachers deliver their writings to her at the end of each week and she responds to their writings. She does so by making comments and asking questions. Depending upon the student teachers' writings she suggests things they should read and connects their experiences to theory. Such interactivity with the cooperating teacher is not mentioned as an obligatory part in the plans. But because there are five student teachers in the group, Sara thinks of the log book as a device where she can have closer contact with each of them, and get to know them better. This opens for individual mentoring. She explains:

> Even if we, both the student teachers and I, work to put a group in such a position – everybody can be active and all that, there'll be some who hold more back, quite often. And then – the log book becomes such an arena where they can also appear clearly, at times – and then we can use what they're writing about in their log as input to the whole group when giving them guidance. Needless to say, they also need to think this is ok, too. But often the log books give me – just as much input as the student teachers give me in the mentoring conversations (int010303, p. 12).

Sara's experience is that student teachers often find it difficult to use the log book in a meaningful way. She wants to avoid falling into the trap where their writing is something they do for her sake. She says:

> That's to say they don't feel it's – the log book's there to show that I [the student teacher] have listened, and that I'm showing that I'm doing something here, but they should also see it as a useful tool. Therefore it's always difficult to know how much I should require when it comes to what the log book should be. Some times the student teacher has written minutes of facts, and then slowly but surely we have put some more content into it, a bit more reflection upon it (int010303, p. 12).

Over the years that she has worked as a cooperating teacher Sara has become aware of how it can be useful to suggest themes for the student teachers' writings, often different themes for each of them. The following is often heard in mentoring conversations; "You can write more about this in your log book" (mc111102, p. 4), "In the log book you [one of the student teachers] can reflect upon how you could have developed the station further, perhaps another

use of the numbers?" (mc112002, p. 8). Sara finds it difficult to separate the different processes she and the student teachers are engaged in, and explains:

> I have thought much about this. Where is the distinguishing line between mentoring and planning, preparing their instruction and writing their log book, when I give a response to the log book, when is it mentoring – when the students have started a discussion and I might withdraw, almost, and merely sit and listen – perhaps that's the best mentoring they have? So I choose to think that mentoring is – I think that mentoring is the processes you initiate – that make things move in their minds, that cause them to think and reflect, that they try out things and such. (…) What's important is the processes that occur (int010303, p. 16).

Sara finds it to be part of her job to stimulate the student teachers' curiosity in literature and theory on teaching, and not least their curiosity into what lies behind what they are doing as teachers. She further sees it as her job to help student teachers understand the connection between theory and practice, to see connections between what they are engaged in at the university college and what they experience being with her and the class. She puts it like this: "I really think that my role is not at all to show them that practice is completely different from theory. My role is to tie practice and theory together. That's also the role of the teachers at the university college" (int032803, p. 2). From her point of view, not only the student teachers but all involved parties could have gained from more collaboration between all parts of the teacher education. Sara has become aware of this through the experience of being a participant in a project involving the teachers of Norwegian at the university college. She explains how as a cooperating teacher she "gained insight into what they [the student teachers] had been working on in their theoretical studies. (...) And not least the seminars we had where we worked together – that gave me much more confidence when it comes to feeling that we're pulling in the same direction, and I think this is particularly important when we have so much – when we have so many things to cover" (int032803, p. 3).

### *The five student teachers*

In my research I focus on Sara and want to bring her voice out; how she both thinks about and performs her mentoring of first-year student teachers.[56] But within the framework of socio-cultural theory it is of course impossible to understand her thoughts and actions without presenting the five student teachers. As already mentioned, Eric, Eli, Ian, Ina and Irene spent six weeks with Sara and her class of third graders during the first year of their teacher education programme.

Eric[57] was 21 years old when he first stepped into the halls of Seaside School. Before he

[56] And then it is part of my study to see how this can be of educative value for student teachers' development of pedagogical content knowledge in mathematics.

[57] Two of the student teachers have worked as teachers before they started their formal education. I have chosen

attended teacher education he worked one year as a teacher, mostly teaching third and seventh graders.[58] In the mentoring conversations Eric often connects his experiences from this year of teaching to what they do in Sara's class. In an early interview Sara describes Eric "as being on his toes" both in the classroom and in mentoring conversations. She further talks about Eric as a natural talent in his contact with the kids, and as an example she says that his name was the first one the kids learned. Eric is, according to Sara, eager to learn and at the same time understands that there is a lot to learn. This can be understood from the expectations he places on the field experience; he wants to understand why things are done and connect what he experiences to theory. Eric is the one who is most worried about whether they know enough to plan their teaching; he often says that he does not know what the kids can do and often asks Sara questions directly related to this.

The other student teacher with experience is one of the girls, Eli, who is 22 years old. Before she started her teacher education Eli studied German at the university and worked one year as a teacher. She taught Norwegian as a second language for children in grades 1-7. Sara finds that Eli very clearly shows that she has experience with kids. Sara remembers how in their very first meeting Eli expressed that she looked forward to, and was excited to get the chance to lead the whole class. She took the challenge of making an overall plan for the English lessons. Sara found Eli to be an active participant who made worthwhile contributions to the discussions. She even experienced Eli to be the one who propelled the discussions by asking directly, "Is that so? No, I don't believe that's true" (int010303, p. 28).

Ian is 20 years old and before he began to take teacher education he studied sports science at the university for one year. With no teaching experience he entered teacher education more by chance as he was not quite sure what occupation he should pursue. Although Ian managed to have good contact with the kids, Sara remembers him telling her the first time they met that he just wanted to walk around in the class for a period of time to get a feel for what it was all about. He also stated that he needed experience in reading for the kids. Even if Ian is a bit reserved, Sara finds him to be “very spot on” considering he is a first-year student teacher. She found Ian to be a thoughtful, inquisitive young man and, not least, he was the one who asked many practical questions; have we thought about this and that and so on. In a way, Sara found him to be the one who "kept everybody's thinking in order and stated what we thought just there and then. He summed up and maintained our thread" (int010303, p. 28).

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pseudonyms that start with E for the experienced student teachers, and names that start with I for the inexperienced student teachers. In the same manner I will use names on the pupils that starts with P.

[58] Due to lack of teachers in some areas in Norway students are hired as teachers for one year at a time.

Ina is 20 years of age with no experience from teaching. Sara describes her as a girl who in the mentoring conversations made some thoughtful contributions and "was spot on", especially in the spring period. In the classroom, however, Sara found her to be more focused on herself than the kids and she liked to have the pupils' attention. Sara thinks that Ina must have the opportunity to be in that role for a while, young and inexperienced with teaching as she is. One of Ina's expectations for her student teaching is that she hopes to learn more about observation. She believes it will be a great challenge "with as little experience as I have, or rather with no experience" (lbin111102). Another one of Ina's expectation is that she first and foremost wants to be more inspired to become a teacher.

Just like Ina, Irene, 22 years of age, appeared to be more concerned about herself than the kids when she first arrived. Irene came to Sara wondering if she had made the right choice of careers, expressing that she felt insecure and would like to share responsibility with someone during her first days of teaching, and admitting that she would have preferred to have had her student teaching in grades 8 to 10. However, she does see this as an opportunity to experience working with younger kids. Sara finds that Irene really has idealistic thoughts about how things should be done in the school; especially her ideas on how to work with subjects like Norwegian and religion and ethics.

From this brief presentation of the student teachers we can see that they are five very different persons, when it comes to teaching experience, roles in the group and expectations for their field experience. All five are in their early twenties; two of them with one year of experience from teaching while the other three have virtually just finished 12-13 years as pupils in the Norwegian school system. As a group Sara is impressed by the way they interact and collaborate, and as seen above, through the presentation of the student teachers Sara has observed how they take on different roles. Ian says in the interview that Eli and Eric with their experience were a strength for all of them. As a group they had decided to help each other and he found the others to be pleasant and supportive, both in the class and in planning sessions. He adds "it's the same with Sara really" (intia, p. 2). Both Eric and Ian point out that they felt safe and confident with Sara; in the classroom, during the mentoring conversations and in other settings. They were, for example, together with her at parent meetings in the evenings. They found it easy to ask her questions and to ask for practical help, and they knew that if they needed help they would get it. Eli liked the way they could choose their own pace: "our pace and what we have wanted to master – in a way she has allowed us to decide this ourselves. Then you will see the light while you are on the way. (...) It's difficult to explain, but when you are allowed to decide your own pace, when you determine your own

development yourself, then you see the light as you proceed" (intel, pp. 4-5).

### *The mentoring conversations*

Although I could see Sara and the student teachers discussing and sharing information both during teaching in the classroom and during breaks in the staff room, most of the interactions and dialogues occurred during the scheduled mentoring conversations. With few exceptions there were conversations at the end of each day; on Mondays also in the morning. The conversations lasted from one to two and a half hours depending on the end of the school day and if there were staff meetings, either for Sara alone or also with the student teachers in attendance. The conversations never lasted longer than four o'clock. From my point of view there was a friendly and humorous atmosphere between Sara and the student teachers. The meetings for conversations were situated in a lightly coloured room furnished with a rectangular table surrounded by six chairs. I placed my audio recorder on the table while the video recorder was in the same corner where I sat.

In this landscape, at the end of each day, Sara and the student teachers met and talked about what had happened that special day and what they should do the next day and the following days. Thus the content of the mentoring conversations entailed both planning for and discussions on the performed teaching. The time was divided between all the subjects and lessons that were undertaken or were to be undertaken. Or to put it another way, the processes I will refer to regarding teaching mathematics were similar for processes in teaching other subjects as well, for example a project called "newspaper" in Norwegian in the autumn period. Even if the student teachers did not have English as an obligatory subject in their teacher education programme they wanted to teach this subject as well. Additionally, there were discussions on topics that the student teachers raised, for instance "play and learning", and Sara sometimes informed them as response to questions, for example on how she has worked on the social aspect of the learning environment. Sometimes Sara initiated discussions, for instance by asking how kids learn. She also engaged the student teachers in a discussion about "the role of the teacher". So, there were many topics and many things to discuss during these meetings. Sara describes it this way:

> I really am continuously (pause) being made aware of the fact that there's very much to be dealt with all the time. That's to say many things happening all at once. There's much happening, a lot of things in a short period of time – so it's all about how can you manage – what's the best way of using the time (p. 17). (...) You really can't sit for hours - and at the same time there's so much you should have discussed (p. 20) (int052503, pp. 17, 20).

Even if each conversation entailed pre- and post-teaching conversations, meaning

mentoring before and after teaching the various subjects, Sara approached the two differently. The pre-teaching conversations were generally a collaboration starting with brainstorming and then plans were refined over several days. The planning went back and forth between the student teachers working alone at home and returning with their ideas for discussion with Sara and the rest of the group. Then the plans could be revised. The pre-conversations had a loose structure when it came to who was talking when. If some of the student teachers held a low profile one day, Sara let it go and explains it like this:

> Because I think – these conversation sessions are so intense and there are so many of them too, that I'm not really certain that I should demand that everybody should be equally as attentive all the time, and I think perhaps that I – with such a large group too – then you might not manage this – but it's rather more like that I see and register that some seem to disconnect themselves, and if this repeats itself, then – or I think about how during the next session I might – get them connected again – two or three years ago I was much more like I've got to have them all connected all the time. I think I'm a bit more relaxed about this now (int050503, p. 7).

Thus Sara finds that she can allow some silence from some of them during these conversations without feeling it as a strain. Rather, such moments should be regarded as an opportunity to think. She believes that this is the only way to activate all student teachers, saying:

> People must be allowed to think. I think that's the only way to get everyone to join in. Because if we don't give everyone the time to think, then it'll be those who have thought about it before – those who have thought already who'll say something. Same as when you ask questions in a class, and you let those who have answers answer first without giving the others the chance to think. So I'm not afraid to let people think for a little while. But I also know that I might personally be one of those who might be too fast – at moving on. So I try to keep an eye on myself so I let them have the time to think – but I don't know [whether I succeed] (int050503, p. 1).

Sara tells me that she is keenly aware that she is capable of dominating the conversations, and if she is to succeed in the way she wants, being a successful resource person in the student teachers' process of learning, she has to give them time and space. The way Sara collaborates with the student teachers through planning sessions is part of my findings and will be elaborated on in Chapter 6.

The post-teaching conversations followed another pattern. As will be seen below, in their teaching of mathematics the student teachers had the kids working at stations (also a primary form of teaching in the other subjects). Thus all the student teachers were teaching at the same time and none of them saw what was happening at any of the other stations. Because of this, Sara dealt with each of them in turn in the post-teaching conversations, or it may be more accurate to say that she dealt with one of the stations at a time because sometimes two of the student teachers shared the teaching at the same station. When everybody had shared their experiences, different kinds of discussion emerged due to their experiences with the kids (in

the classroom)[59]: for example, the discussion referred to above, how do kids learn? The way Sara reflects upon and deals with the student teachers' experiences from teaching the kids is elaborated on in Chapter 7.

### *Experiences in teaching of mathematics in Sara's class*

As I followed Sara and the student teachers almost every day for six weeks I had access to all their experiences with mathematics. In the fall period I observed Sara teaching mathematics in the class circle sitting together with the student teachers, also observing. I heard Sara talk about the importance of connecting mathematics to other subjects and the kids' everyday experiences. I watched as she showed the student teachers how the kids had drawn patterns for embroidery, a task they had started before the student teachers arrived and fulfilled while they were in attendance. Mathematics in everyday use was prevalent during the mornings where there were regularly scheduled talks on the date and weather, which were systematically reported, as a basis for making statistics (sometimes done using the English language). This was a task that both Sara and the student teachers performed depending on the situation. I could even witness how in planning processes Sara tried to persuade the student teachers to let mathematics be part of the Norwegian project "Newspaper" and to let it be part of the outdoor day on Mondays. However, as she did not get an immediate response she did not follow up on this.

In the weeks during the autumn I walked around observing the kids and the student teachers while they had their classes with mixed-age groups on Thursdays; as mentioned above the third graders then were in groups with seventh graders. The responsibility for the stations was divided among the teachers on the two teams. Sara's station focused on the use of tangram, a Chinese puzzle consisting of seven pieces that she used to promote understanding of how certain geometrical shapes consist of other shapes. As each of the student teachers followed one group of kids around, all of them experienced how Sara interacted with them and how they collaborated on the tasks. Actually, they also had the opportunity to see the other third grade teachers as well. On the other stations the kids played different sorts of games, role played a shop, worked with different kinds of measuring and practised origami, Japanese paper folding, that are intended to develop both creativity and understanding of geometry. The student teachers did not take an active role in planning and teaching these days. Sara introduced them to the learning aims for each station, and asked them to observe

[59]I refer to the classroom even if this could also mean being in the schoolyard, in the school-kitchen or in the hall.

which possibilities there were for the kids to learn. The student teachers' experiences were discussed in mentoring conversations.

I made all the experiences and observations referred to above during the three autumn weeks in between the student teachers' own teaching of mathematics (and as mentioned, also other subject matters). In the spring session the student teachers did not experience teaching of mathematics beyond their own. Through my analysis I have divided the student teachers' own teaching into four teaching periods, two in the autumn session and two in the spring. Each of the periods lasted for several days. Below I will give a short summary of these periods; how they occurred, the mathematical content and Sara's role. I will end the section by outlining common traits of the student teachers' teaching of mathematics.

### *The student teachers' teaching of mathematics*

The first period of mathematics teaching starts the very first day of the student teachers' field experiences. Sara is the one who has decided what the mathematics topic is to be, the place value system. She has also designed the activities for the first two days, and the student teachers have no other responsibilities than to observe how Sara interacts with her class and how the kids interact with each other. Both days Sara and the kids start by participating in activities with dice in the class circle. Then the kids, in pairs, play two dice games connected to the place value system; one game each day. The third day, each of the student teachers sits down with a small group of kids. They were asked by Sara the day before if they wanted to help the kids to develop their understanding of carrying to the tens. Each of the student teachers planned this session on their own. I have identified what happened these first three days to be part of what I refer to as findings or an answer to my research question; how Sara facilitates the student teachers' development of pedagogical content knowledge in mathematics. Thus episodes both from the classroom and from the mentoring conversations these first days will be elaborated on in Chapter 5.

Period two of the mathematics teaching occurred in the second autumn week. Eric, Irene and Ina started to plan mathematics while Eli and Ian started to plan the Norwegian topic "Newspaper". Sara proposed this and said: "No one should finish the thinking, but some of you start and then we structure and think together, then we do it [the teaching] and assess, would that be fine?" (mcwu111802, p. 2). The student teachers agreed and Sara encouraged them to think about what they had noticed about the kids the week before and how they would like them to work. She can give them some ideas, but first she wants them to discuss what they can do.

The next day the three student teachers submitted their ideas to the whole group, including Sara, and all six agreed that they should make five stations for the kids, where the overall objective was to develop the pupils' understanding of the place value system through collaborative activities. The mathematical activities at four of the stations were based on suggestions from the three student teachers. At one station the kids should find ways of counting a number of stones and then divide them into three parts. At the other two stations they were to play games, a board game using two dice and a well known dice game called Yatzy. The content of the fourth station concerned putting digits in their right positions in numbers. At the fifth station the student teachers had some ideas about measuring by using weights. When they discussed this they found that the content was not in accordance with the mathematical topic of the other four stations, the place value system. Sara proposed an idea about a magic square puzzle; a three-times-three square where the sum should be the same both vertically and horizontally by putting the numbers from 1-9 in their correct positions. This became the activity of the last station. The student teachers undertook the more detailed planning of one station each. They did the teaching in the classroom, teaching the same content, or perhaps it is more appropriate to say, leading the same activity five times the next day.

The third period of mathematics teaching occurs in the spring session. The mathematical topic for this teaching period comes from a suggestion from the student teachers. As mentioned above, they should carry out a minor mathematical project during their student teaching sessions. When they meet with Sara to plan the spring session (in all subjects) each of the student teachers presents tasks they have prepared for the kids. The core of their project is that the student teachers will explore what kids can do within the area of numbers and addition and subtraction. Sara's first response is that they should remember to focus on *how* the kids solve the tasks, not only whether or not they can solve them. Turning to the content of the different tasks, Sara questions what they want to see or learn from the kids while they are doing them. The student teachers give some mathematical answers, for example if the kids connect the word fifteen to the number 15 and see if they know that 52 is more than 25. Sara points out that without being aware of it they may also register the kids' ability to read. Ian says he has given thought to that point in the textual problems he has made. Sara emphasises that by being aware of the challenge of reading one can help the kids, and when it comes to writing, we have to “interpret everything in a very benign manner” (mc032003, p. 3). When they present the different tasks they have made, the student teachers ask questions like:

> Can they [the kids] add 150 + 76? (p. 1).
> Maybe a bit difficult that one? (p. 4)
> Numbers up to a thousand, I don't know? (p. 4)
> We want to have some more textual problems but first I want to ask what they [the kids] have done before (p. 6).
> (mc032003, pp. 1,4,6).

Sara answers the questions and informs the student teachers about what the pupils have been up to in class since the end of their first session in November. But she also reminds them that what the kids have done in class and what they have learned are two different things and that there are still differences between them. They decide to divide the kids into two groups; half of them doing mathematics and half undertaking reading activities together with one of the student teachers (as part of a project in Norwegian). Thus four of the student teachers are with thirteen (fourteen) kids in the classroom. This makes it possible to observe the kids more thoroughly; not only with an eye to ascertaining if they manage to solve the tasks they are given, but also how they do the tasks.

In the last mentoring conversation before the kids are to carry out the tasks, Ian adds that they should number the tasks because he has made a form. Surprised, Sara asks "can we make a copy of it so we can all have a look?" (mc032403, p. 5). Ian explains how he has tried to capture what they have been discussing earlier. In addition to marking if the kids manage the different tasks, he has made a column where the student teachers can write down if and how they have helped the pupils. Another column is for writing down what arithmetic strategies the kids use. Ian stresses that he made the form so they will not forget what they have observed, but he is unsure if he and the other student teachers will manage to use it. Sara follows up by saying:

> All these forms are intended as tools in your situation, we don't use forms so that we can force the kids into forms, but we use forms to help us record what we think is important and create order in what we observe, so there's nothing that says we shouldn't note down a bit here and there if we see there are other things that should also be included (mc032403, p. 5).

The student teachers decide to use the form, and if necessary they can revise it. They find it difficult to estimate how much time the kids will need to work through the booklet they have made for them. Sara proposes that they start with it and then find out as they go along. She points out how there are always improvisational aspects in teaching; you often do not know how things are going to turn out. The third day they work on this the student teachers encounter a problem as some of the kids have finished the tasks and need additional work. Sara asks if the student teachers have noticed who has completed the work; "Will that be kids with good understanding?" The answer is yes, and Sara continues: "That probably means they

need some challenges now?" (mc032603, p. 4). This third teaching period lasted for three days with mentoring conversations in between where adjustments were discussed.

When they started the third period of teaching mathematics the student teachers' intention was to find out what each kid could do with numbers. Based upon their findings the intention in the fourth teaching period was to make activities that could address each kid's individual needs. It did not turn out quite the way they planned because the student teachers found it difficult to summarise their observations of how the kids solved the tasks. Sara found it wise to not dwell on this too much, in part because she saw that the student teachers needed to carry on but also because she was confused about her role in this project. She was afraid that the project might take "a totally different direction than what might have been intended" (int052503, p. 13) and that she probably would "misguide them more than guide them" (int040303, p. 6). She finds that it must be "incredibly frustrating for the student teachers if we as mentors set some demands, and then the teachers at the college present other demands" (int052503, p. 17). As this was meant to be part of their mathematical project Sara was convinced that they would be supervised[60] by the teachers of mathematics when they got back to the university college.

The fourth period of mathematics teaching starts with a brainstorming phase. Eli and Irene talk about how the kids should be doing activities. Eric proposes that the kids probably should work in small groups. They all agree, but throughout the discussion it is apparent that they are unsure as to how to best organise this; should they make homogenous groups based upon what the kids need to do more work on (or as Sara would have put it, need more experiences of)? Even if they find it difficult to summarise their observations from the previous teaching period the student teachers have observed great differences among the kids. Sara has also praised them for having made rather accurate observations of how some of the kids both do and think about mathematics.

Building upon the student teachers' above-mentioned proposals, Sara suggests that each of them could prepare for one activity, making five stations. The kids should work in the groups they are used to. This will be a challenge for them as teachers, and Sara explains how this will affect their role:

> [It's] the challenge of the adult who follows the group - the role of inserting questions or formulating questions so that everybody has a challenge on his or her level even if this is not a homogenous group. (...) Perhaps we manage, it really depends on how we plan this, I think (silence). What do you think? (mc032803.

[60] I use the word supervise because my definition of mentoring is connected to field experience, see the introductory chapter, page 6.

pp. 3-4).

Thus the role of the student teachers should be to adapt the activity to each kid. In Sara's opinion adaptive teaching should not only be about giving each kid different textbooks and different tasks. In an interview she explains her thoughts as follows: "Adapted teaching – successful adapted teaching, I really think this is when the kids can work together regardless their skills and in spite of this experience that they are challenged at the place they are" (int052503, p. 19).

With a smile Ian expressed how this would be difficult. But the student teachers wanted to try because none of them feel comfortable making homogenous groups. They were not sure if their observations were accurate enough. This initiated a discussion on and a search for possible content and activities at the stations. By the time the student teachers are ready for more detailed planning they have agreed with Sara on an overall aim; through collaboration in play activities each kid should develop their understanding of calculating. Furthermore they have agreed that some of the activities should be outdoors. In his log book for this day Ian wrote:

> Is it possible to prepare a maths plan where there is equal learning for all? I feel this is an incredibly difficult question to answer. I say this because much of the learning that occurs is almost impossible for us to ascertain when observing. Much more happens in the brain of an eight-year old than we can see and analyse, I think. But we must of course assume that learning occurs, so we must base our thinking on that when we prepare plans for all the 27 pupils. I think it will be difficult to achieve an equal amount of learning for all, perhaps it's even impossible. But I hope and believe that we can prepare a plan that will challenge both the strong and the weak pupils. Where everybody can take part and do some of the work. I think that should be the main aim when we plan this. I hope we will be able to manage this plan with outdoor maths and maths stations, because I think this will be fun for the pupils, and thus a success because they are having fun (lbia032803).

The way this topic was organised turned out differently than Sara expected when she left the planning. Originally there were five stations, and the student teachers were to talk and work with five to six kids at a time. When the student teachers came back with their ideas after further planning they had decided to divide the class into three groups which were to rotate between three stations on three succeeding days. When Sara encouraged them to give each kid challenges she thought one of the student teachers would be involved with five to six kids taking part in one activity. The way it turned out there were eight or nine kids taking part in several activities at each station. Sara did not ask the student teachers why it turned out like this but in an interview she explains it as follows when they had completed the teaching of the first group:

> When they returned and organized it this way, I took it as a signal that they wanted to be two and two together – to feel sort of confident together (p. 8). So basically I kept this idea in mind, that it could have

> been – that it could have been arranged differently, but now I think that they gained some experiences suggesting that this is the way it is (p. 7) (int040303, pp. 7, 8).

Eli and Eric shared the responsibility for one station with two activities, making waffles and measuring lengths. Irene and Ina have together prepared for three activities in the schoolyard; tossing rings, working with a magic square puzzle and skipping rope. Ian was responsible for one station alone. The kids with him were to play a dice game, guess the amount of some objects and bowl using bottles. The student teachers asked Sara if she could follow the group with the new boy. The student teachers did not know him well and they could see how he needed some extra help, to which Sara agreed. This last teaching period was carried out in the class on three successive days with mentoring conversations in between.

I will end this section, and the chapter, by outlining five common traits of the way the student teachers planned and performed their four periods of mathematics teaching. First, there was no teaching of the whole class. The kids were divided into groups of various seizes. They rotated between a number of stations or posts where they undertook various activities or tasks. As a consequence, the second trait is that the teaching was planned both as collaborative and individual processes by the student teachers. Through collaboration with Sara they discussed and agreed upon overall aims for the lessons and how they could arrange the various stations. The final, detailed planning of the activities at each station was done either individually or in pairs by the student teachers depending upon the number of stations. This means that each of the student teachers was engaged in all the teaching of mathematics they were responsible for as a group in Sara's class.

The third common trait is that due to the activity-based teaching the student teachers never used textbooks in their teaching. Sara has told them that the third grade teachers at Seaside School have decided to teach without using one specific textbook. There were textbooks available for the kids, and Sara told the student teachers that if they preferred to use them they could do so. They chose not to, but sometimes the kids used textbooks as one of several choices for additional work. Other choices could be playing mathematics games on the computer, working with their embroidery, reading a book or playing dice games. These could be used, for instance, when waiting between activities, or waiting for the next station to be free or at the end of the day when the kids had finished the obligatory work in all their subjects. Sara showed the student teachers where they could find teaching guides but they did not ask for them until the planning of the last topic when they needed some ideas for activities. Some of the student teachers had turned to textbooks and teachers guides at the university college in the planning they did before they met Sara to discuss the third teaching

period.

The fourth trait of the student teachers' teaching is that the mathematical content of the lessons dealt with different aspects of numbers. Some of the activities or games required that the kids were focused on calculation. Others focused on recognising ones and tens in the place value system. The fifth and last trait is that before and after their work with activities on the stations all the kids were gathered in the class circle. Before their work they were given information, mostly of a practical nature concerning how they were divided into groups, where they should start and what they should be engaged in. Afterwards the kids were encouraged to talk about what they had learned, problems they had encountered or nice experiences they wanted to share with the whole class. The student teachers shared the responsibility for leading these sessions.

In summarising the student teachers' experiences in the teaching of mathematics I find that they became acquainted with and performed activity-based, interactive and constructivist teaching approaches as is emphasised in the national curriculum, C-97. This is in accordance with the overall plan for the subject in the teacher education programme; "The mathematics subject in teacher education reflects the same view of the subject found in the syllabus in force for primary school" (KUF 1999, p. 112, my translation). It is further stated that student teachers' competence in mathematics teaching should be in accordance with the governing curriculum for the Norwegian school. As mentioned in the introductory chapter national documents emphasise the necessity of making a connection between the "the subject content, the education's pedagogical-“didaktiske” content and the practice field” (Tveitereid 1997, p. 9, my translation ). However, both personal experience and research (Sundlie 2001) have shown me that not all student teachers and cooperating teachers practise such teaching approaches. In Chapter 3 I mentioned that I had reason to believe that Sara’s teaching of mathematics was in accordance with C-97. I was not, however, certain that the student teachers would perform such teaching. Furthermore, I mentioned this as one of the issues that astonished me. Another one was how Sara took on such an active role in the student teachers’ planning processes. Through my final analysis I learned that these two issues are interrelated. Sara finds that her role is to inspire and assist the student teachers to teach mathematics in a way they can learn from. The next three chapters, 5 to 7, deal with the three themes I have found to be the answer to my research question; how Sara’s way of mentoring facilitates the student teachers’ development of pedagogical content knowledge in mathematics. Each of the three themes serves as the basis for one chapter.

# Chapter 5
# Moving towards shared focus of attention by focusing on the kids

A century ago Dewey (1904) feared that the immediate aim of acquiring skills and techniques would come before the long-term goal of good workmanship in student teaching. His solution was to call for the "Laboratory School" to ensure that student teachers encountered progressive rather than traditional pedagogy. He further emphasised the need to observe practice, not to “accumulate a store of methods by which he [the student teacher] also may teach successfully. (…) [But rather] to see how teacher and child react upon each other – how mind answers to mind” (p. 155). This chapter deals with how Sara struggles with questions similar to Dewey’s as she ponders how best to start student teachers’ field experiences. Similar to Dewey, Sara fears that if student teachers start teaching on their own immediately they will be what she refers to as “technical teachers”; teachers who just deliver the subject matter. As she sees it, this will make the teacher the most important person in the classroom. Sara, however, wants the student teachers to understand teaching as the interplay between the teacher and all the different kids. She wants the student teachers to be aware of and understand how each kid understands and develops mathematics in his or her own way, and recognise how this affects their teaching.

The story in this chapter shows that Sara decides to start the very first days of the collaboration with Ian, Ina, Irene, Eli and Eric by letting them see her teach. As we shall see, seeing Sara teach is closely connected to getting close to the kids. In addition to seeing her teach, Sara designs other opportunities for the student teachers to develop their understanding of the kids’ learning. By putting different pieces of data together this story is created to illustrate how Sara reflects upon and deals with turning the student teachers’ attention towards the kids during the first days of their field experiences. Into this story, or illustrations, I will insert interpretative comments to help the reader make connections between the details that are being reported and the more abstract argument that I provide through use of theory (Erickson 1986). The comments are important because even if, as I argued in Chapter 3, p. 36, there are multiple ways of interpreting and thinking about different actions, it is the way I have interpreted the data that makes my choice of theory understandable.

As mentioned in Chapter 3, I will interpret and discuss each theme in chapters 5, 6 and 7 in two ways. First I interpret Sara’s reflections and actions under the heading “How can the story be understood?” To understand and interpret this first story I build upon the concept of

*intersubjectivity*, arguing that Sara's intention is to ensure that she and the student teachers have a shared focus of attention for their further collaboration. Scholars within the socio-cultural tradition point to intersubjectivity as an important underlying notion of interactional learning situations, such as mentoring (de Haan 2001, Rogoff 1990, Tharp & Gallimore 1988, Wertsch 1984, 1985). I will especially draw upon Wertsch's (1984, 1985) work on the connection between intersubjectivity and the concept of shared situation definition. Second, under the heading "What could be the educative value for the student teachers?" I use theory and research results within the field to discuss how Sara's actions can facilitate or have significance for the student teachers' development of pedagogical content knowledge in mathematics.

## *Mowing towards shared focus of attention; the story.*

This story consists of two sections and is created to show how Sara deals with the first days of the student teachers' field experiences. The first section of the story, Sara's reflection on focusing on the kids, provides her reasons for her actions and how she has arrived at the approach she takes. In the second section I exemplify how Sara's reasoning is put into action through her mentoring of Eli, Eric, Ina, Ian and Irene. This account is told as it unfolds over three succeeding days. I argue that Sara moves the student teachers attention towards the kids by engaging the student teachers in a number of activities and discussions.

### Sara's reflections on focusing on the kids.

Sara talks respectfully about her responsibility as a cooperating teacher for first-year student teachers. She finds their first encounter with both mentoring and field experiences to be very important, and maintains that cooperating teachers should be "(q1)[61] humble about their job" (int010303, p. 20) and be aware of how they "build up their [the student teachers'] understanding of field experiences and mentoring right from scratch" (int010303, p. 19). Although Sara has worked as a cooperating teacher for a number of years, she admits that every time she starts with new groups of student teachers she has a sense of uncertainty, especially with first-year student teachers. She wonders a lot about where they should start. As the quote below shows, some questions worry her:

> (q2) Always when I'm starting with a new student-teacher group, and especially when it's first-year student teachers, I wonder a lot about – how do I start? What do I start with? What's most important right now? Is it most important that they get to stand up there and teach a lot of classes, what they themselves feel that school

[61] (q1) means "quote number 1". All quotes in each of the chapters 5 to 7 are numbered like this.

> is, and feel confident in the classroom – and then gradually discover things there? (p. 7) Is it more important to discuss the technical things a little more? Or is it, as maybe I think I believe, is it important to find out if we have solid basis, like, right from scratch – is that what's most important to begin with? I don't know. Or is it important to use a little time at the start to get them to see the kids and think a little deeper? (…) But it can also be different from student teacher to student teacher (p. 26). When you have first-year student teachers there are quite a few things they need to know right from scratch. Things that just have to be done. But do they have to do these things right from the start or can they come later? You never really know for sure (p. 25). (int010303, pp. 7,25,26)

Even if Sara knows that some of the student teachers are eager to start whole class teaching on their own immediately, she is not convinced that they should do so. She believes this because previous student-teacher groups have told her that being with her and the class is so different from what they remember as pupils, the methods are different and the kids are more engaged as participants.[62] This way Sara has become aware that

> (q3) the student teachers come with an image of the school in their head, and maybe they all have very different images, and then I talk from my image, my world in a way. I think it is important that they see me [teach] so they get some understanding of it [today's school] (int010303, p. 17).

Because of all these different images of what school and hence teaching is Sara finds that the student teachers should see her teach to understand how she believes kids learn and how that affects how she teaches or works with her class. Sara does not believe it would be sufficient to tell the student teachers how she reflects around her teaching, and she explains it like this:

> (q4) I have experienced with parents, I'm talking to them at parent-teacher meetings and tell them about the day-to-day life at school and how I work, and I see that the parents are not getting it – they don't manage to see what it's really like, not before I say to them, guess what, now we're going to do various activities together, the kids, you and me – so that I think there's something that they [the student teachers] also need to see (int010303, p. 17).

So while Sara expresses confusion and uncertainty as to what is the right way to start student teaching, she is more convinced about the importance of seeing her teach as expressed in quote (q3) and (q4). Sara stresses that seeing her teach does not mean the student teachers should feel they have to act like her. She tells them that by seeing her teach "(q5) you can see what the kids are used to, that does not mean you have to copy, there's no guarantee that that's right for you" (obsj111102, p. 3). Sara admits that she may be a role model, but the aim is not

[62] Sara builds upon her experiences gained from former groups of student teachers. In my data material I find that Ina and Ian are astonished by how different school is from what they remember as kids. Ina writes in her log book the very first day that she found it interesting to see how Sara comes close to the kids while seated in the class circle. From her own school days Ina remembers the teacher in front with the kids seated at their desks (lbin111102). In the interview Ian points out how the school has changed since he was a pupil (intia, p. 1). What is most interesting to note is how Eli does not compare with her own schooling, but from the year she worked as a teacher for small groups of kids (told in Chapter 4). In the classrooms she attended "there were the desks and the blackboard and the teacher up there in front" (intel, p. 1). Being with Sara, Eli experiences "How they [the kids] learn when you just cooperate with them, not standing in front of them and instructing them. That difference there, that I got – it was like bingo! It opened my eyes, I think a lot" (intel, p. 1).

to force the student teachers into a certain style, but

> (q6) they can see my way of doing things, and then they meet another cooperating teacher and they can see another way of doing things, and then they can see that in one situation I do things this way, and in another situation I also do things differently. But I feel it's important, that the student teachers should also observe and be present and not always be in the role of the teacher. Because the teacher role is so new for them, maybe they would prefer to just be – have focus on themselves, and not see the interplay. But if they can sit and observe, then they see (int010303, pp. 17-18).

Through these quotes (q4), (q5) and (q6) we can see how Sara believes that to understand her philosophy of teaching the student teachers should be engaged in activities and have the opportunity to observe and thus see. She wants them to see and experience the interplay as expressed in the sixth quote. So instead of starting to teach immediately the way they believe school and hence teaching is Sara wonders if it is more important that student teachers should come close to small groups of kids, and she justifies her thoughts like this:

> (q7) I believe that when you are a student teacher or are a new teacher – if it is me and the class – then it's easy to see the class as almost equal to the subject matter – the subject matter is one thing and the class is one thing – and then you deal with things [the teaching] with that in mind – in that way you automatically fall into the role of, more like instructing or giving away, I believe. But if you first, if first you go amongst the kids and notice each kid and see how much each kid has to give – and then you get to know more and more of the kids, then it doesn't matter that there are many of them like, because then you have, like then you know that here there are a lot of kids that will be playing on the same team as me (int041103, p. 12).[63]

This is connected to Sara's belief about what first-year student teaching should focus on:

> (q8) I've tried to think like now during the first year it's important that they get in – as much of the basic ideas as possible and not have so much focus on themselves, but more on the learning environment and what the basic values and views on humanity are. So all this means: how do kids learn? (int050503, p. 12).

As we have seen, throughout her work as a cooperating teacher Sara has gained experiences that lead her to question and reflect upon what would be the best way to start student teachers' field experiences. Nonetheless, as seen in the eighth quote, she is convinced that throughout their first year of field experiences student teachers should be aware of and pay attention to the learning environment and how kids learn. Furthermore, we have seen above that Sara is convinced that student teachers should be engaged in activities and come close to the kids to understand this. This is connected to her aim that first-year student teachers should most of all focus on "basic values and views on humanity", especially connected to how kids learn (q8). We have also seen, in the first quote how Sara finds that the way student teachers conceive field experiences and mentoring from the beginning is

[63] In Chapter 4, page 71 we saw how Sara remembered this trait from her own teaching during the first years of her career. She was to be good at imparting subject matter. Down through the years her focus has moved from her and the textbook to the kids and the interplay between them. That is why some of the questions concern her. If she changed, might not also the student teachers change?

important. Hence, before the student teachers start their own teaching, Sara decides to spend some time on letting them be aware of all the different kids and their learning. This is the important part of teaching. In the next section I will illustrate how Sara arranges opportunities for the student teachers to experience this.[64]

## Sara's way of focusing on the kids

### *The first day: Sara arranges activities to experience interaction in teaching*

The very first day of their student teaching, the student teachers have no other responsibilities than to observe how Sara teaches, or interacts, with her class. In the mathematics lesson she starts as usual by gathering the kids in the class circle.[65] The student teachers are seated among the kids observing Sara doing some tasks together with them. Sara focuses on "ones and tens" by asking questions like "how many chocolate bears (*Bamsemums*) do you want, that many or that many?" simultaneously pointing at the numbers written on the board, 21 and 12. The kids laugh and one of them is asked to answer. He points to 21 saying "because that's the most". This goes on for a while, with Sara asking different kids and using different numbers. Some of the kids explain their answers on their own, others are asked to do so by Sara. In the second task Sara asks the kids to use cubes to show her different amounts like 62 and 26, still focusing on the difference between ones and tens. In the third exercise Sara rolls a pair of dice. Her first roll gives her two ones and she asks her kids what numbers she can write. The kids laugh and say "eleven" almost simultaneously. Sara's next roll gives her 6 and 2. One of the boys says that she can make 62 and 26. "You've got it" is the smiling response from Sara. The boy continues by saying that 62 is the larger number and 26 the smaller. Sara asks if he can explain why this is so and he points to the tens; six tens are more than two tens (obsj111102, pp. 10-11).

Throughout this sequence Sara displays what she finds to be important in mathematics teaching; the kids should explain their answers and share their thinking with each other. While some of them manage to do this in the same flow as they answer, others are encouraged by

[64] I have chosen to relate the episodes I find significant in the order that they unfold. This is important because, as will be seen, the episodes build upon each other. However, throughout the three days there were other discussions and other lessons between them.

[65] As mentioned in Chapter 4, throughout the six weeks of their field experiences the student teachers were mainly responsible for the teaching of mathematics except for the first three days. Therefore, even if Sara maintains that they should see her teach, they did not see Sara's mathematics lessons in class over a long period of time. The way she interacts with the class as seen here occurred the two first days. However, as mentioned in Chapter 4, the student teachers saw her teach mathematics in a class with kids of different ages on Thursdays in the autumn period. They also saw her teach lessons in other subjects the first week and some lessons or parts of lessons in between their own teaching the other five weeks.

Sara to express their thoughts. Bearing C-97 in mind, we learnt in Chapter 4 that Sara strongly believes kids learn by sharing their thoughts through collaboration. Sara explains it like this to the student teachers: “(q9) The kids who learn best are the ones who explain to others – who don't just give the answer but explain how they are thinking” (mcwu111202, p. 13).

The next activity Sara arranges for the kids to do and for the student teachers to observe is a new dice game, the dice game of one hundred. The winner is the one who gets closest to a hundred without going over. Throwing one die the kids could choose to make it, for instance, 60 or 6. The three tasks referred to above have been an introduction to this game. Sara asks the kids to work in pairs. They should start by reading the rules and figure out what they are going to do. The kids find their partner, go to their seats and start playing. While they play the game, Sara asks the student teachers to walk around, observe and talk with the kids. She makes a few suggestions about what they might focus on, from observing the reasoning each of the kids applies to how they collaborate by, for instance, giving each other advice.

