Negotiating change

A case study of teachers making sense and use of ground rules for talk and microblogging for exploratory talk in the classroom

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Summary

With increasing use of technology in the classrooms, it requires clear pedagogical intentions and activities in order to promote students’ learning. Educational research has emphasized studies showing that many teachers use technology as an extension of established pedagogical strategies. Even though this might promote efficient teaching strategies, it does not automatically lead to increased learning outcomes for the students. The current field of educational research also highlights the significance of 21st century skills such as critical thinking, problem solving and collaboration. These skills are becoming increasingly necessary for students to learn as they enter into an ever-changing, unpredictable world.

This case study is placed within the early phases of an educational research-intervention where a combination of methodology and technology is introduced to a group of teachers. The researchers want to examine if and how the combination of ground rules for talk and the microblogging tool TalkWall might enhance students’ agency in the classroom exploratory talk in order to promote 21st century skills such as collaboration and critical thinking. Through a combination of the qualitative methods interviews and observation, I have studied how teachers participating in this research project, perceive the combination of ground rules for talk and TalkWall, and how they make use of ground rules for talk and TalkWall in the early phases of the intervention-project. My research questions were: RQ1 How do teachers perceive the relationship between ground rules for talk, dialogic teaching and TalkWall?, RQ2 How do teachers perceive practice change at this point in the intervention-project?, RQ3 How do teachers use ground rules for talk and TalkWall in the classroom? The theoretical stance is based on theories about dialogue connected to the sociocultural learning theory and selected elements from Activity Theory.

The main findings from the interview analysis suggest that teachers are negotiating with the introduced methodology and technology as they problematize and show signs of destabilizing their established practices. Their negotiation seems to be related to a discrepancy between teachers’ and researchers’ goal for the appropriation of this combination in the classroom. Teachers seem to focus on their teaching efforts when working with the subject-matter content rather than focusing on what this combination could mean for a new practice towards enhancing students’ agency in the exploratory dialogue. The interaction analysis from observation data indicates that dependent on the use of TalkWall in their lesson designs,
teachers are affected by the new technology in terms of using the tool to mediate classroom talk in ways that would not have been available without it. Overall the interaction analysis serves to exemplify how teachers negotiate between established and new tools and thus between established and new forms of practice. They show signs of using TalkWall in ways that promote a ‘dialogic space’ in which their interaction with students in whole-class settings shows traces of dialogic markers that are related to exploratory talk. Together, these analyses suggest how the teachers in different ways negotiate with the intervention in light of their established practices. In sum this thesis has illuminated how negotiating change is related to signs of teachers’ gradual change in the early phases of the intervention-project.
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As a teacher, I return to the classroom with widened perspectives on aspects of change, and an extended reflection repertoire in the intersection between technology and classroom dialogue. The process with this thesis has been engaging, fun and challenging, and it has been highly educational both in terms of the selected topic and in terms of personal development. Although the master life tends to be a lonely one, I have in the process of writing about dialogue also been fortunate to have great conversation partners.

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1 BACKGROUND FOR THESIS

The application market is in general a multi-billionaire industry, and the learning app-industry is no different. Teaching resources are flooding the web with suggested learning apps and positive testimonies of how the apps and software solutions have changed the daily routines and workloads for teachers. One might argue that the teachers’ offload using these apps could increase the time spent on student guidance, and that this in fact could lead to what is considered good teaching. In addition, we find that numerous learning apps include agent-based prompts, such as, the recently launched Google-assistant or advanced adaptive systems with a promise to address the learner’s progression.

Compared to this optimistic rhetoric, research studies have a more in-depth approach to the discussion. From a sociocultural standpoint, the relevant discussion regarding application, software or digital tools in general, has never exclusively been about what kind of technology, but has also been about iterative assessments regarding how and when it’s put to use and for what purpose (Rasmussen & Ludvigsen, 2010). In other words, there seems to be a need for detailed studies about the variety of technology and a continuous reflection about what learning outcomes they potentially promote at different times, in order to make informed decisions. On the basis of sociocultural learning theory, no tool in itself enhances learning outcome as this is dependent on the interaction with the tool (Wertsch, 1991). Thus, it makes little sense to exclude the need for the teacher as the more competent other, as teachers’ scaffolding is significant to make this interaction productive. To assess any learning app, software or environment, it also seems crucial to acknowledge that pedagogical principles have been applied in programming and designing, and in the decision making of when and how it should be put to use.