In the mentoring conference at the end of the day the student teachers share their experiences from their first day with Sara and her class of third graders. I have shown an example of how Sara interacts with the kids during the mathematics lesson, but there have been other lessons with other subjects as well. However, in answering an open question on how they have experienced the day, Ian immediately mentions difficulties during the mathematics lesson when he observed the kids playing the dice game. He was very unsure whether he should intervene when he saw the kids using wrong solutions and how he should help them when they asked him for assistance. Sara saw that what Ian called “wrong solutions” was the kids making their own algorithms, but she did not believe that she could “(q10) tell them [the student teachers] things so they will know that is how it is - but [instead] let them see” (int010303, p. 7). So based on experience her response is:

> (q11) We'll see later, later we'll look a little closer at some of this, because there were some smart algorithms there - you could see a system for how they calculate and you can see a very big difference in the way some of them understand numbers (mc111102, p. 1).

In addition to preparing for interpreting the kids' algorithms, Sara decides to let the student teachers observe the kids play another dice game the next day. The first day the student teachers walked around here and there in the class and Sara was open to different types of focus in the observations. This time she asks each of the student teachers to concentrate on one group of kids (in Chapter 4 we first saw that the kids are seated in groups) to examine more thoroughly how each of them does the mathematics involved in the game. Sara thus draws attention to the importance of observing kids while they are working on acquiring

information about how they work and how they think.[66]

### *The second day: Sara arranges activities to experience how kids think*

In the next mentoring conference Sara experiences that the student teachers have something to say about how the kids did the mathematics. This time the kids were to throw two dice and make the smallest and biggest numbers possible before they added the two numbers. When they reported what they saw by observing the kids doing this task, the student teachers especially focused on the question of "ones and tens". They stated such things as:

Dialogue 1[67].
(u1)Ina: I tried to get her to understand: Yeah, should I add a one up on there now? And there was little understanding of what the one means. (…) I tried to get her to understand that it was the tens place.
(…)
(u2)Eric: There were some who were completely stumped when there was a 0 or when there was nothing. When it said 36+3 – then there was just the three in the ones place, then they filled up the tens place.
(…)
(u3)Irene: Some understand numbers as single digits. But then they come to the numbers higher than this and then they don't know what they're doing after that – many of them don't know where they're to put the carry-over numbers. They didn't understand the point of it, I think.
(…)
(u4)Eli: They wondered why they couldn't write 13 in the tens place – and first I tried to draw.
(mc111202, p. 2).

The student teachers, apparently finding this to be a matter of misunderstanding, continued to focus on how they tried to get the children to understand by telling and drawing for them, here exemplified by a quote from Eli: "(q12) It's a matter of what you make out of it when you explain to them – what you use as a teaching tool and explain ones, tens and hundreds, that you like show how many there are and – draw for them or show them" (mc121102, p. 4). In this sequence the student teachers do most of the talking. Sara listens and supports them by saying "mm" or "yes". This is a recurrent trait of Sara's mentoring approach. She often leans back and lets the student teachers talk. By listening she apparently obtains information that enables her to decide on further action. When the student teachers have talked for a while Sara either summarises or asks questions to draw their attention to important issues.

This time Sara draws attention to an observation she has made; the kids did not pick up concrete objects as tools as they would normally do when they are not able to find the sum.[68]

[66] This is a recurring trait that I will elaborate on more in Chapter 7.
[67] All dialogues are numbered in each of the chapters 5 to 7. Utterances in the dialogues are numbered; (u1) means that this is "utterance number one".
[68] Later in this chapter I point to the fact that it is interesting to note that none of the student teachers commented on how most of the kids actually managed to find the right sum even if they did not know "where to put the tens". Sara did not comment on that either. My interpretation of this episode is that Sara knew why the kids did not pick up concrete objects; using their own strategies for finding sums they probably did not need

Thus she draws attention to an important device which can help the kids in their mathematical thinking. The student teachers were too focused on their own telling and drawing. After a discussion about using concrete objects, Ina says that she could have shown the kids by sorting the cubes. Sara comments by saying "(q13) yes, they [the kids] could have sorted them [the cubes]" (mc111202, p. 5). Thus she moves attention from teacher activity to pupil activity. Following up on this theme, Sara tells the student teachers about learning by using different senses. When she talks Sara consequently uses the word "experience" where the student teachers before used the word "explain". Once more she draws attention to pupil activity instead of teacher activity without saying it explicitly.

Sara follows up by telling the student teachers about differences in the class without mentioning names: some of the kids still use their fingers to count small numbers while others can do multiplication with two-digit numbers. She states that their challenge ahead is to reach every child in the class, give them opportunities to learn, and she explains this by saying "(q14) walk the path together with them until they can walk it alone" (mc111202, p. 7). Thus she emphasises that each kid learns differently and needs to be treated differently. They are not only a part of a group. Sara thinks it is important that the student teachers see each kid as a resource and states:

> (q15) I want the student teachers to come close to some of the kids – that they really see the kids – like, they don't see the class as an entity. Like the class is not a group, it is in fact many persons, there are many individuals. And they have to remember they [the kids] are individuals, and that the kids are the resource that plays – plays a large part in this here. That they have to get close to the kids – I think that's very important – so that they'll see that it is in fact not us – or I as the teacher that is the most important person here (int010303, p. 7).

Thus we can see that Sara is aware of how student teachers often are too concerned about themselves to be able to see the kids. When Sara experiences that these student teachers, just like others before them, focus on themselves and are most concerned with what the kids can not do, she turns their focus to what they can do. She accomplishes this by turning the student teachers' attention to the interpretation of what she called 'smart ways of calculating' from the first day. We have already seen above that Sara believes student teachers have to see and experience in order to understand what she tells them.

Sara draws the student teachers' attention to different ways of finding sums by giving them copies of the way two of the kids, Peter and Pam added when they played the first dice game as mentioned on page 94. The illustration given here is from the discussion on how Pam

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them. However, apparently she uses the concrete objects as a tool to focus on the kids' own activity instead of the student teachers' telling and drawing. Unfortunately this episode was never discussed with Sara.

solved the problem of adding 170 + 32.

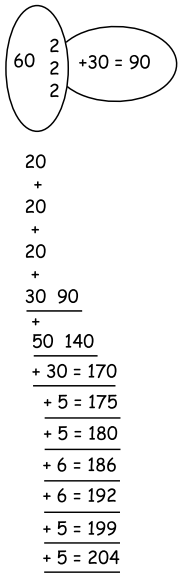


**Figure 4: Pam's way of adding 170 + 32**

Sara asks if the student teachers can explain how Pam has been thinking. The student teachers seem to be eager to both understand and explain because they interrupt each other all the time. This brief extract exemplifies this:

Dialogue 2:
(u1)Ina: First easy, so it's possible to find out that 2+2+2,and then it had become 20+20+20=60, and then she took 60+30=90
(u2)Ian: //(indistinct on the tape)
(u3)Ina: and then she got – and she's got – like first she has like - the second tens
(u4)Irene: a hah
(u5)Ina: and then she started on the ones
(u6)Eric: that's 90
(u7)Ian: but does she call it 50?
(mc111202, p. 9)

This goes on for a while. Sara does not say anything until she asks: "Does she have a carry over?" (mc111202, p. 9) and the following dialogue takes place.

Dialogue 3:
(u1)Ian: Yeah
(u2)Sara: How many?
(u3)Eric: She actually has, but really
(u4)Sara: Really, she has a carry over for each step downwards, does she?
(u5)Eric: She's written how many she has every time.
(u6)Sara: Yeah
(u7)Eric: It's neat to do it like that.
(u8)Sara: Yeah
(u9)Ian: But they have -
(u10)Sara: It's not before right here at the end that she gets it wrong.

(u11)Eric: Yeah
(u12)Ian: But she hasn't like understood place value - like only adds the tens and adds the ones and then adds the hundreds, the total sum.
(u13)Eric: Yeah, she's tried something else here first.
(u14)Sara: mm
(u15)Eric: Or – no, maybe she's written it first, and then she's counted with that, and then written 90 or?
(u16)Sara: You know something? I don't know.
(mc111202, p. 9).

Referring to the last utterance (u16) in this dialogue, Sara says that unfortunately she did not observe the girl so she does not know the order in which she did this. In the last dialogue we can see how Eric (u5 and u7) finds this to be an appropriate way of calculating while Ian (u12) apparently questions if it is appropriate to add the ones, tens and hundreds each on their own. Sara and the student teachers continue to examine how Pam has found a way of using carry-over numbers. They are used as a reminder down through the process and Sara summarises by showing how this girl is on her way to understanding something about both a carry over and vertical algorithms.

Although Pam is not using the "official grown-up" algorithm she is able to add 170+32 almost correctly by using her own strategy. Actually, as mentioned in footnote 68 on page 95, in finding sums in the two dice games most of the kids managed to get the right answers (or very close) although they did not use the formal algorithm. Even if one of the boys wrote 20040 for two hundred and forty, he was well aware that it was less than his classmate's 300. He just did not know how to write it down, or it may be more exact to say that he wrote it down in his own way. However, none of the student teachers ever mentioned that. They were all too focused on the fact that the kids did not use the "right algorithm" by carrying to the tens. By inviting the student teachers to interpret the two kids' solutions, Sara opened their eyes to other ways of calculating.

After some more experiences later on, Eric expresses it like this: "(q16) That a kid of eight can sit down and calculate in a way I don't understand and still get it right, know what I mean? that's just – (laughs a little). That's interesting, to say the least" (inter, p. 5). Eli points out the same thing. She states that she has always believed that the important thing about mathematics was "(q17) that it's supposed to be just like that, and just like that, and just like that, so it's not really like that at all. You just have to try to find your own method for it and she [Sara] helps them [the kids] to find it" (intel, p. 2). Actually, as seen in Chapter 4 this is an important part of the national curriculum, C-97; the children should be allowed to use their own algorithms on their way to understanding the place value system.

*The third day: Experiences with teaching the kids*

As seen throughout the episodes told so far Sara and the student teachers have been involved with kids' understanding of the place value system both in the classroom and in the mentoring conversations. At the end of the second day Sara asked the student teachers if they would like to have their first teaching experience so they could 'freshen up carry-over numbers' and thus develop the kids' understanding of the issue of carrying the tens. Ina says she feels uncertain because she does not know the kids. The response from Sara is: "(q18) Maybe this is the chance to get connected. (…) To see who has got it and who hasn't. See what they [the kids] can do" (mcwu111202, p. 14). Eric supports the idea of starting their teaching with a small group of kids, and so on the third day all five student teachers taught a group of four to five kids each.[69]

We have already seen several times how Sara advocates the need to get close to the kids, and we have seen how she has arranged possibilities to do so while she was in charge of the teaching. In the quote below she argues that student teachers also should teach small groups of kids before they lead a whole class:

> (q19) I think about this, that I think that it's important that – that they don't – that we don't focus on teaching a whole class instead of having small groups, that you see each kid. Because I'm afraid that if they have too much focus on teaching a whole class, a class isn't – a class has no soul. Right – yeah, but there's something about this that first they need to see that there are many kids here, and not until we have relations to each of these kids – then I think we can be really good at working with a class (int041103, p. 12).

In sharing their experiences from teaching the kids, Sara deals with one student teacher at a time. This is, as mentioned in Chapter 4, a recurring trait in post-teaching conversations. The topics of the conversations were not the same, and it clearly depended upon which issues each student teacher raised. The tasks they talked about varied from focusing on themselves as teachers feeling that they had chaotic conditions or were losing control to focusing on the kids, either considering their difficulties in understanding what the kids told them or being afraid of hurting someone's feelings. All the student teachers brought cubes with them to use as concrete objects but throughout the conversation it becomes clear that they have done things differently. Only Eric started out by saying he was satisfied with how the lesson progressed. He was not sure how to use the cubes so he put them aside. Instead he discussed

[69] I ran into some difficulties regarding my intention of observing in the classroom. The kids always worked at different stations in the mathematics lessons and as my focus was on Sara, I never decided what would be the best way to observe. Should I follow her around or should I stay with one group? I walked around, looking more on the whole situation than focusing on one group the whole way through the lessons. Thus I have no observational data showing exactly how each of the student teachers dealt with their teaching. However, I have recorded some small episodes and written notes from my observations.

with the kids what a carry-over number could be and what it could be called. Using a story he remembered from his year working as a teacher Eric engaged the kids by telling them about "the smart guy".[70] Sara observed this and encouraged Eric to tell the other student teachers about it.

The other student teachers revealed a degree of uncertainty. Through her comments and questions Sara managed to convert the experiences to become more positive. She did this in different ways. Eli was praised for having dealt well with a girl who tried to express her thoughts. When Sara asked Irene, who felt the classroom was in chaos, if she believed that this was also what the kids experienced Irene admitted that she did not think so. Sara told her that she could not see the chaos and it seemed as if the activity with cubes went well. Ian was also told by Sara that she could not see the loss of control he reported. Sara added that

> (q20) it was the kids who experienced and moved the cubes and changed and could see how will this be? You posed questions more than you – I could not see one time when I was there that you said we do like this or we do like that but – you didn't say that, you asked questions (mc111302, p. 4).

Ina was praised for letting the kids make their own problems when she ran out of ideas. Thus, through her comments Sara once again draws attention to the kids. Moreover, she also gives all the student teachers feedback that converts their bad feelings into something positive without losing sight of kids and mathematics. She reinforces what has been focused on the days before; the kids should express their thoughts, they should be activated in the use of cubes and Ina used the kids as resources when she did not know what to do. Through Sara's comments we understand that she has observed how the student teachers opened up for the kids more than they did the day before. This time they did not tell Sara that they tried to explain by telling and drawing.

When Sara asks if they believe that some of the kids learned something Eli says that she does not believe her group learned the carry-over number. Ian, the one who started the focus on mathematics by revealing his uncertainty the first day reflects on this as follows:

> (q21)Yes, no, I think the lesson today was more like finding out what the kids know. (…) Because I didn't feel I had enough knowledge to plan for something they could learn from, I didn't know where they were – but anyway, I learned what the kids could do – I found out that actually they knew how to calculate (mc111302, p. 12).

Sara's comment on this is: "(q22) Yes, you got a little more insight into what each kid was thinking and where you can start" (mc111302, p. 12). So even if Ian felt he did not manage to

[70] The point of the story is this: "The smart guy", the carry-over number, always wants to escape and we have to make sure he does not manage to get away. Putting him on the top of the tens is the same as putting him in prison. I did not observe this. Eric told about it in the mentoring conference.

teach in a way through which the kids could learn, he acknowledged that he himself learned from the experience. This is reinforced by Sara as an important part of having field experiences.[71]

Sara summarises the session by giving the student teachers a great deal of credit for having raised different themes, like kids' use of language and use of concrete objects. She also reminds them of the fact that already, after only three days, they have gained quite a few experiences of the differences in kids' understanding. Thus she points out how important this is. She ends the session by thanking them for a nice lesson in the classroom; "(q23) There was a lot of learning for me, there was a lot of learning for the kids, and I believe there was a lot of learning for you as well" (mc111302, p. 15). She adds that her experience was that none of the kids 'checked out'; they listened and were focused on the task even if the student teachers felt they had difficulties. She explains this by saying "(q24) maybe you put too big demands on yourself this time" (mc111302, p. 15). And in this subtle way she tells them that she does not expect more from them so early in their fieldwork.

## *How can the story be understood?*

I started the story about the first days of the collaboration between Sara and the student teachers by pointing out how Sara talks respectfully about her job as a cooperating teacher. She finds that the way student teachers first encounter both mentoring and teaching experiences will probably colour how they look upon their field experiences through the rest of their teacher education programme. We saw how Sara struggled – and probably still does – to decide what would be the best way to start student teaching. She fears that letting them start the way student teachers usually want to probably will reinforce their predetermined images of school and teaching. Sara's experience is that such images focus on the teacher as the most important person in the classroom. Through Sara's reflections we learnt that her actions are based upon experiences with former groups of student teachers. However, as we have seen the story unfolds, Sara recognises that also some of these student teachers are more concerned with themselves as teachers than with the kids as learners. Sara wants the student teachers to understand an interactive, constructivist way of teaching where the kids and their learning are the centre of focus. Thus a recurring trait in the story is that Sara constantly turns the student teachers' attention towards the kids in different ways. First, she does so by designing activities so the student teachers can experience and see. We have seen how she starts the first two

[71] This issue will be elaborated on more deeply in Chapter 7.

mathematics lessons by using an interactive teaching form in the class circle before she arranges collaboration between the kids by letting them play dice games. She further invites the student teachers to interpret two of the ways the kids find the sum in the dice game. These activities are meant to let the student teachers both experience and see how differently kids think and how the kids learn through collaboration by sharing their thinking with each other. Second, Sara consequently turns the student teachers' attention to the kids' activities rather than the teacher's activities when they share their teaching experiences. She does so mainly by reframing utterances and giving feedback, pointing out what the student teachers did well in relation to kids and mathematics.

Within a socio-cultural framework of teaching, learning and mentoring Sara's intention this first week of her collaboration with Ian, Ina, Irene, Eric and Eli can be understood in terms of establishing or ensuring *intersubjectivity*. The concept of intersubjectivity points to the idea that different interlocutors may have different representations of the same object, activity or event (de Haan 2001). As the story reveals, Sara is not sure that she and the student teachers share the same representation or images of what school and hence teaching is. We could see in quote (q3) how Sara found it problematic that she and the student teachers talked from different understandings or images of what school is. de Haan points to the importance of shared perspectives in order to communicate. What these shared perspectives mean and how the concept of intersubjectivity is used and defined differ within the socio-cultural tradition. The term has been used in studies focusing on communication in adult-child dyads (Trevarthen 1979, Wertsch 1979), in teacher-whole class interactions (Moen 2004) and in peer collaboration (Tudge 1992). The definitions of the concept may differ from one scholar to the next, but a key word seems to be "shared"; Rogoff (1990) uses "shared purpose and focus", Kozulin (1990) uses "shared social world" and, as we have seen, de Haan (2001) uses "shared perspectives". In dealing with the notion of intersubjectivity Wertsch (1984) uses the term "shared definitions of the situation". For the sake of my study, Wertsch's (1979, 1984, 1985) connection between the two concepts of intersubjectivity and shared situation definition is most relevant.

Wertsch (1985) maintains that "intersubjectivity exists between participants who act in the same activity setting when they share some aspect of their situation definitions" (p. 159). According to Wertsch, the notion of situation definition both includes "the way a setting or context is represented or defined" (1984, p. 8) and "the way in which objects and events in a situation are represented by the participants in the setting" (1985, p. 159). Through her experiences with former groups Sara has reason to believe that she and the five student

teachers do not share the same definition of what school and hence teaching is. Her experience is that if the student teachers start teaching at once they will be the subject or the most important person instead of taking the kids' perspective.[72]

Wertsch (1985) argues that the concept of situation definition allows us to characterise what Sara is reasoning about; interlocutors may differ in their representation of the same set of contexts, objects and events. He claims that this difference may be predominantly present in the kind of interpsychological functioning of primary interest to Vygotsky (1978, 1981a): adult-child interaction in the zone of proximal development. Because the same concrete objects and events are perceptually available to both adult and child, they are in one sense in the same situation. In another sense, however, they are not because they do not define these objects and events in the same way. Often a child does not understand the definitions of the objects or the useful significance of behaviour that are assumed by an adult. In paying attention to the concept of activity setting I will argue that it is reasonable to deduct from Wertsch (1985) that the concept of situation definition is highly relevant also for understanding and characterising the interaction or collaboration between cooperating teachers and student teachers. Furthermore, the concept of activity setting contributes to understanding the significance of Sara's actions for the process of mentoring through field experiences.

As seen above, Wertsch connects the concept of intersubjectivity as a shared situation definition between participants who act in the same activity setting. The concept, as outlined by Tharp & Gallimore (1988), has already been presented in Chapter 2 and we remember that activity settings are the events and people in our work and relations to one another. They are the "who", "what", "when", "where" and "why" of the small recurrent drama of everyday life played on such stages as home, workplaces, schools or field experiences (Tharp & Gallimore 1988). As such, both Sara and the student teachers are engaged in various activity settings during these weeks of collaboration, both in the classroom, during breaks and in the mentoring conversations. For the sake of my study and this discussion I choose to refer to field experiences or the practice field as "the where" of the activity setting. This is the stage where all the activities take place between Sara and the student teachers. The practice field is a social institutionally defined setting within teacher education. Such settings are named

[72] Through utterances in dialogue 1 (u1 and u4) and quote (q12) we have seen that some of the student teachers are mostly focused on what they as teachers should do. At the same time, on page 100 we saw that Eric was more preoccupied by the kids. As seen in Chapter 4, and as will be seen in Chapter 7, due to these differences Sara finds it challenging to give each of the student teachers both the support and challenges they should have.

instructional activity settings by Wertsch (1985).[73]

Wertsch (1985) claims that "an activity setting is grounded in a set of assumptions about appropriate roles, goals, and means used by the participants in that setting" (1985b, p. 212). Tharp and Gallimore (1988) express similar ideas; why an activity setting exists and functions can be described in terms of its motivation and its meaning. The first is usually provided by the goal while the second facet, its meaning, provides part of the reason why activity settings exist and continue. By asking two questions; what is this activity about (why does it exist?) and why are we doing this activity (what is the goal?) we can see that the meaning and the motive are highly interrelated. However, institutionally defined activity settings[74] are often not readily recognised or accessible to conscious reflection by the individuals participating in them (Wertsch 1985). When participating in such activity settings, the subjects usually do not identify settings consciously. Thus neither the motives nor the meanings are always identical for all members or participants in the setting. This point has been made in relation to schools in works by Matusov (2001) and Tharp and Gallimore (1988). Related to field experiences this issue can be illustrated by using research results mentioned in the introductory chapter. In a study from the UK we learnt that student teachers want to be looked upon as competent practitioners only in need of more experience in the classroom (Edwards & Collison 1996). Student teachers are often too impatient to be teachers and as a consequence sometimes attend too little to their own learning needs and the need to acquire knowledge about teaching. This will affect how they understand the context of field experiences. As expressed by Edwards and Collison (1996), "students [student teachers] rarely see themselves as learners in classrooms full of pupils" (p. 24).

There is reason to believe that student teachers in Norway share this understanding. An evaluation of teacher education in Norway shows that student teachers want "more realistic teacher training providing room for individual tryouts" (Harnæs 2002, p. 31). They find it to be problematic to be accompanied by three to four other student teachers and the cooperating teacher. Thus we may assert that student teachers define the context of student teaching as an arena for training performance in the classroom. But the cooperating teacher may think of field experiences as a learning venue, as we can see Sara does. Her motive is, as we have seen, that student teachers should learn about kids and how they think and learn before they

[73] Instructional activity settings are contrasted with labour settings. According to Tharp and Gallimore (1988), activity settings connect human interpsychological functioning to social institutional forces.

[74] Tharp and Gallimore (1988) argue that activity settings occur in response to a goal and exist for as long as it takes to reach it. What Wertsch (1985) points out here is that institutionally defined settings exist as part of the institutions. In the case of this study, the setting even is limited by time.

start teaching on their own. In order to teach in an interactive, constructivist way, attuned to the curriculum, you have to learn to attend to the kids, acknowledging their differences. Thus Sara and the student teachers may define the activity setting they are engaged in quite differently.

When such conflicts occur Wertsch (1985) claims that the definition of the activity setting will determine which is given priority and which is sacrificed (p. 213). The meaning participants attach to the setting will impact to a high degree on the goal or motive for being there. Furthermore, it will influence important matters such as the strategies applied or the manner in which participants interact; "the what" in the description provided by Tharp and Gallimore (1988). So even if Sara is well aware of the different images of school the student teachers bring with them and how this may affect their teaching, the concept of activity setting helps us to see that it also affects the mentoring. What should be said and done in the mentoring conversations will be coloured by the motive attached to the setting. If their goal is teacher training, the student teachers may want to hear the mentor's critique on their teaching performance rather than discuss how kids calculate or do mathematics (Schön 1987). According to Tharp and Gallimore (1988), it is important that activity settings should tend to create motivational homogeneity for members. Thus the participants must develop a mutual understanding, or shared understanding, something which takes us back to the concept of intersubjectivity.

Wertsch (1985) maintains that when interlocutors such as cooperating teachers and student teachers approach a setting with different intramental situation definitions, it may at first be difficult to see how they could carry on an effective communication or collaboration. After all, as we have seen, they may represent many aspects of the setting in quite different ways. It is argued by Wertsch that to understand this apparent problem one needs to invoke the notion of intersubjectivity. I have already stated that intersubjectivity, though used and defined differently, has become an important concept within the socio-cultural approach to teaching, learning and mentoring. We have seen in Chapter 2 how such an approach refers to social origins of intramental functioning. Individual learning thus has an interactional feature. de Haan (2001) maintains that intersubjectivity is an important underlying notion in descriptions of interactional learning situations like mentoring. We can also find it more exactly expressed by Tharp and Gallimore (1988), for example. They argue that activity settings are intermental contexts that have the nature of collaborative interaction, assisted performance (presented in Chapter 2) and intersubjectivity. Furthermore, Rogoff (1990) claims that "by its nature, communication presumes intersubjectivity" (p. 71). Thus

intersubjectivity is seen as a prerequisite for or a characteristic of communication and collaboration.[75] However, as seen above, Tharp and Gallimore (1988) point out that intersubjectivity is not only a prerequisite but also emerges through communication and collaboration. Intersubjectivity is negotiated through joint activity (Rogoff 1990).

The challenge for the cooperating teacher is to find a way to communicate with the student teachers so they can participate in interpsychological functioning and through that eventually can come to define the task setting in a new, culturally appropriate way (Wertsch 1985). Wertsch (1984) maintains that particular ways of talking about objects, events and tasks determine the level at which intersubjectivity is to be established.[76] The issue of how greater or lesser degrees of intersubjectivity between interlocutors are created, maintained and re-established lies at the foundation of Rommetveit's approach to the study of human communication. According to Rommetveit (1979), "communication aims at transcendence of the 'private' worlds of the participants. It sets up what we might call 'states of intersubjectivity'" (p. 94). In quote (q3), Sara points out that she and the student teachers most probably interpret the activity setting of school differently; they talk from different images or "different worlds". As we have seen, Sara's way of communicating is connected to letting the student teachers first see and experience, being engaged in joint activities before she, while sharing the experiences, turns the conversations in the direction of the kids in different ways. Thus her particular way of talking about objects, events and tasks apparently has the aim of shared focus of attention, "a state of intersubjectivity" as maintained by Rommetveit (1979). Through this shared focus of attention Sara hopes the student teachers will define the kids' learning to be most important, and understand how teaching relates to this. We saw, through quote (q21) that Ian acknowledges that even if he did not feel that his teaching had succeeded, he learnt more about the kids. In her response to Ian, Sara points out that this is an important part of student teaching (q22). By focusing on the kids Sara has an aim of getting the student teachers to realise that in order to teach you must acknowledge the kids as resources. You

[75] Matusov (1996, 2001) warns against using a notion of intersubjectivity in which intersubjectivity is defined as "having in common" or "overlapping subjectivities". He argues that such an understanding implies that "all the participants hold the same vision of activity in terms of what and how to act, so that they can act as one individual" (1996, p. 27). He calls for a concept of intersubjectivity defined as a process of coordination of individual participation in joint activities. In particular, he shows that disagreement, instead of agreement alone, can be part of this process. Bearing Matusov's contention in mind, I find it appropriate to emphasise that I of course acknowledge that Sara and all the five student teachers most probably both agree and disagree upon matters of discussions. Actually, this is part of the dynamic of collaborative settings.

[76] Studies of dyadic interactions between adult and child different identify a number of levels (Rogoff 1990, Trevarthen 1979, Wertsch 1979). Trevarthen (1979), for instance distinguishes between primary and secondary intersubjectivity. The first is a joint focus of attention which includes only the people involved while the latter refers to how they have shared attention on an event or object.

have to know and understand how kids learn, what they can do and how they can contribute to each other's learning. This is Sara's underlying motive. According to Leontèv (1981) to understand why separate actions are meaningful one needs to understand the motive behind the whole activity. Wertsch (1985) claims that motive is an aspect of a socio-historically specific, institutionally defined setting that specifies what is to be maximised in that particular setting. He further contends that the implicit assumptions of an activity setting determine the selection of actions and the operational compositions of actions, and determine the functional significance of these actions. Sara's assumption for the activity setting of field experiences is, as we have seen, to focus on learning more than training. The guiding and integrating force of these assumptions is what Leontèv (1981) called the motive of an activity. The situations Sara designs, seeing her teach, observing the kids playing dice games and interpreting how the kids calculate can be understood as goal-directed actions to fulfil her motive. These goals are preliminary stages en route to the main motive behind the activity. Taken together they may satisfy that overarching motive (Leontèv 1981).

Even if Sara designs and arranges the activities for these days, they apparently unfold as an interactional process. Beforehand, she has not planned actions beyond the very first day. It is by listening to the student teachers that she decides further actions based on her motive, the object of the activity. Sara acknowledges that some of the student teachers do not appreciate the way kids use their own way of calculating.[77] Moreover, they talk about it in terms of misunderstanding and find that as teachers their task is to explain the right way to do mathematics. Thus Sara recognises images of teaching not attuned to the curriculum. Although Sara builds upon her experiences with former groups of student teachers, her decisions and actions are influenced or guided through the interactions with Eli, Eric, Ina, Ian and Irene. In accordance with Stone (1993), I contend that what happens is a "fluid interpersonal process in which the participants' communicative exchanges serve to build a continually evolving mutual perspective on how to conceive the situation at hand" (p. 180). In the last mentoring conference referred to on page 99 we could see that some of the student teachers talked more in terms of the kids than they did before. I will use Ian as an example. We saw on page 94 that he was confused about what he called wrong solutions in calculating. Furthermore, on page 98 (dialogue 3, u12) we understand that he was not quite sure that the way the girl counted really was acceptable. In quote (q21), page 100 he acknowledges that he has learned about how kids calculate in their own way. Thus he acknowledges that he can

[77] It is important to remember that kids using their own algorithms was part of the national curriculum (C-97) at the time the study was conducted.

learn through teaching. Building upon Wertsch (1979), we can conclude that the student teachers do not first carry out the task because they share the cooperating teachers' definition of the situation. It is precisely the opposite: They "come to share the definition of the situation because they carry out the task" (p. 20).

To summarise; throughout this discussion I have shown how the concept of intersubjectivity can be useful in understanding the intentions of Sara's actions this first week of her collaboration with Eli, Eric, Ina, Ian and Irene. I have shown that even if the concept of intersubjectivity is both defined and understood in different ways within the socio-cultural tradition, there is agreement that aspects of the notion are necessary to establish useful collaborating situations such as mentoring. I have especially focused on intersubjectivity as a shared focus of attention or as Wertsch (1998) maintains "intersubjectivity concerns the degree to which interlocutors in a communicative situation share a perspective" (p. 111). This is what I claim Sara is doing; she moves the student teachers' perspective from themselves to the kids to establish a shared definition of some aspects of the situation. She wants to ensure that they share the same definition of "the why" of their activity setting; what does teaching mean and what should field experiences be about? Thus, beyond focusing on the kids and their learning, Sara also focuses on the student teachers' learning. However, both her actions and my interpretations of them can only be fully understood in light of important traits of Sara's mentoring during the other five weeks. Through guided planning she helps the student teachers to see the importance of focusing on the kids' learning while teaching. This also affects the way she deals with their teaching experiences. I will return to these issues in the next two chapters. In the last section of this chapter I will use theory and research results to discuss how Sara's actions can have significance for the student teachers' development of pedagogical content knowledge in mathematics. I especially draw upon work based on Lortie's (1975) term "apprenticeship of observation".

## *What could be the educative value for the student teachers?*

My research focuses on how Sara through her way of mentoring can facilitate the student teachers' development of pedagogical content knowledge in mathematics. In the introductory chapter I told that this knowledge has been identified by Shulman (1986, 1987) and his collaborators as an amalgam of pedagogy and subject-matter content that is the specific domain of teachers. Moreover, this knowledge has individual features. Two decades have passed since Shulman introduced this concept in his work. Since then there has been an overwhelming amount of research in the area both in mathematics and other subjects as

researchers attempts to further identify what this knowledge might entail, how its multiple forms of knowledge interplay, how it develops and what it could mean for teacher education (see for instance Cochran et al. 1993, Grossman 1990, Gudmundsdottir 1990, 1995, Hasweh 2005, Marks 1990, McCaughtry 2005).

Pedagogical content knowledge is associated with experience and therefore, not surprisingly, findings suggest that this knowledge is not well developed by student teachers (Hasweh 2005, Marks 1990). Because this knowledge is so closely connected to teaching, formal teacher education will of course have an impact on the development of pedagogical content knowledge both through field experiences and studies of subject matter at the university college. However, there are also other sources. By providing images of teaching, the student teacher's own experiences as a pupil are identified as one source[78] that contributes to the development of pedagogical content knowledge (Ball & Cohen 1999, Grossman 1990). In referring to Lortie (1975), Grossman further refers to these experiences as apprenticeship of observation and maintains that to develop pedagogical content knowledge this apprenticeship needs to be overcome. Below I will argue that by focusing on the kids, Sara contributes to overcoming this apprenticeship and hence she may facilitate the student teachers' development of pedagogical content knowledge in mathematics.

The term apprenticeship of observation, introduced by Lortie (1975) refers to the fact that through all their years attending school as pupils, student teachers have developed strong images of what it means to be a teacher. Though not a true apprenticeship, spending as many as twelve years or more in ordinary mathematics classrooms can be a powerful apprenticeship for learning how to teach mathematics (Ball 1988, Calderhead & Robson 1991). As we could see in the introductory chapter, in spite of the new curriculum, the ordinary mathematics classroom in Norway is still rather conservative; it is dominated by recitation and a seatwork pattern of textbook-centred instruction. The teacher explains from the blackboard and the kids do exercises which are corrected by the teacher (Alseth et al. 2003).[79] This implies that the

[78] Grossman (1990) refers to at least four sources identified through research. The other three are disciplinary background, professional coursework and classroom experience. Within these, both collegial collaboration and school development can be seen as sources. I would like to add all kinds of informal learning that will affect the way a teacher thinks about teaching mathematics, for instance through being a parent. Another point is that as they are learners at the university college, the student teachers may continue their apprenticeship of observation (Grossman 1990, Ball & Cohen 1999).

[79] Alseth et al. (2003) claim this is the overall picture. However, they emphasise that in their study they found examples of another way of teaching mathematics in Norwegian classrooms. Even if the quality may fluctuate, they found that teaching that followed the thinking of C-97 was "marked by exploration, communication, cooperation, varied teaching tools and connection to everyday life. (…) This also lays the groundwork for individual adaptation of the pupil activities" (p. 34). Alseth et al. believe that this shows that "teaching of mathematics has great development potential and that this is attainable when the conditions facilitate for this"

student teachers probably have experienced such forms of mathematics teaching as pupils, and in footnote 62 we could see that Eli, Ina and Ian remember teaching as being like this. Such images are based upon teaching as performed in classrooms and may provide incomplete images of what it means to be a teacher (Ball & Cohen 1999, Grossman 1990, Feiman-Nemser & Buchman 1985, Lortie 1975).

The two aspects of pedagogical content knowledge Grossmann (1990) identified as being most informed by an apprenticeship of observation have significance for my study. First, experiences as pupils provide prospective teachers with memories of strategies for teaching specific content. Pupils have more access to the teachers' actions than their aims and thus the memories provoke student teachers to connect the means of instruction with the potential end; knowledge of the content becomes confounded with knowledge of instructional strategies. This mirrors the findings in my study and will be further elaborated on in the next chapter. Second, prospective teachers rely on memories of themselves as kids to help shape their own expectations for their kids. They have a tendency to use themselves as implicit models for the kids they will encounter in the classroom, referred to as "presumptions of shared identity" by Jackson (1986, p. 26). Student teachers seem to think that what has worked for them will work for others. Their own feelings of liking or disliking subject matter inform their teaching. If they struggled with mathematics they see it as also being a difficult subject for others and vice versa (Ball 1988, Gellert 2000, Grossman 1990, 1991, Jackson 1986).

Since prospective teachers have seen teaching only from the viewpoint of the learner, Grossmann (1990, 1991) argues that apprenticeship of observation is a rather problematic source from which to develop pedagogical content knowledge. The knowledge may be more tacit than explicit, more conservative than innovative. It is important to note that Lortie (1975) argues that images of teaching gained as pupils in classrooms prove difficult to overcome. Later studies support this claim (Ball 1988, Edwards & Collison 1996, Gellert 2000, Grossmann 1990). Hence, leaving the apprenticeship of observation unchallenged will most probably support conservatism in teaching as teachers tend to replicate the strategies they experienced as pupils. With access only to the visible part of teaching, prospective teachers enter teacher education on the wrong or at least incomplete premises. Moreover, these premises serve as filters throughout formal teacher education. Student teachers respond positively to what confess their preconceptions of how they see themselves as teachers. Moreover, they are likely to be more receptive to strategies and techniques they can use

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(pp. 34-35).

immediately in the classroom (see for instance Bullough 1989, 1991, Calderhead & Robson 1991, Dewey 1904, Lortie 1975, Zeichner & Gore 1990). Bearing this in mind, one presupposition for learning to teach is the need to overcome the apprenticeship of observation (Ball & Cohen 1999, Feiman-Nemser & Remillard 1995, Grossmann 1991). It appears to be important to support student teachers in a way that involves overcorrection for prior experiences and assumptions they have developed during their own schooling (Grossman 1990, 1991). Teacher education must help student teachers break away from prior experiences as pupils and begin to develop the perspective of a teacher (Feiman-Nemser & Buchmann 1986).[80] Such a perspective includes, for instance, pedagogical reasoning beyond what is visible[81] and an understanding of the learner. The first step in such a transition may involve what we have seen Sara doing; by constantly focusing on how differently kids both think about and understand mathematics she apparently helps the student teachers overcome the presumption of shared identity which is seen as a key part of apprenticeship of observation. We saw that in quotes (q16) and (q17) both Eric and Eli acknowledge that the kids both understood and worked with mathematics in a way that differed from theirs. What is most important is that even if they were surprised by this, they apparently responded positively to the experience.

Knowledge of learners is an important part of pedagogical content knowledge, and Ball (2000) states that included in pedagogical content knowledge

> is knowledge of what is typically difficult for students, of representations that are most useful for teaching a specific idea or procedure and of ways to develop a particular idea. (…) Understanding why a 6-year-old might write '1005' (for hundred and five) and not reading it as a mistaken count requires the capacity to appreciate the elegance of the compressed notation system that adults use readily for numbers but which is not automatic for learners (p. 245).

When they arrived, the student teachers did not seem to appreciate the way the kids in Sara's class solved the problem of adding when they played dice games. The student teachers were more confused about the fact that the kids did not carry over than to see that they managed to add big numbers using their own strategies. Building upon their own experiences they seemed to be worrying more about where the kids should be instead of understanding where they were (Ball 2000, Rodgers 2001). Ball claims that the core activity of teaching is figuring out what

[80] As will be see later in Chapter 7, this can be a rather tricky task because student teachers essentially have two jobs; they have to teach and they have to learn to teach. Teacher educators must help student teachers balance this double role as "students of teaching and teachers of students" (Dewey 1904, Edwards & Collison 1996, Grossman 1990, Wildman, Nilse, Magliaro & McLaughlin 1989).

[81] In the next chapter I will deal with how Sara collaborates with the student teachers through planning sessions; for pupils this is an invisible part of teaching.

kids know. Recent research in the area of pedagogical content knowledge shows the importance of knowing the kids or understanding the learner on what may be called a local level; that is beyond an understanding of what children in general have tendencies to either misunderstand or find difficult in learning mathematics. Teaching and hence decisions made about content, curriculum and pedagogy are informed by how teachers know their pupils, not only academically but also emotionally and socially (Aubrey 1996, Furlong & Maynard 1995, McCaughtry 2005, Moen 2004).

In a study by Maynard (1996), mentors claimed that they found it difficult to contribute to student teachers' learning with respect to subject matter. Their contribution would be to develop student teachers' understanding of what they called child-centred approaches to teaching and pupil learning. In one way this mirrors Sara's thinking. We have seen in quote (q8) how Sara finds that the student teachers should focus on "basic values and views on humanity" and develop a basic attitude that pervades everything you do as a teacher. As repeated several times, she wants the student teachers to see and understand that teaching and hence learning occurs in interaction between the teacher and all the different kids. What makes Sara's actions different from the study reported by Maynard (1996) is that Sara seems to be aware of how this relates to teaching subject matter; pedagogical content knowledge is imbued with values and beliefs, as pointed out by Gudmundsdottir (1990, 1995).

Research findings show that for interactive, constructivist teaching approaches, knowing kids on the local level may be the most important part of pedagogical content knowledge (Hasweh 2005, Marks 1990, McCaughtry 2005). In the Norwegian national curriculum, C-97, we find a constructivist stance towards learning that builds upon interactive teaching approaches. Knowing is created rather than transferred. Thus teachers must understand how kids construct and use their understanding by for instance developing their own methods of solving mathematics problems. Moreover, C-97 claims that teaching should be adaptive to each pupil. The more a teacher understands each pupil's constructions, the more effective the teaching is likely to be. Teaching is about bringing the pupil further, as expressed by Lerman (1994), or linking the child and the curriculum, as expressed by Dewey (1938) and Hawkins (1974, 2000).

Understood within a socio-cultural framework, and as expressed by Sara in quote (q14), teachers should "walk the path together with them [the kids] until they can walk it alone". To achieve this, teachers must know their kids' prior knowledge and mode of understanding, and hence such teaching approaches necessarily are informed by the knowledge about the learners. Thus we understand the importance of focusing on the kids to understand and be

engaged in what is called child-centred or constructivist teaching approaches. The strong ideas about teaching that student teachers bring with them often make it difficult to consider alternative visions of teaching and learning. Studies have shown that this seems to be more difficult regarding mathematics than other subjects (Furlong & Maynard 1995, Maynard 1996). If student teachers do not break away from these early conceptions they may not acknowledge they have something to learn (Edwards & Protheroe 2003).

To summarise; there are strong implications that student teachers' images of teaching are grounded in their own experiences as pupils. As these images seem to guide both what they need to learn and how they best learn it this "apprenticeship of observation" has to be overcome. As an important aspect of this apprenticeship concerns using themselves as models for what kids can do, being aware of how kids vary in their way of thinking is essential. Thus we understand the importance of how Sara moved the student teachers' perspective towards the kids. The way Sara arranges these very first days of their field experiences also provides the student teachers with another vision of teaching. As will be seen in the next chapter, the student teachers seem to be inspired to perform such an approach to teaching.

# Chapter 6
# Making the invisible visible through guided planning

In the previous chapter we saw how Sara designed and discussed experiences to help the student teachers become aware of all the different kids and their various ways of learning mathematics. I argued that her intention was to ensure a shared focus of attention for further collaboration. Sara strongly believes in collaboration as an opportunity for learning, whether it concerns kids, student teachers, cooperating teachers, colleagues or others. This chapter deals with how Sara collaborates with the student teachers through the planning phase of their teaching. For student teachers, teaching is highly connected to performance in the classroom, the visible part. Planning is an invisible part of teaching to those who have not been engaged in it. As such, it is a new task for student teachers and a rather complex one that has to be learnt.

As seen in Chapter 2, working together with more skilled partners through joint activity in natural settings is seen as essential to learning within a socio-cultural framework. Research in this field shows how such joint activity can take on different forms, for instance as guided participation (Rogoff 1990), as assisted performance (Tharp & Gallimore 1988) or as legitimate peripheral participation (Lave & Wenger 1991). These approaches have inherent traits of ancient apprenticeship models as they emphasise the learning of skills and knowledge in their social and functional context. They deviate from such models by being more focused on communities of practice than on the relationship between a master and an apprentice (Nielsen & Kvale 1999). Sara attends this community with a dual role of participant and mentor. Understood within a socio-cultural framework, such mentoring can be seen as interactional where all parties both influence and are dependent on each other.

As with the theme presented in Chapter 5, the story in this chapter has also been created by putting different pieces of data together, and interpretative commentaries are incorporated in it to make my theoretical interpretation understandable (Erickson 1986). The aim of the story is to illustrate how Sara reflects upon and deals with her collaboration with the student teachers during the planning sessions of their teaching. The collaboration emerges through what I have called guided planning. To interpret and discuss Sara's actions I build upon the concept of *cognitive apprenticeship* (Collins et al. 1989, Collins, Brown & Holum 1991), arguing that Sara makes her thinking visible by means of tools. Traditional apprenticeship models can teach us something about situational learning, but as they do not take the invisible

aspect into account they are indefinite as models for learning to teach. Cognitive apprenticeship is developed within a socio-cultural framework as an extension of traditional apprenticeships models to make thinking visible while dealing with complex tasks. In the last section of this chapter I discuss how Sara's way of guiding the student teachers' planning can have educative value for the student teachers. I do so by connecting my findings to research results and theories within the field of learning to teach and the development of pedagogical content knowledge.

## *Making the invisible visible; the story*

In the first section of the story, Sara's reflections on guided planning I present Sara's argument and her reasons for why she has come to take on such an active part in student teachers' planning processes. In the second section, through two illustrations I give an account on how Sara's reasoning is put into action through her collaboration with Eli, Eric, Irene, Ina and Ian.

### Sara's reflections on guided planning

Dialogue 1:
(u1)Sara: What are we going to do now? You've been working with math this weekend.
(u2)Eli: That's right.
(u3)Sara: What have you done?
(u4)Eli: We've figured out what stations we want to have at least.
(u5)Sara: Okay, let's hear.
(mc033103, p. 1)

This is the opening dialogue in one of the pre-teaching conversations between Sara and the student teachers. This brief dialogue tells us four important things about the student teachers' teaching of mathematics. First, utterance (u1) shows us that the student teachers have been working on their own to figure out how they will teach mathematics the next few days. Second, utterance (u4) shows us that they have their focus on kids working at stations, and third, implicit in the same utterance we understand that they have not finished their planning. The final point is that Sara opens for them to tell her about their planning in the last utterance (u5). What the dialogue does not tell us is that although the student teachers have been working on their own figuring out which stations they want the kids to work at, they did not start quite on their own. As seen in Chapter 4, planning of the mathematical topic of a new teaching period always starts with brainstorming and sharing of ideas in the whole group, which includes Sara. Then the student teachers refine and develop the ideas either individually, in pairs, or all together. Their thoughts are then shared in pre-teaching

conversations. Sometimes new ideas emerge so that the planning process goes back and forth for several days. Thus Sara takes an active part in the student teachers' preparations from their first ideas until they actually perform the teaching.

This trait of Sara's mentoring has developed over time as we also could see in Chapter 5 when we looked at her way of starting off with first-year student teachers. Her reasons are connected; she wants to ensure "(q1) that they [the student teachers] won't get hung up in the school they themselves attended" (int050503, p. 19). All the way through my collaboration with Sara she expresses a positive attitude towards her job as a cooperating teacher. She considers student teachers to be sound contributors to their collaboration. When groups of student teachers like this one have ideas on what they want to do, when they take responsibility and are eager to learn, Sara experiences her work as really satisfying. She finds Eli, Eric, Ina, Ian and Irene to be enthusiastic and eager to try out ways of teaching they are not used to. Nonetheless, as Sara expresses: "(q2) I feel confident that the student teachers – that they know, that they see, and that they can ask and they can think. At the same time you could say that in a way I don't trust them to go their own way" (int050503, p. 20).

Building upon her experiences with former groups of student teachers, Sara is afraid that if the student teachers plan on their own, their teaching will turn out to be rather traditional. She fears that it will be a reproduction of their own experiences as pupils, experiences they have never reflected on and thus there will be no new learning. Even their ideas and experiences from the university college are from their perspectives as learners and not as teachers so Sara finds it better to let them

> (q3) walk the path together with me and see how I think about what I am doing. And then they should – they should learn from my reasoning, while it's what they do that makes me ask the questions in a way. (…) I believe it is extremely important that first-year student teachers experience that we are doing things together (int050503, p. 20).

We can see how Sara emphasises "first-year student teachers"; she is pointing out that she will not be so active when groups of second- or third-year student teachers make plans for their teaching. As seen below in quote (q4), by collaborating with them during this process Sara wants first-year student teachers to learn from her thinking, but it is also a way of supporting them:

> (q4) For me it is about how we are mentoring – how we support them, that'll be a little like what we do to kids. That's to say, it's much better to be present along the way and give hints or ask questions and all the time put them on the right track, rather than telling them now you finish writing this, and then you hand it in to me, and then you'll get my opinion – what I think about it (int050503, p. 19).

The handing in that Sara talks about above is connected to the planning document. As told

in Chapter 5 student teachers (and hence cooperating teachers) are asked by teachers at the university college to use such documents when they plan their teaching. The most straightforward document focuses on the what, how and why of teaching; what is the content of the lesson, how will it be performed and why should we do so. The intention of a more elaborated model is to show the student teachers how the categories “aims, learning presuppositions, content, learning process, framework factors and assessment" are related to each other. The model, called “the ‘didaktiske’[82] relationship model”[83] is visualised like this:

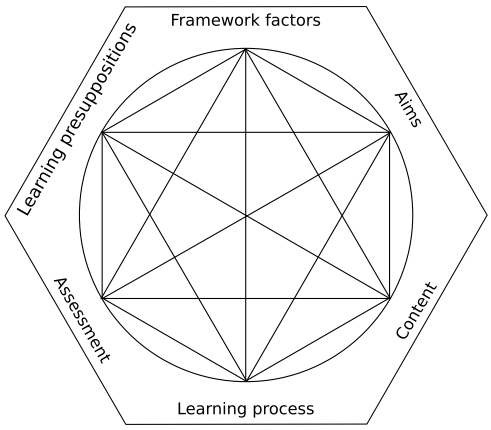


**Figure 5: The "didaktiske" relationship model**

There are always factors influencing and creating the complexity in school settings, and this model makes visible factors teachers need to take into account while planning, assessing and even analysing their teaching. However, all factors or categories are of course interrelated. Sara's experience is that it is not uncomplicated for novice student teachers to identify or understand these factors on their own. As will be shown below it is not so for this group either.

When Sara began working as a cooperating teacher, she was very keen to comply with the instructions and did as she was told. Hence she asked the student teachers to submit their lesson plans by using one of the documents mentioned above. The planned teaching often turned out to be traditional and Sara also found some misunderstandings regarding the categories or concepts; as will be seen below misunderstandings that have consequences for the aim of the teaching. But Sara felt it very difficult to intervene when the student teachers, as far as they were concerned, already had finished their planning. After all, they had put a lot

[82] I prefer to use the Norwegian word “didaktiske” as explained in footnote 10.
[83] The model was first presented by Bjørndal & Lieberg (1978). In their original model framework factors and learning presuppositions were one category called “didaktiske” presuppositions. I am responsible for the translation to English.

of work into the planning and often seemed very proud of their efforts. After a while Sara had, as she says, "the courage" (int010303, p. 8) to think:

> (q5) What do I actually get out of this, and not least, what do the student teachers get out of this? And I believe that in this the student teachers and I together, we have to figure this out, that's like when is the planning document useful for us (int010303, p. 9)?

These thoughts came after several occasions where student teachers expressed confusion about using such planning documents. Although the model as such was known from their education lessons at the university college, student teachers did not quite understand the meaning and they found the form difficult to use. Sara expresses it like this: "(q6) It's totally distanced from the practice. That's like, if they don't have any practical examples, it won't be useful at all" (int010303, p. 9). When Sara first began to reflect upon these difficulties she filled in such a form for her own lessons in an attempt to improve the student teachers' understanding. She did this sometimes before teaching and sometimes afterwards. However, Sara told me about an episode with a former group to illustrate what she has found to be the best way of starting to use such a model:

> (q7) I did not call it the 'didaktiske' relationship model on purpose - I just took a regular, white sheet of paper and asked [the student teachers]: what are we going to do? And then I just started to draw – and then I drew, right, with circles and some arrows – and then I said [simultaneously] yes, I have to remember that, I have to remember what room I can use – do the kids know anything about these things then? What have they [the kids] learnt beforehand? Like, I just draw [while I was talking] – and then it turned out to be the 'didaktiske' relationship model. And then I asked: Can you see now (int041103, p. 17)?

Sara remembers the perplexity of a male student teacher saying "so that's what it is" (int050503, p. 14). For him (and other student teachers) the model represented theory and the field experiences represented something else, and as Sara says: "(q8) There was such a wide gap (int050503, p. 14). (…) He [the male student teacher] didn't realise that this was something going on in his mind – and I think that's a point" (int041103, p. 17). According to Sara she has to find links that can help student teachers understand how the written model with all the five categories connects to the practice of teaching. Reflecting on this Sara has developed a way of using the model that she finds constructive to illustrate important features of teacher planning and how these are related to each other (this will be illustrated below). As seen in the quote below she finds that the model may help student teachers name and connect the knowledge they have to use and think about while planning:

> (q9) I have experienced it to be extremely useful when we have been able to use it [the planning document] with the model. And it is useful to create links - [in the model] the element of how do I assess along the way appears, what are the learning presuppositions – and I think that also emerges more clearly for the student teachers, I believe, to see: Is there a relationship between the aims and the methods I choose to use, the processes I arrange for and how do I assess this? – but it's not always that they [the student teachers] manage

to name this and see clearly – how will the connection be between aim and – processes – and – it varies a bit (int050503, p. 10).

So far I have presented Sara's reasons for why she finds it valuable to be engaged in student teachers' planning of teaching. Below I will illustrate or provide evidence for how Sara's ideas arise when working together with Ian, Irene, Ina, Eric and Eli. I start with an illustration taken from the autumn period. I choose this to exemplify recurring patterns in Sara's process of mentoring through planning sessions. The second illustration is from the spring period and is chosen to exemplify what I have identified to be Sara's overall aim with her collaborative mentoring; to move the student teacher's attention from what the teacher should do to what kids should learn and how best they can learn it. In a way, the first illustration highlights processes Sara uses in her guiding collaboration, while the second illustration highlights her aim. Of course, as will be seen, it is not easy to separate these two issues or, in the words of Wells (1999), to separate the dancer from the dance.

## Sara's way of guiding the student teachers' planning

### *Guided planning, Illustration 1:*

In a brainstorming session Sara and the student teachers have just started talking about letting the kids collaborate on working in different stations. Eric has proposed this mode of teaching. Building upon experiences from his year working as a teacher, he proposes that one of the stations should be about counting big numbers, using for instance stones, as a way of working with the place value system or carry-over numbers, the mathematical content of the teaching period. While Eric is explaining his ideas he is encouraged by Sara who utters "yes" several times simultaneously while Eric is talking. Then the following dialogue takes place:

Dialogue 2:

(u1)Ian: The question is that if we use the groups some of the kids may be very dominating – it may be that one pupil controls the whole process.

(u2)Eric: The point is that we gave them [the pupils he taught the year before] time (yes),[84] we gave them a fixed time, I'm not quite sure, we gave them two or three or five minutes (yes) and one pupil alone did not basically have any chance to count alone.

(u3)Ian: No, but one pupil can control the whole process.

(u4)Eric: Yes, but regardless, the point is regardless, if one of the pupils decides, they are quite dependent on, it's only nice that one of them says that maybe it's smart to do like this, but they do it in their own ways, one of them said we do it like this because that's the easiest way (yes) the point is we [the teachers] could see how they could solve it [the counting problem].

(u5)Irene: If one of the groups should be extremely dominated so everything goes wrong, we can talk with that pupil about what he believes is the reason why things didn't turn out so well. If one pupil dominates so it goes wrong then they'll learn eventually that others may have a turn so maybe it is not wrong that one of them dominates.

[84] I have marked Sara's utterance this way to mark that there is no stops in Eric's telling. Sara often makes such utterances when the student teachers' talk. I will mark it like this in all dialogues.

(u6)Sara: Can we ask that each of the kids in the group first makes a solution to the problem, and then they should agree upon how to do it and then they start?

(The student teachers nod)

(…)

(u7)Sara: When I work on kids' collaboration I'm aware of both the subject and social aims, when the collaboration has ended they [the kids] should assess if they have reached the subject aim at the same time as they should evaluate the collaboration, or the social skills, for instance that everybody should make proposals. Another skill is to encourage each other, give praise and let everybody try in turn.

(mc111802, pp. 1-2)

Through this dialogue we can see how both Ian (u1 and u3) and Irene (u5) express some reluctance because they are afraid that one of the kids may dominate the situation. In utterance (u4) Eric finds it acceptable if one kid suggests a way of solving the problem because they still need to cooperate to finish the counting. Sara, as seen in utterance (u6), then proposes that each pupil can suggest solutions first and then agree upon how they will do the counting. This is an example of Sara's use of what I have called guided questioning.[85] This is a recurring trait of Sara's mentoring. She often proposes questions by starting with "can we?" or "is it so that?" I see these guiding questions as a way of making her thinking and experience visible and at the same time helping the student teachers to see possibilities without saying "do like this". Another way of revealing what she thinks is seen in utterance (u7). Apparently, with her belief in collaboration, she does this to encourage Eric's suggestion of arranging stations where kids can collaborate.

When the student teachers return with their refined plans for discussion Sara draws the ”didaktiske” relationship model on a sheet of paper on the table so everybody can see. At the same time she invites the student teachers to talk about their plans so far:[86]

(q10) Then those of you who have had some thoughts about this should be the ones to start, and consider where you want to start, what have you looked at? Then you might tell us about it and we can fill in the model (mc111902, p. 1).

Listening to the student teachers as they talk about and question their plans, Sara writes on the ”didaktiske” relationship model at the same time as she comments on their utterances, answers their questions and asks her own. She takes them through the five concepts, or categories of the model both to capture their ideas and understanding and, as will be seen, to

[85] See Appendix 2 on how this developed. I do not find these questions to be like "leading questions". I see the latter are used when the aim is to reach a clear-cut solution or a target. Sara proposes a suggestion, but it should not be seen as a solution to solve a task. From my data material I can see that the student teachers do not take all these proposals from Sara into account.

[86] As seen in Chapter 4, who is in charge of developing plans from the brainstorming session depends upon planning of other subjects as well. The example I use in this illustration builds upon planning by Eric, Irene and Ina. Ian and Eli were responsible for developing some thoughts around the project "newspaper" in Norwegian. Mostly they chose which subject matter they wanted to develop further from the brainstorming session.

make them refine their thoughts. Thus she uses the model as a device to guide both theirs and her thinking. Focusing on one category at a time Sara helps the student teachers to structure important elements of teacher planning, but also helps them to see the relational aspect.

What the kids in this class can do is discussed under the heading of learning presuppositions:

Dialogue 3:

(u1)Eric: We really have a very weak basis, I think. So we used C-97; and then we looked at what they had learnt last year and what they would learn this year. And what we know they have studied this year. Before we thought of which stations we should have.

(u2)Sara: Yeah, but then we should try something about the learning presuppositions, you know. What do we know about this group?

(u3)Irene: //(indistinct on the tape)

(u4)Eric: Should we only make notes as we go along, should we do it or?

(u5)Sara: Yeah, we're trying now, we're trying out. What is it you feel you know about this group that are the presuppositions and skills in this group?

(u6)Irene: I think this is a strong group academically. I really think so.

(u7)Sara: Yes, but more specifically, that is, what do they know? What do they know about this subject? Now you're setting up math stations.

(u8)Irene: They can add?

(u9)Sara: Yes.

(u10)Ian: Ones and tens, they know position quite well.

(u11)Eric: Well, can we write, they are familiar with the position system?

(u12)Sara: Yes, I think it's an important thing you're pointing out here, Eric, because they're familiar with it. Some master it very well already – and some know well what we're talking about when we say ones and tens, but they don't always remember it, before we tell them. Not before we ask how many tens do you have here now? Then they start to think, yeah right, there was something about the ones and the tens.

(mc111902, p. 1)

They decide to write down that the kids are acquainted with the place value system and through a similar dialogue they also arrive at the conclusion that the kids are acquainted with addition and subtraction, but as Sara says: "(q11) The level of what they know varies – how large the numbers are that they can work with. All master the numbers up to a hundred" (mc111902, p. 2). In Chapter 4 I told that these student teachers never used textbooks or teacher guides in their planning. Eric started this dialogue by referring to how they have used the national curriculum, C-97, to understand what third graders could do and what they should learn (u1). In utterance (u2) Sara turns their focus to what they know about the kids in her class. She then asks them to instantiate this (u7) and emphasises by following Eric's utterance (u11) that kids are different (u12). Eric experiences this in this way:

> (q12) I think she [Sara] helped us when she saw that our plan might be – basically a bit sloppy, like – in the way she knows this class, like. (…) As the mentor for the group she has a very important role if we are to prepare the best possible programme for the class. As long as she can use the knowledge she has about the class to help us, that's really a bonus for us (inter, p. 2).

In the previous chapter I showed that local knowledge and understanding of learners are

essential in performing interactive, constructivist teaching forms.

Sara's local knowledge is essential also when focusing on framework factors. Necessarily Sara both answers and asks questions to make sure they have the time, place and equipment to arrange stations. But even if they focus on one category at a time, Sara explains to the student teachers how planning may not be a linear process:

> (q13) We can always – when you're sitting and filling in like this, then you can go back to a field, as your thinking process goes, you'll think of things. Perhaps you suddenly realise that, yeah, right, that was a presupposition. They must for example be able to write numbers – some things you think of when working further on things. And you'll think of some framework factors too (mc191102, p. 3).

Here Sara is interrupted by Ian saying "(q14) must be able to read, you know – if we're going to do this" (mc111902, p. 3), and the following dialogue occurs:

Dialogue 4:

| | |
|---|---|
| (u1)Ian: | So they have to read the task. But I wasn't certain – don't know really. |
| (u2)Eric: | No, these are some things we were really uncertain about how to resolve. |
| (u3)Sara: | Yes? |
| (u4)Irene: | Everybody can read, really, but how well they do. |
| (u5)Sara: | mm. |
| (u6)Irene: | But that part they have to read we should probably have that, you perhaps should write it on the board – but if they don't really understand – |
| (u7)Eric: | The point is really in a way that they walk around as a group, that this – perhaps those who are best at it read aloud for the others. |
| (u8)Sara: | You say they should walk around as a group. Should they walk around in their family group?[87] |
| (u9)Eric: | That's what we thought. |
| (pause) | |
| (u10)Sara: | Yeah, well, but then I think it's an important learning presupposition that the group already has been established as a group – then you don't have to start working with having the kids function as a group. |
| (u11)Ian: | Sure, but the environment group is really quite freshly established, isn't it? |
| (u12)Sara: | Sure, yes, you can say that – this group is newly established. But they have lots of training and experience in cooperating and acting as a group. |

(mc111902, p. 3)

Here we can see that in utterance (u7) Eric sees the possibility of collaboration between the kids; one of them can read out loud. Sara follows up by taking them back to "learning presuppositions" (u10); these kids are used to working together in established groups. Additionally, both in quotes (u10) and (u12) Sara points out that working together is something that has to be learnt. Because her kids are used to it, the student teachers can arrange for the kids' sharing of knowledge. This is another example of how Sara uses her knowledge of the kids and the class to inform the student teachers. At the same time she also draws their attention to the fact that the learning presuppositions are about more than subject matter knowledge.

[87] "Family group" refers to the way the kids in Sara's class are grouped together as told about in Chapter 4.

Sara refers to the learning presuppositions and framework factors as "what we know" and "what we have". Taken together they tell us "where we are" (mc111902, p. 3). In quote (q12) Eric expresses that Sara's local knowledge was important for the student teachers. Sara, however, finds the ”didaktiske” relationship model most important in making visible "where am I actually going with this?" (int010303, p. 8). She points out that being aware of and understanding what the different categories entail helps student teachers to see if there is a correspondence between the aims and the methods employed, the intended processes and not least, how to assess them. She wants the student teachers to be aware of and develop what she calls a basic attitude, meaning that whatever they do in classes in every subject, there is something that permeates what teachers do related to the kids. Sara finds that the model visualises this:

> (q15) [The model] is nice to use to create links and relationships – I think this works very well as the basis for raising awareness of the kind of choice we make – thinking over: is there a link between what I wanted to do and what I have planned now? – that is to see – is there a link between my idea and what I do in practice? (p. 9). Get this shaken up a bit – what is fundamental? What is your main idea with this? And can you defend what you're planning? That is, can you really stand for what you're trying to do now (p.13) (int010303, p.9, 13).

Right now the main idea behind using the stations is twofold. In addition to an aim of learning more about the place value system Eric proposes that "(q16) there's cooperation – like – or aim perhaps - if we can write that?" (mc111902, p. 4). Sara follows up this by asking them to state the reasons for why the kids should collaborate, and the following dialogue takes place:

Dialogue 5:

| | |
|---|---|
| (u1)Eric: | Because some have things inside, and there are some that don't know this. |
| (u2)Ina: | Learn from each other. |
| (u3)Eric: | mm. |
| (pause) | |
| (u4)Eric: | For many of these tasks they really depend on cooperating. |
| (u5)Sara: | Yes? |
| (u6)Eric: | There are two sides to that, that they both should learn and so they'll get better at cooperating. |
| (u7)Sara: | Yes – so it's an aim they should learn from each other? |
| (u8)Eric: | mm – learn from each other through collaboration. |
| (pause) | |
| (u9)Sara: | Is another aim then that some should put into words what they can do, what they have of knowledge, and use it? That they should be able to express their knowledge and share it with others? |
| (u10)Irene: | mm |
| (u11)Ian: | Learn to express themselves – like – learn to say – |
| (pause) | |
| (u12)Sara: | Put knowledge into words? Established knowledge? |
| (u13)Ian: | Put into words. |

(mc111902, p. 4)

Once again we can see that Sara first listens to the student teachers and after a pause she uses

guiding questions in both utterance (u9) and (u12). This exemplifies another trait of her mentoring. Guiding questions most regularly are offered when the student teachers either seem to struggle with problems or dilemmas or if Sara perceives there is something they misunderstand or do not understand at all. In this case Sara helps them to instantiate what the aim to learn through collaboration means in this situation. If the aim is that kids should learn about the place value system by cooperating with each other, then they must have the opportunity to both express knowledge and listen to each other to learn. Thus aims are connected to both the process of learning and the content; the kids are to develop their understanding of the place value system through collaboration. And once more Sara introduces some guiding questions by turning the student teachers' attention to the assessment:

> (q17) But when they have finished this counting station – when they have counted and either found – well, whether they have counted this way or that, are you going to sum up the counting with them, as to how they resolved the task and what they chose to do? Should the kids be allowed to discuss this afterwards? Should they – should they be allowed to try again? (mc111902, p. 11)

This is connected to Sara's ambition to make the relational aspect visible, "(q18) if we have an aim that they should cooperate, how can we assess whether they are cooperating or not?" (mc111902, p. 16). This leads to the following dialogue where Sara proposes her suggestion in utterance (u11):

Dialogue 6:

| | |
|---|---|
| (u1)Eli: | For example, with this where they are counting all the pieces, now if they can manage to find a way of doing this and count all the pieces in the time they have, then there has been cooperation. |
| (u2)Sara: | Yeah? [Irene murmurs and Sara turns her attention towards her] |
| (u3)Irene: | But they could also cooperate without reaching agreement, couldn't they? If they – like they don't need – even if they have not reached agreement they might have cooperated anyway. (yes) If they only – if they disagree a bit and perhaps need time, so I wouldn't say that they have failed in cooperating if they can't manage the task. We must look at - |
| (u4)Ian: | discussion of facts. |
| (…) | |
| (u5)Sara: | Are there other ways than observing where we might assess whether they satisfy the aims? |
| (They repeat the aims) | |
| (u6)Eli: | Couldn't we have them explain one station each? Like, when we're sitting in the class circle, then we see if they have learnt – to put into words things, like – we should attain through cooperation. |
| (u7)Irene: | //Indistinct on the tape |
| (u8)Ina: | This could very easily go wrong – like we would have to control them a bit. |
| (u9)Eric: | On the counting station this could be done. |
| (u10)Eli: | Yes, generally only ask the pupils. |
| (u11)Sara: | Is it possible to sum up with the group before they leave a station? Ask them – ask them to think for themselves. What have you – what did you work with here now? |

(mc111902, pp. 15-16)

In dialogue 2, utterance (u7) Sara told the student teachers how she used to ask the kids to take part in the assessment process. Here in dialogue 6 she emphasises this in utterance (u11).

So far we have seen how Sara shows the student teachers how different aspects of

teaching depend upon each other and how this must be taken into account while planning. This is exemplified by focusing on what collaboration between the kids means in terms of learning subject matter. In between the discussions on collaboration two brief dialogues emerged. They tell us that, as with former student teachers, there are some misunderstandings of concepts in this group too. The first dialogue occurs when Sara asks what the content of each station should be:

Dialogue 7:
(u1)Eli: The content, what we should do?
(u2)Sara: Yes.
(u3)Eli: Should we just fill in the stations [into the planning document], the tasks?
(u4)Sara: The content – what is – what is the subject matter they should learn here now?
(u5)Irene: Well, then we have to look at the topic, or?
(murmurs, one of them says positions)
(u6)Eli: Yes, take
(u7)Eric: the content, yes
(u8)Irene: the positions, or?
(mc111902, p. 5)

Eli understands content to be about the activities at the stations, for instance counting stones. Below we see that when they are talking about learning process, Ian understands it to be about what he as a teacher should do.

Dialogue 8:
(u1)Ian: Should we include – should we include what our role is, or what? That we should be at the stations, or whether we should follow a group or something? Or is it?
(u2)Sara: No, you don't need to write this in now. For the learning process here you can write how the kids should work, what they should do
(mc111902, p. 6)

These misunderstandings take us to the next illustration.

### *Guided planning, Illustration 2:*

This illustration can be seen as "a snapshot" or a way of highlighting the most problematic area of understanding what the categories in the model or more exactly in teaching mean; the connection between content, learning process and aims. I will show below how Sara's reflections on the theme reveal that these misunderstandings are problematic when it comes to teaching. Sara opens up for and builds upon the student teachers' ideas that come from different sources, for instance mathematics teaching at the university college, Sara's own teaching and other experiences. Eric in particular shares ideas he remembers from the year he worked as a teacher. Sometimes the ideas from all these sources are a bit vague. During brainstorming sessions they decide what the mathematical content should be, for instance the place value system. When the student teachers suggest their ideas for discussion, Sara finds

they are more about activities they would like the kids to be engaged in, especially activities that will be fun to do,[88] instead of focusing on the mathematical content of tasks and activities. The dialogue below illustrates Sara's experiences:

Dialogue 9:
(u1)Sara: How should we continue working?
(u2)Eli: I have thought about baking or preparing waffles.
(….)
(u3)Ina: I would like to do maths outdoors of some kind – don't know what really.
(silence)
(u4)Sara: Sure, we can do that –
(silence)
(u5)Sara: Do you envisage different stations with different themes? Multiplication at one?
(silence)
(u6)Eli: Envisaged something much more practical – now it's the preparing waffles idea.
(u7)Sara: That's multiplication, isn't it?
(mc032803, pp. 3-4)

Sara shows in utterance (u5) that she thinks they should connect other stations, like being outdoors, to mathematical content, but her words are met with silence and none of the student teachers follow up Sara's utterance. Eli admits that she was a bit confused in this discussion: "What does she [Sara] really mean now? Perhaps she doesn't want to include this station?" (intel, p. 5). Sara's understanding is that they had not considered the subject matter content; "(q18) They have thought more about – methods and this thing about cooperation and activities and such things. And then math comes next – that's what I experienced. So nobody continued these thoughts about topics in math" (int050503, p. 16). Sara explains how she in utterance (u7)

> (q20) tries to define for them what we are using of subject matter in this by telling them that this is multiplication. Like – simply because they should also know that here we are dealing with subject matter aims too – like we're not only making waffles but we should explain why we're doing what we're doing with waffles – because we have learning aims [in maths] when we do this. Not just teach them to make waffles (int050503, p. 16).

However, Sara believes that

> (q21) basically they sat there for a while with the maths – that is they had the maths on their minds – when we started thinking about it [in the brainstorming session]. (…) But as soon as there is the opportunity to play games or bowling or something, then I think what happens very often with these newly trained teachers, that when they become so concrete, then they lose sight of the aims, and then they – they become clerks – that's to say they only become organizers (int030403, p. 8).

Sara finds that these student teachers "(q22) come up with ideas about this stuff with pupil

[88] Talking about mathematics in terms of "we have to make it fun" or "I think they had fun" is a recurring theme in the student teachers' conversations (see for instance a quote from Ian's log book on page 85 and a quote from Irene (q34) on page 157). Ball's (1988) and Gellert's (2000) studies about prospective teachers' preconceptions of mathematics teaching find the same tendency.

activities and interaction and communication and these things, so it appears they actually get some of these things" (int032803, p. 10). Thus Sara acknowledges that they have some ideas about the process of learning; how they want the kids to learn, but they tend to focus too much on the activities per se. We could see in the dialogue above that in utterance (u6) Eli comments on Sara's utterance about multiplication; she wants it to be more practical. Sara recognises that the problem is

> (q23) this here with how do I connect these things then – my general attitude as to how do kids learn, that I have. But my [student teachers'] math experiences are so different – that I can't find – how do I include math into such an activity? Or – they get stuck here, like (int050503, p. 17).

Reflecting upon this Sara has come to believe that student teachers connect concepts like multiplication and place value to work in textbooks, their world is books and sheets with tasks. They can see other tasks and activities that are fun to do, drawing pictures, playing games and things like that, but it is difficult to connect them to the mathematical content. She explains like this:

> (q24) And this is – this is what is the challenge for them, isn't it, either they manage to think about pupil activity, methods and organisation and these things – or they manage to think about the subject matter. And if they are to think about the subject matter then it has to be sitting still with a book. Because then we manage to think about the subject matter, because then we don't have to think about all the surrounding elements. With pupil activities and such you need to consider many things all at once. So therefore it's so easy to use the textbook – if you need to think about the subject matter (int050503, p. 24).

So Sara has to help them to see how activities outside the textbook can be used to address the content. When they discuss the different stations Sara often has to keep them on track and keyed on the mathematical content. She makes utterances like these:

> So the waffle making will be about doubling, then? (p. 2)
> That's wonderful, and it's clear that you can include lots of practice in carrying to the tens (p. 3).
> So the bowling will also be like they have to add and find points – so that they [the kids] get practice with handling numbers? (p.6)
> (mc033103pp. 2, 3, 6)

Building on their ideas of activities Sara draws their attention to the possibility of working with mathematical content. She explains it to the student teachers:

> (q25) So that we do not end up with making this an activity where they do things, like throw rings, and there's one kid who stands there and counts and calculates for everyone. So they just throw and get their points. You got 40, Irene, sure, you say and then you go and throw again – because then there's no learning in it – each kid has to master this thing about calculating, we have to make sure we include the maths, that we don't do as I just said, have one kid standing there and do the maths for everyone, because what is important is to win the game (mc033103, p. 8).

Sara reveals attitudes of neither being too focused on details nor too focused on tricks of the trade. She explains it like this in an interview:

(q26) But I could certainly have taught them much more about what – given them tips and ideas about excellent ways of organising. Because I get feedback all the time that this is something I can do – that I do this a lot. But this may also be why I hold back, as it were, because I'm afraid it would become too – technical – that they'll focus even more on technical stuff so they loose sight of the kid (int041103, p. 11).

Sara guides the student teachers' planning because her wish is to extend the student teachers' thinking and have them make connections between different areas of knowledge; what kids should learn, how they learn and how this is connected to the mathematical activities. The most important issue is focusing on the aims, as she expressed to the student teachers:

(q27) And it's important that we should remember that it's the aims, so that we look at this along the way - so that we see what will be our challenge here now, that's how to deal with – mathematical development for the child at play – it's not really play either, but in this type of activity, how to make sure that as many as possible of the kids can develop – I don't know whether this was well put, but – ensure might not be a good word – but how to stimulate mathematical development during play, interaction and activities, perhaps (mc033103, p. 9).

## *How can the story be understood?*

In Chapter 5 I told how Sara has often experienced that student teachers bring quite different images of school and teaching than hers to their first field experiences. These images are often based upon the visible part of teaching, what they have seen through all their years as pupils in classrooms. But there is an invisible part of teaching they have usually never witnessed. Planning is a task no one who is not engaged in teaching has ever undertaken or seen.[89] Throughout the story of how Sara's participation in planning sessions comes into view I have pointed out on several occasions how she reveals or makes visible her own thinking in different ways. I find that the concept of cognitive apprenticeship, introduced by Collins et al. (1989) is useful in trying to understand what happens in the interactions between Sara and the student teachers. This concept is developed within a socio-cultural framework as a synthesis of schooling and apprenticeship. While traditional apprenticeship models focus on what can be easily observed, the aim of cognitive apprenticeship is to reveal the thinking behind complex tasks. Elements from the concept are found to be successful in teaching different subject matter like reading (Palincsar & Brown 1984) and problem solving in mathematics (Schoenfeld 1985). Common to these approaches is that both the teacher's and the pupils' thinking are deliberately revealed and brought to the open so that they all can learn from each other.

Even if the concept of cognitive apprenticeship was developed in the context of schooling

[89] Of course, in this particular group of student teachers, Eli and Eric have been involved in planning during the year they worked as teachers. But Eli, as seen in footnote 62, admits that her previous teaching experiences were rather traditional.

I will argue that it is even more suitable in the context of mentoring as is evident in this study. This is because in outlining the sociology of the concept Collins et al. (1989) argue that the task should be completely situated in the workplace and the skills to be learned should be inherent in the task itself.[90] Student teaching and mentoring fulfil both claims and as such I find it useful to extend the concept to mentoring. Moreover, we can see from Illustration 2 in the story that Sara acknowledges how dealing with new forms of teaching is a fairly complex task for student teachers.

The concept of cognitive apprenticeship focuses on two issues. First, the method is aimed primarily at teaching the processes that experts[91] use to handle complex tasks. The method emphasises that conceptual and factual knowledge are exemplified and situated in the context where they come into use. This implies that teacher planning is best learned in the context where it is used. According to Collins et al. (1989) this will both encourage a deeper meaning of the concepts and facts included in the process and create a rich web of memorable associations between them and the contexts. In their words: "It is this dual focus on expert processes and situated learning that we expect to help solve the educational problems of brittle skills and inert knowledge" (p. 457). The story about Sara's guidance told us that both former groups and this group of student teachers found it difficult to understand important concepts (or categories) of teacher planning. Through Illustration 2 I argued that misunderstandings of the concepts could make it difficult to see both the content of the kids' learning and how they best could learn that content. Thus such misunderstandings will hamper the most important thing in school, kids' learning. If the concepts lack substance for student teachers, it will be difficult to acknowledge what the aim of the teaching should be. If you believe that the content is the activity, it may turn out to be that the aim is to play "ring tossing" instead of developing understanding about the place value system.

Second, the term cognitive apprenticeship refers to the focus of cognitive and metacognitive processes, rather than physical skills and processes (Collins et al. 1989). Collins et al. argue that traditional apprenticeship occurs in settings where the process of carrying out target skills is external and thus readily available for observation, comment and refinement. This is a relatively transparent relationship to concrete products. Applying

[90] According to Tharp and Gallimore (1988) this is a problem in schools as they are de-contextualised. Daniels (2001) even finds this point to be a limitation of the model of cognitive apprenticeship as used in schooling.

[91] The word expert is used by Collins et al. (1989, 1991) and, as can be seen on page 131, also by Rogoff (1990). Even if it is also used in the field of research on teacher knowledge, for instance focusing on differences in expert–novice thinking I feel a bit uncomfortable using it. I even think Sara does. For me it implies that there is a right way of doing things. Vygostky, and his "more capable other" (1987, p. 86) and Dewey's the "more mature" (138, p. 38) are terms that I find preferable.

apprenticeship methods to largely cognitive skills requires externalisation of processes that are usually carried out internally. Thus they assert that as with traditional apprenticeship, cognitive apprenticeship ought to be a "learning-through-guided-experience" process (Collins et al. 1989, p. 457). Methods designed to bring thinking processes into the open should be used. The aim is to make visible and explicit complex thinking strategies that experts use in particular domains. Such complex thinking strategies are mental, and are therefore not easily observed by the novice. I have already claimed that this is the situation with planning strategies; the planning process itself is not visible, and the strategies used by teachers are also hidden.

Collins et al. (1991) emphasise that cognitive apprenticeship does not require the teacher to permanently assume the role of the "expert". In contrast to the ancient traditional apprenticeship model as in learning of crafts like carpentry and tailoring, cognitive apprenticeship connects to a collaborative way of teaching or mentoring; the novice can also be the expert. Over the last few decades there has been a redefinition of the apprenticeship model from "a person-centred relationship between master and apprentice to a decentred relationship where the decisive factor is not the master but a community of practice" (Rasmussen 1999, p. 204, my translation). This redefinition of the apprenticeship model is developed within the socio-cultural tradition acknowledging learning as an interactional process (Lave & Wenger 1991, Rogoff 1990, Wells 1999, Wenger 1998). Rogoff's (1990) description of the apprenticeship model has obvious similarities with the relationship Sara and the student teachers in this study are involved in:

> The apprenticeship model has the value of including more people than a single expert and a single novice; the apprenticeship system often involves a group of novices (peers) who serve as resources for one another in exploring the new domain and aiding and challenging one another. Among themselves, the novices are likely to differ usefully in expertise as well. The 'master,' or expert, is relatively more skilled than the novices, with a broader vision of the important features of the cultural valued activity. However, the expert too is still developing breadth and depth of skill and understanding in the process of carrying out the activity and guiding others in it. Hence the model provided by apprenticeship is one of active learners in a community of people who support, challenge and guide novices as they increasingly participate in skilled, valued sociocultural activity (p. 39).

Bearing in mind what Rogoff says above, Sara is obviously the person with a broader vision of the important features of the cultural valued activity of teacher planning. But the student teachers serve as resources for each other in exploring the new domain. As seen in the dialogues, they both support and challenge each other in the conversations with Sara (see for instance dialogue 2, 4 and 6). They probably also do this when they are engaged in the planning that goes on in the intervals between the mentoring conversations. This is hidden from both Sara and me. The student teachers inherit different experiences; the most overt is

that two of them have worked one year as teachers. They probably also inherit different expertise in different subject matter. We already know that their attitudes toward mathematics differ. As seen in Chapter 4, on page 77, Ian acknowledges how Eli and Eric, because of their experience, have made things easier through planning sessions. But this quote from Eli shows how she has changed her thinking from the year she worked as a teacher:

> I used to be very much like that before – I prepared a plan, and then I carried it out. And then there was like a new plan. I think I got stuck on this making good plans without thinking about the pupil at all. (…) [I must] develop this bit about understanding each pupil and try to understand much more before I start making a plan (intel, p. 2).

Cognitive apprenticeship is not a model that gives teachers a packaged formula for instruction. Instead, it must be seen as an instructional paradigm which is useful when dealing with complex tasks (Collins et al. 1991), and, I would like to add, when dealing with new tasks. However, in learning environments that promote cognitive apprenticing Collins et al. (1989, 1991) identify important methods such as modelling, scaffolding, fading and coaching.[92] But as they point out, there is no formula for how to implement this approach. Each teacher, or in the case of mentoring, each mentor has to find their own way of employing methods that are appropriate in making thinking visible within their specific socio-cultural setting. I have already shown, especially through Illustration 1 how Sara uses the ”didaktiske” relationship model interactively with telling and questioning to reveal both her and the student teachers' thinking. This is connected to an important feature of socio-cultural theory, the use of cultural tools in mediated activity.