Research in the field of education and technology has culminated in significant policy reports published in recent years. The OECD report dated 2010, can still be viewed as valid, as it points to a timeless issue concerning teachers’ use of technology in the classroom. The report points out that the existence of technology in itself does not lead to changes in learning outcomes, and by the same reasoning, does not automatically lead to changes in teachers’ practices. Even though this report was based on a survey study with limitations, it provides us with important insights. The Norwegian public inquiry 2015:8 is a policy report which focuses on a curriculum renewal and promotes in-depth learning that is needed to develop
deeper and more sustainable interdisciplinary knowledge instead of developing skills to master the curriculum goals exclusively. Technology and innovation seems to be even more prominent in the recent OECD-report from 2016, where it’s reported that education needs to be innovated in order for students to become innovators in the future. A collaborative research effort between the New Media Consortium and the Norwegian Centre for ICT in Education produced a report in 2017, which provides a прогноз of the future technological trends in categories of short-term and long-term perspectives. Pointing towards what the future holds in terms of these trends, their main point serves to highlight a consensus in the comprehensive field where education and technology intersects; namely that technology cannot take precedence over pedagogy, thus pedagogy needs to transform in order to take advantage of new opportunities (Adams Becker et al, 2017).

As a result of technology enriched classrooms, empirical studies in the field promote the need for a transformation of the teachers’ role and the students’ agency, and an advanced pedagogy to avoid digitized translation of established practice (Sharpe, Beetham & Freitas, 2010, Verenikina, 2010). The digitized expansion has stimulated a normative belief in technology to mediate learning in new ways, but this mediation needs to be empirically realized in productive ways to enhance learning outcome (Rasmussen & Ludvigsen, 2010).

It is within these discussions I place my thesis, as the research intervention I have studied focuses on implementing both new technology and pedagogy in terms of the microblogging tool TalkWall and ground rules to support ways of talking. Together they have been developed and designed to support and enhance exploratory classroom dialogue to promote students’ collaboration skills and critical thinking (in the knowledge domains), and is placed in the intersection between digital and analog classroom interaction. This intersection is what initially captured my interest, because it seeks to make digital and analogue advantages complement each other when trying to enhance classroom dialogue. The second interesting thing about this project is that the researchers base their intersection between technology and dialogue on the premise of changing the established dialogic practice and thereby the established learning culture. With my background as a junior high school teacher, and with a rooted interest in promoting dialogue as part of my teaching, I decided to study how three of the involved project-teachers make sense of and make use of TalkWall and ground rules for talk in the initial phase of the research intervention.
1.1 Research questions

This case study aims to reveal how the involved teachers in the early phases of the intervention, use, experience and understand the conceptual framework introduced by the DiDiAC- researchers illuminating a connection between ground rules for talk and TalkWall to enhance dialogic teaching and exploratory talk. The first analysis will take a close look at how teachers perceive the framework as isolated elements and in relation to each other. The second analysis will address how teachers use these elements in the classroom.

*RQ1: How do teachers perceive the relationship between ground rules for talk, dialogic teaching and TalkWall in the early phases of the intervention project?*

*RQ2: How do teachers perceive practice change at this point in the intervention-project?*

*RQ3: How do teachers use ground rules for talk and TalkWall in the classroom?*

1.2 Structure of thesis

This thesis will start by introducing the case description and TalkWall as a technology. I have chosen to do this because I argue it is beneficial to connect the research questions to its respective context before accounting for which theoretical framework it relates to and what research studies that are regarded as relevant. Then I will present relevant literature and reviews before accounting for my design and research methods. The two analyses will follow each other and the empirical findings will be summarized and point to relevant perspectives and issues from theory and previous research in the field. The discussion will treat the connection between empirical findings and theory and review in a more in-depth manner, before concluding and pointing to potential implications and potential aspects worthy for further research.
1.3 Case description and participants

This case study is located within the recently launched DiDiAC-project (digitalized dialogues across the curriculum). This research intervention is an effort in collaboration between University of Oslo and University of Cambridge. It seeks to investigate how classroom dialogue and technology use come together and enables teachers to embrace students’ experiences with technology (Rasmussen et al, 2016, p. 1) with the aim of increasing students’ agency in dialogues. The project has a duration of four years and is funded by the Norwegian Research Council to investigate whether TalkWall and ground rules for talk supports the exploratory classroom dialogue and promotes critical thinking amongst students. TalkWall/Samtavla is a digital wall, which enables students and teachers to post short contributions from mobile units, i.e mobile phone and iPads. In their project description, the researcher group argues that the introduction of new technology demands a change in the dialogic practice in order for teachers to work with technology as a partner. Therefore they focus on ground rules for talk (Sacks, 1992, Rojas-Drummond et al, 2003, Mercer, 2013) as situated strategies which are context dependent and which need to be made explicit together in order to raise the quality of the dialogue and critical thinking. Prior to the implementation of TalkWall, the project organized and led three teacher-researcher workshops held at Oslo Science Park. Themes concerned both dialogic methodology and it’s relation to critical thinking and the specifics and affordances of TalkWall as a technology. After the workshop period, the teachers entered the first implementation phase which included using methodology and technology in their classrooms and also holding planning sessions at their respective schools with researchers present. Towards the end of the first implementation phase, the teachers participated in lesson plan sessions with classroom video-elicitation, also conducted at their workplace and led by researchers. 15 teachers from four different schools in the Oslo-region are participating in the research project. I have followed the research project for five months from the workshop stage until the end of first implementation phase, with special focus on three of the involved teachers. Claire and Pete are co-workers in social science and natural science on the same team, at the same school which is featured by a high degree of homogenous group of students. The school is known for its project-based focus and high ranking achievements. Jack belongs to another school also teaching natural science and the school is featured by a much larger degree of diversity. Claire has taught for 17 years, Pete for 9 years and Jack for one year. At the end of the first implementation phase Claire and Jack rated themselves as regular users of TalkWall, and Pete as a low-frequent user.
1.4 TalkWall – ART OF THE TECHNOLOGY