Vygotsky (1978, 1981b) sees both language and diagrams as semiotic means or psychological tools.[93] They are devices for mastering mental processes. Tools mediate social and individual functioning, connect the external and the internal, the social and the individual (Wertsch & Stone 1985). Thus semiotic mediation enables participants to collaborate effectively in activities of increasing complexity (Wells 1999). In Chapter 2 I told that the idea of mediation, the claim that higher mental functioning and human action in general are mediated by tools and signs, is so central in Vygotsky's writings that Wertsch (1985, 1991) claims it is the key concept of the whole theory. Every human action employs cultural tools or

[92] As seen in Chapter 2 these processes are recognisable within a socio-cultural framework of teaching, mentoring and learning. Both Wood et al. (1976) and Tharp and Gallimore (1988) talk about modelling as a feature of scaffolding (or assisted performance) while Collins et al. (1989, 1991) put it on the same level as scaffolding. It is also a bit confusing that in their description, Collins et al. include both modelling and scaffolding in coaching. I will not develop this issue further. My intention is to see how Sara employs the methods, well attuned with the thinking inherit in cognitive apprenticeship; each mentor has to find her own way of implementing this approach.

[93] In Chapter 2 I told how Vygotsky made a distinction between psychological and technical tools.

mediational means.[94] Thus tools can be found on different levels, from communities using, for instance, systems of languages as a psychological tool to individuals using a pole in pole vaulting as a technical tool (an example used by Wertsch). There are also tools developed in the area of microgenesis, for instance the planning document in teacher education. The document is supposed to both help the student teachers in their planning process and at the same time show the cooperating teacher their thoughts. However, above we could see that Sara's experience was that the student teachers on their own did not master the tool they were told to use. Thus it was of no use to her either (q5).[95] Actually, the document hindered useful collaboration as Sara found it difficult to intervene when the planning was considered finished from the student teachers' point of view. This is not unusual according to Wertsch (1998), who claims that cultural tools are often not easily and smoothly appropriated or mastered by agents. Instead, there is often resistance, and minimally what might be called "friction" (p. 54) between mediational means and unique use in mediated action.[96] Wertsch emphasises that an agent's skill in using tools is developed precisely through using them. And, understood within a socio-cultural framework this happens best through joint activity in natural settings.

Even if tools can be used by individuals, they always inherit properties of the socio-cultural setting in which they occur because they are developed and shaped throughout history. However, as pointed out by Wells (1999), they will always be transformed:

> It is a central tenet of cultural historical theory, however, that tools – including cognitive artefacts – are created at a particular moment in the historical trajectory of a culture, in response to the demands of the activity in which they are used, and that they continue to be modified in use, by those who continue the activity (p. 315).

From the story we could see how Sara has developed the use of the ”didaktiske” relationship model as a tool for teacher planning. She recognised how the student teachers tried to plan by

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[94] I will use the terms cultural tools, mediational means and semotic means interchangeably as both Vygotsky (1978, 1981b) and Wertsch (1991, 1998) do.

[95] This is not completely true. Sara expresses it like this: ”I can quite easily see what they [the student teachers] focus on – I can see if their focus is on ‘will this work’? ‘Can I fill a whole lesson’? – Then I can see how they focus more on themselves than on the kids. Sometimes, by using the planning document this can be better understood [by Sara] than just sitting down talking. At the same time it will show how some student teachers are able to see the connections” (int010303, p. 9). So in a way, the document served as a means for Sara to capture the student teachers’ “actual level” to use a term from Vygotsky. But as Sara found it difficult to intervene, most often the student teachers could perform the planned teaching, even if she found it to be rather traditional.

[96] I find it appropriate to mention that my experience, both as a cooperating teacher and a teacher of education is that student teachers often resist to using the planning document. They argue that teachers do not use it in their daily work. This is a good example of how planning may go from inter to intra functioning as expressed by Vygotsky (1978). For experienced teachers, planning has become routinized (Grossman 1990, Tharp & Gallimore 1988). Actually, they start with a sketch of the lesson and make it unfold through the interaction with the kids. Student teachers do not seem to acknowledge how using such forms could be a stage in a process of learning.

employing a tool that they were not familiar with. Wertsch (1998) claims that such use "actually impedes our performance" (p. 59). So by listening to student teachers and experimenting with different ways of using it, Sara has found a way of using the model that suits her way of mentoring first-year student teachers; she emphasises collaboration in order to enhance and extend the student teachers' understanding of teacher planning. Other mentors, or perhaps Sara if she mentors second- or third-year student teachers, may use other tools, or use this tool in another way. Actually, Sara may transform the use in mentoring another group of first-year student teachers.

According to Kouzulin (2003) mediation has two faces, one human and the other symbolic. People may act as mediating artefacts or tools in the same way as objects. This means that Sara herself is a mediator in the student teachers' learning. Mediational means are inseparably connected to an individual's actions, and can have an impact only when an agent uses them (Daniels 2001, Wells 1999, Wertsch 1998). The quote below from Kouzulin (2003) shows how this is interconnected:

> Symbolic tools have a rich educational potential, but they remain ineffective if there is no human mediator to facilitate their appropriation by the learner. By the same token, human mediation that does not involve sophisticated symbolic tools would not help the learner to master more complex forms of reasoning and problem solving (p. 35).

Approaches focusing on the human mediator usually try to answer questions like what kind of mentor involvement effectively enhances the student teachers learning? As seen in Chapter 2 the scaffolding metaphor is often used to describe this involvement or guidance proposed by either mentors or more capable peers within socio-cultural theory. In cognitive apprenticeship, the notion of scaffolding refers to the support the mentor provides to help student teachers carry out complex tasks. We have seen how, by making visible her experience and knowledge of the kids, Sara guides and facilitates the student teachers' possibilities of using interactive teaching forms. As a group the student teachers have emerging ideas and beliefs of what they want to do in the classroom, but as seen through Illustration 2, they need help to make it worthwhile learning for the kids. It is reasonable to assume that the way the help is provided also scaffolds their understanding of planning.

However, as seen in Chapter 2, scaffolding has an interactive nature (Stone 1993, Wells 1999). As teachers, we can help learners through the questions we ask and the guidance we give. But we can also receive help and guidance from the questions and suggestions of learners – if only we are ready to accept them. We could see Sara in quote (q3) say that the student teachers made her ask the questions she did in the dialogues with them. There is an

ongoing interplay between mentor and student teachers in the joint completion of a task. It is not only Sara who helps the student teachers through the questions she asks and the guidance she gives. She will also receive help and guidance from the questions and suggestions from the student teachers, and as mentioned above, the student teachers will receive help and guidance from each other. The conversations and the use of mediational means open for not only the more mature person's thinking but also the novice's ideas and suggestions on what they intend to do, their thinking or sense making and how they understand things. The ”didaktiske” relationship model is used as a means for formulating and extending the participants' understanding and sense making of the activity in which they are engaged (Tharp & Gallimore 1988, Wells 1999). Thus the written diagram functions as a tool for thinking and offers a possibility for cognitive structuring; a means of assistance that provides a structure for organising elements in relation to one another. As seen in Chapter 2 Tharp and Gallimore (1988) assert that "a good mix of the three types of verbal assistance – instructing, questioning and cognitive structuring – produces a lively and cooperative teacher [mentor]– learner interaction" (p. 57). This interaction provides the basis for what Tharp and Gallimore claim is an important feature of activity settings where assisted performance takes place, the instructional conversation. This is similar to the way Schön (1988) defines instructional supervision as “including *any* activity that supports, guides, or encourages teachers in their reflective teaching” (p. 19, italics in original). He proposes that instructional supervision is a kind of coaching where, through advice, criticism, description, demonstration and questioning, one person helps another to learn to practice reflective teaching in the context of doing. By reflective teaching Schön (1988) means “giving the kids reason” (p. 19). He explains this as listening to kids and responding to them, helping them build on what they already know but cannot say, helping them coordinate their own spontaneous knowing-in-action with the privileged knowledge of the school. I find it suitable to argue that this description fits well with the kind of teaching Sara and the student teachers plan to perform. As already argued, though invisible, the planning phase is an important part of the practice of teaching.

To summarise; throughout this discussion I have shown how the concept of cognitive apprenticeship is useful for understanding what happens in the collaboration between Sara and the student teachers through planning sessions. I have argued that Sara guides and scaffolds the planning by making her own experience, knowledge and thinking visible. I have especially focused on how her use of the ”didaktiske” relationship model connects to the importance of tool-mediated action within socio-cultural theory of learning (Wertsch 1991,

1998). As will be seen in the next section, Sara's actions are recommended by scholars and researchers to facilitate student teachers' development of pedagogical content knowledge.

### *What could be the educative value for the student teachers?*

In the previous chapter we saw how Sara introduced the student teachers to an interactive teaching form where interplay between the teacher and the kids and between kids is underscored. Thus Sara offered a vision of teaching that is quite different from what the student teachers remembered from their own experiences as pupils.[97] Sara's way of teaching mathematics is, as has already been discussed in Chapter 4, attuned to C-97, as it takes into account that kids both understand and develop mathematics differently. Furthermore, the kids are encouraged to share their understanding with each other, also emphasised in the national curriculum. Through the illustrations I have provided in the story recently told we saw that Eli, Eric, Ina, Ian and Irene plan for an interactive teaching form emphasising kids' collaboration. As mentioned in Chapter 4 this is a common trait of their teaching of mathematics. The student teachers seem to be both inspired and encouraged by Sara to use such a teaching form.[98] Scholars and researchers strongly emphasise the importance of what occurs here; the practice field should be considered as a venue for experiencing teaching forms that are attuned to the curriculum (Dewey 1904, Feiman-Nemser 2001, Wolf 2003). This is important if one is to help student teachers construct images of what skilful practice may look like (Dewey 1904, Grossman 1990, Schøn 1987), and to understand what it takes for a teacher to be able to teach in such a way (Ball & Rundquist 1993, Feiman-Nemser 2001, Heaton & Lampert 1993, Wolf 2003). As expressed by Irene: "There was so much to think about that I hadn't thought about".[99]

Due to the improvisational nature of interactive teaching forms they can be difficult to undertake. Several studies have shown how student teachers and novices struggle with the complexity that occurs because of the unpredictability, simultaneity and multidimentionality involved in interactive teaching approaches (see for instance Doyle 1977, Edwards 1998, Nilssen et al.1996). Some of the problems novices encounter seem to be due to a lack of both subject matter knowledge and pedagogical content knowledge (see for instance Ball 1988,

[97] I am well aware of lack of information about these student teachers' mathematics education. However, Eli and Eric said in Chapter 5 that they have thought about mathematics in quite different ways than they experience now. In the previous chapter we also saw that Ian, Ina and Eli admit that school has changed. Irene also expresses that Sara is “innovative ” (intir, p. 1, see quote (q34) on page 157).

[98] It may be strengthened because Eric remembers traits from his teaching experience the year before that fit in.

[99] I overheard this expression from Irene, but unfortunately I did not write it down immediately so the dating is only noted as “the second week”.

2000, Dewey 1933, Hawkins 2000, Nilssen et al. 1996).[100] In the introductory chapter I told how student teachers, supported by their mentors, tried to avoid such teaching in order to let lessons run smoothly.[101] Student teachers mostly produced learning tasks for pupils in which there was a low risk of failure for both student teachers and pupils. As a result, student teachers experience little failure, but they also miss opportunities to learn (Edwards & Collison 1996, Edwards 1998). According to Zeichner (1996) field experiences should be "an important occasion for teacher learning and not merely a time for the demonstration of things previously learned" (p. 216). As seen in Chapter 2, a demonstration of things previously learned can be seen as performing on the actual level of development and, according to Vygotsky (1978), by doing so no new learning takes place. Tharp and Gallimore (1988) argue that to learn new ways of teaching we must construct activity settings that assist student teachers to perform the new skills before they are fully competent. By working together with novices in core teaching tasks, the cooperating teachers can contribute to the novices' learning by helping them perform at a more complex level than they could do on their own (Edwards 1998, Feiman Nemser & Beasley 1997, Tharp & Gallimore 1988, Wolf 2003). Thus, within a socio-cultural framework of mentoring we can understand how Sara's guidance through planning sessions can be of educative value for student teachers' learning. She helps them to undertake teaching forms that are seen as necessary in order to learn to teach and hence develop pedagogical content knowledge in mathematics.

In the previous chapter I argued that by focusing on the kids and their individual learning Sara may help the student teachers overcome the presumption of shared identity and hence the apprenticeship of observation. This was seen as the first step in developing the perspective of a teacher. Another step in developing such a perspective includes pedagogical reasoning beyond what is visible. Throughout all those years as pupils what student teachers learn about teaching is "intuitive and imitative rather than explicit and analytical; it is based on individual personalities rather than pedagogical principles" (Lortie 1975, p. 62). The student teachers have never participated in selecting aims or making preparations. Thus they are not used to placing the teacher's action in a pedagogically oriented framework, as, for instance, the ”didaktiske” relationship model they are told to use in their planning. To understand what this means Grossman (1990) argues that student teachers need to be involved in guided practice.

[100] Novices themselves do not acknowledge this lack of knowledge. In a study made by Veenman (1984) lack of subject matter knowledge is in sixteenth place when it comes to perceived problems. Managerial problems are at the top.

[101] Though not focusing especially on mathematics, Sundli's (2001) study from Norwegian teacher education shows how cooperating teachers and student teachers are engaged in rather traditional settings.

She especially focuses on planning sessions:

> Planning may be one example of a process that must first be explicit before it can become routinized. As cooperating teachers have already mastered many of these routines, their knowledge may be relatively tacit. One role for teacher educators, then, is to make this tacit knowledge explicit for prospective teachers and to help them develop a process of pedagogical thinking that, while artificial at first, will later become second nature (p. 138).

Guided planning is seen as a special kind of learning opportunity as it has conversation built into it. We remember how thinking in the individual develops through intermental processes, a central tenet of a socio-cultural approach to teaching and learning that we looked at in Chapter 2. And as already discussed in the previous section of this chapter: guided planning gives novices an opportunity to gain insights into teachers' thoughts. Thus these conversations may help novices understand not only what more experienced teachers do when they plan for teaching, but also what they think about planning, what they take into consideration and why. This needs to be explicit if student teachers are to develop a framework for planning (Feiman-Nemser & Beasley 1997). As the trusted person in the setting of teacher education, cooperating teachers are well positioned to induct novices into the invisible world of teaching. Moreover, in the previous section we learnt through the notion of cognitive apprenticeship the importance of learning complex tasks in the situation where it is used. Several studies show how by being engaged in co-planning with mentors the student teachers gradually internalise ways of thinking and constructing their own planning framework (see for instance Feiman Nemser & Beasley 1997, Perks & Prestage 1994, Wolf 2003). So far I have argued how the process of guided planning is seen to have significance for student teachers' development of pedagogical content knowledge. I now turn to the issue of what aspects of this knowledge may be developed through such processes.

As pointed out several times in this research text, pedagogical content knowledge inherits a complex knowledge base, identified in different ways by different researchers (see for instance Cochran et al. 1993, Grossmann 1990, Hasweh 2005, Shulman 1986, 1987). Nonetheless, as Ball (2000) maintains, the concept highlights the interplay of pedagogy and subject matter in teaching, for the case of this study teaching of mathematics. Ball further claims that student teachers or novices are left on their own to integrate subject matter knowledge and pedagogy learned through different courses at the university college. She goes on to argue that it is assumed that the integration required to teach is simple and happens in the course of experience. But as she says: "In fact, however, this does not happen easily, and

often does not happen at all" (p. 242).[102] Here it appears that Sara contributes. By acknowledging how first-year student teachers struggle to understand what different categories of teacher planning mean (q5 and q6) she understands that she has to help them find the links (q7). She recognises that she has to be more of a collaborator than an evaluator (q3 and q4). Sara has found a way of using the pedagogical model that helps her visualise what is necessary to bear in mind when teachers plan for kids' learning. She shows how knowledge of mathematics, pedagogy, context and not least, knowledge of the kids in her class are integrated in teaching. Being able to plan for specific kids (or more exactly for one specific kid) to learn a specific content in a specific environment is at the heart of teaching.[103]

In the previous chapter I showed that two areas of pedagogical content knowledge which are mostly informed by apprenticeship of observation have significance for my study. One, understanding of learners, has been discussed in the previous chapter. The other area concerns how experiences as pupils provide student teachers with memories of strategies for teaching specific content. Pupils have more access to the teacher's actions than their aims and thus the memories provoke student teachers to connect the means of instruction with a potential end; knowledge of the content becomes confounded by knowledge of instructional strategies (Lortie 1975). Throughout the two illustrations in the story we can see how my study mirrors Lortie's claim. The student teachers seem to struggle to understand the connection between content, process of learning and aims. This was quite obvious in dialogue 7 and dialogue 8. We also learnt how Sara has experienced this as a difficult aspect, also with former groups. Through several quotes (q1, q2, q5) we understand this to be the reason why Sara has found it wise to be actively engaged in the student teachers' planning.

The cooperating teacher has a key role in student teachers' development of understanding of how knowledge of mathematical "content" or "process" can be "transformed" into activities through which pupils are to learn mathematics (Rodd 1995). What happens here seems to be the reverse, or to use the words of Dewey (1938) "a desire may be converted into a purpose and a purpose into a plan of action" (p. 70). The student teachers have ideas or desires about activities they want the kids to be engaged in, but it is Sara who helps them convert these ideas into a purpose by connecting them to mathematical content. That is her main reason for

[102] It is appropriate to mention here that Ball's writings are situated in the US. She claims that the division between method courses, disciplinary courses and practice is too fragmented. As seen in Chapter 4, teacher education in Norway is different. However, the same problems appear to occur as reported in evaluation reports (Harnæs 2002, Nokut 2006) and studies (Kvalbein 1999).

[103] We will see in Chapter 7 that Sara does not mean planning can foresee everything that happens. On the contrary, her teaching very much develops through interplay with the kids. And as Grossman (1990) points out, for Sara as an experienced teacher this is routinized. Novices have to learn what is involved.

her commitment; ensuring that the student teachers do not get lost in the school they attended as pupils. If they do not focus on what kids should learn, their teaching will be traditional, just dressed differently.[104]

By nature, pedagogical content knowledge is not well developed by student teachers. Both Shulman (1987) and others (Cochran et al. 1993, Gudmundsdottir 1995, Hasweh 2005) assert that it develops through processes of repeated teaching experiences that are both scrutinised and reflected upon. Important to bear in mind is that the term teaching as used here includes both the planning phase, the interactivity in the classroom and what Hasweh (2005) names the post-active phase. I maintain, moreover, that collaborative or guided planning without using textbooks is important for student teachers' development of this knowledge base because the different areas that are needed to teach so kids can learn, the combination of pedagogy and subject matter is actualised through planning sessions. As we have seen, such planning activates their knowledge and perhaps more importantly, it activates what they do not know. Thus they may acknowledge that they have something to learn. What do we know? What do we not know? And what do we need to learn and have more experiences of? This is perhaps underestimated in the process of learning to teach. By using textbooks, student teachers do not have to ask themselves the important question of "why are we doing this?" As expressed by Eli: "There are really very many good ideas there [in textbooks], but – you really don't know – do they fit these pupils?" (intel, p. 8).

To summarise; by nature, we cannot expect first-year student teachers to inherit the knowledge needed to plan for teaching. Actually, as this knowledge is the domain of teachers, this is what should be learnt through teacher education. Understood within a socio-cultural framework of teaching, learning and mentoring, it is not difficult to understand how this knowledge may develop through working together with Sara in preparing for teaching specific kids. Another source for development of pedagogical content knowledge is classroom experiences. How Sara assists the student teachers in this learning process is the theme of the next chapter.

[104] I find it appropriate to mention that through an evaluation of how the reform of C-97 is implemented in schools, it turned out that there are a lot of activities in Norwegian schools, especially on the lowest levels (Haug 2004). Haug says: "In all this changing activity it may be unclear what for the purpose is. It may be interpreted as if doing something and being active is more important than learning something" (p. 31, my translation).

# Chapter 7
# Encouraging educative experiences by focusing on aims

In Chapter 3 I argued that Sara has a guiding principle and long-term aim for mentoring first-year student teachers' teaching of mathematics. She wants the student teachers to understand that kids learn and develop mathematics in different ways and that teaching relates to this. Sara strongly believes that "understanding builds upon experience" (mc111202, p. 3), and this chapter thus deals with how she encourages the student teachers to learn through their experience of teaching.

The implicit trust in first-hand experience is particularly evident in discussions on learning to teach. Teachers argue that they have learned to teach through the experience of teaching and gained little from theories (Feiman-Nemser & Buchmann 1985, Grossmann 1990, Shulman 1998). Eraut (1994) points out that learning from different sources, such as theory, other individuals and experience is a key part in educating people for professions. He also claims that learning from experience is the most problematic source because in spite of its popular appeal, there is little available documentation on what and how one learns through experience. Throughout the world this pervasive myth of learning from experience is questioned from a number of viewpoints (Britzman 1991, Feiman-Nemser & Buchmann 1985, Grossman 1990, Kvernbekk 1995, Shulman 1998, Zeichner 1996). Nonetheless, one source of development of pedagogical content knowledge is classroom experience (Cochran et al. 1993, Grossmann 1990, Gudmundsdottir 1995, Hasweh 2005, Shulman 1987). According to Grossmann (1990), the problem is that if left alone, student teachers may interpret their experience by focusing more on "what works" than on the overall aims of their teaching. There is a tendency to focus more on external than internal matters, to use Dewey's terms (1904). A quote from Sara shows that she seems to be aware of the importance of focusing on "internal matters" more than on "what works" and that she conveys this to the student teachers: "It's not just a question of establishing order in the classroom, but rather the learning that comes out of it" (mcwu040403, p. 1). As will be seen throughout this chapter, the learning Sara points to involves both the kids' and the student teachers' learning.

The story in this chapter has been created in the same way as the stories in the two previous chapters; various pieces of data are put together and integrated with interpretative comments (Erickson 1986). The aim of the story is to illustrate how Sara reflects upon and deals with the student teachers' learning or understanding from the experience of teaching the

kids. I argue that Sara encourages the student teachers' understanding by focusing on aims as looking glasses into this process; the aims help them see. I understand Sara's use of the word "see" to encompass more than what it would cover if it were merely a synonym for "observe". To see is to understand and the ways to accomplish this are to observe, talk with and listen to.[105] Under the heading "How can the story be understood?" I interpret and discuss the story using Dewey's (1938) concept of *educative experiences*.[106] Dewey uses this concept to point out that not all experiences are worthwhile or educative. He maintains that two intertwined principles come into play to judge an experience as educative; continuity and interaction. Continuity shows how experiences should be connected to each other while interaction shows how an individual's needs and capabilities interact with the provided environment. Through this concept Dewey further accentuates the important role of the educator, or the more mature person in the novice's process of learning from experience. As mentioned above, there is a strong belief in learning through experience in teaching and teacher education, and I therefore find it useful to extend Dewey's concept to mentoring in this field. As will be seen, Dewey also has a strong voice in the last section of this chapter where I discuss "What could be the educative value for the student teachers?"

## *Encouraging educative experiences; the story*

In the first section of the story, Sara's reflections on focusing on aims I present Sara's argument and her reasons for why she uses aims to deal with the student teachers experiences from their teaching of the kids. The section also includes data that show how Sara is aware of the student teachers' individual needs. They differ in their capacity to see by means of aims. In the second section I give an account of how Sara's reasoning is put into action through her collaboration with Eli, Eric, Irene, Ina and Ian.

### Sara's reflections on focusing on aims

In the previous chapter we saw how Sara collaborated with the student teachers by guiding their planning processes. However, which teaching experience they wanted to have was

[105] Later in this chapter I will show how scholars and researchers use the word in much the same way as Sara does (Dewey 1974, Edwards & Protheroe 2003, Feiman-Nemser & Buchman 1985, Schön 1987). As expressed by Dewey (1916): "The ear is as much an organ of experience as the eye or hand" (p. 186).

[106] Others have also been inspired by Dewey's writings to understand and develop teacher education. Examples are Eikseth and Nilsen (2004), Feiman-Nemser (2001), Frykholm (1998) and Zeichner (1996). Schön's (1983, 1987) work on the "reflective practitioner" is also based upon Dewey's writings. Even if Schön's original work did not include teaching, it has influenced teacher education through the emphasis on reflection in the education of professionals. As will be seen later in this chapter, Schön has written about reflection in teaching in later works (Schön 1988).

something that the student teachers made evident over the last five weeks of their collaboration.[107] Utterances from Sara like "What do you want to do next week?" (mc032703, p. 6) and "How should we do this? How should we spend the time?" (mc032603, p. 3) were often heard in the mentoring conversations. We saw an example in Illustration 2 in Chapter 6 where the student teachers wanted to make waffles and do outdoor activities for the mathematics lessons. They could do this, but by focusing on aims Sara turned their attention from the activity to the content; what kind of mathematics could the kids learn by doing these activities? Sara's way of being open to the student teachers' initiatives and thus allowing them to gain experience can be seen in a similar way; what could the student teachers learn about the kids while they were engaged in these activities? This can be explained by turning back to quote (q27) on page 129 in the previous chapter. Here we saw how Sara emphasised that the student teachers' aims for the kids' learning should be used like glasses; the aims decided what they should be looking for while teaching. At the end of the planning sessions Sara initiated discussions on how this best could be done by saying such things as:

> (q1) How should you determine [whether the aim has been attained]? First have a little brainstorming session on how many ways we might use to determine this. And how should we determine this here (mc111202, p. 13)? But then there's the really exciting question: how do we plan the work process so that we can observe as much as possible of each kid (mc032003, p. 8)?

Sara's focus on aims in teaching connects what she calls two arenas; the kids' and the student teachers' learning. She explains it like this:

> (q2) [I must be careful] so I don't lose the thread in my students teachers' learning, because – I really think this is something that is great fun to work with – that's to say I have – I have my eye on the same thing the student teachers have, which is what the kids learn, and what should be happening in the classroom. But I also have my focus on the student teachers' learning, so that I have two – two arenas the whole way (int010303, p. 10).

Thus Sara acknowledges how she is responsible for the student teachers' learning. She has changed the way she thinks about this responsibility. She remembers how in her first years as a cooperating teacher she was probably too didactic. Sara thought her job was to pass on all of what she and her colleagues had tried out – and say “look, here it is!” By now she has come to believe that her most important contribution to the student teachers' learning is to make them understand the importance of being "(q3) alert and interested and awake and thinking – while we're working. (...) Keeping focus on the aims – and become aware of what is needed to keep the focus on the aims" (int041103, p. 10). But as already touched upon several times in this research text, Sara does not believe that she can simply tell the student teachers and then they

[107] As mentioned in Chapter 4 the first week was designed by Sara.

will understand; she is convinced that understanding builds upon experience. Her role is to assist and support the student teachers to gain experience that makes them see: "(q4) I actually try to make them see things. (...) Make experiences in the classroom, so they will be able to see" (int010303, p. 7). Apparently Sara believes that being focused on the aims helps the student teachers to develop their seeing through the experience of teaching.

We can understand Sara's emphasis on developing the student teachers' capability to see as she emphasises how seeing is an important part of a teacher's daily work in the classroom. To the student teachers she claims that as teachers "(q5) we have to be good at seeing. (...) We must learn about the kids and get to know them by seeing, speaking with them" (obsj111102). She explains to the student teachers that if they do not they will not gain any insight into how those kids who are quiet think. Even if Sara is more open to student teachers' initiatives than she was before, she is concerned about what sort of experience the student teachers should have, and as seen in the two quotes below she connects this to seeing:

> (q6) They might try out what I do on a day-to-day basis to determine how kids think, try to place it in – what I know, really – about how kids build understanding in a subject. That's to say kids may build understanding in different ways (int032803, p. 3). I really think this is important, when it – when the student teachers realise that kids, they think this way! And kids – find ways of solving things – and when they become aware of what potential the kids have, and what kids might contribute (int050503, p. 14).

Sara underscores this by praising the student teachers' seeing. She often summarises mentoring conversations by saying such things as:

> (q7) But I really think it's very nice to listen to you now, how much you have seen and how well you know the kids and are starting to see – and then you're starting to see new aspects, because we get this first impression, and then you start to see that hey!, in this situation a new impression emerges. That's important (mc112002, p. 10).

In the same way as she encourages the student teachers to explore and listen to what kids can do, Sara conveys that she has to look to find where the student teachers are. She obtains information and understanding through careful observation and by listening to the student teachers in the classroom and in the mentoring conversations. The student teachers' log books are another important source for understanding how they differ in what they see and perceive of their teaching experiences. Furthermore, Sara is aware of how it may be difficult for some of the student teachers to see because "(q8) what is most obvious to the student teachers is that it is the social aspects they experience, what they experience in the interaction – that come first. And this – this is an important part of the teaching job, a very important part" (int052503, p. 14). Sara finds it natural that the two student teachers with one year of teaching experience, Eli and Eric, are more capable of what Sara calls seeing than the other three; they

have already been through the important experience of “feeling what they are as teachers”.

Sara points out that she has to remember that in the same way as her kids, each student teacher is different and not only part of a group. She explains it this way:

> (q9) Occasionally I feel doubtful whether I actually manage to give each individual – do I manage to get close enough to each [student teacher]? Not necessarily close enough to each person, but do they feel that – that I’m there for them too? This is really the same thing I'm working on in my class, and which I have emphasised a lot there, that the children must not feel just like one of a group – but that each individual must be visible too (int032803, p. 2).

Sara hopes that the way they use log books interactively (see Chapter 4, page 74) can help with this. Even if she tries to talk to each of the student teachers a little once in a while and tries to give individual feedback to all of them, she is not quite sure that she is able to satisfy the expectations the student teachers might have. She explains:

> (q10) I'm afraid they lose some of their individual lives, that they'll be left sitting and thinking that I didn't get any assistance with this or that. I didn't develop when it comes to this or that. But I have tried to say that they can just see me and remind me, give me input and take more initiative themselves (int032803, p. 2).

Sara is aware of how she and the student teachers are always ‘spinning many plates on sticks like in a circus,’ that they have a lot of things to do all at the same time. She has come to believe that the positive thing about this is that each of the student teachers can contribute in different ways due to different interests; for instance by making "outline plans" and taking responsibility for different parts of the subject content.

Sara finds it to be important, but still a challenge, to take into account how the student teachers have different expectations, or aims for their student teaching and how they expect to have different types of experience. She says:

> (q11) There are student teachers out there who have more than their hands full just being with the kids, and you must deal with them, and you must also deal with student teachers who have worked for a year or two already, and who have – who're really thirsting to – discuss the experiences they had then. Really thirsting to hear what others think, or apply a theory to it or something. This is a major challenge (int052503, p. 12).

Due to these differences Sara wants the student teachers to acknowledge that even if they sometimes are not satisfied with the lesson they have had with the kids, they should, as she puts it in an interview, think "(q12) now if it was only positive learning for you as a student teacher – what did you get out of this? What did it give you?" (int010303, p. 7). She finds it important to turn the student teachers’ focus from thinking how unsuccessful things were to what they learned from the experience. What were the aims? What did you see? Sara finds that her role is to assist the student teachers in gaining experience and facilitate optimally for all the student teachers so they might acquire as much experience and learning as possible through their field experience.

So far, we have seen how Sara has become aware of her responsibility to focus on and assist each of the student teachers' learning from their experience of teaching the kids. She believes that her main contribution is to encourage them to be "alert and interested and awake and thinking" in order to learn about the kids' and their learning. As teachers they need this attitude to acquire knowledge about the kids. Sara believes that focusing on aims will help the student teachers in this process. Through two illustrations in the next section I provide evidence of how Sara's understanding of her double role, encouraging the student teachers' learning and encouraging them to take care of the kids' learning, surfaces when working together with Ian, Irene, Ina, Eric and Eli. I start with an illustration taken from the autumn period. I choose this to exemplify how focus on aims becomes a recurring pattern in Sara's process of mentoring through the post-teaching conversations; the aims are used to both structure and maintain focus in the conversations. The second illustration is from the spring period and is chosen to exemplify what I have identified to be Sara's overall aim in focusing on aims in teaching; they help to address kids' learning, and they help her to take care of the student teachers' learning through her mentoring. In a way, the first illustration highlights processes Sara uses in her mentoring, while the second illustration highlights her aims. Of course, as was the case also in the previous chapter, it is not easy to separate the two issues; the processes are both aim-directed and intertwined.

## Sara's way of focusing on aims

### *Focusing on aims, Illustration 1:*

A recurring trait in Sara's mentoring is that the starting point for the content in post-teaching conversations is at the end of the pre-teaching conversations. As shown in Chapter 6, these conversations end by focusing on the aims for the kids' learning. Quote (q1) on page 143 shows us how Sara connects these aims to the possibility the student teachers have to learn about the kids. The content of the post-teaching conversation referred to in this illustration builds upon two intertwined aims for the kids; by sharing their knowledge in collaborative activities the kids should develop their knowledge of the place value system. The student teachers should listen to and observe if and how the kids share their knowledge with each other when they solve the tasks. In this way Sara uses aims to put the student teachers on the track to seeing how important it is for teachers to know if they attain the aims *and* also learn about how kids carry out tasks.

Through the two quotes (q11) and (q12) we saw that though challenging, Sara acknowledges that she is responsible for each student teachers' possibility to learn. I show this

in the illustration here by examining how she deals with three of the student teachers, Eric, Ina and Irene, in the same mentoring conversation. It is important to bear in mind that the kids have rotated between five stations, where each of the student teachers is responsible for one of them. Thus the student teachers have had different experiences in the classroom and have not watched each other teach. Sara, however, has also been moving from station to station, and seen parts of all five student teachers' teaching.

In the post-teaching conversation following the student teachers' performance in the classroom Sara starts with Eric. She starts with him because he is the one who also started and ended the lesson with the kids in the class circle this day (see Chapter 4, page 87). Referring to the station he was responsible for Eric starts by saying that he unfortunately had too little time in the class circle at the end of the lesson. His intention was to let each of the groups tell and perhaps show the others how they solved the task because he experienced that some of the groups were unable to carry out the task in the most efficient way. Sara responds by reinforcing their aim: "(q13) So you believe they might have shared ideas on how they solved it?" (mc112002, p. 1). Eric's answer is yes. Even if the aim was that the kids should share their knowledge in the groups, Eric apparently finds that they should have also done this beyond their own group, because, as we understand from his expression, some of the groups could have learned from other groups. Eric refers to a station where the kids were first to find a way of counting a large number of stones and then divide them into three groups. He describes his experience of this:

> (q14) At my station I had great fun. Because they [the kids] discuss the way adults do, really. They argue for how – they'd like to do it this way – and they demonstrate to each other. (...) There was an incredible number of solutions to things – different things. And they tried out things, really. (...) They discovered they made mistakes and then – not only that they discussed it in advance, but they discovered it while working, and then they changed the approach – that was interesting (mc112002, pp. 1- 2).

Eric described the stone-counting task: some of the kids counted by fives or tens while one of the boys counted one by one and got lost just as he was reaching the end and had to start all over again. The task where they were to divide the stones into three groups was also solved in different ways; some grouped into tens and some used ones to put in three different heaps until they had used up all the stones. Eric also found it interesting to see how some of the kids counted mentally while others needed to count out loud. When the groups did not agree on how to solve the task, he let each of the kids suggest how it should be done, and then let them try their own way. Following this the kids discussed how it could be done. Sara has one question to ask when she and the other student teachers are listening to Eric: "(q15) Did everyone in the group take part – were they paying attention and did they want to join in the

exercise? Or did some of them see it as totally impossible?" (mc112002, p. 2). Eric's answer was that all the kids participated even if some of them were less active. As mentioned Sara is interested in how the aims should both guide the teaching and be used as glasses that enable the student teachers to see. Eric seems to have managed both. We can see how he immediately connects his experiences to the aim of the lesson. He refers to how the kids did the mathematics differently and also finds the kids' discussions to be appropriate for accomplishing the tasks. Furthermore, he has encouraged the kids to collaborate. In his log book Eric writes: "(q16) The fact that they managed to argue well for what they proposed was a clear indication they also had assessed and understood what they were speaking about" (lber112002).

Sara does not say much while Eric reports from his experiences with the kids. Apparently she finds what he is saying to be in accordance with the aims, and we also remember her statement on how Eric is capable of seeing due to his previous teaching experience. From his log book we also understand that he has not only been aware of the aims but also manages to reflect beyond his own situation:

> (q17) In relation to the programme we found there were many things we might have done differently. We spent very much time at some stations and only a short time at others. Thus it was kind of choppy. But we also felt that it wasn't right to extend or shorten some of the stations as this would have detrimentally affected the aims of the stations and also the kids' motivation. We might have prepared more tasks for each station or made the tasks more difficult. But I actually think that everything came out well anyway, as the pupils managed to find things to do to keep themselves activated, such as embroidering, while waiting for the next station. But we learned a lot about how to organise a session and what we need to consider. It was a trial-and-error-improve experience for us all, I felt. And even if we were a bit stressed while it was happening, at least I feel that we and the pupils learned a lot today. Overall I feel we should be satisfied based on the background (particularly the experiences) we had in advance (lber112002).

Now I will move on to Sara's dialogue with Ina to show how Sara deals individually with the student teachers. At Ina's station the kids worked on a puzzle that is known as a magic square. The point is to collaborate on putting the numbers from 1-9 in their correct positions in a three-times-three square so that they total 15 in all the rows, both vertically and horizontally. Ina's first utterance focuses on how from the beginning the kids were active, but when they started to find it difficult they in a way

> (q18) dropped out, so then I needed to help them by hinting at what they needed to think about and things like that. And once I gave them a hint, they managed very quickly to do it (yeah) I don't know, I think most participated well. Or like – some dropped out, but like the others they – initially at least most took part. Might have dropped out a little bit eventually (mc112002, p. 3).

Here we can see how Ina starts to share her experience by following up the question Sara asked Eric in quote (q15): Did everyone in the group take part? Then came the following dialogue with Sara:

Dialogue 1:

(u1)Sara: Did they [the kids] collaborate or was only one of them front and centre [and putting numbers in the square]?

(u2)Ina: Yes, they mostly collaborated. One group wanted to try one-by-one and I let them.

(u3)Sara mm

(u4)Ina: They wanted to try one-by-one. It was like, no, now it's my turn, I want to try, I want to try – so first they all tried and then they collaborated a little bit more afterwards.

(u5)Sara: Did someone ever ask the others: What are you doing now? How are you thinking? Or gave the impression that they were not aware of what was going on?

(u6)Ina: I think Phil once said – now I don't understand what you're doing. And then they tried to explain what they were doing and then he joined in. (…) He got confused when everybody threw themselves into the exercise [the square] and started to summarise the numbers everywhere

(u7)Sara: Did anyone argue why they wanted to move [the numbers]?

(u8)Ina: Yes, it was like – yes, but this is too much because there are two big numbers and there are two small numbers, that's too little, so they changed a bit. And some groups just switched [the numbers] a bit randomly – because they could see how there were two big numbers together and then they switched with two small numbers, and then suddenly, they got it. Other groups worked more systematically – these three numbers make fifteen, and these three and these three.

(mc112002, p. 3)

Here we can see how Sara, through her questioning, helps Ina to focus more on the kids and their collaboration when Ina in quote (q18) starts out by saying that she helped them and then they could do it. Sara's questions in utterance (u5) and (u7) connect to and instantiate what they have decided the aim is to be; the kids are to develop their understanding of the place value system by sharing their knowledge, and the student teachers are to listen to and observe the collaboration so they can see how the kids did the task. Even if Ina starts by focusing on how she gave hints, we see from utterance (u6) and (u8) that she apparently has observed aspects of the kids' collaboration when she gets direct questions from Sara in utterance (u5) and (u7). As will be seen below, from her writings in the log book Ina has apparently been aware of their aim. We can also see how she seems to have developed her seeing skills through her teaching experience. With the first group of kids she was more preoccupied with what she should do rather than what the kids did:

> (q19) We were instructing at stations (our own plans, mathematics) and the environment group started with me. Then I was most focused on what I was going to do and not what they did. The activity went much faster than expected, because I had to give them small hints all the time to keep them interested. (I might perhaps have allowed them to work things out more on their own, but I had the feeling they only lost their concentration and their attention went elsewhere). When planning, we were particularly focused on having pupil-active learning with collaboration. The pupils were clearly active, but how well they cooperated varied from one group to the next. The group with Pam and Patrick initially wanted to try alone. One after the other tried without getting anywhere, and then they started to cooperate and then they solved the problem in a jiffy. It was really nice to see how five brains work better than one. I really think that everyone in the group understood what happened and what they did. I think they learned much more from cooperating. They double-checked each other's figures and found out together that they had prepared a magic square. I think they learned much more from cooperating here than if I (or a teacher) would have gone the round and helped each individual when they got stuck. Even if nobody would perhaps have managed alone without assistance, they all managed through cooperation. The fact that they as a group manage together ensures that each of them achieves something, I think (lbin112002).

So far we have seen how both Eric and Ina apparently have been aware of the aims in

their teaching; the kids have collaborated on the tasks and shared their knowledge, and Eric and Ina "have seen". But while Eric immediately started his narrative by focusing on the aims, Ina needed to be encouraged to do so. As seen through utterances (u5) and (u7) in dialogue 1, Sara renders visible or underscores what collaboration between the kids should entail. Apparently she uses her experience of how kids collaborate to instantiate the aim and this may help Ina to focus on what she saw.

Focusing on the aims they have agreed upon is a recurring and very clear feature of the way Sara deals with the student teachers' experiences. But as the quote below shows, it does not always turn out like this:

> (q20) I have attempted to recall what they have set as their aims, like getting a hold of them to keep the thread in sight. How did the aims fare? Did we manage to make the assessments? Did we achieve what we wanted? (...) But I also feel that very often they [the student teachers] have so much – they have so much on their minds after such an experience [teaching the kids]. They often need – and particularly some of them – to speak about their experiences of it [the teaching]. (...) They are so many [student teachers] and I think it's difficult – particularly when they have all been in action – and they often have been, of course – then I feel it's bad if I cut them off and only focus on one aspect that I think is important, if they don't think so. Because there might be something else they feel is equally important. And I think it's very important that they are allowed to state things afterwards, and that gives me a lot of thoughts, what they say afterwards and what they write in their log books about where they are (int041103, p. 7).

In the mentoring conversation used in this illustration Sara understands, as will be seen below, that Irene probably has not been focused on their aims in her teaching. The mathematical content at Irene's station was hundreds, tens and ones. She read numbers out loud and the kids were to put the digits in their correct positions by using labels with numbers. All the groups finished the task quickly at her station and, as Irene says: "(q21) I could have accomplished more, really, with these tasks, So I started to cut out more. Most knew what they were doing now. Some needed the system that now we're going to put the hundreds and the tens and the ones" (mc112002, p. 3). This was followed by the dialogue below between Irene and Sara:

Dialogue 2:

| | |
|---|---|
| (u1)Irene: | Paul had some problems; I just had to help him. |
| (u2)Sara: | Did his problems concern oral expression of the numbers or did he have problems putting them in position? |
| (u3)Irene: | He mostly had problems putting them in the right positions – especially the ones and tens – actually he got lost with the ones and tens. In fact, he immediately understood the position of the hundreds. But he expressed the numbers orally today, he did that at least. |
| (u4)Sara: | mm |
| (u5)Irene: | Has that been a problem for him before, to orally express the numbers? |
| (u6)Sara: | Yes, it has, but I feel that it has been coming along – it's starting to fall into place, but you heard when he counted at your station today, Eric, then he counted ninety-eight, ninety-nine, ninety-eleven and then he caught himself? Ninety-eleven? No, that'll be hundred and one. So he – he's probably in a phase where he needs lots of experiences with this. |
| (…) | |
| (u7)Irene: | Penny did not quite make it on her own – and I think that's because she feels so insecure and does |

things so carefully.
(u8)Sara: She's struggling with it (p. 5)
(u9)Irene: So I moved her – my intention was to have her – when there were three and two, or like one and two working together
(u10)Sara: Yes?
(u11)Irene: Then I thought she could work alone and Phil and Paula together, but I just had to switch around, because she doesn't manage to sit alone – so I moved Phil to sit alone, that was probably not the most perfect solution either -
(u12)Sara: But you saw possibilities there?
(u13)Irene: Yes. He – he just wanted to put down a sheet [with numbers] – he found it fun to read because he likes to read and ask the others, I think. But when he has to do something on his own it's a bit like, don't want to.
(u14)Sara: But maybe he feels insecure if he -
(u15)Irene: (interrupts Sara) but he can do it.
(u16)Sara: Yes, that's true
(u17)Irene: So I sat down with him and worked a bit together with him – and he knows the different number positions
(u18)Sara: mm
(mc112002, pp. 4-5)

Through Irene's description of the situation we see that the kids have probably not collaborated on the task. Some of them have been seated together but worked alone, and Irene is the one who helps the kids who are struggling. She does not mention collaboration between the kids, nor does Sara draw her attention to this. But as we can see from utterance (u3) and (u17), Irene has seen and can describe how each of the kids has solved the task. This exemplifies Sara's thinking from quote (q12) above; student teachers should feel that what they have done is not without some level of success. In Sara's opinion Irene had captured a lot of important things even if she was a little off when it came to the aim. Instead of mentioning the collaboration aim, we see from utterance (u10) and (u12) that Sara encourages Irene's description and the solution she tried to introduce.[108] This way Sara underlines the importance of what Irene has seen and described with respect to the kids and mathematics. This is a recurring trait of Sara's mentoring in the post-teaching conversations.[109]

To this point we have seen how Sara deals with each of the student teachers, exemplified by three of them and how they are treated differently. Sara's experience is that it is wise to let the student teachers talk about their own teaching experiences immediately; otherwise they may fail to pay attention during the discussions. The post-teaching conversations never end with the student teachers' stories about their experiences with the kids. Sara almost regularly summarises or initiates discussions through questions similar to the one she asks this time:

[108] I have no data on how Irene experienced this. Even if, as mentioned in Chapter 4, Sara encourages writing in the log book, the student teachers choose what and how often they will write. And, I was surprised to see that not all the student teachers were as preoccupied by mathematics as I am. Irene, for example, focused more on the Norwegian subject and social experiences with the kids in her log book.

[109] In Chapter 5 on page 100 I gave examples of the same feature when I showed how Sara reinforced what the student teachers did well in relation to the kids and mathematics.

"(q23) What were the aims of this round? Could you go back and check our plan. (...) Could we now say something about this?" (mc112002, p. 7).[110] Sara sees taking the student teachers back to their aims as a way of bringing them further along the way when there are many together; "(q24) There are five of them and they haven't taken part in the same things. (...) Spend more time to make them see the relations here and now and focus more on – or address what was the aim" (int052502, p. 7). She finds this to be important because her experience is that student teachers seldom ask each other questions or offer comments while they share their individual experiences. Sara sees summaries and discussions as ways of sharing their knowledge, what have we learned together from the teaching experiences with the kids?

*Focusing on aims, Illustration 2:*

This second illustration is constructed to show or highlight what I have identified to be Sara's overriding aim of focusing on aims in teaching; they help teachers to address kids' learning. Here I will present some "snapshots" into how Sara deals with Ina and Irene who were responsible for one station together in their fourth teaching period. A few examples from the other student teachers are used to enlighten Sara's actions. The snapshots are taken from a number of post-teaching conversations held between their teaching sessions over three succeeding days. This time the aim for the kids' learning is that they should develop their own way of calculating. To accomplish this each kid should calculate his or her own sums while collaborating in play activities. One consequence of this aim is that the student teachers should observe if all the kids manage to find their own way of calculating and ask questions that help the kids develop their own strategy. Sara is well aware of how adaptive teaching may be a challenge to the student teachers, but she tells them that adaptive teaching may be difficult with 27 kids, but by teaching small groups of kids it should be possible to adjust. However, Sara conveys to the student teachers that even if the aim is adaptive teaching it may turn out that they learn more about what each kid can do. We remember from quote (q12) above that she wants the student teachers to understand their own learning as an important part of student teaching. Moreover, learning what kids can do is an important part of a teacher's daily work. Through the quote below we understand Sara's way of connecting aims. She explains it like this:

[110] When dealing with the student teachers' individually, Sara never uses the word aim. However, as mentioned in Appendix 2 I have identified how her way of questioning connects to the aims they have agreed upon. I have not discussed this issue with Sara, but I believe that because she wants the student teachers to experience success, she brings in the aims as a common enterprise. As we have seen, some of the student teachers may have other things they want to share (q20) and, as Sara puts it, these are things that are important for them.

(q25) We have organised stations or activities so that we can adapt and [at the same time] have the possibility to see how different they [the kids] work and how it is possible to play 'tossing rings' on different levels and perform adaptive teaching while the kids do the same activity. (...) It gives a much greater opportunity to adapt things so the kids feel they are interacting and working together, but they actually get challenges on their different levels. (...) Such a way of working gives you [as a teacher] much insight (int052503, p. 3).

By teaching small groups the student teachers get close to the kids and thus can adapt to each of them and at the same time acquire the knowledge about the kids that is necessary for teaching.

I start this illustration with a dialogue that took place when the student teachers had been teaching one of the three groups of kids and were sharing their experiences in the post-teaching conversation. Ina and Irene want to change aspects of their teaching before they meet the next two groups of kids.[111] They have apparently experienced difficulties with the tossing rings activity at their station. The dialogue below shows that already before this first post-teaching conversation they have made some changes to this game as preparation for the next day:

Dialogue 3:

(u1)Sara: How did you carry out the tossing rings game?

(u2)Ina: We started – with the first group, things went quite well, it wasn't that windy.[112]

(u3)Sara: But how – how did they [the kids] count?

(u4)Ina: Used the hundreds that were marked

(u5)Irene: (interrupts Ina) Unfortunately, everything was up to a thousand.

(u6)Sara: Hundreds are marked on the game?

(u7)Ina: Yes, 100, 200, 500 points and then they could use plus and minus till they reached 1000 exactly.

(u8)Sara: Yes?

(u9)Irene: Made some smaller numbers now, Penny did not understand numbers over, did not understand large numbers (no) she even thought hundreds were difficult, tried to introduce friends of hundred and friends of thousand, to get a grip on the tens (yes).

(u10)Sara: It's really important to see that she doesn't have that great understanding of the base ten number system or the place value system – that she doesn't manage to transfer her knowledge of friends of ten to friends of hundred, can't think that if seven ones and three ones make ten, then seven tens and three tens must be hundred.

(u11)Irene: Now we have made it like this, one game where they shall reach 1000, one game to reach 500, one to get 100, we can change, at least there are smaller number on some of them (mm) put on new labels with numbers (mm), one with numbers below one hundred (yes).

(small pause)

(u12)Sara: Do you understand how they [the kids] calculate?

(mc040103, p. 1)

From utterance (u5) we understand that Irene recognises how the activity of tossing rings was not as adaptive as their aim was and they have decided to make some changes. They have seen that not all the kids manage to use the game as they intended to; to add numbers on their

[111] In all the post-teaching conversations which I have taken these "snapshots" from Sara and the whole student-teacher group are engaged in similar processes as those shown in Illustration 1.

[112] As mentioned in Chapter 4 on page 86 this station was situated outdoors and there were three different activities for the kids. Ina and Irene divided the group of eight kids in two. One group tossed rings while the other's skipped rope and then they changed. The third activity, working with a magic square puzzle, was done in the group as a whole. For the sake of this illustration I deal with the tossing rings activity.

own. Irene seems to be surprised that Penny does not manage large numbers (u9). In utterance (u10) Sara praises Irene for having seen that. And we see how these two student teachers have made three different games for the next two groups of kids so they will be more adaptive. In the last utterance, (u12) Sara draws their attention to the aim for the lesson by asking if they understand how the kids calculate. The aim for the kids' learning was to develop their own way of calculating and the student teachers were there to help them do this, but they will not be able to this if they do not understand how the kids calculate. The answer from Ina and Irene is that they found it difficult because they used a lot of energy just to group the kids and maintain their attention. Sara reminds them of how they had talked in the planning session that the kids should be aware of what they are to do; spend time on determining how they might calculate.[113]

Sara asked Eli and Eric, who shared the responsibility at one station, the same question as in utterance (u12) in the dialogue above. They could describe how the kids managed to find their own sums and gave examples of how they did this in different ways. When Ian, who was alone at one station, shares his experiences with the others he points out that the kids counted in their heads. He also describes how he has decided to "(q26) talk a bit more about rules because it turned out a bit (...) too much circus across the corridor, too much fun with a ball – too much noise and confusion, but they received good training with counting in their heads – they counted in their heads" (mc040103, p. 2). Sara follows up by saying that he perhaps also should

> (q27) establish that they [the kids] have to note down how they calculate. (...) Bowling is really a wonderful station and good practice for them, but then attention should be paid to having them calculate the sums and try to show – use the paper when they do it or if they don't use the paper but just state it (Ian says mm while she is saying this) (mc040103, p. 3).

As seen in quote (q26) Ian claims that the kids counted in their heads. Sara, however, tells them that she has seen how some of the kids who rapidly counted in their head took over and cried out the answers (as seen in quote (q25) on page 128 Sara with her experience could foresee this). She reminds Ian and the other student teachers of their aim; the kids should do their own calculation. The activities should not turn into a situation where some of the kids calculated for the others. Then these will be activities of doing, not developing calculating as was the aim for the teaching. Additionally, this was an aim for the student teachers' learning;

[113] In a pre-teaching conversation discussing "poetic text" in Norwegian, Sara has told the student teachers that in her opinion kids should know the aims of activities. This issue arose when one of the student teachers asked if they should tell the kids about the aim and Sara answered:" [I] think it's important for the kids' learning activities that they know what they're doing " (mcwu032103, p. 4).

see and understand how the kids calculated differently, as can be seen from the quote below:

> (q28) My intention was to make them [the student teachers] think about how they could use the organisation to – to make the kids write a bit, or could listen and talk – talk with the kids (int041103, p. 8). I especially thought this to be important so that the other student teachers could understand. (…) That there should be something concrete and not only, I believe they [the kids] did the math like this or so. So this was an aim for the student teachers' learning (int052503, p. 8).[114]

We see that Ian has been aware of how the kids should calculate, claiming they counted in their head. Ina and Irene have apparently also been aware of this, but as the dialogue below shows, the two of them found it difficult to explain to the kids that they should calculate on their own.

Dialogue 4:

| | |
|---|---|
| (u1)Ina: | Had a kind of plan on telling them, hopeless, difficult enough to make four of them stand there and listen. |
| (u2)Sara: | Have you thought about this for tomorrow, then? |
| (u3)Ina: | Tell them while they're inside, so we've planned to divide responsibility for the kids, in charge of four kids each. |
| (u4)Sara: | Now we see that as teachers we never become too good at organising – we always see new things we can organise, if we do it this way or that way things go much more smoothly, that's why we see that if we have stations, and repeat things four-five times it goes more smoothly eventually, precisely because we do like you're doing now – use the experiences gained the first time, adjust, and if we can keep our aims in mind – and just don't get stuck organising – but think – what do we want to accomplish? What's the learning for the kids in this? Then you've got to balance it so you don't get too much focus on learning so they don't recognise the game in it. |

(mc040103, pp. 1-2)

We remember from the previous chapter, quote (q26) on page 129 that in planning sessions Sara keeps organisation in the background because she is afraid the focus would be on technical matters and not on the kids. This can be seen as contradicting what she says: "(q29) focusing on the aim – and becoming aware of what I must do then – what is needed to – keep the thread leading to the aim. And that's really about organising and things like that" (int041103, p. 10). But Sara's idea is that the student teachers should experience how organising is connected to accomplishing aims. Sara argues:

> (q30) What's best is if they get to try some [teaching], and then they can reflect and then they get to try again (int041103, p. 3.). I really think it's a point that they should feel this a little – feel it and – feel their needs int041103, p. 11). Because when we start to plan then, then I have what I've experienced, and then I get to think in new ways (int052503, p. 21).

In utterance (u4) in the dialogue above we see how Sara's thoughts on experience, aims and organising are made visible to the student teachers.

With the next two groups of kids the student teachers organise in a way that apparently

[114] Actually, this is an example of the point I made above; the student teachers should in the second half of the post-teaching conversation share their experiences by discussing how different kids solved the tasks at each station.

makes it easier to listen to the kids. I continue to use Ina and Irene as an example. While these two female student teachers experienced the first day to be a bit chaotic, Ina describes the next two days like this:

> (q31) It functioned a little bit – better and better as the week progressed. The kids got more out of it eventually, too, I think. But – it might be rather limited what they learned in just that situation. (...) We didn't change the programme so much, we just changed the organisation a bit. We had the same things and the same way of doing it. We focused much more on telling each kid which task they had to do at each station, and what they should do. I explained it much more precisely than on the first day. (...) I learned a bit about how they calculate and think in different ways or – how they arrive at the answers. There was something that was very interesting – when they were playing with the rings, they were calculating, on paper. And some did it in their heads. It showed very clearly there, this understanding of the decimal system, whether they really understood it or not. There were some who had it licked up to the hundreds, but once they got into the thousands, the fifties became fives and the hundreds might become thousands. Just see how they – how it was difficult for them, to put it that way (intin, pp. 4-5).

The kids have apparently been working on mathematical activities beyond just playing games as Ina has observed how they struggle with their calculations. Ina has both seen and experienced how "the base ten number system" is difficult for some kids. Sara also acknowledges that the kids were involved in doing mathematics but as she says:

> (q32) When I was in there and looked they were at it, but I also found that they [the student teachers] did not – did not grab the opportunities they had for varying and adapting to each kid – they were working, but it was so simple for some [of the kids] that it was only – it was only the game. Should we simply only play – there was no challenge (int052503, p. 9).

The dialogue below, taken from the last post-teaching conversation of this teaching period shows how Irene experienced the adaptation as really challenging. Sara's first utterance (u1) in the dialogue below points back to an utterance Irene made earlier in the conversation when she shared her experiences with the others: "(q33) I introduced challenges yesterday. What Pam and Paula thought were good challenges did not work for Patrick, boring, boring [he said]" (mc040303, p. 2).[115]

Dialogue 5:

| | |
|---|---|
| (u1)Sara: | Like you said, Patrick found it boring. Maybe we could have changed the numbers in the game? |
| (u2)Irene: | There were quite different numbers, you could work with hundreds and then you had the tens, I believe there were really various numbers |
| (u3)Sara: | maybe another variation could be that when you toss a yellow ring you multiply by two or when the yellow ring lands in the hundreds you can multiply by two, try to adjust, try and do something about it if he thinks it's boring. |

[115] This is another example of how Sara in the second part of the post-teaching conversations raises the aims again. As mentioned, Irene's quote (q33) occurred while she was describing her experiences. Dialogue 5 occurred when they discussed how the activities at all stations could have been more adaptive to each kid. This issue came up because the student teachers, as seen, struggled with the adaptation. Sara's last utterance before the dialogue with Irene was: "Then we're talking about whether it might not be necessary to control it so hard, but when you're present and see that things are happening we don't want to happen, there's no learning for some who are not working, then we have to intervene and adjust so there's some activity" (mc040303, p. 4). And then Sara says "like you said.." and dialogue 5 took place.

(u4)Irene: In my opinion I provided a lot of challenges. Gave him the possibility to use both multiplication, minus and plus and – something that functioned yesterday did not function today
(u5)Sara: Sometimes you experience that the kids are not motivated, or not all the plans are always successful.
(u6)Irene: In my opinion I provided quite good challenges, but at the same time I asked if he may have had some ideas (yes) and I tried to get them [the kids] to write down their calculations on paper (yes).
(mc040303, p. 4)

From utterance (u6) in the dialogue above we see that Sara by uttering yes praises Irene for what she has done. And apparently Irene bears in mind their agreement or their aim, the kids should be challenged and they should write down their calculations. Irene admits that she finds it challenging to teach mathematics, and explains it like this:

> (q34) I feel that it must be possible to make it fun, but I don't know how to do this – I'm trying desperately to be creative in a subject – but I believe that everyone might do well in maths if they receive the right assistance along the way – Sara is innovative in what she's doing – making them talk about how the math they're doing is really difficult – finding the right language is a challenge – have poor language myself in maths so it's difficult to help others – don't have adequate skills in maths to teach it (intir, p. 1).

Reflecting on her experiences of how the student teachers performed and talked about their teaching in this illustration Sara thinks:

> (q35) And so I'm sitting and – thinking about this, when there's such a focus on organisation. They might have organised this better, that might have worked better for all the kids.[116] Everybody might have benefited more – but then I also think that I've got to remember that these are first-year student teachers, and some of what we've been talking about as most important to accomplish, is really that they communicate with the kids. Perhaps I'm expecting too much from first-year student teachers. There's this balance here too – actually we should be impressed that they initiate these stations and show the kids the way and do this (int040303, p. 9).

Sara finds that due to a lack of experience some of the student teachers probably "(q36) have their hands full just organising at times – and think about the aims and see the kids and their learning in the middle of this" (int052503, p. 12). She also points out that it is demanding to deal with several aims at the same time and "(q37) have variation so that everybody has challenges – in the same game – it's too much to organise for them" (int050503, p. 21). She says to the student teachers: "(q38) But we also become much better at organising and structuring to satisfy our aims. And of course this is an endless discussion, do we structure and organise the kids too much so they aren't allowed any input? That might happen" (mc040303, p. 3).

## *How can the story be understood?*

We have seen that Sara encourages the student teachers to explore and learn about kids

[116] In an interview (int040303) Sara acknowledges that what Irene in this example (and other student teachers other times) conceives as challenges may not be experienced as such by the kids.

through the experience of teaching mathematics. This is accomplished by observing the kids, being in dialogue with them, talking with each of them and listening to their collaboration while teaching. The student teachers also need to see this as an important part of their work as teachers in the future; they should be good at seeing. Aims are used as looking glasses in this process; they become the focal points for the student teachers' seeing. As will be seen below, Sara's way of thinking about student teachers' learning is much attuned to Dewey's philosophy of educative experiences. In answer to criticism of his progressive education, Dewey (1938) emphasises the important role of the educator, or the more mature person in the novice's process of learning from experience.[117] According to Dewey, it is the responsibility of the more mature person, in this case the cooperating teacher, to prepare for and assist novices to learn optimally from experience. I will argue that the way Sara focuses on aims in the story told above can be understood in light of Dewey's claim as the aims both prepare for and assist the student teachers' chances of learning from the experience of teaching.

As mentioned in the introduction to this chapter, the pervasive myth that learning from experience is all one needs to become a teacher is questioned. In a similar way, Dewey (1938) stresses that experience and education cannot be directly equated to each other. He maintains that "the more definitely and sincerely it is held that education is a development within, by, and for experience, the more important is it that there shall be clear conceptions of what experience is" (p. 28). It must be framed with reference to what is to be done and how it is to be done. The cooperating teacher should arrange the physical and social conditions in such a way that learners have growth-producing or educative experiences. Turning to Dewey again: "The belief that all genuine education comes about through experience does not mean that all experiences are genuinely or equally educative" (p. 25). As mentioned on page 142, Dewey emphasises two intertwined principles which he sees as fundamental in the construction of experiences that are worthwhile or educative: the principles of *continuity* and of *interaction*. The first principle points out that the future has to be taken into account at every stage of the educational process. In the second principle, interaction clarifies how an individual's needs and capacities interact with the provided environment. In their active union with each other

[117] Due to experience of how his educational thoughts had been put into practice in American schools during the first decades of the previous century, Dewey (1938) pointed out in his book "Experience & Education" that it is odd that teachers were excluded as members of the group. He claimed that this was a reaction from one extreme to another, maintaining that it is an idea too absurd to require refutation that the children are seen as individuals whose freedom should be respected while the more mature person should have no freedom as an individual. He emphasizes: "Just because traditional education was a matter of routine in which the plans and programs were handed down from the past, it does not follow that progressive education is a matter of planless improvisation" (Dewey 1938, p. 28).

these two principles provide the measure of the educative significance and value of experience. Below I will develop further what is meant by these two principles and how they can be useful in understanding and interpreting Sara's actions. I will start by outlining the principle of continuity and show how Sara's focus on aims connects to this.

Through the principle of continuity of experiences, or the experimental continuum, Dewey (1938) explains that educative experiences are connected to each other. This means that "every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after" (p. 35). Educative experiences are experiences that promote rather than retard future growth and lead to richer subsequent experiences. Everything depends upon the quality of the experience which is had. The quality of any experience has two aspects. The first, an immediate aspect of agreeableness or disagreeableness is, according to Dewey (1938), obvious and easy to judge. The second aspect, the effect or its influence upon later experiences, is not "borne on its face" (p. 27).[118] This places responsibility on the shoulders of the educator. It is the job of the cooperating teacher to arrange for the kind of experiences which do not discourage the student teachers, but rather engage their activities, which are more than immediately enjoyable as they promote having desirable future experience. The challenge to an education based upon experience is to select the kind of present experiences that live fruitfully and creatively in subsequent experiences. While each experience is agreeable or even exciting in itself, experiences may be so disconnected from one another that they are not linked cumulatively to one another. Dewey (1938) claims that "each experience may be lively, vivid, and 'interesting,' and yet their disconnectedness may artificially generate dispersive, disintegrated, centrifugal habits. The consequence of formation of such habits is inability to control future experiences" (p. 26).

The principle of continuity rests upon what Dewey (1938) calls "the fact of habit" (p. 35), the basic characteristic of which is that every experience enacted and undergone modifies the one who acts and undergoes. Whether we want it to or not, this modification affects the quality of subsequent experiences; for it is a somewhat different person who enters into them. Dewey's use of the word habit covers the formation of emotional and intellectual attitudes; it covers our basic sensitivities and ways of meeting and responding to all the conditions which we meet in daily life. It obviously goes deeper than the ordinary conception of a habit as a

[118] Dewey developed these ideas with schools in mind. I think it is appropriate and interesting to point back to the previous chapter where Sara tried to make the student teachers' activities for the kids something more than just fun, or to refer to Dewey, from an immediate aspect of agreeableness to what mathematics could be learned; the influence upon later experiences.

more or less fixed way of doing things.

Sara's way of mentoring connects to the principle of continuity in different ways, or I might say on different planes. To understand what is meant by this I have to argue beyond the evidence provided in the story in this chapter and point back to other parts of the research text. The key word is aims.[119] Sara has both long-term and short-term aims that guide her way of mentoring. The first one is probably hidden for the student teachers. Actually, it is part of the answer to my research question. In Chapter 3 I argued that Sara has a long-term aim for her way of mentoring mathematics. She wants the student teachers to understand how kids learn and develop mathematics and how teaching relates to this. In the two previous chapters we have seen how this long-term aim affects Sara's actions. In Chapter 5 we learned how she turned the student teachers' attention towards the kids from the very start of their student teaching. In Chapter 6 we saw how she found it wise to guide the student teachers' planning to help them see kids' learning as the important part of teaching. In the story told in this chapter Sara focuses on how the student teachers can address both the kids' learning and their own learning through the experience of teaching. Thus she provides the student teachers with experiences that are connected to each other over the entire six-week period of their collaboration.

Moreover, through the story told in this chapter we understand from the two quotes (q3) and (q5) that Sara wants the student teachers to develop a habit of mind or emotional and intellectual attitudes for talking with and observing kids in their daily work as future teachers. Thus Sara connects student teachers' current and future needs, or to echo Dewey (1904), Sara's immediate aims have an ultimate aim. Dewey uses the words immediate and ultimate aim to emphasise the importance of making student teachers thoughtful and alert students of education rather than focusing on attaining immediate proficiency. He explains it like this:

> The *immediate* aim, the way at getting at the ultimate aim, is to supply the intellectual method and material of good workmanship, instead of making on the spot, as it were, an efficient workman (p. 143). (…) It aims, in a word, at control of the intellectual methods required for personal and independent mastery of practical skill, rather than at turning out at once masters of the craft (p. 144, italics in original).

In all the three chapters 5 to 7 we have seen how Sara justifies her actions in different ways by pointing out that her aim is to avoid the student teachers becoming what she refers to as technical teachers who simply deliver subject matter. Student teachers need to see and understand other aspects of teaching. An important part of good workmanship, as expressed by Dewey, is to develop the competence of what Sara calls seeing. Sara apparently finds the

[119] I will return to criteria of what Dewey calls good aims later in this section.

aims to be the looking glasses that assist student teachers in this process. Sara's focus on the aims has a long-term or an ultimate aim.

One example of the principle of continuity is growth, not only physical but also intellectual and moral growth. But growth can develop in many directions, and not all of them are desirable. As an example Dewey (1938) mentions that through experiences a man can grow into a highly expert burglar or a corrupt politician, and, I would like to add, a teacher who is not able to see the kids and their learning. Therefore Dewey argues that the direction in which growth takes place must be specified. It is, he claims, the task of the educator to see what direction an experience is heading in. The cooperating teacher should be on the alert to see what attitudes and habitual tendencies are being created. She[120] must, if she is an educator, be able to judge what attitudes are actually conducive to continued growth and what are detrimental to this. Illustration 2 shows us that Sara understands that the way the student teachers understand and interpret their experiences may head in wrong directions. Ian found the kids to be unruly (q26) and Irene experienced that one of the boys became bored (q33). Sara apparently understands how the student teachers are on their way to blaming the children, and by reminding them of the aims, Sara's intention is to make the student teachers see things from another perspective. Did the kids know the aims of the activity? Perhaps the tasks were not challenging enough or the organisation could have been better? As Sara sees where the student teachers' experiences are heading she helps them to see how they can organise conditions that make them and also the kids capable of accomplishing the aims; through adaptive activities the kids are to develop their competence in calculating and the student teachers are to develop their understanding of how the kids do this. By referring back to my socio-cultural framework and the previous chapter, I maintain that Sara uses the aims as a tool to help keep the student teachers on track.

According to Dewey (1938), there is no point in the cooperating teacher being more mature if she wastes her insight instead of using it to help organise the novice's conditions of the experience. The relation of the present to the future is not an either-or situation; the present always affects the future. As Dewey sees it, the persons who have achieved maturity in a case are the ones who should have some idea of the connection between the present and the future. In this case Sara is the one who knows what it takes to perform the adaptive, interactive teaching forms emphasised in C-97. As we have seen in the two previous chapters, through their apprenticeship of observation (Lortie 1975) student teachers most probably have

[120] Dewey uses male pronouns in his writings. I will do the same in direct quotations; otherwise I will use female pronouns when talking about the cooperating teacher, also when I refer to Dewey's work.

no idea of this. Hence, the responsibility for instituting the conditions for the kind of present experience which has a favourable affect upon the future rests upon the educators. As seen in quote (q5) Sara knows that as teachers the student teachers "have to be good at seeing" to learn about the kids and accomplish adaptive teaching approaches. Hence, even if they have immediate aims for their lessons, Sara focuses beyond this, as we can see in the way she deals with Irene in Illustration 1 and how she reflects on the student teachers' experiences in Illustration 2. In the first case Irene has really seen how individual kids solved the problem. In the second case Sara found that even if the aim of adaptive teaching was not attained at all the stations, the student teachers apparently were aware of how the aims should guide their organisation. These are experiences for the future.

Dewey (1938) maintains that on any given occasion the more mature person has no right to withhold from the younger person whatever sympathetic understanding his own experience has given him. Education as growth or maturity should be an ever-present process, also for Sara as a cooperating teacher. Moreover, Dewey (1938) claims that "failure to take the moving force of an experience into account so as to judge and direct it on to the ground of what it is moving into means disloyalty to the principle of experience itself" (p. 38). This disloyalty operates in two directions. First, as mentioned above, the educator is disloyal to the understanding she should have obtained from her own past experience. Second, she is disloyal to the fact that all human experience is ultimately social; it involves contact and communication.[121]

To understand how Sara is loyal to the understanding she has obtained from her past experiences I once more need to point back to other parts of the research text. Sara often refers to how through her work as a cooperating teacher she has become aware of important aspects of her job. These experiences have great impact on how she collaborates with Eli, Eric, Irene, Ian and Ina. We could see in Chapter 5 that Sara's previous experiences informed the way she started this student-teacher group's field experiences. In the previous chapter we learned that through experiences she found it wise to guide the student teachers' planning. This will ensure a teaching approach that will provide the student teachers with the experiences they need to understand and develop what Dewey (1904) refers to as good workmanship instead of being craft persons. They need to come close to the kids and develop

[121] This is, as we remember from Chapter 2, an important feature of socio-cultural theory; Vygotsky claims that an individual's intramental functioning depends upon her or his experiences in intermental settings (1981a). As such this is an example of my claim in Chapter 3 and Appendix 2 that Dewey's writings bear similarities to socio-cultural theory. Dewey claims that the principle of interaction means that education is essentially a social process. I will come back to this point later in this section.

a habit of seeing. The story told in this chapter also showed us how Sara is true to the understanding she gains from her experience of collaborating with this group of student teachers; she has to know them and deal with them individually. This is an important part of what Dewey (1938) calls the second chief principle for interpreting an experience in its educational function force; interaction. Below I will outline what is meant by this principle and show how Sara's way of dealing with each of the student teachers connects to this.

Interaction means that internal and objective conditions in experiences are equal; any normal experience is an interaction of these two conditions. The idea of internal conditions refers to how experiences influence the formation of attitudes of desire and purpose; what is going on inside a person. This has already been touched upon above when we looked at the notion of "fact of habit". But experiences are constantly fed from sources outside the individuals, referred to as objective conditions by Dewey. Throughout life we live in a world of persons and things that by and large measure what life is according to what has been done and transmitted from previous human activities.[122] To illustrate this Dewey mentions how a country boy will have different experiences from a city boy. On the microgenesis plane and for this case study, student teachers in what can be understood as traditional or conservative settings[123] will have other experiences than those who are with Sara. When objective conditions are ignored, experience is treated as if it were something which takes place exclusively inside an individual's body and mind. Taken together, or in their interaction, internal and objective conditions form what Dewey calls a situation; individuals live in a series of situations.

The two concepts of situation and interaction cannot be separated from each other. An experience is always what it is because of a transaction between an individual and what, at the time of the experience, constitutes her environment. This environment could consist of persons with whom she is talking about some topic or event, for instance kids doing mathematics. Important to note is that the subject talked about also is part of the situation. The environment can also be the book one is reading and the topic of that particular book. Thus the environment is whatever conditions are interacting with personal needs, desires, purposes and capacities to create the experience in question. Through the notion of situation we understand how the two principles of continuity and interaction are not separate from each other but must be seen as the longitudinal and lateral aspects of experiences. Different situations succeed one another, and because of the principle of continuity something is carried

[122] This is also an important feature of socio-cultural theory as outlined in Chapter 2.
[123] In Norway this is not uncommon for student teachers' field experiences, according to Sundli (2001).

over from the earlier to the later ones. The environment or the world of an individual expands as she passes from one situation to another. Dewey (1938) maintains that what is learned by way of knowledge and skill in one situation becomes an instrument of understanding and dealing effectively with situations which follow. This process persists as long as life and learning continue.[124] The immediate and direct concern of an educator is the situations in which interaction takes place. Because the individual who enters as a factor into the situation is what she is at any given time, Dewey claims that what places responsibility on educators is the importance of objective conditions; they can to some extent be regulated by cooperating teachers.

The phrase "objective conditions" includes both what is done by the educator and the way in which it is done; not only words spoken but the tone of the voice in which they are spoken. It also includes available materials, or to put it another way "the total *social* set-up of the situations in which a person is engaged" (Dewey 1938, p. 45, italics in original). Cooperating teachers should not only be aware of how actual experiences are shaped by environmental conditions; they should also recognise which surroundings are conducive to having experiences that lead to growth. As expressed by Dewey (1938), "above all, they [the educators] should know how to utilise the surroundings, physical and social, that exist so as to extract from them all that they have to contribute to building up experiences that are worth while" (p. 40). But if there is a lack of mutual adaptation between internal and objective conditions, the process of learning and mentoring will be by accident. Therefore, responsibility for selecting objective conditions carries with it the responsibility for understanding the needs and capacities of the individuals who are learning at any given time. It is not enough for the cooperating teacher to take into account how certain materials, methods and ways of interacting have proved effective with other individuals at other times. Moreover, there must be a reason for thinking that they will function in generating an experience that has educative quality with particular individuals at a particular time. Dewey (1938) maintains that "the principle of interaction makes it clear that failure of adaptation of material to needs and capacities of individuals may cause an experience to be non-educative quite as much as failure of an individual to adapt himself to the material" (pp. 46-47). Thus the educator must have an understanding of individuals as individuals which gives her an idea of what is actually going on in the minds of those who are learning.[125]

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[124] This will be elaborated in the last section of this chapter where I discuss "What could be the educative value for the student teachers?"

[125] Orland (1997) shows in a study that teachers develop into mentors or cooperating teachers as they

As we have seen, Sara has become aware of her responsibility to address the fact that student teachers have different needs, wishes and expectations (q11). Hence they need different experiences, or to put it another way, they differ in what they can gain from their experience of teaching the kids. They have different capacities to see, to use Sara's words, and they probably also have aims of their own beyond their common focus.[126] From the story told in this chapter we have seen how Sara takes advantage of the objective conditions, or utilises the surroundings around the way they teach to encourage educative experiences for each of the student teachers. By planning and performing teaching with small groups of kids rotating between stations, the student teachers are allowed to gain experiences in accordance with their individual wishes and capacities. In Illustration 1, we saw how through a flexible attitude Sara encourages the student teachers' own descriptions of their teaching. She utilises the situation to praise and highlight what they have experienced and seen. Apparently the long-term or ultimate aim that guides her actions assists her. Through collaborative planning and post-teaching discussions Sara takes into account the social aspect of learning as emphasised in socio-cultural theories; intramental functioning originates intermentally (Vygotsky 1978). Taking them back to the aims, we understand through quote (q23) and (q24) that Sara's intention is to discuss what they as a group have learned from their individual experiences of teaching the kids.

Even if Dewey (1938) sees the objective conditions as the responsibility of the cooperating teacher, he claims that they should not impose on the novice. To avoid this he underscores "the importance of the participation of the learner in the formation of the purposes which direct his activities in the learning process" (p. 67). Noddings (1995) maintains that Dewey uses purpose and aims as synonyms; in the quote above he thus points out how the learner or the novice should influence the aims of her process of learning. But according to Dewey (1938), one needs to understand what a purpose or an aim is and how it arises and functions in experience:

> A genuine purpose always starts with an impulse, but a purpose differs from an original impulse and desire through its translation into a plan and method of action based upon foresight of the consequences of acting under given observed conditions in a certain way (p. 69).

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understand the importance of "tuning in" to the student teachers.

[126] Through quote (q11) from Sara we understand how these student teachers have different expectations or aims, even if together they develop shared aims for their teaching. I do not know this, I only know, as pointed out in Chapter 4, that they differ in their expectations. Both in the previous and current chapter I have shown how they agree upon shared aims both for the kids' and their own learning. However, not all of them talk and I have no evidence of how this is understood by each of them. Nonetheless, from the story told in this chapter there is evidence to claim that they all in some ways are aware of the aims but differ in the way they manage to realise them.

The occurrence of a wish and impulse is not the final end, but an occasion that requires the formation of a plan and method of activity. In his theory of educative experiences Dewey maintains that the cooperating teacher's task is to see that the occasion is taken advantage of. We have already looked into how Sara addresses this in both this and the previous chapter. Sara used the planning sessions to help the student teachers develop their impulses and wishes into activities that promote the kids' learning; they developed aims for the kids' learning. Moreover, building on this, Sara invites and assists the student teachers in developing aims for their own learning as seen in quote (q1). The occasion involves developing what Dewey (1916) characterises as one criterion of a good aim: "The aim set up must be an outgrowth of existing conditions. It must be based upon considerations of what is already going on" (p. 104). Moreover, as seen below, the way Sara acknowledges the student teachers' different needs and wishes and the way she makes use of the aims satisfy other criteria for what Dewey calls good aims related to educative experiences.

According to Dewey (1916), "an educational aim must be founded upon the intrinsic activities and needs (including original instincts and acquired habits) of the given individual to be educated" (pp. 107-108). Thus aims must not be so uniform as to neglect the specific powers and requirements of an individual. Therefore, a good aim has to be flexible so it can be altered to accommodate whatever circumstances are present. Aims are never divorced from conditions. The planning must be flexible enough to provide room for individuality of experience and yet firm enough to give direction to continuous development of power (Dewey 1916, 1938). Educational aims direct the activities, but usually, at least when acted upon in complicated situations, they bring to light conditions which have been overlooked. This calls for a revision of the original aim. Otherwise it "does harm". Dewey (1916) expresses as follows:

> Any aim is of value so far as it assists observation, choice, and planning in carrying on activity from moment to moment and hour to hour; if it gets in the way of the individual's own common sense (as it will surely do if imposed from without or accepted on authority) it does harm (p. 107).

Even if the aims that are developed together assist both Sara's and the student teachers' actions, they are used flexibly and provide room for individuality of experience. This was particularly evident in Illustration 1.

According to Dewey, the principle that development of experience arises out of interaction means that education is essentially a social process. He also maintains that this quality is realised in the degree to which individuals form a community group. In the previous chapter I showed that the collaboration between Sara and the student teachers has

obvious similarities with what in a socio-cultural tradition is known as "communities of practice" (Wenger 1998), and this can be seen as a redefinition of the ancient apprenticeship model: "The decisive factor is not the master but a community of practice" (Rasmussen 1999, p. 204, my translation). This definition acknowledges that the master or the expert is relatively more skilled than the novices within the particular socio-cultural setting they belong to as a community group. But, "the expert too is still developing breadth and depth of understanding in the process of carrying out the activity and guiding others in it" (Rogoff 1990, p. 39). Through the concept of educative experiences Dewey (1938) underscores the importance of acknowledging the more mature person as a member of the community group. Above we saw that not taking into account that experience is a social process is disloyal to the principle of experience. Dewey (1938) finds it "impossible to understand why a suggestion from one who has a larger experience and a wider horizon should not be at least as valid as a suggestion arising from some more or less accidental source" (p. 71). He admits that it is of course possible "to abuse the office" and to force the activity of the novices into channels which express the more mature person's, or in this case, the cooperating teacher's purpose rather than that of the novices. But the way to avoid this danger is not for her to withdraw entirely.[127]

The way, as already mentioned above, is first for the cooperating teacher to be keenly aware of the capacities, needs and past experiences of those under instruction, and, secondly, to allow the suggestion made to develop into a plan and project by means of the further suggestions contributed and organised into a whole by the members of the group. The plan, in other words, is a co-operative enterprise, not a dictate. The development of a plan occurs through reciprocal give-and-take, the cooperating teacher taking but not being afraid also to give. The essential point is that the purpose or aim evolves and takes shape through the process of social intelligence. When education is based upon experience and educative experiences are seen to be a social process, the more mature person should lead the group activities. Dewey (1938) adds: "Since freedom[128] resides in the operations of intelligent

[127] I find it appropriate to remind of how Dewey (1938) developed his philosophy of educative experiences as a response to a critique of his progressive education. He asserts that "basing education upon personal experience may mean more multiplied and more intimate contact between the mature and the immature than ever existed in the traditional school, and consequently more, rather than less, guidance by others. The problem, then, is: how these contacts can be established without violating the principle of learning through personal experience. The solution of this problem requires a well thought-out philosophy of the social factors that operate in the constitution of individual experience" (p. 21).

[128] The following three quotes from Dewey's writings illustrate what is meant by the concept of freedom: "Freedom means essentially the part played by thinking – which is personal – in learning; - it means intellectual initiative, independence in observation, judicious invention, foresight of consequences, and ingenuity of adaptation to them" (1916, p. 302). "But the essence of the demand for freedom is the need of conditions which will enable an individual to make his own special contribution to a group interest, and to partake of its activities

operations and judgement by which a purpose is developed, guidance given by the [cooperating] teacher to the exercise of the pupil's [student teachers'] intelligence is an aid to freedom, not a restriction upon it" (p. 71).