TalkWall is a microblogging web-based digital tool which visualizes immediate contributions written on and sent by the students’ digital units, like an iPad. Teachers create a new wall made visible on a big screen or projected to a canvas or a white board. Students log in to the wall by participating, filling in pin code and a name from their chosen digital unit. Students will then get access to the same question and feed, and the teacher administrates the contributions from the feed by pinning them onto the wall. Students are also able to operate their own wall, meaning that the contributions students pin from the feed is only visible on their own wall, unless the teacher chooses to illustrate the student’s wall in whole class by clicking the casting symbol in the upper left corner and choosing a student or a group.

At the head of the wall shown in the image 1 above, the teacher has formulated a question for the students to respond to. In order to post a new contribution students click on the orange plus sign in the lower left corner and formulate their contributions using maximum 140 signs. The feed of real-time contributions is located in the far left and can be extended showing more and enlarged contributions. Each contribution is marked by a name and there is also a menu that makes teachers able to edit, erase, pin or exiting the contribution menu. The students have the same options, but are only able to erase their own contributions. In order to make the contribution visible on the wall located in the middle on the teacher’s wall (visible to whole class), the teacher will pin the contributions from the feed. The table to the far right illustrates filtering functions on names or hashtags used in the contributions. Tables can be hidden, thus visualizing the wall exclusively, like shown in the image 2. Pinned contributions on the wall may also be enlarged by the zoom function in the upper right corner.

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1 Enlarged illustrations in appendix 1
2 Illustrations and information was retrieved from [http://digitaliseddialogues.no/how-to](http://digitaliseddialogues.no/how-to) 15.03.17
2 THEORETICAL STANCE

As this thesis concerns the study of how teachers make sense of and to what extent they make use of the intervention; TalkWall and ground rules for talk, I find it appropriate to address the relevant theoretical stance in an orderly manner. I will start with theories about dialogue before connecting the use of language and technology as mediating artifacts for learning to the sociocultural perspective and elements of Activity Theory. The following theoretical stance will serve as the basis for the discussion chapter.

2.1 Theories about dialogue

In order to illuminate the matter of dialogue as one of the prominent and basic elements in my case study, it is appropriate to present the selected theorists’ approaches as premises for my study of this phenomenon. Edwards (1997) defines talk as action rather than a representation of cognitive processes, as he constitutes language as socially grounded and situated. More specifically he addresses language in three ways, as to describe, to act and to subversion. In addition he uses the terms: sequential organizing, intersubjectivity and repair (Edwards, 1997, pp.100-101). These terms stand to constitute the foundation of dialogue wherein individuals participate in a dialogue through sequential turns, where they in different degrees reach intersubjectivity as in shared understanding, and where they use repair strategies to overcome challenges for this intersubjectivity. According to Edwards (1997), the communication model is too simple by only denoting “(...) minds-goals-intentions (...)” (p.90), wherein individuals are assumed to obtain knowledge and notions about others knowledge, which they in turn use to formulate messages to achieve different goals in the conversation with others. It does not account for the communicative built-in procedures in conversations or how individuals obtain notions about the content of other’s minds, thus explaining intersubjectivity as occurring when minds communicate. The claim of a too simplistic communication model does not exclude the need for psychology, but Edwards (1997) argues that it depends on how we believe it can contribute and what we hold it accountable to explain. By reducing the weight on explaining communication as the inner mental processes for individuals engaged in the dialogue and viewing talk as action, he claims we are able to analytically account for how intersubjectivity is achieved.