Some of the points Dewey makes here are similar to Skagen's (2000) contention that the cooperating teacher in Norway has abdicated or become invisible over recent decades. He claims that at times the cooperating teachers appear to be afraid to make suggestions to the members of a group of student teachers, apparently due to the strong emphasis on reflection and development of reflective practitioners that has been prevalent since the early eighties. This was in part inspired by the work of Schön (1983, 1987), while in Norway Handal & Lauvås' (1983) model of reflective supervision had major impact. The idea was to extend the student teachers' awareness from the aspect of "doing" or external behaviour to a more internal or reflective approach to teaching. One reason for this new way of thinking was the apprehension that cooperating teachers were too authoritative.[129] There was a shift from modelling, instruction and transfer of "tricks of the trade" to emphasising reasoning and reflection. The problem, according to Skagen (2000), is that the cooperating teacher, just like the teacher in the realisation of Dewey's progressive education, has become invisible. It looks like there has been a shift from "do as I say", where the cooperating teacher dominates and instructs and the student teachers have no room for their own ideas, to "do as you say", where the cooperating teacher becomes invisible for fear of not giving the student teachers room for their thoughts and ideas. As Dewey (1938) says:

> When external control is rejected, the problem becomes that of finding the factors of control that are inherent within experience. When external authority is rejected, it does not follow that all authority should be rejected, but rather that there is need to search for a more effective source of authority. Because the older education imposed the knowledge, methods, and the rules of conduct of the more mature person upon the young, it does not follow, except upon the basis of the extreme *Either-Or* philosophy, that the knowledge and skill of the mature person has no direct value for the experience of the immature (p. 21, italics in original).

Within a socio-cultural framework of situated, assisted learning as outlined in Chapter 2 it is natural to assert the importance of "we'll do it together". Within such a framework we understand through Dewey's writings how the cooperating teacher, without imposing on the novices, can have the legacy of being the "expert authority" which Skagen (2000) claims has been lost. Through mentoring understood within such a framework the cooperating teacher

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in such ways that social guidance shall be a matter of his own mental attitude, and not a mere authoritative dictation of his acts" (1916, p. 301). "The only freedom that is of enduring importance is freedom of intelligence, that is to say, freedom of observation and of judgement exercised in behalf of purposes that are intrinsically worth while" (1938, p. 61).

[129] I use the word "apprehension" because according to Skagen (2000) there was no empirical research on which to base this claim; it was based upon experiences.

will never transfer her competence or experiences to the student teachers. Her role is to arrange circumstances or provide objective conditions so the student teachers can acquire and develop knowledge, skills and attitudes (Lyngsnes & Rismark 2000).

To summarise: throughout this discussion I have shown how the concept of educative experience helps us to understand what happens between Sara and the student teachers in the post-teaching conversations. I have argued that through her focus on aims as looking glasses, Sara enhances the student teachers' learning from the experience of teaching. I have argued that Sara's use of aims fulfils Dewey's criteria of how they should develop from the student teachers' own impulses and wishes and be used flexibly. According to Dewey (1938) this is necessary for an experience to be educative for each individual as members of groups. In the last section of this chapter I will use theory and research results to discuss how Sara's way of encouraging student teachers' seeing through the experience of teaching can have significance for their development of pedagogical content knowledge in mathematics.

## *What could be the educative value for the student teachers?*

The story in this chapter has told us that the student teachers have been encouraged by Sara to learn from their experience of pursuing an interactive, constructivist teaching approach. Though difficult for novices,[130] as mentioned in the previous chapter, it is acknowledged that the planning and performing of such teaching are important aspects of student teachers' learning (see for example Edwards & Collison 1996, Zeichner 1996). Teacher educators have to accept that student teachers essentially have two jobs; they have to teach and they have to learn to teach. It is the responsibility of the cooperating teacher to help student teachers balance this double role as “teachers of students and students of teaching” (see for example Dewey 1904, Edwards & Collison 1996, Grossman 1990, Lowery 2002, Schön 1987, Wildman et al.1989).[131] Lowery (2002) puts it as follows: "Teaching strategies were planned, implemented, adjusted, and evaluated by the preservice teachers as both teacher and learner" (p. 10).

This means that field experiences "should be pursued primarily with reference to its reaction upon the professional pupil in making him a thoughtful and alert student of education, rather than to help him get immediate proficiency" (Dewey 1904, p. 151). Otherwise, as seen in the previous section of this chapter, immediate skill may be acquired at

[130] And with reference to footnote 79 I would claim probably also for some experienced teachers.

[131] As mentioned on page 1, Edwards and Collison (1996) find that student teachers have problems acknowledging this. They want to be seen and act as competent practitioners.

the cost of the ability to continue growing. According to Tharp & Gallimore (1988), the practice field must be a setting that assists student teachers in performing new skills before they become fully competent. Student teachers must be allowed to be learners (Edwards & Collison 1996). As a consequence, "purposes of learning to teach cannot automatically be subordinated to the aim of pupil learning. [Cooperating] teachers must see themselves also as teacher educators willing to plan for the learning of a novice" (Feiman-Nemser & Buchman 1985, p. 64). We have seen in quote (q2) that in her work Sara has learned that student teachers should be allowed to be learners. Throughout the story told in this chapter we have seen that Sara's intention is to facilitate for both the kids' and the student teachers' learning by connecting their aims; the aims for the kids' learning become looking glasses that encourage the student teachers' learning. As seen in the two quotes (q35) and (q37), Sara acknowledges that it is not easy to perform interactive, adaptive teaching. At the same time she expresses that the student teachers need experience. She encourages them to think that even if they do not feel they have performed successful teaching they should think about what they have learned from the experience (q12).

Throughout this research text I have repeatedly touched upon how the Norwegian national curriculum, C-97, and the mathematics syllabus promote learning environments that encourage implementation of a constructivist learning perspective in mathematics (Kleve 2004). I have further argued that Sara's beliefs about teaching mathematics and the way she conveys this to the student teachers is attuned to such a teaching approach. In Chapter 5 I told that research findings show that for such adaptive teaching forms, knowing the pupils on the local level may be the most important part of pedagogical content knowledge for teaching in primary school (Hasweh 2005, Marks 1990, McCaughtry 2005). Being able to adapt teaching to meet the needs of pupils exemplifies development of pedagogical content knowledge (Lowery 2002). Such knowledge cannot be learned through coursework or by reading books. It is developed from the experience of teaching specific pupils over time. Thus it is both a prerequisite for and develops through teaching. The following quote from Eli shows how she has recognised this:

> What she's about – Sara manages to attain this – manages to have each of them learn. She knows the pupils so well that she like – there's really a lot of adaptation in the way she does things – and that's a trick we need to try and develop I think – so this is really a great challenge. It must – it really takes many years – of always developing. But actually really being aware that you must develop continuously, you're never finished – you're never a good enough teacher, if only, if you're aware of this, then I think that you've come a long way along the road. Or at least are in the process of getting there (intel, p. 2).

By paying attention to the importance of local knowledge of pupils we may understand why

student teachers find it difficult to carry out interactive, adaptive teaching approaches. They do not simply inherit this knowledge.[132] However, in quote (q6) we can see that Sara finds it important that student teachers develop a habit of mind and competence in listening to the kids to both acknowledge the importance of and develop such knowledge, not only as student teachers but also as part of their daily work as future teachers. As will be seen below, scholars and researchers support this trait of Sara's thinking and see it as fundamental in helping student teachers to accomplish interactive, constructivist teaching of mathematics (Se for example Ball 2000, Ball & Cohen 1999, Dewey 1938, Hawkins 2000, Lowery 2002, Wolf 2003).

Undoubtedly the task of the teacher is to connect the pupil to the subject matter. Hawkins (1974) argues that without the subject matter which he calls "the it", the teacher and the pupil, "the I and thou" have no reason to meet. Successful teaching depends upon the teacher's ability to provide connections or bridges between the learner and what should be learned. According to Hawkins (2000), teaching with the aim of covering the curriculum is easy, but to actually teach so that pupils learn is an art.[133] Moreover, he connects this art to listening to the kids:

> The great teaching art is that of observing and listening, of searching for clues, and of then providing that which may steady and further a budding curiosity, or failing, may lead to further clues. It is as profoundly inductive, in its own way, as children's own learning should be. Teachers, in their own differently ordered minds, can often convict children of error, when in fact, the children's statements are right answers to questions different from those the teachers' thought they had asked (pp. 24-25).

According to Hawkins, texts can serve as resources in teaching, but not guides. The children and their learning are the guides that give the teacher the necessary clues about when, how and how much to intervene or carry on. As Dewey (1933) claims: "the problem of the pupils is found in *subject matter;* the problem of teachers is *what the minds of pupils are doing with the subject matter.* (…) The teacher has to be a student of the pupil's mind" (p. 275, italics in original). The teacher must "understand the child's understanding" (p. 83) as Duckworth (1987) puts it. Sara has repeatedly focused on how she wants the student teachers to not only explore what and how kids think, but also acknowledge the kids as resources. This is mirrored

[132] As seen in the previous chapter, there may also be a lack of both subject matter knowledge and other aspects of pedagogical content knowledge. Profound subject matter knowledge is seen as essential for using interactive, constructivist teaching forms (see for example Ball 2000, Dewey 1904, 1933, 1938, Hawkins 1974, 2000).

[133] Dewey (1933) asserts that we cannot claim that there has been teaching unless there has been learning. He uses an analogy from trading to illustrate this: "No one can sell unless someone buys. We should ridicule a merchant who said that he had sold a great many goods although no one had bought any. But perhaps there are teachers who think they have done a good day's teaching irrespective of what pupils have learned. There is the same exact equation between teaching and learning that there is between selling and buying" (pp. 35-36).

by a quote from Ball and Cohen (1999):

> [Teachers] would need to become insightful in listening to and interpreting children's ideas about academic subjects. They would need ways to expand the interpretative frames they likely bring to their observations of students so that they could see more possibilities in what students could do. And they would need to come to see children as more capable of thinking and reasoning, and less as blank slates who lack knowledge (p. 8).

Thus examining pupil's thinking is a core activity of practising teaching. Teachers should listen to and interact with children as learners themselves (Ball 2000). This great teaching art, as expressed by Hawkins (2000), is something that has to be learned.

Studies show that student teachers are surprised both by how pupils think differently in mathematics and how difficult it is to understand their thinking (Nilssen et al. 1996, Wolf 2003). Bearing this in mind, cooperating teachers (or university college tutors) should create learning situations for the student teachers so they learn to talk with kids and understand what they say (Rodd 1995, Wolf 2003). In this way the student teachers will learn about, from and with children (Lowery 2002). Student teachers should come close to the kids to "hear and listen, to notice and be surprised" (Wolf 2003, p. 97). Being surprised is seen as important in order to learn from experiences because it makes you think (Dewey 1938, Schön 1987,1988). Dewey (1938) expresses it like this:

> Unless a given experience leads out into a field previously unfamiliar no problems arise, while problems are the stimulus to thinking. (…). Occasions which are not and cannot be foreseen are bound to arise wherever there is intellectual freedom. They should be utilized. (…) Growth depends upon the presence of difficulty to be overcome by the exercise of intelligence (p. 79).

Feiman-Nemser and Buchman (1985) point out the importance of developing "habitual ways of seeing"[134] (p. 58) in settings that are like the one they will meet in their work; student teachers "should rather work with the pupils and find out about their learning that way" (p. 57). They argue that it must become part of student teachers' conception of what teaching means. As with the planning phase, teaching understood as observing and listening may be invisible for the student teachers through their apprenticeship of observation (Lortie 1975). As pointed out and discussed in the previous section, Sara builds upon the student teachers' wishes or impulses and turns them into natural learning situations. The student teachers are encouraged to talk with and listen to the kids, and understand this as part of teachers' daily work. Above we saw how Hawkins (2000) finds listening to and observing kids to be the art of teaching. According to Schön (1987), the student teachers need to acquire the kinds of artistry essential to competence in the indeterminate zones of practice that schools inherit. He

[134] As remembered from footnote 105, scholars and researchers use "seeing" in much the same way as Sara does.

also points out what has been touched upon above; student teachers practise in a double sense, they engage in the practice they wish to learn and they learn by practising or performing that which they seek to become adept at. Building upon the work of Dewey (1974), Schön (1987) argues that learning all forms of professional artistry depends, at least in part, on "freedom to learn by doing in a setting relatively low in risk, with access to coaches who initiate students into the 'traditions of the calling' and help them by 'the right kind of telling,' to see on their own behalf and in their own way what they need most to see" (p. 17).[135] I have repeatedly mentioned that Sara believes that the student teachers cannot just understand by only being told; they need to see and the right kind of telling helps them see. Ian experiences Sara's way of mentoring like this:

> During the post-teaching conversations, when she asked many questions which – which we might consider. Because you like sat and – we had lots – I had many – I had lots of thoughts after I had finished each day, at least during the first practice period. Like my mind was buzzing with thoughts. So it was better when she asked all these questions, because then – really found words for some of if then (p. 6). And also that she always finds words for the things we do well – then I felt that then it was OK to try again like – I think she was good at – finding words for things. (...) These are experiences I make during practice, and then she's able to find words for this for me. So for the next time I really have like a better system when thinking about it (p. 6). So it's better she asks the questions and we bring the experiences – rather than we bring the questions and she says why this is the way it is (p. 7) (intia, pp. 6,7).

As mentioned in the previous chapter, Shulman (1987) and others (for example Cochran et al. 1993, Grossmann 1990, Hasweh 2005) have shown how different aspects of pedagogical content knowledge develop through processes of repeated teaching experience that are both scrutinised and reflected upon. As shown above, one such aspect is local knowledge of the kids; understanding what experiences each kid needs or should be engaged in to learn specific content. Another aspect may be organisation. In illustration 2 we saw that Sara thinks of organising as an important element of successful teaching, but to make sure that the learning aims are kept in focus in managing the kids, she decides to let the student teachers experience the need themselves. Sara's ideas are mirrored by Dewey (1904) who argues that all teachers know that pupils have an inner attention, that is a mental power and an external attention manifested in physical attitudes rather than in the movement of thought. He claims that novice teachers do not have the experience of giving attention to pupils' inner attention, but know they have to maintain order, and as a consequence "the inherent tendency of the situation

[135] The quotes in quotation marks that Schön uses here point back to the two following quotes from Dewey (1974): "The customs, methods, and *working* standards of the calling constitute a 'tradition,' and that initiation into the tradition is the means by which the powers of learners are released and directed" (p. 151, italics in original). "He has to *see* on his own behalf and in his own way the relations between means and methods employed and the results achieved. Nobody else can see for him, and he can't see just by being 'told,' although the right kind of telling may guide his seeing and thus help him see what he needs to see" (p. 151, italics in original).

therefore is for him to acquire his technique in relation to the outward rather than the inner model of attention" (p. 149). Dewey (1904) therefore argues that student teachers should develop the habit he sees as the most essential habit of the teacher; "that habit which looks upon the internal, not upon the external; which sees that the important function of the teacher is direction of the mental movement of the student, and that the mental movement must be known before it can be directed" (p. 158). In order to attain such a habit Dewey (1904) claims that

> observation should at first be conducted from the psychological rather than from the 'practical' standpoint. If the latter is emphasized before the student [teacher] has an independent command of the former, the principle of imitation is almost sure to play an exaggerated part in the observer's future teaching, and hence at the expense of personal insight and initiative. What the student [teacher] needs most at this stage of growth is the ability to see what is going on in the minds of a group of persons who are in intellectual contact with one another. He needs to learn to observe psychologically – a very different thing from simply observing how a teacher gets 'good results' in presenting any particular subject (pp. 155-156).

Scholars and researchers around the world concur with the point made by Dewey here, arguing that student teaching must proceed beyond the "tools or tricks of the trade" and the immediate concern of performing skills, for example classroom management or what is referred to as craft knowledge (see for example Frykholm 1998, Jaworski & Watson 1994, Perks & Prestage 1994, Shulman 1998). They take this back in various ways to what may be called "reflective practice" and more focus on inquiry or exploring attitudes. Schön (1988) defines reflective teaching like this:

> Listening to kids and responding to them, inventing and testing responses like to help them get over their particular difficulties in understanding something, helping them build on what they already know, helping them discover what they already know but cannot say, helping them coordinate their own spontaneous knowing-in-action with the privileged knowledge of the school (p. 19).

We have seen how the student teachers are encouraged to be engaged in what Sara calls "seeing", understood as observing, listening and understanding what you saw. But we have also seen that Sara is aware of the differences between the student teachers when it comes to their ability to see. The very first day Ina expresses it like this: "I have never observed, written, reflected or thought" (obsj111102). Obviously, this is a task that has to be learned. In the interview Ina says that she believes she has learned more about this task but still she finds it to be difficult, expressed like this: “I really learned a lot about observation, because that was something I never really had learned before. (...) I think it's very difficult to make observations – it's probably something you can practise and get better at over time, I hope” (intin, p. 6).

As teacher education cannot teach prospective teachers all the knowledge and skills they

will need in their future teaching careers, one of its function is to prepare student teachers to learn from further classroom experience (see for instance Ball & Cohen 1999, Feiman-Nemser 1983, Grossman 1990, Shulman 1998). This is an aspect of what Dewey (1938) refers to as the continuity of educative experiences: "In a certain sense every experience should do something to prepare a person for later experiences of a deeper and more expansive quality. That is the very meaning of growth, continuity, reconstruction of experience" (p. 47). Even if each educative experience has value in itself, Dewey (1938) claims that the most important attitude that can be formed is that of the desire to go on learning and says:

> What avail is it to win prescribed amounts of information (…) if in the process the individual loses his own soul: loses his appreciation of things worth while, of the values to which these things are relative; if he loses the desire to apply what he has learned and, above all, loses the ability to extract meaning from his future experiences as they occur? (p. 49)

To summarise; we cannot by nature expect first-year student teachers to inherit the local knowledge of kids that is needed to perform interactive, adaptive teaching. This develops through teaching specific kids over time. However, not any teaching will do. It develops through performing what Hawkins (2000) calls the art of teaching and Schön (1988) calls reflective teaching; observing and listening to kids to know what they understand and can do. Such approaches to teaching are not only seen as important for kids' learning but also acknowledged as difficult to perform. Hence student teachers need to learn or understand through experiences what it takes to perform such teaching. They need possibilities to perform the double role as “students of teaching and teaching of students”. Due to individual differences between the student teachers as to how they manage to see and learn from their experiences, it seems that an important contribution from Sara is to encourage them to develop the habit of mind of seeing.

With this claim in mind I want to point back to the introduction to Chapter 5 where we looked into how Dewey (1904) a century ago argued that student teachers should start their student teaching by observing teaching. This should be done not to "accumulate a store of methods" but to see "how mind answers to mind" (p. 155). This point has been emphasised and expanded on in this chapter; the student teachers should observe the kids and their work from "the psychological rather than from the practical standpoint" (p. 156). Dewey sees this as important for the development of good workmanship in teaching, and to understand what this means he points out that student teachers should encounter what he calls progressive rather than traditional pedagogy. Throughout the chapters 4 to 7 of the research text I have shown how such teaching approaches have been focused on, planned for and performed by

Sara and the student teachers. I have shown how Sara's way of mentoring in such a setting appears to be of significance for the student teachers' development of pedagogical content knowledge in mathematics. In the next and final chapter of my text I will make some final reflections on my study. I will also outline what I see as the contribution of my research to the field of teacher education and point out new research questions that arise out of this research.

# Chapter 8
# Final reflections

The research question for this study was how a cooperating teacher could facilitate student teachers development of pedagogical content knowledge in mathematics through her way of mentoring. As has been pointed out in this research text this is recognised as the knowledge teachers need and use when they teach mathematics. My intention with the study has been to let the cooperating teachers be heard through an in depth study of how one of them, Sara thinks about and performs her mentoring of first-year student teachers' teaching of mathematics. As seen from this research text, the practice field of teacher education appeals very much to student teachers (Eraut 1994), and cooperating teachers are seen to have great influence on the development of student teachers' thinking, attitudes and teaching strategies (see for instance Jaworski & Watson 1994, Koster, Korthagen & Wubbels 1998, Shulman 1998, Zeichner & Gore 1990). In spite of this, the voices of cooperating teachers in Norway are not strong in historical documents (Strømnes 1983) and there is still a lack of research within the practice field of teacher education (Harnæs 2002). Moreover, Skagen (2000) claims, as seen in Chapter 7, that cooperating teachers in Norway became invisible in student teachers' field experiences during the last decades of the previous century. This story shows another picture. I maintain that as a cooperating teacher Sara has a strong voice and is quite visible in the student teachers' field experiences. Bearing this in mind, I find it important to summarise how through her reasoning, reflections and actions Sara reveals why she finds it important to be so visible, or take on such an active role in the student teachers' field experiences.

Through her years working as a cooperating teacher Sara has developed a vision or what I will call her voice as to what constitutes good student teaching. Her well reflected philosophy of education makes her continuously question and develop her way of dealing with the curriculum of student teachers' field experiences. There seems to have been a continuous developmental process leading her to become the cooperating teacher she is today. Her past experiences are reflected in her current practice as she repeatedly points back to her experiences when she reveals the reasoning behind her mentoring of Eli, Eric, Ina, Ian and Irene. Building upon her experiences with various groups of student teachers, she has developed (and probably still does develop) her beliefs about what is the best way of mentoring first-year student teachers. Sara's actions appear to be underpinned by a strong commitment to ensure that "the student teachers won't get hung up in the school they

themselves attended" (int050503, p. 19). This was explicitly expressed in Chapter 6 when Sara explained why she found it wise to guide the student teachers' planning processes. Through her experiences with former student-teacher groups Sara knows that they all carry with them different images of what school and hence teaching means. Her experience is that these images lead the student teachers to choose rather traditional teaching approaches if they start teaching on their own immediately. Moreover, when first-year student teachers plan teaching on their own she finds it difficult to intervene. This must be understood in light of what she said in Chapter 4; she is not the type of person who likes to go hard at it. After all, the student teachers' planning and teaching are based upon their images and understanding of school and teaching. Sara, however, wants them to understand and develop images of school and hence teaching that are attuned to the national curriculum. Moreover, she believes quite strongly that to be a good teacher you have to be aware of all the different kids. Student teachers' images often focus on the teacher as the most important person in the classroom, and as Sara does not believe in telling as a good strategy she has developed other ways of ensuring that student teachers will not become what she calls "technical teachers" who just deliver subject matter.

Sara has come to believe that the best way to start first-year student teachers' field experiences is to move the student teachers' perspectives from themselves as teachers to the kids as learners. By doing so Sara's intention is to ensure that they all have similar ideas of what teaching means. This was elaborated upon in Chapter 5. I explained how Sara's reflections and actions could be understood through the concept of intersubjectivity arguing that her intention was to establish a shared focus of attention for further collaboration (Wertsch 1985, 1998). Even if Sara uses what we may call an invisible pedagogy, using indirect statements and reframing procedures to move the student teachers' perspective, it is her clear motive that leads me to claim that her actions are visible already in this first phase of her collaboration with the student teachers. Bearing her guided planning from Chapter 5 in mind we understand why Sara finds it important to move the student teachers' attention on to the kids right from the start.

When Sara was asked to be a cooperating teacher her first thought was "what can I give the student teachers?" Over the years she has recognised that it is not part of her role to tell the student teachers about, or give away all the successful "set-ups" she and her colleagues have. In Chapter 5, I stated that Sara still acknowledges that she may be a role model, but she does not want the student teachers to perceive her way of teaching as the only right way of doing it. At the same time she argues that the student teachers should see her teach to

understand the importance of interplay in teaching. Apparently she models how she believes kids learn mathematics and how teaching relates to this. Utterances from the student teachers in the research text (see for instance footnote 62 and quote (q17) on page 98) apparently provide evidence that Sara gives the student teachers another vision of teaching than most of them are used to. I have touched upon the issue of how providing such a new vision of teaching from Sara's perspective also includes invisible aspects of teaching. In Chapter 6 I showed that through guided planning, Sara made various aspects of teachers' planning processes visible. In Chapter 7 I argued that her focus on teaching as listening to the kids could also be understood as making visible an invisible part of teaching. In the discussions in Chapters 5, 6 and 7 I argued that Sara's actions apparently facilitate for the student teachers' development of pedagogical content knowledge in mathematics. I find it important here to elaborate further on the importance of providing another vision of teaching, or modelling a new teaching approach to the student teachers.

Modelling is one of six means of assistance in Tharp and Gallimore's (1988) model of assisted performance in mentoring and schooling as outlined in Chapter 2. They explain modelling as the process of providing behaviour for imitation. In informal situations we learn a great deal from imitations, and in Chapter 2 I explained how Vygotsky (1978) claimed that a re evaluation of imitation in learning in formal situations such as schooling and mentoring, is needed to fully understand his concept of the zone of proximal development. Vygotsky claimed that imitation is more than simple mimicry or a mechanical process. Through the concept of internalisation, as elaborated on in Chapter 2, we gain a better understanding of how it is impossible within a socio-cultural framework to imitate exactly. Transformation of interpersonal processes into intrapersonal processes is the result of a long series of developmental processes. Learners are inspired by, but not exactly copying what they see. Wood et al. (1976) point to the same feature when they make recruitment, awakening the learners' interest for the task, as the first step in their scaffolding model. Thus, according to Vygotsky (1978), imitation should be seen as a sign of development and a starting point for learning. Imitation should be understood as a constructive process because what is imitated is chosen by individuals; it is something they want to do. A person can imitate only that which is within her or his zone of proximal development. This zone defines those functions that have not yet matured, but are in the process of maturation. Thus imitation has to be reconsidered as a starting point for learning (Vygotsky 1978).

The idea of cooperating teachers acting as role models who provide behaviour for imitation has not been that favourable accepted in Norwegian teacher education the last two

decades due to the fear of imposing on the student teachers (Skagen 2000). But as mentioned in this research text, through their apprenticeship of observation (Lortie 1975) student teachers will eventually imitate or copy teaching they have seen. If they are not exposed to other visions of teaching they will most probably imitate old teaching models (Ball 1988, Grossman 1990). This is what Sara has experienced, and is also the reason why she has found it important to be so visible. Moreover, if left alone the student teachers will most likely only focus on and imitate the visible part of teaching. Thus, student teachers should be given the access and opportunity to imitate or be inspired by teaching that is more than "seen-in-use". Student teachers need to have access to the ideas and the knowledge behind the visible performance they have experienced as pupils. This issue was first elaborated upon in Chapter 6, "Making the invisible visible through guided planning". Building upon the concept of cognitive apprenticeship (Collins et al. 1989, 1991) I interpreted Sara's actions to be about making visible or modelling important aspects of teachers' planning processes; she models pedagogical reasoning. In Chapter 7, "Encouraging educative experiences by focusing on aims" I claimed that Sara made visible another aspect of teaching that probably is hidden through the apprenticeship of observation; teaching as observing and listening to the kids. In this way Sara models what is referred to as the art of teaching (Hawkins 2000).

By focusing on aims Sara guided the student teachers to focus on what Dewey (1904) calls internal matters; teachers should observe and be acquainted with how each of the kids thinks about and develops mathematics differently. Thus it is reasonable to claim that Sara models or provides the model for imitation not only of the visible but also of the invisible part of teaching. By doing so, she helps the student teachers to avoid what Dewey (1904) feared; that student teachers only copy the visible part of teaching to accumulate a store of methods to use in their own teaching. Thus, just providing a vision of teaching, although attuned to the curriculum is not enough. It must likely just inspires the student teachers to imitate another visible form of teaching. If the cooperating teacher does not model or provide insight into what it takes to perform such a new vision, the student teachers will probably go on only imitating what they have seen. I can use Illustration 2 provided in Chapter 5 as an illustration of this issue. The student teachers apparently were inspired by Sara to prepare for collaborative activities for the kids. However, their planning led them to be more focused on the activities than on the mathematical content of the tasks. If Sara had not been there, guiding their planning and assisted them to focus on kids' learning outcome, it is reasonable to believe that the student teachers could have misunderstood this new vision of teaching and merely seen it as providing the kids with activities.

Throughout this research text I have pointed out that ancient models of apprenticeship have unwelcome connotations, or drawbacks, that should be avoided when learning such a complex profession as teaching. These models mostly deal with what can easily be observed and have inherent features that make us think of the right ways of doing things. Probably the more unwelcome connotations of the concepts modelling and imitation are a heritage from such models. Through this research text I have pointed out that this ancient apprenticeship model has been redefined within a socio-cultural framework where learning as an interactional situated process is acknowledged (see for instance Collins et al. 1989, 1991, Nielsen & Kvale 1999, Rogoff 1990, Wenger 1998). Sara's way of modelling or providing behaviour for imitation must be understood within such a framework. In Chapter 6 I argued that Sara's actions could be understood through the concept of cognitive apprenticeship (Collins et al. 1989, 1991). In this concept Collins et al. emphasise the importance of modelling thinking strategies when dealing with complex and new tasks as for example teachers' planning processes. It is important to bear in mind that the concept connects to a collaborative way of mentoring; the novice can also be the expert. The decisive factor is not the master but a community of practice (Nielsen & Kvale 1999). Such an apprenticeship model has the value of including both a mentor who is relatively more skilled in the profession of teaching and a group of novices (peers) who serve as resources for one another in exploring the new domain and aiding and challenging one another (Rogoff 1990). Dewey (1938) tells us that the more mature person, naturally accepted as a member of the group, should not impose on the novices. Sara seems to be aware of what Dewey (1938) argues to be the way not to do so; the cooperating teachers should take into account the capacities and past experiences of the student teachers and allow suggestions from all of them to develop into plans made by the members themselves. The teaching is a co-operative enterprise, not a dictate. The essential point is that the purpose or aim grows and takes shape through the process of social intelligence. From this point of view it is not only Sara who is modelling or providing behaviour for imitation. As told in Chapter 4, Ian found it inspiring to work together with Eric and Eli due to their earlier teaching experiences. All six, Sara and her five student teachers, bring various types of knowledge into the discussions on how to perform their teaching of the kids.

So far I have pointed out that Sara is quite visible in the student teachers' field experiences. This seems to inspire them to perform teaching in a way that is recognised as necessary if they are to develop pedagogical content knowledge in mathematics. However, throughout this research text I have revealed that not all aspects of the student teachers'

teaching turned out successfully, or at least it was not experienced as totally successful by all of them. It is very easy to understand their uncertainty, as they have just started their four years of teacher education. We can see that at the start of these six weeks the inexperienced teachers, Ian, Ina and Irene, have strong apprehensions about themselves as teachers. Ina for instance, reports how she found it difficult to be aware of the kids because she was more concerned about what she should do. Fuller (1969) reports that this is a normal feeling for fledgling teachers; they start with concerns about themselves, then about teaching and finally about the pupils. She claims that teacher educators have to take this into account, and this is precisely what I believe Sara does. Through her collaboration with former groups of student teachers she has become aware that student teachers are mostly concerned about themselves and understand teaching mainly in terms of delivering subject matter, or providing the kids with activities. But, in Sara's image of school and teaching it is impossible to teach well without being concerned about the kids. As the practice field of teacher education provides a setting that makes it possible to come close to the kids, it seems reasonable to act the way Sara does. From utterances in Chapters 5 and 7 I find evidence that enables me to claim that the student teachers have become aware of the importance of seeing the individual kid (see for instance (q16) and (q17) on page 98, dialogue 3 on page 153). The first step in developing pedagogical content knowledge is to overcome the presumption of shared identity (Jackson 1986). This is also the student teachers' first step in their long-term process of learning to teach mathematics. In light of this we understand the importance of encouraging the "habit of mind" to learn through further class room experiences as discussed in chapter 7. Within a socio-cultural framework I maintain that the way Sara deals with her collaboration with the student teachers enables her to assist, or scaffold not only their immediate process of teaching but also the student teachers' understanding of interactive, adaptive teaching approaches and what it takes to perform them.

Writings and research on of how pedagogical content knowledge develops reveal both strengths and shortcomings regarding the Norwegian system of teacher education in which my study is situated. This category of teacher knowledge is both a necessity for and develops through teaching. Cochran et al. (1993) assert that different aspects of pedagogical content knowledge, the amalgam of pedagogy and subject matter develop simultaneously. Norwegian teacher education provides the recommended frames for such a development as the student teachers have field experiences simultaneously with their study of mathematics and education at the university college. Thus this continuous interaction between different learning venues is the strength. The shortcomings are that the student teachers are supposed to and are eager to

start teaching apparently before they have acquired the knowledge and understanding required to perform interactive, constructivist teaching attuned to the national curriculum. I maintain that this story of Sara and her student teachers shows that we need to reconsider the role of field experiences for first-year student teachers. Student teachers' first field experiences should not be about acting as teachers "in the real world". As Zeichner (1996) contends "teacher practice is an important occasion for teacher learning and not only a time for demonstration of things previously learned" (p. 216). Sara very clearly offers the student teachers an arena with opportunities for learning. If we are to regard the practice field as an arena for learning, which we certainly should, there needs to be some continuity in the experiences of the student teachers. Since they often do not have the knowledge to teach on their own during their first teaching period, the aim must be to develop tools for further learning, and, as we have seen Sara emphasising, to become aware of the most important persons, the kids and their learning. I find support for my views in the writings of both old and more recent scholars. I have already told how Dewey in 1904 suggested that field experiences should be about observations, not for the sake of seeing how good teachers teach, or for picking up tips that may be employed in one's own teaching, but to discern meaning for observation and reflection. Almost a century later Feiman-Nemser (2001) proposes a continuum in learning to teach. She states that right from the start it is important that student teachers "develop an understanding of learners, learning, and issues of diversity [and] develop the tools and dispositions to study teaching" (p. 1050). They should of course still act as teachers. After all, it is through the experience of teaching they develop pedagogical content knowledge. However, before they are going to act "in the real world of teaching" student teachers have to acknowledge field experiences as a venue for learning where they are allowed to be inspired, surprised and challenged, and where they are allowed to make mistakes and become frustrated. The aim should not be to act as or be assessed as competent practitioners.

The intention of this study of Sara was never to obtain any fixed and everlasting answers or solutions to mentoring teaching of mathematics through field experiences. Within the framework of socio-cultural theory, such an idea would of course be self-contradictory. This story can be seen as one way of seeing and acting in the world; this time the world of mentoring from the perspective of student teachers' development of pedagogical content knowledge in mathematics. I have already pointed out that if another case study of Sara with another student-teacher group were to be undertaken, it would probably turn out differently and hence give other answers to the same research question. As Clark (2005) has claimed,

conducting such a study will probably provide me with more insight into how Sara develops in her work as a cooperating teacher. It will probably also serve as an example of the interactive nature of collaborative practices. Hence the story about Sara and how she deals with her mentoring of Eli, Eric, Ian, Ina and Irene should rather be considered as a thinking tool or a cultural scaffold because it may initiate further reflections on the topic of mentoring in teacher education (Gudmundsdottir 2001, Moen 2004). The story could be used to inspire and initiate, to debate and discuss in a way that helps the practice of mentoring through field experiences constantly develop and improve. Depending upon the person who is reading this story and this person's particular social, cultural and institutional setting, there are innumerable ways in which this text can be interpreted and function as a thinking tool. However, as a former cooperating teacher and as a teacher of education I have some ideas of how my study and the story I have told can contribute to discussions in the field of teacher education.

There are few studies of mentoring in the practice field of teacher education in Norway. One recently carried out and referred to in this research text shows how cooperating teachers and student teachers perform in rather traditional settings (Sundli 2001, 2002). The story told through my research text is another story. Sara and the student teachers are engaged in what is known as interactive constructivist teaching approaches, and, as we have seen, rather intentionally, from Sara's point of view. As already touched upon, field experience is not in itself a presupposition for learning. This study enlightens what it takes for student teachers to accomplish teaching approaches that make field experiences become a true learning venue. As shown in Chapters 5 to 7 and reinforced in this final chapter, being involved in and discussing such teaching approaches is seen as a presupposition for developing pedagogical content knowledge in mathematics. From this point of view this story makes an important contribution to understanding more about the practice field of teacher education. It is quite obvious that teacher educators in all subjects, as well as cooperating teachers, could use the story as an inspiration for any number of discussions. For instance, how should the apparent problem of understanding aspects of teachers planning be addressed? What is the best learning venue for teacher planning?

I also hope this study will initiate a discussion on the way student teachers think about their field experiences. In the introductory chapter I referred to how student teachers often regard field experiences as a place to train; "the student teachers want a more real teacher training with room for independent testing. Practice groups of up to five student teachers with one cooperating teacher are not sufficient for giving each student teacher experience of

independent teaching" (Harnæs 2002, p. 31). This quotation makes me reflect upon two issues that can be illuminated through the story of Sara and her student teachers. First, one can question if student teachers' understanding of what they call "the real world of teaching" is attuned to the school of today. The student teachers want to have independent teaching responsibility, a natural desire bearing their apprenticeship of observation in mind. We cannot assume that first-years student teachers understand that the modern school is more of a collaborative enterprise than the one they have experienced and seen through their own years as pupils. The teacher left alone in her classroom is now a rather seldom occurrence in Norwegian schools. Actually, much time is allotted to collaboration with colleagues. Working together as a team is something that has to be learned.

Second, I think this study reveals other important aspects of teaching than those student teachers have in mind when they regret how little time they have on their own to be engaged in independent teaching responsibility, or as it is often called "real teaching". Sara has shown the student teachers other aspects of what teaching means. This makes me reflect upon the notion of training. In the introductory chapter I explained how I wanted to avoid words and concepts that give connotations to field experiences more in terms of training than learning. I can see now that my view of this issue is connected to how the concept of teacher training has been traditionally understood. Student teachers should still train, or as expressed by Sara, gain experience. There are, however several aspects of teaching that student teachers should be aware of. The point is; student teachers and teacher educators have to take into account how teaching as listening to the kids must be experienced over and over again. This study has shown how this important aspect of an adaptive interactive teaching approach is perceived as challenging. Student teachers apparently need to train to listen to the kids.

At the end of my research text I would like to mention that being with Sara and the student teachers and creating the story about them has inspired me to reflect upon new areas of research. Sara once told me that she "becomes more and more aware that I [Sara] don't have any answers, only questions" (int030411, p. 6). We remember how she found things to be easy through her first years of both teaching and mentoring. As she became more aware of the kids and the student teachers and their individual processes of learning, new questions emerged. So it is with research as well. When we begin to dig into complex areas, new topics of interest emerge. As discussed in Chapter 3, one aim of undertaking case study research on a single case is to gain an understanding of topics for further research, to develop new research questions. This study has pointed out that different areas of knowledge are necessary to deal with and understand such complex settings as teaching and mentoring. Thus there are

questions for further research from different perspectives connected to the practice field of teacher education.

Even if I have claimed that Sara is quite visible in student teachers' field experiences I can also see how she performs a pedagogy that can be understood as invisible. I have already showed how this is especially apparent in the way she dealt with the student teachers' first days of their field experiences. It can also be seen in Chapter 7 where she dealt differently with each student teacher's experience from their teaching. I would like to explore more thoroughly, as action research how student teaching could be focused more in terms of communities of practices where it is more overtly expressed that we are here to learn from each other. This must be seen in connection with the point made above; student teachers should regard the practice field more as a venue for learning than for training their own performance in the classroom. Being together as a group should not be seen as a constraint on field experiences, rather it should be regarded as a strength, and understood within a social-cultural framework, the cooperating teacher should be accepted as a member of this community of practice.

This opens for another topic I belive need more insight; the student teachers' processes of learning and understanding. Even if this study focused mostly on Sara I also had access to the student teachers' thoughts and reflections, mainly through their utterances in the mentoring conversations and their writings in log books, but also through the interviews I conducted with each of them. Reading this data material piqued my curiousity. In another study I would like to explore more directly how student teachers perceive field experiences and the mentoring they receive. This study has made me keenly aware of that fact that they will certainly do this in different ways. I would like to interview them regularly and ask them to write log books, not only about their teaching experiences but also about their experiences from the mentoring conversations. Another area to dig into from the perspective of the student teachers is their collaborative processes. Both Sara and I knew that they made overriding plans and prepared work stations together as collaborative processes, either as pairs or in the whole group but this was hidden to both of us. I would like to observe and make recordings of these processes, interview each of the student teachers and have them write log books to understand more about how their collaboration hopefully can be of value for their development of pedagogical content knowledge.

Sara's utterances are full of words and phrases like "try to", "my attempt is to", "my intention is" and so on. We have seen how her thoughts and aims concerning student teachers' field experiences go beyond the immediate teaching as performed during these few weeks.

However, Sara finds it problematic that she never knows the end of the story. Did the student teachers understand what she tried to convey, and how did her work influence their work in the future? Inspired by Sara's reflection, my third topic of interest is understanding more about the influence student teachers' field experiences have on their development as teachers. I would like to make in-depth studies of how student teachers develop through their teacher education, especially through their field experiences and into their first years of teaching.

I will end this research text by reflecting on the phenomenon Lortie (1975) has described as apprenticeship of observation. He argues that what student teachers remember from their own years as pupils lead to rather traditional teaching approaches. As we have seen, Sara has also found that to be her experience. Moreover, she remembers that during her first years of teaching she thought mostly of teaching in terms of imparting subject matter. Sara sees this as being hung up in the school you attended and experienced as pupils. However, there are reasons to believe that not all student teachers have experienced what is known as traditional teaching approaches. For decades the national curricula in Norway have called for what is known as a child-centred teaching approach, or what more recently has been called a constructivist approach. My experience as a teacher is that some student teachers most probably have been pupils in a school system strongly influenced by what I have referred to as an interactive, constructivist teaching approach. This is supported by Alseth et al. (2003) who reported that even if the overall picture of mathematics teaching still is rather traditional, there are exceptions. Nonetheless, as a cooperating teacher and as a teacher educator, my experience is quite similar to what Sara has had and what Fuller (1969) proposes; student teachers focus much more often on what they should do than on what the kids should learn. The student teachers we have met in this study plan and perform what can be called a constructive teaching approach; still some of them struggle to relate their aim to the kids' learning more than to what they should do as teachers. An example is a quote from Ina (q19) on page 149, where she admits that she was thinking more about herself than the kids. This makes me wonder if the question is more about remembering the teacher as an important person than remembering teaching approaches. For pupils the teachers' actions are visible in both traditional and progressive teaching approaches, and they probably remember the performance of the teacher more than what they did as pupils. One thing Sara said led me to reflect more on this issue; she described how Eli and Eric have been through the important experience of "seeing themselves as teachers", and hence they are, from the start more able to see the kids than the other three student teachers.