The claim that dialogue is socially constituted is also evident in Linell’s (2009) approach. According to him, the conversation is a series of monologic acts between a sender and a
receiver, and the dialogue is defined as the jointly accomplishment of meaning-making. Similar to Edwards (1997) he does not exclude the instrumental passing of information between individuals, and states that this process is dependent on context and the fact that participants in a dialogue need to actively interact with the environment in order to achieve an understanding of their surroundings. In dialogism, the individual does not cease to exist, but claims existence in the act of “a social being interdependent with others” (Linell, 2009, p. 47). Linell (2009) defines meanings as intersubjective by the same token. While emphasizing the individual as a social being who is interdependent with others, he describes the role of the other as an evident and significant part of defining dialogism. The orientation towards the other in the dialogical approach deals with intersubjectivity which stresses the goal of unity and consensus. Alterity defined by difference and unfinalizability, is in a broad sense aligned to dialogue. However, it seems that the need for unity in communication is paramount to achieve coherent meaning (Linell, 2009). Moreover, he argues the need for a dialogic model in order to grasp the relationship between the individual, the other, including the object and the social context in which they interact. According to him, a dialogue is where the participants jointly construct a series of sequences depending on both the contributions they both provide and influenced by the context surrounding them. In this way, the participants are actually co-constructing each others’ contributions or inhabit the role of “coauthors” in a joint activity to achieve meaning (Linell, 2009, p.73). This seems also to be the case for Mercer’s (1995, 2008, 2013) assumptions about dialogue and ground rules for talk, which will be revisited later in this chapter.

2.1.1 Dialogic teaching
Edwards’ (1997) and Linell’s (2009) theories about dialogue constitute the underlying rationale for the appropriating dialogue in teaching and learning. In order for students to engage in an active dialogues like presented above, it seems essential that teachers are able to organize for such activity in classroom settings. Alexander (2008) is one of the most prominent and cited researchers in the field of dialogic teaching, and underlines the power of dialogue in shaping students thinking and learning. His focus on the goal of dialogue in educational terms is in line with the overall focus on 21st century skills such as critical thinking and collaboration. With the basic claim that speech not only manifests thoughts of the individual, but also affects and shapes the mental processes, he emphasizes the need for teachers to create opportunities for students that foster this mediation. However, he states that
teachers seem to acknowledge this in broad terms, and even if there is a great deal of talking taking place in classroom settings, talk where students actively engage in scaffolding each others’ learning processes and understanding is less common than it should be (Alexander, 2008, p. 92). He underlines that talk in schools traditionally has had a low status which he argues to be a result of policy decisions. This has led to difficulties in recognizing that dialogic teaching is meant to be applied across curriculum goals. In affiliation with Linell (2009), Alexander (2008) makes distinctions between conversations and dialogue in the classroom by denoting the questions as “pseudo questions” (p. 104) in conversation that might seem open and friendly, but which essentially has a closed agenda where the teachers’ leading questions at some point will lead the students in the direction of the correct answer. He finds the distinction between conversation and dialogue very important as there is a real difference even though they’re often treated as synonyms. The most central distinctions presented are the conscious end-point at the outset of a classroom dialogue, which the form of conversation lacks. “(…), classroom dialogue explicitly seeks to make attention and engagement mandatory and to chain exchanges into a meaningful sequence” (Alexander, 2008, p.104). The mandatory aspect reflects the interdependence between the participants and the purposefulness of the activity.

2.1.2 Exploratory talk
Following the previous theorists’ focus on dialogue and its affordances in creating shared knowledge and promote learning processes, Edwards and Mercer (2012) emphasize that it’s natural for individuals to seek a common understanding when interacting with others in different contexts. They approach the development of shared knowledge as dependent on a set of mechanisms that individuals apply in their conversations with others either consciously or not, and that these mechanisms serve as the foundation for the expanding shared knowledge through discourse in the future. In contrast to the communication model, these mechanisms do not follow a specific sequence and are influenced by what kind of talk individuals interact in. Mercer (1995) emphasizes how teachers and students use talk to guide the construction of knowledge. I will start by mainly focusing on his presentation of the most common teacher strategies when dealing with classroom talk and their relation to his theory of exploratory talk where the mechanisms of achieving shared knowledge will be illuminated, as these aspects are considered most relevant to my research questions.
**IRF-structures as important building blocks for dialogues**

Mercer and Dawes (2008) refers to the traditional IRF-structure of talk originated as a term in educational research conducted in the 1970s and defined as a three part exchanges of initiating, responding and feedback. The latter sequence often turned into another three-part sequence. Mercer (1995) explains the IRF-structure where the teacher *initiate* with a question, the students *respond* and the teacher provides some kind of *feedback* to this response. Teachers elicit information from students, respond to students and describe important elements of shared learning experiences. Direct elicitations refer to questions to which the teachers know the answers, but need to know whether or not students also know, and different students are questioned until the right answer is provided. *Cued elicitations* that provide students with hints in order to retrieve the right answers are widespread among teachers using a student-centered approach (Edwards & Mercer, 2012, p. 142).

Mercer and Dawes (2008) argue that this asymmetric form of conducting classroom talk is still very dominant and often but though not always relates to closed questions. An IRF-structure also depends on the conversational contract that exists in the given classroom. They refer to this form of contract as conversational rules or ground rules, which regularly are held implicit. The ground rules related to the IRF-structure reflect a quite strict organizing of classroom talk, such as teacher being the only one who nominees students to talk, the only one who can talk without asking for permission and the only one who evaluates responses when giving feedback. The students are expected to respond to teachers’ questions accurately and briefly and speak only when nominated by the teacher. Such ground rules are nevertheless important for maintaining a social order in the classroom while also directed towards standards such as curriculum goals. As ground rules basically exist in all forms of social interactions they are to a large extent taken for granted. These ground rules might not be the best applied in all situations and when perspectives on education and content evolves, it might be beneficial to make ground rules explicit and also re-evaluate their purpose when aiming at a new perspective of the given target. According to Mercer (1995), IRF-structures are not rated as either bad or good, but are dependent on context, which means that they “have their place and time” (p. 38) and that they are part of a shared history and points to a joint future. Mercer (1995) also points out that the balance of making students explore and discuss, and giving them directions framed by the curriculum goals, is hard to achieve. Still, he argues that relying too much on IRF-structure might inhibit students developing a coherent understanding of a subject or a concept and that this teacher-led structure only provides
students to contribute with brief responses in an educational discourse and not with opportunities to practice being part of an educated discourse themselves. The distinction between educational and educated discourse is explained by level of participating. He claims that the main goal is not for the students to take part in the mere exchanges of this teacher-led educational discourse, but to make students “develop new ways of using language to think and to communicate” (Mercer, 1995, p.80) in order to become active members of the broad specter of educated discourses. According to Mercer (1995), students need to practice the transformation of their everyday discourse into educational discourse in order to become educated, and teachers can scaffold the students’ participation in educational discourse with the goal of promoting students learning together without the teacher being present.

When both theory and educational research claims that dialogue, like previously defined as a more symmetric conversation, is needed for enhancing students learning outcome, this entails doing something different about the structure of talk in the classrooms (Mercer & Dawes, 2008). In a similar vein, Wells (1993) proposes to view classroom discourse through the lens of Activity Theory by claiming that the use of discourse as a semiotic tool constitutes the mediating artifact used to reach a certain goal. Different discourse patterns relate to the various sets of goals. In light of this, it is appropriate to evaluate the discourse in connection to the task and the overall activity (Wells, 1993, p. 31). Nassaji and Wells (2000) claim that the traditional IRF-structure can be enhanced. By initiating questions addressing known content might develop into dialogic patterns if the teacher avoids posing evaluative follow-up questions, and rather proceeds to ask for justifications, connections to counter-arguments and allows students to choose for themselves what they will contribute with. When this happens, the initial IRF-structure will fade into the background and is temporarily replaced with a conversational genre which resemblance a dialogue (Nassaji & Wells 2000, p. 33). In these moments, we might consider the structure as having dialogic markers.

Mercer & Dawes (2008) underline some suggestions in order to provide room for dialogue to occur, like preparing students of discussion sessions where it’s expected that students air out their thoughts and different view points of a topic, opening up for different responses without immediately evaluating them, letting students prepare for whole-class discussion by discussing in groups, open up for students ideas before linking it to a specific and definite explanation, make students nominee other students in whole-class discussions and talk about how the talk has been conducted (meta-talk) in order to evaluate the form of talk and
collaboration. It also depends on the quality of students’ talk in groups given that the even if the symmetrical structure between students provide promising potentials for dialogue, educational research haven’t found evidence that students participate in productive talk when left on their own. They either don’t know how to conduct a productive discussion or don’t realize that this is what is expected by the teacher, thus they seem to be driven by their own and implicitly held ground rules. This point to a need for new ground rules and for teachers and students to agree upon them and that they are explicit in a starting phase.

Mercer (1995) emphasizes three ways of talking and thinking to illuminate ways of learning together: Disputational talk, Cumulative talk, Exploratory talk (p. 104). Disputational talk is characterized by participants disputing and competing without consensus as a goal. Cumulative talk is driven by adding contributions of agreement and elaborations to reach agreement, but where little dispute or challenging views occur. Exploratory talk consists of contributions that are exploratory by nature, containing flexible ideas which are open to be investigated and challenged, explained, made visibly reasoned and accounted for through talk. Additionally, he underlines the need for the participants to reach a consensus in order to make progress. Exploratory talk is favored as the type of talk which contributes most to problem solving in collaborative activity. Mercer (1995) highlights the cultural value of exploratory talk when he promotes students being trained in exploratory talk in order to be well equipped to enter and participate in various social and professional communities later on. As we have seen, the IRF-structure is the foundation for much classroom talk and serves as an important building block towards achieving productive dialogue, but in order to enhance students’ agency in emerging dialogues, productive ground rules for talk need to be put to work by both teachers and students.