The issue of what student teachers remember from their experiences as pupils and how it

affects their student teaching and how all teacher educators, not only the cooperating teachers should deal with this is an area we most likely should dig into, explore further, make more visible and discuss. This is important because in the public debate on teacher education strong voices claim that field experiences should be extended to make the education more "profession oriented". But as seen through this research text, not any teaching will do. Thus, hopefully, the story of Sara and her mentoring can be part of this discussion. As a voice from the cooperating teachers it is just one story out of many that could have been told. I believe we need to bring more of them into the open to make an important part of teacher education more visible.

# References


Alseth, B. (2004). Endret læreplan = endret matematikkundervisning? Matematikkopplæringen på småskoletrinnet etter R97 [Changed curriculum = changed teaching of mathematics? The teaching of mathematics in the lower classes of primary schools following C-97; in Norwegian]. In K. Klette (ed.), *Fag og arbeidsmåter i endring? Tidsbilder fra norsk grunnskole* [Changes in subject matter and ways of working. Pictures of a period in Norwegian primary school; in Norwegian], pp. 38-54. Oslo: Universitetsforlaget.

Alseth, B., Brekke, G. & Breiteig, T. (2003). *Endringer og utvikling ved R97 som bakgrunn for videre planlegging og justering. Matematikkfaget som kasus* [Changes and development from R-97 as background for further planning and adjustment. The subject of mathematics as a case; in Norwegian]. Notodden: Telemarksforsking.

Aubrey, C. (1996). An investigation of teachers' mathematical subject knowledge and the processes of instruction in reception classes. *British Educational Research Journal,* 22(2), pp. 181-197.

Bakhtin, M. (1981). Discourse in the novel. In M. Holquist (ed.), *The dialogic imagination. Four essays by M.M.Bakhtin*, pp. 259-422. Austin, TX: University of Texas Press.

Bakhtin, M. (1986). *Speech genres and other late essays.* C. Emerson & M. Holquist (eds.), Austin, TX: University of Texas Press.

Ball, D. L. (1988). American prospective teachers' images of mathematics teaching and learning and of students as learners of mathematics. Unpublished paper. Michigan State University.

Ball, D. L. (1991). Research on teaching mathematics: Making subject matter knowledge part of the equation. In J. Brophy (ed.), *Advances in research on teaching*, pp. 1-41. Greenwich: JAI Press.

Ball, D. L. (2000). Bridging Practices. Intertwining content and pedagogy in teaching and learning to teach. *Journal of Teacher Education,* 51(3), pp. 241-247.

Ball, D. L. & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In L. Darling-Hammond & G. Sykes (eds.), *Teaching as the learning profession. Handbook of policy and practice*, pp. 3-32. San Francisco: Jossey-Bass.

Ball, D. L. & Rundquist, S. S. (1993). Collaboration as a context for joining teacher learning with learning about teaching. In D. K. Cohen, M. W. McLaughlin & J. E. Talbert (eds.), *Teaching for understanding. Challenges for policy and practice*, pp. 13-42. San Fransisco: Jossey-Bass.

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall.

Bassey, M. (2000). *Case study research in educational settings.* Buckingham: Open University Press.

Bjørndal, B. & Lieberg, S. (1978). *Nye veier I didaktikken?* [New ways in “didaktikk”; in

Norwegian]. Oslo: Aschehoug.

Blanton, M. L., Berenson, S. B. & Norwood, K. S. (2001). Exploring a pedagogy for the supervision of prospective mathematics teachers. *Journal of Mathematics Teacher Education,* 4(3), pp. 177-204.

Bogdan, R. C. & Biklen, S. K. (2003). *Qualitative research for education. An introduction to theories and methods.* (4th ed.). Boston: Allyn & Bacon.

Britzman, D. P. (1991). *Practice makes practice. A critical study of learning to teach.* New York: State University of New York Press.

Bruner, J. (1986). *Actual minds, possible worlds.* Cambridge, MA: Harvard University Press.

Bruner, J. (1996). *The culture of education.* Cambridge, MA: Harvard University Press.

Bullough, R. (1989). *First-year teacher. A case study.* New York: Teachers College Press.

Bullough, R. (1991). Exploring personal teaching methaphors in preservice teacher education. *Journal of Teacher Education,* 42(1), pp. 43-51.

Burke, K. (1969). *A grammar of motives.* Berkeley and Los Angeles, CA: University of California Press

Calderhead, J. & Robson, M. (1991). Images of teaching: Student teachers early conceptions of classroom practice. *Teaching and Teacher Education,* 7(1), pp. 1-8.

Clark, C. M. (2005). Real lessons from imaginary teachers. *Teachers and Teaching: Theory and Practice,* 11(3), pp. 233-237.

Cochran, K. F., DeRuiter, J. A. & King, R. A. (1993). Pedagogical content knowing: An integrative model for teacher preparation. *Journal of Teacher Education,* 44(4), pp. 263-272.

Cole, M. (1985). The zone of proximal development: Where culture and cognition create each other. In J. V. Wertsch (ed.), *Culture, communication, and cognition: Vygotskian perspectives,* pp. 146-161. New York: Cambridge University Press.

Cole, M. (1996). *Cultural Psychology: A once and future discipline.* Cambridge, MA: The Belknap Press of Harvard University Press.

Cole, M., Engeström, Y. & Vasquez, O. A. (1997). Introduction. In M. Cole, Y.Engeström & O. A. Vasquez (eds.), *Mind, culture, and activity. Seminal papers from the Laboratory of comparative human cognition,* pp. 1-21. Cambridge: Cambridge University Press.

Collins, A., Brown, J. & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator,* (Winter), pp. 6-46.

Collins, A., Brown, J. & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing and mathematics. In L. B. Resnick (ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser,* pp. 453-494. New Jersey: Lawrence Erlbaum Associates.

Creswell, J. W. (1998). *Qualitative inquiry and research design. Choosing among five traditions.* Thousand Oaks, CA: Sage Publications.

Daniels, H. (2001). *Vygotsky and pedagogy.* London: Routledge Falmer.

de Haan, M. (2001). Intersubjectivity in models of learning and teaching: Reflections from a study of teaching and learning in a Mexican Mazahua community. In S. Chaiklin (ed.), *The theory and practice of cultural-historical psychology,* pp. 174-199. Aarhus: Aarhus University Press.

Delamont, S. (1992). *Fieldwork in educational settings. Methods, pitfalls, & perspectives.* London: The Falmer Press.

Denzin, N. K. (1983). Interpretive interactionism. In G. Morgan (ed.), *Beyond method. Strategies for social research,* pp. 129-146. Beverly Hills, CA: Sage Publications.

Denzin, N.K. (1989). *The research act. A theoretical introduction to sociological methods.* (3rd ed.). New Jersey: Prentice-Hall.

Denzin, N. K. & Lincoln, Y. S. (2005). Introduction. The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (eds.), *Handbook of qualitative research* (3rd ed.), pp. 1-32. Thousand Oaks, CA: Sage Publications.

Dewey, J. (1904/1965). The relation of theory to practice in education. In M. Borrowman (ed.), *Teacher education in America: A documentary history,* pp. 140-171. New York: Teachers College Press.

Dewey, J. (1916/1997). *Democracy and education. An introduction to the philosophy of education.* New York: Simon & Schuster.

Dewey, J. (1933). *How we think. A restatement of the relation of reflective thinking to the educative process.* Lexington, MA: D. C. Heath and Company.

Dewey, J. (1938/1997). *Experience and education.* New York: Simon & Schuster.

Dewey, J. (1974). Individuality and experience. In R. D. Archambault (ed.), *John Dewey on education. Selected writings,* pp. 149-156. Chicago: Random house.

Doyle, W. (1977). Learning the classroom environment: An ecological analysis. *Journal of Teacher Education,* 28(6), pp. 51-55.

Duckworth, E. (1987). *"The having of wonderful ideas" & other essays on teaching & learning.* New York: Teachers College Press.

Dysthe, O. (2001). Sosiokulturelle teoriperspektiv på kunnskap og læring [Socio-Cultural theory perspective on knowledge and learning; in Norwegian]. In O. Dysthe (ed.), *Dialog, samspel og læring* [Dialogue, interaction and learning; in Norwegian], pp. 33-72. Oslo: Abstrakt forlag.

Edwards, A. (1995). Teacher education: Partnerships in pedagogy? *Teaching & Teacher Education,* 11(6), pp. 595-610.

Edwards, A. (1998). Mentoring student teachers in primary schools: Assisting student teachers to become learners. *European Journal of Teacher Education,* 21(1), pp. 47-62.

Edwards, A. & Collison, J. (1996). *Mentoring and developing practice in primary schools. Supporting student teacher learning in schools.* Buckingham: Open University Press.

Edwards, A. & Ogden, L. (1998). Constructing curriculum subject knowledge in primary school teacher training. *Teaching and Teacher Education,* 14(7), pp. 735-747.

Edwards, A. & Protheroe, L. (2003). Learning to see in classrooms: What are student teachers learning about teaching and learning while learning to teach in schools? *British Educational Research Journal,* 29(2), pp. 227-242.

Eikseth, A.G. & Nilsen, E. (2004). Lærerstudenten kan lykkes - i spenningsfeltet mellom støtte og utfordring [The student teacher can succeed – in the field of tension between support and challenge; in Norwegian]. In M. Brekke (ed.), *Norsk lærerutdanningsdidaktikk i endring. Læring, undervisning og danning i lys av ny forskning* [The change of Norwegian teacher education ”didaktikk”. Learning, teaching and upbringing in light of new research; in Norwegian], pp. 92-127. Kristiansand: Høyskoleforlaget.

Eisner, E.W. (1991). *The enlightened eye. Qualitative inquiry and the enhancement of educational practice.* New York: Macmillan Publishing Company.

Eraut, M. (1994). D*eveloping professional knowledge and competence.* London: Falmer Press.

Erickson, F. (1986). Qualitative methods in research on teaching. In M. C. Wittrock (ed.), *Handbook of Research on Teaching,* pp. 119-161. New York: Mac Millan Publishing Company.

Fagplaner for allmennlærerutdanning 1-3 studiår. Studentkullet 2002 – 2006. Fastsatt av Avdelingstyret i møte 18. juli 2002 [Plan of study for subjects in teacher education 1-3 year of study. Student teachers studying from 2002 – 2006). Established by The Faculty Board July 18, 2002].

Feiman-Nemser, S. (1983). Learning to teach. In L. S. Shulman & G. Sykes(eds.), *Handbook of teaching and policy,* pp. 150-170. New York: Longman.

Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record,* 103(6), pp. 1013-1055.

Feiman-Nemser, S. & Beasley, K. (1997). Mentoring as assisted performance: A case of co-planning. In:V. Richardson (ed.), *Constructivist teacher education: Building new understandings*, pp. 108-126. London: The Falmer Press.

Feiman-Nemser, S. & Buchmann, M. (1985). Pitfalls of experience in teacher preparation. *Teachers College Record,* 87(1), pp. 53-65.

Feiman-Nemser, S. & Buchmann, M. (1986). The first year of teacher preparation: Transition to pedagogical thinking? *Journal of Curriculum Studies,* 18(3), pp. 239-256.

Feiman-Nemser, S. & Remillard, J. (1995). Perspectives on learning to teach. In F. Murray (ed.), *The teacher educator's handbook*, pp. 63-91. San Francisco: Jossey Bass.

Frykholm, J.A. (1998). Beyond supervision: Learning to teach mathematics in community. *Teaching and Teacher Education*, 14(3), pp. 305-322.

Frykholm, J.A. (1999). The impact of reform: Challenges for mathematics teacher preparation. *Journal of Mathematics Teacher Education*, 2(1), pp. 79-105.

Fuller, F. (1969). Concerns of teachers: A developmental conceptualization. *American Educational Research Journal*, 6(2)**,** pp. 207-226.

Furlong, J. & Maynard, T. (1995). *Mentoring student teachers. The growth of professional knowledge.* London: Routledge.

Gadamer, H.-G. (1989). *Truth and method.* (2nd ed.). London: Sheed & Ward.

Gadamer, H.-G. (2000). Om förståelsens cirkel [About the circle of understanding; in Swedish]. In K. Marc-Wogau, L. Bergström & S. Carlshamre (eds.), *Filosofin genom tiderna. Efter 1950* [The philosophy over the years. After 1950; in Swedish], pp. 326-334. Stockholm: Stiftelsen Bokförlaget Thales .

Gadamer, H.-G. (2001). Språk og forståelse [Language and understanding, in Norwegian]. In S. Lægreid & T. Skorgen (eds.), *Hermeneutisk lesebok* [Reader of hermeneutics; in Norwegian], Oslo: Spartacus.

Gage, N. L. (1978). *The scientific basis of the art of teaching.* New York: Teachers College Press.

Gallimore, R. & Goldenberg, C. N. (1992). Tracking the developmental path of teachers and learners: A Vygotskian perspective. In F. K. Oser, A. Dick & J. L.Patry (eds.), *Effective and responsible teaching. The new synthesis*, pp. 203-221. San Francisco: Jossey-Bass Publishers.

Gallimore, R. & Tharp, R. (1990). Teaching mind in society: Teaching, schooling, and literate discourse. In L. C. Moll (ed.), *Vygotsky and education. Instructional implications and applications of sociohistorical psychology*, pp. 175-205. Cambridge: Cambridge University Press.

Geertz, C. (1973). *The interpretation of cultures: Selected Essays.* New York: Basic Books.

Gellert, U. (2000). Mathematics instruction in safe space: Prospective elementary teachers' views of mathematics education. *Journal of Mathematics Teacher Education*, (3), pp. 251-270.

Gilje, N. & Grimen, H. (1993). *Samfunnsvitenskapenes forutsetninger. Innføring i samfunnsvitenskapenes vitenskapsfilosofi* [The assumptions of the social sciences. Introduction to the philosophy of social sciences; in Norwegian]. Oslo: Universitetsforlaget.

Glaser, B. & Strauss, A. L. (1999). *The Discovery of grounded theory. Strategies for qualitative research.* New York: Aldine De Gruyter.

Glesne, C. & Peshkin, A. (1992). *Becoming qualitative researchers: An introduction.* New York: Longman.

Goetz, J. P. & LeCompte, M. D. (1984). *Ethnography and qualitative design in educational research.* Orlando, FL: Academic Press.

Grant, G. (1991). Ways of constructing classroom meaning: Two stories about knowing and seeing. *Journal of Curriculum Studies,* 23(5), pp. 397-408.

Greeno, J., Collins, A. & Resnick, L. (1996). Cognition and Learning. In D. Berliner & R. Calfee (eds.), *Handbook of Educational Psychology*, pp. 15-46. New York: Simon & Schuster Macmillan.

Grossman, P. (1990). *The making of a teacher: Teacher knowledge and teacher education.* New York: Teachers College Press.

Grossman, P. (1991). Overcoming the apprenticeship of observation in teacher education coursework. *Teaching and Teacher Education,* 7(4), pp. 345-357.

Guba, E. G. & Lincoln, Y. S. (1988). Do inquiry paradigms imply inquiry methodologies? In D. M. Fetterman (ed.), *Qualitative approaches to evaluation in education. The silent scientific revolution,* pp. 89-115. New York: Praeger.

Gudmundsdottir, S. (1990). Values in pedagogical content knowledge. *Journal of Teacher Education,* 41(3), pp. 44-52.

Gudmundsdottir, S. (1991). Ways of seeing are ways of knowing: The pedagogical content knowledge of an expert teacher. *Journal of Curriculum Studies,* 23(5), pp. 409-421.

Gudmundsdottir, S. (1992). Den kvalitative forskningsprosessen [The Qualitative Research Process; in Norwegian], *Norsk Pedagogisk Tidsskrift,* 5**,** pp. 226-272.

Gudmundsdottir, S. (1995). The narrative nature of pedagogical content knowledge. In K. Egan & H. McEwan (eds.), *Narrative in teaching, learning, and research*, pp. 24-38. New York: Teachers College Press.

Gudmundsdottir, S. (1997). Narrativ forskning på pedagogisk praksis [Narrative research on school practice; in Norwegian]. In B. Karseth, S. Hopmann & S. Gudmundsdottir (eds.), *Didaktikk: Tradisjon og fornyelse*.["Didaktikk": Tradition and renewal; in Norwegian] Festskrift til [Commemorative volume for ] *Bjørg Brandtzæg Gundem*, pp. 147-173. Oslo: Universitetet i Oslo, Pedagogisk Forskningsinstitutt.

Gudmundsdottir, S. (2001). Narrative research on school practice. In V. Richardson (ed.), *Fourth handbook of research on teaching*, pp. 226-240. Washington DC: American Educational Research Association.

Gudmundsdottir, S. (2004). Kasusstudier av undervisning og læring i klasserommet. Et sosiokulturelt perspektiv [Case studies of teaching and learning in the classroom. A socio-cultural perspective; in Norwegian]. In T. Pettersson & M. B. Postholm (eds.), *Klasseledelse* [Classroom management; in Norwegian] (2nd ed.), pp. 21-38. Oslo: Universitetsforlaget.

Handal, G. & Lauvås, P. (1983). *På egne vilkår.* [In their own way; in Norwegian] Oslo: Cappelen Akademisk Forlag.

Harnæs, H. (2002). *Evaluering av allmennlærerutdanningen ved fem norske institusjoner. Rapport fra ekstern komité* [Evaluation of the teacher education for primary and lower secondary schools at five Norwegian institutions. Report from the external committee; in Norwegian]. Oslo: Norgesnettrådet.

Hashweh, M. (1987). Effects of subject-matter knowledge in the teaching of biology and physics. *Teaching and Teacher Education*, 3(2), pp. 109-120.

Hashweh, M. (2005). Teacher pedagogical constructions: A reconfiguration of pedagogical content knowledge. *Teachers and Teaching: Theory and Practice,* 11(3), pp. 273-292.

Haug, P. (2004). *Resultat fra evalueringa av Reform 97* [Results from the evaluation of Reform 97; in Norwegian]. Oslo: Noregs forskingsråd.

Hausfather, S. J. (1996). Vygotsky and schooling: Creating a social context for learning. *Action in Teacher Education,* XVIII(2), pp. 1-10.

Hawkins, D. (1974). I, thou, and it. In D. Hawkins (ed.), *The informed vision: Essays on learning & human nature*, pp. 48-62. New York: Agathon Press.

Hawkins, D. (2000). *The roots of literacy.* Colorado: University Press of Colorado.

Heaton, R. M. & Lampert, M. (1993). Learning to hear voices: Inventing a new pedagogy of teacher education. In D. K. Cohen, J. E. Talbert. & M. W. McLaughlin (eds.), *Teaching for understanding. Challenges for policy and practice*, pp. 43-83. San Francisco: Jossey-Bass.

Henderson, R. W. & Cunningham, L. (1994). Creating interactive sociocultural environments for self-regulated learning. In D. H. Schunk & B. J. Zimmerman (eds.), *Self-regulation of learning and performance. Issues and educational applications*, pp. 255-281. New Jersey: Lawrence Erlbaum Associates.

Jackson, P. W. (1986). *The practice of teaching.* New York: Teachers College Press.

Jaworski, B. (2004). Research and mathematics teaching development – principles, processes, practices and practitioners. In T. Steen-Olsen, T. Guldal, A. Krogstad, S. Lorentzen & V. Nilssen (eds.), *FoU i Praksis 2004. Profesjonsrettet FoU i lærerutdanning* [R&D in practice. R&D in teacher education; in Norwegian]. HiST ALT rapport no.13. Retrieved September 12, 2006, from www.alt.hist.no/fou2004/fouipraksis2004.pdf.

Jaworski, B. & Watson, A. (1994). Mentoring, co-mentoring, and the inner mentor. In A. Watson & B. Jaworski (eds.), *Mentoring in mathematics teaching*, pp. 124-138. London: Falmer Press.

John-Steiner, V. & Mahn, H. (1996). Sociocultural approaches to learning and development: A Vygotskian framework. *Educational Psychologists,* 31(3/4), pp. 191-206.

KD (Kunnskapsdepartementet) [Ministry of Education and Research] (2006). Læreplanverket for kunnskapsløftet. Midlertidig utgave juni 2006 [The curriculum for knowledge

promotion. Prelimenary edition; in Norwegian] Oslo: Utdanningsdirektoratet [Norwegian Directorate for Education and Training].

Klages, W. (2000). Lære ved å arbeide sammen. Veiledet praksis i førskolelærerutdanning analysert som legitim perifer deltakelse [Learning by working together. Supervision in the practice field of teacher education for pre-schooling analysed as legitimate peripheral participation; in Norwegian]. In K. Skagen (ed.), *Kunnskap og handling i pedagogisk veiledning* [Knowledge and action in pedagogical supervision; in Norwegian], pp. 71-90. Bergen: Fagbokforlaget.

Kleve, B. (2004). Interpretation and implementation of the L97's mathematics curriculum. In T. Steen-Olsen, T. Guldal, A. Krogstad, S. Lorentzen & V. Nilssen (eds.), *FoU i Praksis 2004. Profesjonsrettet FoU i lærerutdanning* [R&D in practice. R&D in teacher education; in Norwegian]. HiST ALT rapport no.13. Retrieved September 12, 2006, from www.alt.hist.no/fou2004/fouipraksis2004.pdf.

Koster, B., Korthagen, F. & Wubbels, T. (1998). Is there anything left for us? Functions of cooperating teachers and teacher educators. *European Journal of Teacher Education*, 21(1), pp. 75-89.

Kozulin, A. (1990). *Vygotsky's psychology: A biography of ideas.* Cambridge, MA: Harvard University Press.

Kozulin, A. (1995). The learning process: Vygotsky's theory in the mirror of its interpretation. *School Psychology International,* 16 (2), pp. 117-129.

Kozulin, A. (2003). Psychological tools and mediated learning. In A. Kozulin, B. Gindis, V. S. Ageyev, & S. M. Miller (eds.), *Vygotsky's educational theory in cultural context*, pp. 15-38. Cambridge: Cambridge University Press.

Kristvik, E. (1925/1941/1946/1953). *Læraryrket. Innføring i pedagogikk* [The Teaching Profession. Introduction to Education; in Norwegian]. Oslo: Olaf Norlis forlag.

KUD ( Kirke og utdannings departementet [Ministry of Church and Education affairs]) (1980). Studieplan for Allmennlærarutdanning. [Teacher education for primary and lower secondary schools. Plan of study; in Norwegian]. Oslo: Universitetsforlaget.

KUF (Kirke-, utdannings- og forskningsdepartementet [Ministry of Education, Research and Church Affairs]) (1994). *Rammeplan for 4-årig allmennlærerutdanning* [Framework plan for 4-years teacher education for primary and lower secondary schools; in Norwegian]. Approved by KUF July 10, 1992. Oslo: Lærerutdanningsrådet.

KUF (Kirke-, utdannings- og forskningsdepartementet) [Ministry of Education, Research and Church Affairs]: (1997) *Læreplanverket for den 10-årige grunnskolen, L-97* [The Curriculum for the 10-year Primary School, C-97; in Norwegian] Oslo: Nasjonalt læremiddelsenter [The Norwegian Board of Education].

KUF ( Kirke-, utdannings- og forskningsdepartementet [Ministry of Education, Research and Church Affairs]) (1999). *Rammeplan og forskrift for 4-årig allmennlærerutdanning* [Framework plan and regulation for the 4-year teacher education for primary and lower secondary schools; in Norwegian]. Oslo: Norgesnettrådet.

Kvalbein, I. A. (1999). *Lærerutdanningskultur og kunnskapsutvikling* [Culture of teacher education and development of knowledge; in Norwegian]. Oslo: Høgskolen i Oslo.

Kvernbekk, T. (1995). Erfaringstyrrani eller teorityrrani - et filosofisk perspektiv på praksis [Tyrrany of experience or tyrrany of theory – a philosophic perspective on field experieneces; in Norwegian]. In B. Midtgård (ed.), *Profesjonsutdanning og forskning. FoU-perspektiver på praksisfeltet* [Educating for professions. R&D perspectives on the practice field; in Norwegian], pp. 17-27. Oslo: Lærerutdanningsrådet.

Lampert, M. (2001). *Teaching problems and the problems of teaching.* New Haven, CT: Yale University Press.

Lave, J. (1996). Teaching, as learning, in practice. *Mind, Culture, and Activity,* 3(3), pp. 149-164.

Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge: Cambridge University Press.

LeCompte, M. D., Preissle, J. & Tesch, R. (1993). *Ethnography and qualitative design in educational research.* San Diego: Academic Press.

LeCompte, M. D. & Schensul, J. J. (1999). *Analyzing & interpreting ethnographic data.* Walnut Creek, CA: Altamira Press.

Leontèv, A. N. (1981). The problem of activity in psychology. In J.V. Wertsch (ed.), *The concept of activity in Soviet psychology*, pp. 37-71. New York: M. E. Sharpe.

Lerman, S. (1994). Reflective practice. In A. Watson & B. Jaworski (eds.), *Mentoring in mathematics teaching*, pp. 52-64. London: Falmer Press.

Liedman, S. E. (2001). *Ett oändligt äventyr. Om människans kunskaper* [An endless fairy tale. About the knowledge of human beings; in Swedish]. Stockholm: Albert Bonniers förlag.

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic inquiry.* Newbury Park, CA: Sage Publications.

Lincoln, Y. S. & Guba, E.G. (2002). Judging the quality of case study reports. In A. M. Huberman & M. B Miles (eds.), *The qualitative researcher's companion,* Thousand Oaks, CA: Sage Publications.

Lortie, D. (1975). *Schoolteacher. A sosiological study.* Chicago: The University of Chicago Press.

Lowery, N. V. (2002). Construction of teacher knowledge in context: Preparing elementary teachers to teach mathematics and science. *School Science & Mathematics,* 102(2), pp. 68-83. (Retrieved from the database Academic Search Elite, February 2004).

Luria, A. R. (1981). *Language and cognition.* Washington: Winston.

Lyngsnes, K. & Rismark, M. (2000). Veiledning i fagopplæringen – mer enn det tradisjonelle mester-lærling-forholdet? [Supervision in vocational training – more than traditional

apprenticeship?]. In K. Skagen (ed.), *Kunnskap og handling i pedagogisk veiledning*. [Knowledge and action in pedagogical supervision, in Norwegian], pp-91-103. Bergen: Fagbokforlaget.

Lægreid, S. & Skorgen, T. (2001). Innledning [Introduction; in Norwegian] In S. Lægreid & T. Skorgen, (eds.), *Hermeneutisk lesebok* [Hermeneutics reader; in Norwegian]. Oslo: Spartacus.

Lærarutdanningsrådet [Teacher Education Council] (1986). *Studieplan for allmennlærarutdanning* [Curriculum for teacher education for primary and lower secondary school, in Norwegian]. Oslo: Lærarutdanningsrådet.

Løwing, M. (2006). *Matematikundervisningens dilemman. Hur lærare kan hantera lärandets komplexitet* [The dilemmas of teaching mathematics. How teachers can handle the complexity of learning; in Swedish]. Lund: Studentlitteratur.

Marc-Wogau, M. (1981). Filosofisk hermenevtik och begrepet förstå [Hermeneutic philosophy and the concept of understanding; in Swedish]. In M. Marc-Wogau (ed.), *Filosofin genom tiderna, filosofiska strömningar efter 1950* [The philosophy over the years. Philosophical trends after 1950; in Swedish], pp. 322-325. Stockholm: Bonniers.

Marks, R. (1990). Pedagogical content knowledge: From a mathematical case to a modified conception. *Journal of Teacher Education,* 41(3), pp. 3-20.

Mathisen, L.-K. (2000). Nye veier i praksisopplæringen: situert læring - et alternativ til refleksjon over handling [New ways of practice training: situated learning - an alternative to reflection on action; in Norwegian]. In K. Skagen (ed.), *Kunnskap og handling i pedagogisk veiledning* [Knowledge and action in pedagogical supervision; in Norwegian], pp. s. 35-70. Bergen: Fagbokforlaget.

Matusov, E. (1996). Intersubjectivity without agreement. *Mind, Culture, and Activity,* 3(1), pp. 25-45.

Matusov, E. (2001). Intersubjectivity as a way of informing teaching design for a community of learners classroom. *Teaching and Teacher Education,* 17**,** pp. 383-402.

Maynard, T. (1996). Mentoring subject knowledge in the primary school. In D. McIntyre, & H. Hagger (eds.), *Mentors in schools: Developing the profession of teaching*, pp. 34-55. London: David Fulton Publishers.

McCaughtry, N. (2005). Elaborating pedagogical content knowledge: What it means to know students and think about teaching. *Teachers and Teaching: Theory and Practice,* 11(4), pp. 379-395.

Merriam, S. B. (1998). *Qualitative research and case study applications in education* (2nd ed.). San Francisco: Jossey-Bass Publishers.

Miles, M. B. & Huberman, A. M. (1994). *An Expanded Sourcebook. Qualitative Data Analysis* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Moen, T. (2004). "Kids need to be seen": A narrative study of a teacher's inclusive education.

Dissertation. Trondheim: NTNU.

Moll, L. C. (1990). Introduction. In Moll, L. C. (ed.), *Vygotsky and education. Instructional implications and applications of sociohistorical psychology*, pp. 1-27. Cambridge: Cambridge University Press.

Moll, L. C. (2001). Through the mediation of others: Vygotskian research on teaching. In V. Richardson (ed.), *Fourth handbook of research on teaching*, pp. 111-129. Washington DC: American Educational Research Association.

Newman, D., Griffin, P. & Cole, M. (1989). *The construction zone: Working for cognitive change in school.* Cambridge: Cambridge University Press.

Nielsen, K. & Kvale, S. (1999). Mesterlære som aktuel læringsform [Apprenticeship as an actual way of learning, In Danish]. In S. Kvale & K. Nielsen (eds.), *Mesterlære. Læring som sosial praksis* [Apprenticeship. Learning as social practice; in Danish], pp. 11-53. Oslo: Ad notam Gyldendal.

Nilssen, V., Wangsmo-Cappelen, V. & Gudmundsdottir, S. (1996). *"Dæm tænkt på ein heilt anna måte enn ka æ gjor" En kasusstudie av en lærerstudents matematikkundervisning i 2.klasse.* ["They thought in a quite different way than I did" A case study of a student teachers' mathematics teaching in second grade; in Norwegian] Trondheim: Tapir Forlag.

Noddings, N. (1995). *Philosopy of education*. Boulder, CO: Westview Press.

Nokut (Nasjonalt organ for kvalitet i utdanningen) [National agency for quality in education; in Norwegian] (2006) Evaluering av allmennlærerutdanningen i Norge 2006 Del 1: Hovedrapport [Evaluation of teacher education for primary and lower secondary school in Norway 2006. Part 1: Main report; in Norwegian] Retrieved September 28, 2006, from www.nokut.no/graphics/NOKUT/Artikkelbibliotek/Norsk_utdanning/SK/Rapporter/ALUEVA_Hovedrapport.pdf. Oslo: Nokut.

NOU [Norges offentlige utredninger] [Official Norwegian Reports] 1974: 58. *Lærarutdanning I. Dei pedagogiske høgskolane – verksemd og skipnad. II. Studieplan for allmenn lærarutdanning*. [Teacher education. I. The pedagogical university colleges – activity and organisation. II. Plan of study for teacher education for primary and lower secondary school; in Norwegian]. Oslo: Universitetsforlaget.

NOU [Norges offentlige utredninger] [Official Norwegian Reports] 1996: 22. *Lærerutdanning mellom krav og ideal* [Teacher education between demands and the ideal, in Norwegian]. Oslo: Statens forvaltningstjeneste, Seksjon statens trykning [Section, state publishing].

Ongstad, S., Hudson, B., Pepin, B., Imsen, G. & Kansanen, P. (2005). *Didaktik and/in mathematics education. Studying a discipline in international, comparative and communicational perspectives.* Oslo: Oslo University College.

Orland, L. (1997). *Becoming a mentor: A study of the learning of novice mentors.* Dissertation. Haifa: University of Haifa.

Orland-Barak, L. & Klein, S. (2005). The expressed and the realised: Mentors' representations of a mentoring conversation and its realisation in practice. *Teaching and Teacher Education,* 21**,** pp. 379-402.

Palincsar, A. S. & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction,* 1(2), pp. 117-175.

Patton, M. Q. (2002). *Qualitative research & evaluation methods.* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Perks, P. & Prestage, S. (1994). Planning for learning. In A. Watson & B. Jaworski (eds.), *Mentoring in mathematics teaching*, pp. 65-82. London: Falmer Press.

Phillips, D. (1992). *The social scientist's bestiary. A guide to fabled threats to, and defences of, naturalistic social science.* Oxford: Pergamon Press.

Polanyi, M. (1973). *Personal knowledge.* London: Routledge.

Rasmussen, J. (1999). Mesterlære og den almene pædagogik [Apprenticeship and general education, in Danish]. In K. Nielsen & S. Kvale (eds.), *Mesterlære. Læring som social praksis* [Apprenticeship. Learning as social practice; in Danish], pp. 199-218. København: Hans Reitzels Forlag.

Ricoeur, P. (1971). The Model of the text: Meaningful action considered as a text. *Social Research,* 38**,** pp. 529-562.

Ricoeur, P. & Thompson, J. B. (1981). *Hermeneutics and the human sciences. Essays on language, action and interpretation.* Cambridge: Cambridge University Press.

Roberts, A. (2000). Mentoring revisited: A phenomenological reading of the literature. *Mentoring and Tutoring,* 8(2), pp. 145-170.

Rodd, M. (1995). Dimensions of mathematics mentoring in school-based initial teacher education. *Teachers and Teaching: Theory and Practice,* 1(2), pp. 229-246.

Rodgers, C. R. (2001). "It's elementary": The central role of subject matter in learning, teaching, and learning to teach. *American Journal of Education,* 109(August), pp. 472-480.

Rogoff, B. (1982). Integrating context and cognitive development. In M. E. Lamb & A. L. Brown (eds.), *Advances in developmental psychology* (vol.2). Hillsdale, NJ: Erlbaum.

Rogoff, B. (1990). *Apprenticeship in thinking. Cognitive development in social context.* New York: Oxford University Press.

Rogoff, B. (1995). Observing sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. In P. Del Río, A. Alvarez & J. V. Wertsch (eds.), *Sociocultural studies of mind*, pp. 139-164. Cambridge: Cambridge University Press.

Rommetveit, R. (1979). On the architecture of intersubjectivity. In R. Rommetveit & R. M. Blakar (eds.), *Studies of language, thought and verbal communication*, pp. 93-107.

London: Academic Press.

Ryle, G. (1949). *The concept of mind.* London: Hutchinson.

Ryle, G. (1971a). The thinking of thoughts. What is 'le Penseur' doing? In G. Ryle (ed.), *Collected papers, 1929-1968*, pp. 480-496. London: Hutchinson.

Ryle, G. (1971b). Thinking and reflecting. In G. Ryle (ed.), *Collected papers, 1929-1968*, pp. 465-479. London: Hutchinson.

Säljö, R. (2001). *Læring i praksis. Et sosiokulturelt perspektiv.* [Learning in Practice. A Socio-Cultural Perspective; in Norwegian]. Oslo: Cappelen Akademisk Forlag.

Salomon, G. (1993). No distribution without individuals' cognition: A dynamic interactional view. In G. Salomon (ed.), *Distributed cognitions. Psychological and educational considerations*, pp. 111-138. New York: Cambridge University Press.

Samaras, A. & Gismondi, S. (1998). Scaffolds in the field: Vygotskian interpretation in a teacher education program. *Teaching and Teacher Education,* 14(7), pp. 715-733.

Schoenfeld, A. H. (1985). *Mathematical problem solving.* Orlando, FL: Academic Press.

Scribner, S. (1985). Vygotsky's uses of history . In J. V. Wertsch (ed.), *Culture, communication, and cognition: Vygotskian perspectives*, pp. 119-145. New York: Cambridge University Press.

Schön, D. A. (1983). *The reflective practitioner. How professionals think in action.* New York: Basic Books.

Schön, D. A. (1987). *Educating the Reflective Practitioner.* San Fransisco: Jossey Bass.

Schön, D. A. (1988). Coaching reflective teaching. In G. L. Erickson & P. P.Grimmett (eds.), *Reflection in teacher education*, pp. 19-38. New York: Teachers College Press.

Shulman. L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher,* 15(2), pp. 4-14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harward Educational Review,* 57(1), pp. 1-22.

Shulman, L. S. (1998). Theory, practice, and the education of the professionals. *The Elementary School Journal,* 98(5), pp. 511-526.

Skagen, K. (1998). *A mind free from distraction: A micro-sociological study of supervision conferences in teacher training.* Dissertation. Tromsø: Institute for Education, Faculty of Social Sciences, University of Tromsø.

Skagen, K. (2000). Norsk veiledningstradisjon i lærerutdanning - analyse og kritikk [Norwegian supervision tradition in teacher education- analysis and criticism; in Norwegian]. In K. Skagen (ed.), *Kunnskap og handling i pedagogisk veiledning* [Knowledge and action in pedagogical supervision; in Norwegian], pp. 19-34. Bergen: Fagbokforlaget.

Skagen, K. (2001). Veiledningssamtaler i bakhtinsk perspektiv [Supervision conversations within a Bakthinian perspective; in Norwegian]. In Dysthe, O. (ed.), *Dialog, samspel og læring* [Dialogue, interaction and learning; in Norwegian], pp. 197-218. Oslo: Abstrakt forlag.

Slåtten, K. (1998). Fagrelatert didaktisk kunnskap. Perspektiver på begrepet "pedagogical content knowledge"[Subject related didactic knowledge: Perspectives on "pedagogical content knowledge"; in Norwegian]. *Nordisk Pedagogikk*, 18(3), pp. 163-173.

Stake, R. E. (1985). Case study methods in educational research: Seeking sweet water. In R. M. Jaeger (ed.), *Complementary methods for research in education*, pp. 253-300. Washington: American Educational Research Association.

Stake, R. E. (1995). *The art of case study research.* Thousand Oaks, CA: Sage Publications.

Stake, R. E. (2000). Case studies. In N. K. Denzin & Y. S. Lincoln (eds.), *Handbook of qualitative Research* (2nd ed.), pp. 435-454. Thousand Oaks, CA: Sage Publications.

Stake, R.E. (2005). Qualitative case studies. In N. K. Denzin & Y. S. Lincoln (eds.), *The Sage handbook of qualitative research* (3rd ed.), pp. 443-466. Thousand Oaks, CA: Sage Publications.

Stone, C. A. (1993). What is missing in the metaphor of scaffolding? In E. A. Forman, N. Minick & C. A. Stone (eds.), *Contexts for learning. Sociocultural dynamics in children's development*, pp. 169-183. New York: Oxford University Press.

St.meld.nr.12 [Governmental white paper no 12] (1999-2000) *… og yrke skal båten bera…Handlingsplan for rekruttering til læraryrket* ['…education is survival'…Action plan for recruiting to the teaching profession; in Norwegian]. Oslo: KUF.

St.meld.nr.16 [Governmental white paper no 16] (2001-2002) *Kvalitetsreformen. Om ny lærerutdanning: mangfoldig - krevende – relevant* [The quality reform. About new teacher education: diversified – demanding – relevant; in Norwegian]. Oslo: KUF.

Strauss, A. L. & Corbin, J. M. (1998). *Basics of qualitative research. Techniques and procedures for developing grounded theory. (*2nd ed.). Thousand Oaks, CA: Sage Publications.

Strømnes, Å. L. (1994). Fagdidaktikken sin plass i fagplanane i lærarhøgskolane [The place of 'fagdidaktikk' in the syllabus of teacher education colleges; in Norwegian]. *Prismet*,(5), pp. 217-223.

Strømnes, Å. L. (1983). Praksisrettleiaren - har han falle ut av den pedagogiske historia? [The supervisor of practice – has he fallen out of the history of education?; in Norwegian] In K. Skagen & T. Tiller (eds.), *Praksisveileder eller øvingslærer? Om veiledning i lærerutdanning og skole* [Supervisor of practice or cooperating teacher? About supervision in teacher education and school; in Norwegian], pp. 39-60. Oslo: H. Aschehoug & Co.

Strømnes, Å. L. (1999). *Praksisopplæringa i grunnskolens lærarutdanning - eit historisk oversyn* [The practical teacher training in the teacher education for primary and lower

secondary school – a historical overview; in Norwegian]. Notodden: Stiftelsen "Skolen - årbok for norsk utdanningshistorie" [The school – Yearbook for Norwegian Education History; in Norwegian].

Sundli, L. (2001). *Veiledning i lærerutdanningens praksis - mellom refleksjon og kontroll* [Mentoring in the practice field of teacher education – between reflection and control; in Norwegian]. Dissertation. Oslo: Høgskolen i Oslo, Avdeling for lærerutdanning.

Sundli, L. (2002). *Veiledning i virkeligheten. Praksisveiledning med lærerstudenter.* [Mentoring in the real world. Mentoring student teachers through field experiences; in Norwegian]. Oslo: Gyldendal akademisk.

Søndenå, K. (2002). *Tradisjon og transcendens, ei fenomenologisk studie av refleksjon i norsk førskulelærarutdanning* [Tradition and transcendence, a phenomenological study of reflection in Norwegian pre-school teacher education; in Norwegian]. Dissertation. Göteborg: Acta Universitatis Gothoburgensis.

Taylor, C. (1985). Interpretation and the sciences of man. In C. Taylor (ed.), *Philosophical papers*, pp. 15-57. Cambridge: Cambridge University Press.

Taylor, S. J. & Bogdan, R. (1998). *Introduction to qualitative research methods. A guidebook and resource.* (3rd ed.). New York: John Wiley & Sons.