**Ground rules for exploratory talk**

Mercer and Dawes (2008) emphasize that exploratory talk promotes critical thinking and suggest making ground rules for talk explicit and cultivate them, in order to create opportunities for exploratory talk to take place. As we are influenced by different sets of ground rules depending on the activity or other participants involved in the interaction, they highlight the need for an agreement between teachers and students about what talk in the classroom is for and how it should be conducted. Rules that stimulate exploratory talk is related to providing relevant information, engaging in other’s ideas in a critical, constructive and respectful manner, provide explanations and justifications for view points or opposite
opinions, offering alternative ideas and consider ideas before reaching a joint agreement (Mercer & Dawes, 2008, Littleton & Mercer 2013). In order for students to develop new ways of using language to communicate and think, these ground rules needs to be made explicit and cultivated before they in time becomes an implicit part of students educated repertoire. Mercer (1995) further emphasizes that ground rules for exploratory talk are not alien to either adults or children because the rules builds upon real experiences. In this sense, everyone is capable of using these rules when interacting with others. He points out however, that ground rules for talk might be taken for granted by the teachers, or otherwise be regarded as a too detailed way of working which comes in conflict with their established pedagogical beliefs.

Quite similar to viewing talk as action and talk as containing mechanisms for achieving shared knowledge, Littleton and Mercer (2013) connects exploratory talk and ground rules for talk to the concept of ‘interthinking’. This is explained as language being used to promote collective intellectual activity and thereby achieving more when working together than alone. In addition, technology as a tool might be used to support this ‘interthinking’ when serving as a visual focal point for individuals to reference their ideas. In a similar vein, Wegerif (2007) uses a dialogic approach to assess technology as a tool that can help people create dialogues, rather than considering technology as a cognitive tool for learning. According to Wegerif (2007) technology can promote “(…) dialogic spaces that enable people to think, learn and play together” (p. 7). This approach highlights the sociocultural stance towards the use of technology in education. This way, exploratory talk is a tool for both sorting out thoughts individually, but also beneficial for more individuals to do the same by sharing ideas with each other collaboratively (Mercer & Dawes, 2008, p. 66). According to Mercer & Dawes (2008), teachers should model the use of ground rules in order for students to use them in whole-class and in groups, specifically demonstrating that providing a response does not need to exclusively provide the ‘right answer’. Students need help on establishing new ground rules building on their prior and implicitly held language acts. Well-designed group work or activities are needed to provide students with opportunities to exercise ground rules in collaboration. Overall, Littleton and Mercer (2013) emphasize that dialogic teaching and more explicitly exploratory talk is meant to be used as one part of the great and varied repertoire teachers make use of when teaching. This means that it is not intended to be used exclusively as a pedagogical method as it is not regarded to fit all the phases of collaborative activity or all kinds of classroom activity.
Bakhtin’s focus on students’ ‘voices’

In a setting with different stakeholders, like in this case study’s relatedness to the intervention project, it seems natural to account for different theoretical stances when it comes to the phenomena dialogue.

The Russian language, literature and culture theorist Bakhtin considers dialogue to belong to the ontological perspective, where dialogue is an inherent human phenomenon and that has a value of training for its own sake (Dysthe, 2012). Although there are several elements in the theory presented by Alexander and Mercer that illuminates a reverberation to Bakhtin, there are some basic assumptions they hold differently. According to Bakhtin, the dialogue constitutes the relationship between me and ‘the other’ (Dysthe, 2012). It is not the individual but the collective that creates meaning. Bakhtin make use of the word ‘voice’ to denote the speaking personality. He explained this by turning to the notion that when several voices express themselves, they always refer to different point of views influenced by both the sociocultural and by personal experiences. In an educational sense, a group is always polyphonic because of the various voices based on different backgrounds and experiences. Dialogue occurs only when ideas are tested through confrontation between the different voices. He also emphasizes the goal of understanding each other on their own premises, withholding respect for their own voice. Consensus is not a goal for itself, and he promotes articulating differences and the will to live in a contradictory environment (Dysthe, 2012).

Mercer, as previously noted, emphasizes consensus. Littleton & Mercer (2013) do not however, exclude the significance of working with contradiction, but underlines the possibility of choosing the easy way out by agreeing to disagree in terms of ‘groupthink’ and that students with the goal of consensus are more encouraged to explore their own and others’ ideas. This is how they argue for guiding students to follow ground rules such as providing relevant information.

The tradition of holding dialogue as a social activity with a common goal of intersubjectivity rather than primarily focusing on the cognitive processes of the individuals involved, has a long history (Rommetveit, 1992). Theoretical frameworks presented by Edwards, Linell, Alexander, Mercer and Bakhtin all relate to the sociocultural learning perspective which in the following will be accounted for in light of dialogue and the use of technology to support ‘interthinking’.
2.2 Sociocultural learning theory

The collective theoretical framework of dialogue presented above, has its roots in sociocultural learning theory and has always played a prominent role in the theory deriving from a Russian psychologist in developmental psychology. According to Vygotsky (2001), learning occurs through the use of language and participation in social practices and that each phase of a child's development appears first on the social level and then on the individual level. He emphasized the connection between thought and language, and presented the development of thought as determined by language. In this sense he defined language as the mental tools and that the child's sociocultural experience and the child's intellectual growth is dependent on its linguistic mastery (Vygotsky, 2001, p. 95). Unlike the constructivist Piaget, he claims that childrens’ everyday concepts are not replaced, but rather acts as important building blocks when developing scientific concepts. He uses an example of the chess player when describing the link between reflective consciousness and the scientific concepts. The chess player's movements on the board are determined by what he sees, and when his perception of the game is changed, so is the strategy (Vygotsky, 2001, p. 154).

In sociocultural learning theory, all action is mediated by artifacts and thus explaining how humans develop and they are distinguished by being characterized as psychological artifacts and physical artifacts (Wertsch, 1991). The main point in this theory is that humans interact with each other and with the environment through and with the use of mediating artifacts, and that it is this mediated interaction that leads to higher cognitive developments. Psychological artifacts may refer to signs such as language, and physical artifacts may refer to tools as in natural artifacts such as flowers and artifacts created or manipulated by humans such as books or computers. These artifacts are also culturally conditioned which means that they are bearers of the specific cultural context they have been used in and that this conditionality shapes the individuals who use the given artifacts. People use and manipulate mediating artifacts as signs and tools for meaning making and to solve practical problems in their day to day life, while at the same time being influenced by the artifacts and their culturally conditionality (Wertsch, 1991). In interacting with mediating signs and artifacts the individual regulates itself and others. One of several examples of this is Engestrøm’s (2011, p. 610) reference to Vygotsky’s (1987) description of Lewin’s experiment in a study asking participants to wait in a room without knowing for how long. A few participants used the clock on the wall as mediating artifact and made their own deadlines as of when to leave the
room. This serves to show how individuals regulate themselves by interacting with their environments.

Learning in the classroom is in this perspective mediated through language and tools, both culturally conditioned artifacts in the given learning environment. The DiDiAC-project recognize that classroom talk traditionally is culturally conditioned, meaning that talk in a broad sense is used for instructional purposes and for lecturing, and to a much lesser degree used for high quality discussions. They target the language and its cultural conditionality by trying to affect this psychological artifact in order to include a broader and deeper appropriation of it for learning purposes. The researchers pursue a combination of phycological and physical artifacts to promote exploratory dialogue in the classroom in order to support the higher cognitive development such as critical thinking. In light of Mercer & Dawes (2008), they turn to ground rules for talk in combination with a new technological tool TalkWall. This is a new tool which could mean that is not yet cultural conditioned in the same way as other technical tools used by teachers. At the same time it resemblances other digital tools which might affect teachers perceptions of it.

Vygotsky’s most cited notion in developmental psychology is the zone of proximal development. This zone is defined by the space between actual level and the level a child can reach with support from a more competent other. The act of imitation within such a zone serves to foster a child’s independence. What a child can do together with someone today, it can master alone tomorrow (Vygotsky, 2001, p.166-167). As such, the DiDiAC-project aims for collaboration and critical thinking mediated through teachers’ and students’ use of ground rules for talk and TalkWall in order to equip students with communicative skills that they will be able to apply in productive interactions later on and as part of participating fully in the society on their own.

2.2.1 Scaffolding
In line with Vygotsky’s zone of proximal development, Wood, Bruner and Ross (1976) developed the term scaffolding which served to explain the role of the competent other in the learning process. The support is provided at each level until the support is no longer needed and the construction or the learner stands without help. The latter is in this theory commonly referred to as fading. Because the unit of analysis in this thesis is the mediated conversation and teachers’ understanding of this by the use of both TalkWall and ground rules for talk in
the classroom dialogue through participating in a research program, the term scaffolding will be used related to both language and technology. As previously accounted for, Mercer & Dawes (2008, and Littleton & Mercer 2013) consider language to have a significant role when it comes to scaffolding or building shared knowledge through interthinking. Its significance is emphasized in relation to both teachers’ explicit use of ground rules for talk in classroom exploratory dialogue, and teachers encouraging students to make such rules explicit when talking and collaborating with each other to achieve consensus.