Tharp, R. G. & Gallimore, R. (1988). *Rousing minds to life. Teaching, learning and schooling in social context.* Cambridge: Cambridge University Press.

Trevarthen, C. (1979). Communication and cooperation in early infancy: A description of primary intersubjectivity. In M. Bullowa (ed.), *Before speech. The beginning of interpersonal communication*, pp. 321-347. Cambridge: Cambridge University Press.

Tudge, J. R. (1992). Processes and consequences of peer collaboration: A Vygotskian analysis. *Child Development*, (63), pp. 1364-1379.

Tveitereid, M. (1997). *Matematikk, naturvitenskap, teknologi. Tiltak for å styrke disse fagområdene i norsk utdanning: Sluttrapport* [Mathematics, science, technology. Attempts to strengthen these subject areas in Norwegian education: Final report; in Norwegian]. Oslo: KUF.

UFD [Department of Education and Research] (2003). Rammeplan for allmennlærerutdanningen [Overall fremework for teacher education for primary and lower secondary school; in Norwegian]. Retrieved September 12, 2006, from www.dep. no/archive/ufdvedlegg/01/04/2Ramm012.pdf. Oslo:UFD.

UFD [Department of Education and Research] (2005). Strategiplan. *Realfag, naturligvis - strategi for styrking av realfagene 2002-2007* [Strategy plan. Science and mathematics, naturally – strategy for strengthening science and mathematics; in Norwegian]. Oslo: The Ministry.

Veenman, S. (1984). Perceived problems of beginning teachers. *Review of Educational Research***,** 54, pp. 143-178.

Vygotsky, L. S. (1978). *Mind in society. The Development of higher psychological processes.*

Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1981a). The genesis of higher mental functions . In J. V. Wertsch (ed.), *The concept of activity in Soviet psychology*, pp. 144-188. New York: M. E.Sharpe.

Vygotsky, L. S. (1981b). The instrumental method in psychology. In J. V. Wertsch (ed.), *The concept of activity in Soviet psychology*, pp. 134-143. New York: M.E.Sharpe.

Vygotsky, L. S. (1986). *Thought and language.* Cambridge, MA: The MIT Press.

Vygotsky, L. S. (1987). Thinking and speech. In R. W. Rieber & A. S. Carton (eds.), *The collected works of L.S. Vygotsky. Volume 1. Problems of general psychology*, pp. 39-285. *New* York: Plenum Press.

Wells, C. G. (1999). *Dialogic inquiry: Towards a sociocultural practice and theory of education.* New York: Cambridge University Press.

Wenger, E. (1998). *Communities of practice. Learning, meaning, and identity.* Cambridge: Cambridge University Press.

Wertsch, J. V. (1979). From social interaction to higher psychological processes. *Human Development*, 22(1), pp. 1-22.

Wertsch, J. V. (1981). An introduction to Vygotsky, L. S.: The genesis of higher mental functions. In J. V.Wertsch (ed.), *The concept of activity in Soviet psychology. An introduction*, pp. 144-147. New York: M. E. Sharpe.

Wertsch, J. V. (1984). The zone of proximal development: Some conceptual issues. In B. Rogoff & J. V. Wertsch (eds.), *Children's learning in the "zone of proximal development"*, pp. 7-17. San Francisco: Jossey-Bass.

Wertsch, J. V. (1985). *Vygotsky and the social formation of mind.* Cambridge, MA: Harvard University Press.

Wertsch, J. V. (1991). *Voices of the mind. A sociocultural approach to mediated action.* Cambridge, MA: Harvard University Press.

Wertsch, J. V. (1994). The primacy of mediated action in sociocultural studies. *Mind, Culture, and Activity*, 1(4), pp. 202-208.

Wertsch, J. V. (1998). *Mind as action.* New York: Oxford University Press.

Wertsch, J. V., del Río, P. & Alvarez, A. (1995). Sociocultural studies: history, action, and mediation. In J. V. Wertsch, P. del Río & A. Alvarez (eds.), *Sociocultural studies of mind*, pp. 1-34. Cambridge: Cambridge University Press.

Wertsch, J. V. & Stone, C. A. (1985). The concept of internalisation in Vygotsky's account of the genesis of higher mental functions. In J. V. Wertsch (ed.), *Culture, communication and cognition: Vygotskian perspectives*, pp. 162-179. Cambridge: Cambridge University Press.

Wildman, T. M., Niles, J. A., Magliaro, S. G. & McLaughlin, R. A. (1989). Teaching and

learning to teach: The two roles of beginning teachers. *The Elementary School Journal,* 89(4), pp. 471-493.

Wolcott, H. F. (1990). *Writing up qualitative research.* Newbury Park, CA: Sage Publications.

Wolf, N. (2003). Learning to teach mathematics for understanding in the company of mentors. *Teachers and Teaching: Theory and Practice,* 9(2), pp. 87-106.

Wood, D. (1998). *How children think and learn. The social contexts of cognitive development.* (2nd ed.). Oxford: Blackwell.

Wood, D., Bruner, J. S. & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry,* 17**,** pp. 89-100.

Yin, R. K. (2003). *Case study research. Design and methods.* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Zeichner, K. (1996). Designing educative practicum experiences for prospective teachers. In K. Zeichner, S. Melnick & M. Gomes (eds.), *Currents of reform in preservice teacher education,* pp. 215-234. New York: Teachers College Press.

Zeichner, K. & Gore, J. (1990). Teacher socialization. In W. R. Houston, M. Haberman & J. Sikula (eds.), *Handbook of research on teacher education. A Project of the Association of Teacher Educators,* pp. 329-348. New York: Macmillan.

Zinchenko, V. P. (1985). Vygotsky's ideas about units for the analysis of mind. In J.V. Wertsch (ed.), *Culture, communication and cognition: Vygotskian perspectives*, pp. 94-118. Cambridge: Cambridge University Press.

# Appendices

## *Appendix 1*

## *Overview of the data material*

In the table below I present what kind of data material I collected and what abbreviations I have used in the research text.

| Data sources | Abbreviations | Example |
|---|---|---|
| Transcriptions from mentoring conversations that were either taped or video-recorded | mc and date (month, day, year) | mc030403 |
| "Write ups" from mentoring conversations | mcwu and date (month, day, year) | mcwu030403 |
| Observations from the classroom and mentoring conversations | obsj and date (month, day, year) | obsj111102 |
| Transcriptions from interviews with Sara | int and date (month, day, year) | int030403 |
| Transcriptions from interviews with the student teachers | int and the two first letters of the student teachers' names | intel (interview with Eli) |
| Log books from the student teachers | lb and the two first letters of the student teachers' names plus date (month, day, year) | lbel121102 (log book from Eli) |
| A booklet with information to the student teachers from Sara | infb and page number | Infb, p. ? |

Direct quotes are marked with a reference to page numbers, for instance mc030403, p. 3. The quotes have been translated by me and I have carefully tried to be true to the the intention. (…) in the quotes mark that text has been omitted. Text added to the quotes to make them understable is marked with []. The same is done with quotes from literature.

Below I use the abbreviations to show which sorts of data were collected at what time during the field work. In the tables I have marked off the topics of the teaching with the kids. I have not marked off everything that happened regularly; assembling in the class circle every morning and before the kids leave school and additional individual work when there was time left between the main topics. There were also some class meetings as a response to problems reported by the kids. Sara was the one who led those meetings. In the mentoring conversations I have not marked off pre- and post-teaching conversations that took place regularly. I have marked off topics that were discussed beyond what happened in the classroom. See Chapter 4, page 81 for a description of the teaching periods 1-4 in mathematics as referred to in the table below.

*Autumn period, first week:*

| Date | Topics for the teaching in the classroom | Topics that were discussed in mentoring conversations | Data material |
|---|---|---|---|
| 11/11/02 | Mathematics, teaching period 1<br>Newspaper project | Expectations of field experiences | mcwu111102<br>mc111102<br>obsj111102 |
| 11/12/02 | Mathematics, teaching period 1<br>Newspaper project | Use of log book | mcwu111202<br>mc111202<br>obsj111202 |
| 11/13/02 | Mathematics, teaching period 1<br>Newspaper project | Pedagogical principles in MAKVIS<br>Use of textbooks in mathematics | mcwu111302<br>mc111202<br>obsj121102 |
| 11/14/02 | Mathematics, second and third graders together | Use of planning documents | obsj111402 |
| 11/15/02 | Newspaper project<br>Artistic expression | Reading tests | mcwu111502 |

*Autumn period, second week*

| Date | Topics for the teaching in the classroom | Topics that were discussed in mentoring conversations | Data material |
|---|---|---|---|
| 11/18/02 | Reading test<br>Reading together with the kids<br>Newspaper project | Discussing generally about kids who struggle with reading | mcwu111802<br>mc111802 |
| 11/19/02 | Newspaper project | | mcwu111902<br>mc111902 |
| 11/20/02 | Mathematics, teaching period 2 | Discussing the role of the teacher on different grade levels | mcwu111302<br>mc111202<br>obsj112002 |
| 11/21/02 | Mathematics, second and third graders together | Discussing use of log books | mcwu112102<br>obsj112102 |
| 11/22/02 | The kids and the student teachers have a day off. Sara and the other teachers at Seaside attend courses. | | |

*Autumn period, third week*

| Date | Topics for the teaching in the classroom | Topics that were discussed in mentoring conversations | Data material |
|---|---|---|---|
| 11/25/02 | Outdoor day in the woods | Discussing play and learning | mcwu112502<br>obsj112502 |
| 11/26/02 | Cooperative story production | Discussing the role of the teacher based upon prepared "key words" | mcwu112502<br>obsj112602 |
| 11/2702 | Reading the stories | Discussing working with the learning environment | mcwu112702<br>obsj112702 |
| 11/28/02 | Mathematics, second and third graders together | Evaluating Sara and the student teachers' contract for the period | mcwu112802 |
| 11/29/02 | End of Newspaper project<br>Artistic expression | Discussing the aims of different ways of organising kids across classes | mcwu112902 |

*Additional data material from the autumn period:*

*Interview with Sara (int010303). Topics that were discussed:*

- About being and developing as a teacher and a cooperating teacher.
- Her thinking about mentoring; pre- and post-teaching conversations, use of planning documents and log books.
- About cooperation with other cooperating teachers and the teachers at the university college.
- How she experienced her collaboration with Eli, Eric, Ian, Ina and Irene in the autumn.

*Log books from the student teachers:*
Some of them wrote regularly, others just a few days. Some of them wrote rather long passages, others rather short ones. Some of them wrote a lot about mathematics, others did not. I have not found it necessary to write in the table exactly who did the writing on which day.

*Booklet with information about the school and the class from Sara to the student teachers.*

*The Spring period:*

Data material before the student teachers entered the classroom:

*Planning 02/13/03 (mcwu021303):*
Discussed what subjects and topics should be the content of the spring period. They agreed upon mathematics and Norwegian as main subjects. The student teachers also proposed to teach English and take responsibility for activities related to the theme Easter in religion and ethics and in arts and crafts.

*Planning 03/20/03 (mc032003):*
Planning of mathematics, teaching period 3. The student teachers were prepared and the session took place as a pre-teaching conversation.

*Planning 03/21/03 (mcwu032103):*
Discussing teaching of Norwegian. They agree to start with a reading project, and continue with argumentative and poetic texts. They especially discussed how kids should develop their way of giving each other responses on texts and how the kids could use the computer in this work.

*Spring period, first week*

| Date | Topics for the teaching in the classroom | Topics that were discussed in mentoring conversations | Data material |
|---|---|---|---|
| 03/24/03 | Religion and ethics: Easter<br>Reading project | | mcwu032403<br>mc032403<br>obsj032403 |
| 03/25/03 | Reading project<br>Mathematics, teaching period 3<br>English/swimming | Discussing observations of the kids, both structured and unstructured, both in the classroom and in the breaks | mcwu032503<br>mc032503 |
| 03/26/03 | Reading project<br>Mathematics, teaching period 3<br>School based well-being survey | Discussing well-being inquires; the meaning behind | mcwu032603<br>mc032603 |
| 03/27/03 | Mathematics, teaching period 3<br>Artistic expression | | mc032703<br>obsj032703 |
| 03/28/03 | Argumentative texts | | mcwu032803<br>mc032803<br>obsj032803 |

*Interview with Sara (int032803). Topics that were discussed:*

- How she has experienced this first week of the spring period, especially the third teaching period of mathematics.
- About all the things they have to address.
- About her contribution to student teachers' development.
- About her role in mentoring conversations.

*Spring period, second week*

| Date | Topics for the teaching in the classroom | Topics that were discussed in mentoring conversations | Data material |
|---|---|---|---|
| 03/31/03 | Argumentative texts | | mcwu033103<br>mc033103 |
| 04/01/03 | Mathematics, teaching period 4<br>Argumentative texts<br>English/swimming | | mcwu040103<br>mc040103<br>obsj040103 |
| 04/02/03* | Mathematics, teaching period 4<br>Assembly 1-4 graders | | |
| 04/03/03 | Mathematics, teaching period 4<br>Artistic expression | | mcwu040303<br>obsj040303 |
| 04/04/03 | Argumentative texts<br>Poetic texts | Discussing how to talk with kids and give responses on texts | mcwu040403<br>obsj040403 |

*The student teachers were alone the whole day. Sara was at a course at the university college.

This second week the student teachers attended parent meeting with the kids in the evenings. The time for this was taken from the mentoring sessions and hence these mainly focused on pre- and post-teaching conversations.

*Interview with Sara (int030403). Topics that were discussed:*

- How Sara experienced the student teachers' fourth teaching period.

*Spring period, third week*

| Date | Topics for the teaching in the classroom | Topics that were discussed in mentoring conversations | Data material |
|---|---|---|---|
| 04/07/03 | Religion and ethics: Easter<br>Poetic texts | Individual conversations with the student teachers | |
| 04/08/03 | Stations for arts and crafts, Easter | Individual conversations with the student teachers | |
| 04/09/03 | Stations for arts and crafts, Easter | Individual conversations with the student teachers | |
| 04/10/03 | Poetic texts<br>Religion and ethics: Easter<br>Artistic expression | Summing up the field experiences<br>Discussing the connection between actions – values - knowledge in teaching | mcwu041003 |
| 04/11/03 | Easter breakfast<br>Poetic texts | | mcwu041103<br>obsj041103 |

From all three weeks there were log books from the student teachers. See comments above, page 211.

*Interview with Sara (int041103). Topics that were discussed:*

- About student teachers' learning from different sources, from each other, from her,

from teaching, from writing.
- Her role as a teacher and cooperating teacher.
- What she has learned from this student-teacher group.
- Why she finds it important to use interactive log books.
- Pre- and post-teaching conversations.
- About having good relations with the kids.
- About supporting the individual student teacher.

*Interview with Sara (int050503). Topics that were discussed:*

- Watching video from the mentoring of the third teaching period. Sara explains how she experienced episodes, why she asked some of the questions and why she responded like she did to student teachers' expressions.
- Talking about how different the student teachers are.
- Talking about how difficult she finds it to include subject matter thinking.
- About student teachers' experiences with mathematics.

*Interview with Sara (int052503). Topics that were discussed:*

- Watching video from the mentoring of the fourth teaching period. Sara explains how she experienced episodes, why she asked some of the questions and why she responded like she did to student teachers' expressions.
- Talking about the improvisational features of both teaching and mentoring.

*Individual interviews with the student teachers.*

Irene was interviewed on the ninth of May 2003, the other four were interviewed on the twenty third of April 2003. The interviews were semi-structured and these topics were discussed:

- How they experienced their field experiences.
- Three things from Sara that have contributed to their development as teachers.
- How they experienced Sara's way of mentoring and questioning.
- How they experienced writing log books.
- Kids and mathematics.
- How they experienced teaching of mathematics.
- How these field experiences have affected how they think about teaching and their choice of becoming a teacher.
- Adding comments from each of them.

## *Appendix 2*

## *Use of analytical tools in the research process.*

In Chapter 3, "Approaching the field" I explained how I proceeded through the entire research process from my first interest in the issue to the writing of this research text. I situated my research within a qualitative, interpretative tradition, and showed how one feature of qualitative research is the intertwining of data collection and data analysis throughout the entire research process. Furthermore, I explained that my final analysis was carried out in steps so I could better understand what was taking place, or what this could be a case of. I described how I arrived at the three themes (presented in the three chapters 5 to 7) which can explain my finding that Sara inspires and assists the student teachers to teach mathematics in a way they can learn from, or from which they can develop pedagogical content knowledge. This appendix provides a more detailed account of the steps I undertook through the final analysis. In each of the steps described on page 50 I went back and forth between examining or analysing the data material, the ideas I had developed and theories. These processes can be seen as taking "sidesteps".

This text shows how reading literature inspired and developed my thinking, not only relating to how to understand my data but also to my methodological concerns, and also shows how I wrote down my reasoning and thinking in different ways. I will present some of the figures and tables I made to view connections and understand what I was dealing with (Miles & Huberman 1994). The work I describe here is seen as a systematic and structured process, but also as an intuitive and creative process. This makes it difficult to point to exactly when and where I found the answers to my research question. The reconstruction of the process must be seen while bearing this in mind. This must not be seen as an accurate successive account; rather I give examples of analytical tools or devices I used when I made sense out of "mountains of data" (Strauss & Corbin 1998, p. 7).[136]

Taylor and Bogdan (1998) maintain that by the time the intense analysis starts you should know your data material inside and out. I gathered the data mainly in November 2002 and April/May 2003, and the interval between these two periods was used to listen to tape recordings, write transcriptions, read literature and develop ideas. When I left the field it was time to combine insight and intuition with an intimate familiarity with the data material (Taylor & Bogdan 1998). I started my final analysis by sorting the data in accordance with the four periods of the student teachers' own teaching as outlined in Chapter 4. This was when I put together all the material which belongs to each of these periods, field notes, "write ups", transcriptions from mentoring sessions and interviews, log books from all participants and various documents. The rest of the data material, for instance "write ups" of all the mentoring conversations and the transcribed conversations on "mixed-age classes" were sorted by date. The first sorting provided the material for the more systematic analysis I describe here, but the rest of the material informed the process as well. I constantly read through the material and it is important to bear in mind is that all data were available throughout the analysis I made during the fieldwork and the intervening months.

In my final analysis I started with the material from the first teaching period. I analysed or

[136] At this time in my research process I tried to use a computer based system, N'vivo, as a device to help me in the analysis. I found that as I had come too far into the process, using this programme would probably lead me to do "double work" so I abandoned it. But I am curious and in a later project I probably will see what help the programme can provide.

scrutinised every utterance from all the provided data. In the margins I wrote down words and concepts that struck me as I worked; flexibility, seeing the kids, leading questions, strengthening, kids and math and so on. I marked recurring words and what I found to be key sentences. This process was informed by different theories, experiences and ideas developed through the fieldwork. I also marked new ideas that emerged as I examined the data. An example of this is a note, or perhaps more accurately a question I wrote down concerning different speech genres. This was inspired by the work of Skagen (1998, 2001). He points out that mentoring conversations, in terms of Bakthin (1986) can be understood as a specific speech genre. By scrutinising my data material and watching the video recordings[137] I began to wonder if more than one speech genre were present. For instance, there were many passages where the student teachers did all the talking (this occurred in mentoring all subjects) and sometimes there were rather long discussions of themes such as "play and learning" and "the role of the teacher". These thoughts led me to divide the transcription from the mentoring conversations into sequences or episodes. For each of these episodes I asked particular questions; How do the different episodes emerge? Which persons are involved? Who is talking? Which types of suggestions or ideas are coming from the student teachers, and which are coming from Sara? And how does the change between episodes occur? What were the turning points? In this process I especially tried to make sense of Sara's utterances remembering Bakthin's (1986) notion of how utterances always must be understood in their context. Furthermore, Eisner (1991) points to the importance of understanding not only what is said but also how it is said (one of the reasons why I kept watching and listening to the recordings even if I had made transcriptions), and I would add, to understand why it is said. How could I understand when and why Sara responded to the student teachers talk? The result of this was that "seeing the kids" emerged as an important feature.

Through my fieldwork I had came upon the idea of parallelism; in interviews Sara often answered my questions about the student teachers by saying "it's just like the kids" before she gave me examples. This made me look for parallels in different ways. Sometimes I found rather explicit examples; Sara told the student teachers about the kids' work process: "The kids have got to try things out, not just tell them and and not make a recipe to follow", and then she says about the student teachers' process "we'll try now, we'll try things out" (mc111902, p. 1). This feature of her expressions made me wonder if I could understand her interactions with the student teachers in terms of how she wanted the student teachers to interact with the kids. For example she asks: "What can we do so kids can learn from experiences? Does this happen on its own?" (obsj, p. 9). This made me think, "what was Sara doing so the student teachers chould learn from their experiences? Does this happen on its own with them?" I inserted these parallels and my thoughts on them in a table: [138]

[137] Even if these recordings were fixed into texts I kept watching and listening to them.

[138] As will be seen below, tables like this became important analytical tools. I will not reproduce whole tables; some of them are rather long, finding it sufficient here to provide headings and some examples of the type of text I wrote. The text is written just like it was at the time I wrote it down, both in the tables and in the figures I will show below.

| Utterances from Sara | My thoughts | What does she do? How does she connect to the student teachers? |
|---|---|---|
| ”What can we do in the wings so the kids will flourish? I think that’s where it is at.” | What does she do in the wings so the student teachers will flourish? | |
| ”The greatest moment as a teacher is when I get in a dialogue with kids, hear what they are thinking and hear – learn from them, like.” | | When she leans back and listens to the student teachers. |
| ”In all the things we work on for the kids we must gives it in drips over and over again.” | | “Seeing the kids” is being given in drips to the student teachers |

Sara often stated that she does not believe that she can simply tell things to the student teachers and they will understand. Nonetheless, I found that sometimes she did tell or inform the student teachers and I had to understand when and why she did so. This was inspired by Glaser and Strauss’ (1999) constant comparative method and also by Orland-Barak and Klein’s (2005) article where they show that the way mentors express how they think about mentoring often did not fit what they actually did. This led me to analyse from two points of view. First, what was the connection between what Sara said and what she did, and second, how did her thoughts come into action? Gadamer (2000), as told in Chapter 3 points to how researchers have to be in a dialogue with their material, listening to what the data material or the case tells them. To be able to create meaning we must allow the text to open up to our questions and listen to the answers. Along every step of the way there were many questions to ask to maintain my dialogue with the data material. According to Strauss and Corbin (1998) one should make comparisons and ask questions often, using them systematically as major procedures. These are the two main analytical tools, while others, for example tables, figures and diagrams are used to assist those.

Answers to my questions and other thoughts, like the ones referred to above, were handwritten on large sheets (A3 format) for each of the mentoring conversations belonging to each teaching period. I also noted down recurring words (for example: see, experience aim, challenge, strengthen, collaboration, interplay, tool) and key sentences (for example “the teacher is not the most important person”, “so they would not get hung up in the school they attended to”, “we have to be good at seeing”). I noted down that I could see Sara always used the word “we” instead of “you”, and I took it to mean that she saw herself as part of the group. Data from all sources that I connected to each mentoring conversation, such as interviews and log books, were written down on the same A3 page. The aim of this analytical process is to reduce large amounts of data down to a few themes, dimensions, codes or categories as an answer to the research question (see for example Creswell 1998, Miles & Huberman 1994, Patton 2002). The next in reduction of the material was to summarise all the A3 sheets that belonged to the same teaching period. This was done in a word file on the computer. I wrote down descriptions as ordinary text and my thoughts about them in italics. I ended this data reduction by summarising each teaching period in a table like this:

Example, the first teaching period.

| What is Sara doing? | What happens in the mentoring conversations? | Concepts, key words that emerge | My own thoughts on this |
|---|---|---|---|
| Sara puts the student teachers on the track as to what they can observe while the kids play games. | The student teachers share their experiences. | Experiences<br>See | Sara models how she believes kids learn math? |
| Makes visible what she usually does. | Discuss kids' work. | Seeing the kids<br>Twist | Let the student teachers discuss so she can learn what they are thinking about? |
| Turns their experiences into something positive. | Share their experience of teaching the kids.<br>Discuss use of textbooks. | Strengthening<br>Drip<br>Supportive<br>Leading, positive questioning<br>Challenge? | She has apparently seen all the student teachers in the classroom as all five receive comments on their performance. |

When I had worked thoroughly through the two first two teaching periods I came upon the idea of a series of experiences and drew this model:

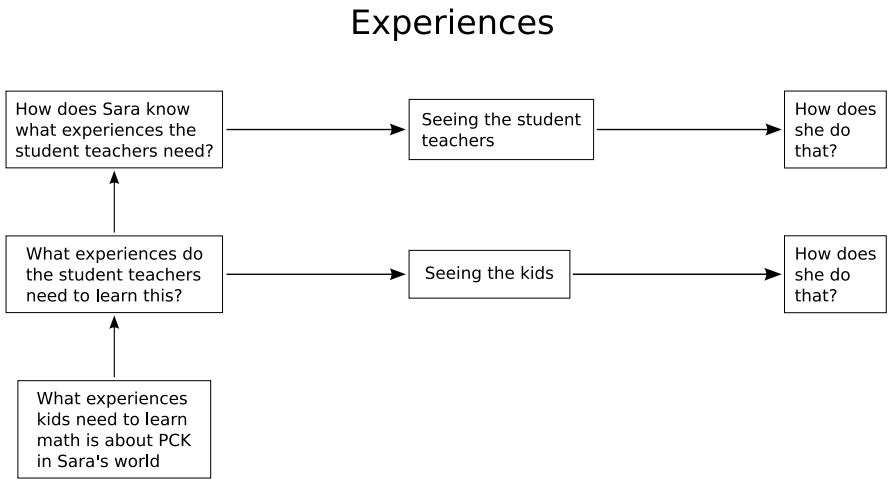


**Figure 6: Experiences (must be read from the bottom)**[139]

I made a number of different summarising tables in this phase. One of them summarised the interviews with the five student teachers. The interviews were semi structured, and I asked similar open-ended questions of all five (see Appendix 1, page 214). There were some recurring traits in the answers and as is the case with the theory, the student teachers experiences and answers became looking glasses. I have put in some examples of questions and text from the table:

[139] PCK is an abbreviation for pedagogical content knowledge.

| Themes I asked about | Eli | Eric | Ian | Ina | Irene |
|---|---|---|---|---|---|
| Spontaneous thoughts on your time with Sara | The cooperation between everyone. The importance of a good class environment for learning | | That we were not responsible for everything. Got time to think. | Learnt something about how to talk with kids | Sara is “innovative” |
| Three important things Sara did so you developed your thoughts about being a teacher | | The way Sara talks with the kids. Safety. You knew you got the help you needed. | She is a person who managed to motivate us. She is eager and seems to be interested in everything we say. Allowed to make mistakes. | How much you have to do for ecah kid, it is not only the class. | She is open |
| Kids and mathematics | Mathematics is fun for the kids, they dare. | Great differences between the kids. Various ways of doing mathematics. | Incredible differences in the way you should act to help all the kids. | How all the kids both calculate and thinks in a number of ways. | |
| About Sara’s way of questioning | The questions are very well thought out. Things are concealed a bit so that you shall find out for yourself. | | | | She asks the right questions to ”get the thinking process going” |

At this time in my data analysis I did a lot of thinking, reasoning, writing, sorting and drawing, trying to understand what this could be a case of. I left the theories for a while. Of course they are always with me, but I did not use them to label my understanding.

This led me to the next model (must be read from the top):

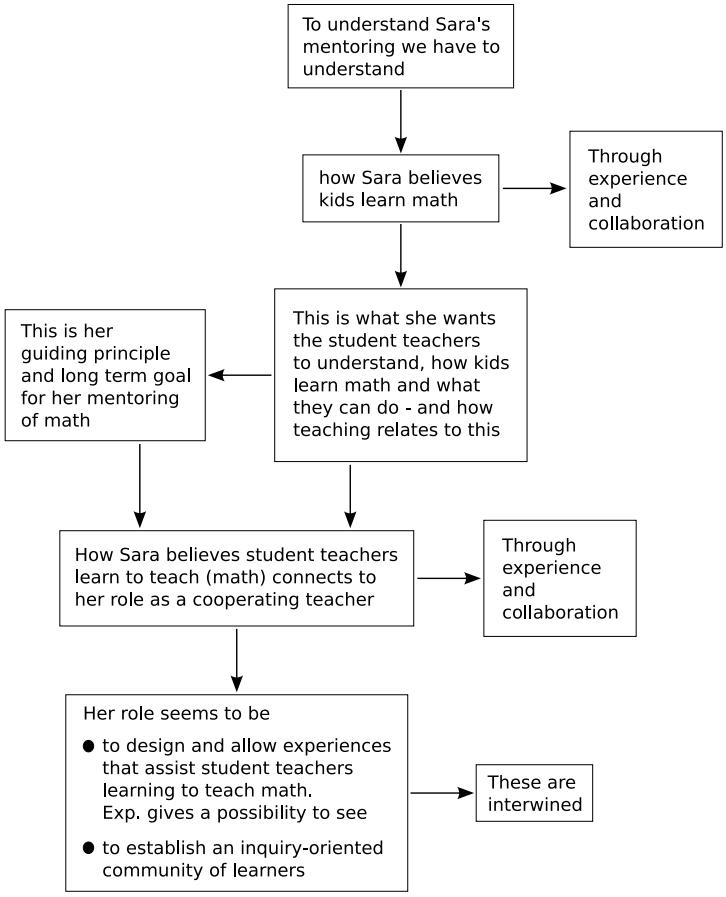


**Figure 7: Steps to understand Sara's mentoring**

Having realised this, my next step was to understand how Sara connects her role as a cooperating teacher to how she believes student teachers learn to teach mathematics. If they learn through experience and collaboration I had to find out more about her role in that process. These two concepts were important for understanding her actions and hence her support. How will the mentoring be when you believe student teachers learn through experience and collaboration? In a way I examined the phenomena of collaboration and experience. Hence I asked new questions, this time inspired by Burke (1969); "What was done (act), when or how was it done (scene), who did it (agent), how he did it (agency), and why (purpose)" (p. xv). Glaser and Strauss (1999) recommend asking similar questions when their constant comparative method is used.

Even if I had reduced a huge amount of data as shown in step one I never left behind the hundreds of pages of "write ups" and transcriptions. By now I had sorted the material according to post- and pre-teaching conversations so I could understand Sara's thinking and actions regarding the two concepts of experience and collaboration. It is useful to sort and examine data in as many ways as possible (Taylor & Bogdan 1998). New ideas became new glasses, and I filled more A3 sheets. This time, for example I put the word "experience" in the middle of the page and wrote down what I decided to be important around it.

The word experience was constantly popping up in the data material and simultaneously with this analysis I turned my attention to the work of Dewey (1938/1997). His work on the concept of educative experience helped me to see that Sara's assistance to and support of the student teachers could be understood in terms of making experiences educative. In analysing the different experiences, "making visible" and "helps to see" emerged as important features of Sara's support in making the student teachers' experiences educative. This is an example of

how the constant interaction between theory and data enables qualitative researchers to gain new insight and understanding in the field of study (Gudmundsdottir 2001). Dewey's (1916, 1933, 1938) work also helped me see the connection between experiences and two other recurring words, see and aims. Earlier in the analysis I had jotted down Leontèv's (1981) tri level activity theory as a means of understanding what I interpreted to be goal directed actions taken by Sara. Dewey's work made it possible to include "seeing the student teachers", a feature that as will be seen below, became more focused through the analysis.

By this time I tried to figure out which of my concepts were well developed and which were not (Strauss & Corbin 1998). I found that I had probably captured some important concepts or categories, but I could see that they were on different levels and were from different perspectives. Some of them described processes while others described content, and some were from Sara's perspective while others were from either the kids' or the student teachers' point of view. An example of the last is "learning from experience". Some of the categories could be subcategories of main categories. I decided to sort my material to make a more thorough analysis of what I had found to be recurring and important concepts; aims, experience, collaboration (used to describe the relation between Sara and the student teachers), cooperation (used to describe the relation between the kids), see, making visible, helps to see, inquiry, tools, gives space. At the same time I sorted out material regarding log books and other features of Sara's mentoring. I will use the notion of "helps to see" as an example of this process.

As a headline I wrote "looking through the pile with 'helps to see' trying to get a grip on it". I took all the pages where "helps to see" were marked off and for each of the marked utterances I wrote down how they connected to "helps to see", for instance:

- by making links
- through questioning
- by being focused on aims
- everything you have to think about
- through stories she tells
- through dripping
- that not everything was unsuccessful

and so on. I ended up with a rather long list on this concept or phrase that I called "help to see". All these utterances were sorted into "*how* does she helps to see" and "*what* does she helps to see". I did the same with all the sorted piles for all the above-mentioned concepts (and ended up with a rather long list for them as well).

Through this process I abandoned some of the concepts, while others were combined into larger categories. As seen in figure 7 I claimed that Sara established an inquiry oriented community of learners (inspired by the work of Jaworski 2004). In my analysis I decided to drop the thought about this as a category or theme, but still felt that there was some importance in the notion. I noted that it seems to be Sara who directs or guides, but probably based upon what the student teachers want and what she thinks they need. Through this process I revealed how similar utterances were marked differently. For instance utterances starting with "is it so that" were marked both as "inquiry" and "helps to see" or "make visible". This is an example of how I through this process arrived at the understanding of guided questioning as a feature of Sara's mentoring. This emerged through the thorough analysis of "making visible", "helps to see" and "inquiry". In a way some of the words (or utterances) from the summarising tables occurred as guiding questions, for example "reinforcement, twist". Sara's own words concerning how she gives things in drips also helped me make sense of this.

Even though I could identify some patterns and traits regarding content and structure of both the pre- and post-teaching conversations I struggled to understand some of the

conversations, especially one of the post-conversations. While I identified how Sara used aims to connect content of the pre- and post-conversations, some of the post-conversations lost focus. In analysing these episodes I came to understand the importance of "seeing the student teachers". Sara's concern for giving one of the student teachers the feeling of mastery became more important than satisfying the aims. It occurred to me that Sara did not treat the student teachers in similar ways, and I asked myself, is it always like that, and if it so, what does this mean? As mentioned, Dewey's concept of educative experiences (discussed in Chapter 7) made this meaningful. In a way, I made a round trip from my early impression of "seeing the kids" to "seeing the student teachers". I began to think in terms of seeing the kids as the content of the mentoring conversations and seeing the student teachers as an important part of the methods or tools Sara used in her mentoring. I drew the figure below:

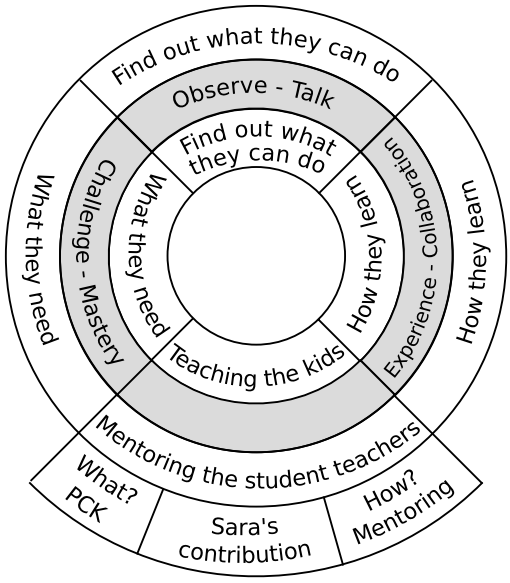


**Figure 8: The connection between the student teachers' teaching and Sara's mentoring**

The inner circle points to the student teachers' teaching, while the outer circle points to Sara's mentoring. The circle in the middle shows that the same key words appear for the student teachers' teaching and for Sara's mentoring. I exemplify this by taking a closer look at the sector where I have illustrated "find out what they can do". Finding out what kids can do is a recurring trait of the content of the mentoring conversations. They discuss the fact that this is an important part of teaching and the way to accomplish this is through observing and talking, as seen in Chapter 7 referred to as seeing by Sara. I find that a recurring trait of Sara's mentoring is that by observing and talking with the student teachers, she identifies what they can do. This is accomplished through such mentoring processes as listening to their discussions and using interactive log books. The same logic as used in this example applies equally to all sectors in the circle.

I finally had captured Sara's voice. I could see more clearly what it was Sara wanted the student teachers to learn through their experiences and what processes she wanted them to be engaged in.[140] I could see why and how she collaborated with them in the process; she does

[140] Although I by this time of the analysis was aware of what Sara told me in an interview, how she tried to use a model or circle of "action learning" I was not quite sure this was what I could see. Even if the aim is to bring out the cooperating teachers' voice, I should not let their story be my story (Gudmundsdottir 1991).

not believe in “a pedagogy of telling”, nor can you learn from experiences alone. I find Sara’s primary concern to be “how are the student teachers going to learn about kids and mathematics so they can learn to teach mathematics?” Turning this issue around I could see that the way to learn about kids and mathematics is to learn through the experiences of teaching mathematics. Thus attitudes on learning from experience become an important part of learning to teach. I find an important feature of Sara’s role to be about inspiring and assisting the student teachers “to teach mathematics in a way they can learn from”. And I drew a new model.

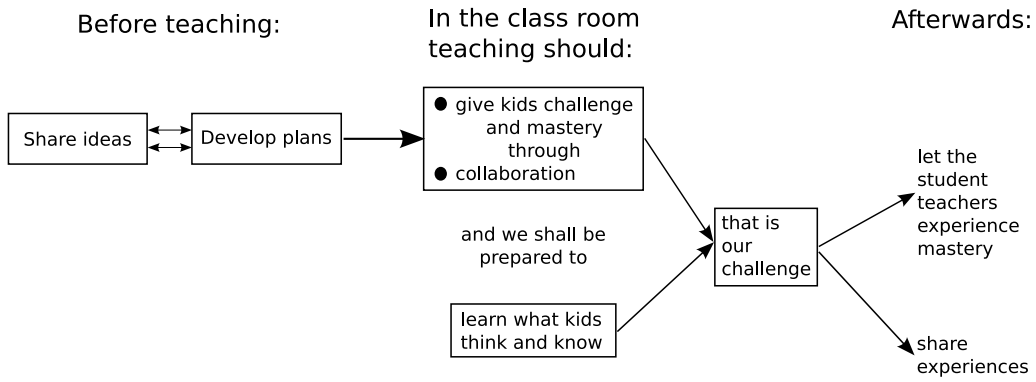


**Figure 9: The pattern in Sara and the student teachers’ collaboration**

Through all this reasoning, reading, writing and drawing I ended up with the three themes or three stories that I first presented in Chapter 3, on page 52, and then discussed through the chapters 5 to 7. From Sara’s perspective, and using my interpretation I have named the three stories “Moving towards shared focus of attention by focusing on the kids”, “Making the invisible visible through guided planning” and “Encouraging educative experiences by focusing on aims”. Taken together the stories show how Sara inspires and assists the student teachers to teach mathematics in a way that encourages educative experiences, experiences they can learn or develop pedagogical content knowledge from.

I will end this description of how I conducted the final analysis with a few concluding remarks. As a qualitative researcher working with two larger projects I find it interesting to reflect on how the end product, the written research text, always looks so simple. When the data are combined into stories and interpreted by means of theoretical concepts it seems like the themes or categories have been laid open from the start. They may be experienced as “ordinary stories” (Gudmundsdottir 1997, p. 5, my translation). But as we have seen this has been a really time-consuming process (and I have not mentioned all the time spent on transcribing the material). Reading through my log book I can see that on the 24th of June 2003 I have written “Sara and aims – is that focus?” I should add that I have travelled a really arduous and long road to get to where to could write the text, as seen from the heading of Chapter 7, “Encouraging educative experiences by focusing on aims”. At the same time it is nice to see how things have developed, not all my notes were as significant as this. There have been detours. Miles and Huberman (1994) remind the qualitative researcher of not understanding the case or the research participant too quickly. Nonetheless, analysis is always “a matter of giving meaning to first impressions as well as to final compilations” (Stake 1995, p. 71).

## *Appendix 3*

## *Letter to the parents/guardians*

The letter has been translated by me. I have also removed details to ensure anonymity.

Vivi Nilssen
[redacted]

To parents/guardians in class [redacted]

I am teaching education at [redacted] with [redacted] and one of her student teacher groups for six weeks in class 3A. While I was there I was undertaking research on mentoring student teachers through their field experiences. [redacted] My focus was on [redacted] and the student teachers in their mentoring conversations following the teaching in the classroom. The aim of the project is to broaden our understanding of how the cooperating teacher as a mentor facilitates the student teachers' development of pedagogical content knowledge in mathematics. This knowledge is necessary in teaching mathematics.

I was interested in the cooperating teachers' thoughts, reflections, utterances and actions in mentoring. In analysing my data I can see that it is relevant to use utterances from the student teachers that refer to episodes in the classroom. Examples of such utterances are:
"It was so interesting to see what pupil X thought when he solved the task"
"I struggled a bit of explaining to pupil Y about memory numbers, it was easier when pupil Z explained how she thought about it"
"Pupil X calculates rather quickly in her head"
"I find it rather strange that pupils can calculate in a way I don't understand and the answer is completely right"

I want to ask if any of you, as parents/guardians have any objections to this way of refering to the kids in the class. The project is a doctoral dissertation and all information will be anonymous. The name of the school will not be revealed and pseudonyms will be used for all names. It will take three years after completion of my field work before the the research text has been completed.
I would like to ask you to fill in the form below and deliver it to [redacted]
Thank you for your cooperation.

Kind regards

Vivi Nilssen

(Cross out the alternative that does not fit)
I/we accept/does not accept that Vivi Nilssen refers to utterances in her dissertation as shown above.

_____

Signature

## *Appendix 4*

## *Form of informed consent*

I agree to collaborate with Vivi Nilssen in her doctoral-degree study.

I agree that she audio or videotape the mentoring conversations and I am aware of the fact that those are transcribed and analysed.

I am also aware that parts of the data material (including quotes from log books and interviews) will be used as empirical data in the research report.

_____

Sign