As the term scaffolding emerged in a time without the extended use of technology as of today, I find it productive to use the perspectives presented by Pea (2004). He addresses the concept scaffolding by introducing his two primary axes; social and technological. According to him, these axes do not only concern how people scaffold each other by using technology, but first and foremost about what social practices that have developed over time. Furthermore, he presents a framework for the definition of scaffolding by both turning to the main source of Wood et al (1976) and using the terms; what, why and how of scaffolding (Pea, 2004, p. 430). He aligns ‘distributed cognition’ with ‘distributed intelligence’ when handling the relation between scaffolding and fading. His main point is that fading as a concept is not relevant in the evolving learning environments, as “people cannot do the activities without the technologies, or it becomes meaningless to ask whether they can do so” (Pea, 2004, p. 431). By the same reasoning he argues that support without fading actually is distributed intelligence. He questions whether students are performing with an understanding or if they’re just imitating certain forms of thinking when using and responding to more or less rigid computer-based scaffolding systems. He also questions if students use the same strategies without the tool. Furthermore, Pea (2004) argues that software programs moreover appear to scaffold-for-performance instead of functioning as scaffolding-with-fading. If this is the case, it is more appropriate to characterize the activity or performance as dependent on the continuous use of the software in order to deliver the desired activity or performance. This is what Pea would denote as distributed intelligence and not in fact scaffolding-with-fading per se in light of the original article written by Wood et al (1976), where the function of “fading is a required component of the scaffolding definition” (Pea, 2004, p. 438). In the discussion I will use the term distributed cognition when analyzing TalkWall’s functionality.

As this thesis study the mediated conversation through the use of both technology and ground rules for talk to support the classroom dialogue I find it appropriate to refer to Tabak’s (2004)
“synergistic scaffolding” (p.318). This means scaffolds that augment, interact and complete each other when targeting the same need, which in turn opens up for multiple opportunities for students to achieve the same goal. She underlines that such synergy is most advantageous when teachers model their interaction with the software and makes rationale for actions explicit. Scaffolds in software do not guarantee that students understand or interpret the support as intended by designers. Thus, she argues that additional support of a teacher is needed to enhance students’ effective use of such scaffolds. The overall point is that a synergy can advance the “culturally appropriate use of the tools” (Tabak, 2004, p. 320).

Referring to Tabak’s synergistic scaffolding, Pea (2004) points out the need for an examination concerning such “mixed-initiative” (p. 444). It is important to study whether both software scaffolding and teacher scaffolding can be achieved by the software or the teacher alone, and whether it’s important that the scaffolding is human and socially interactive and adaptive in its nature, or that the support only needs to be interactive and adaptable. The latter would thus be a support that software might enable through programmed algorithms. Amongst Pea’s (2004) recommendations, he emphasizes the need for designing and using mixed-initiative systems to study accounts for interdependence or a lack thereof. He carefully points out that: “Scaffolds are not found in software but are functions of processes that relate people to performances in activity systems over time” (Pea, 2004, p. 446). With this notion, I’m moving on to the last part of the theoretical stance.

### 2.3 Activity Theory

The complexity of studying learning and changing processes has been highlighted with the use of the sociocultural perspective, which provides researchers with multiple ways of analyzing the individual’s interactions with others and their surroundings through mediating artifacts and scaffolding strategies. Activity Theory has been applied to provide a language and a framework for making sense of the complexity of illuminating collective aspects in learning. Activity Theory will in this thesis become an important contribution in connection to the premises of the sociocultural stance and the research-intervention context where the research questions are studied. Before accounting for this theory, I emphasize that I have made a selection of the central aspects I regard to be appropriate for my analyses.

Engestrøm (1999) describes the use of Activity Theory as a methodology to study and trace the transformations in human activity systems and cycles (p. 35). Activity Theory is often referred to as Cultural Historical Activity Theory (CHAT) (Engestrøm, 1999). Originally this
theory consisted of several dimensions such as subject, object and outcome to explain human activity. The subject has motives for engaging with the object, which is the target for the activity’s focus. He problematizes the notion of emphasizing the individual as unit of analysis, following goal-directed actions. According to him, the focus on the individual's actions in order to understand human functioning, excludes important social interaction and artifact-mediated aspects “of purposeful human behaviour” (Engestrøm, 1999, p.22). In addition, when using the individual as unit of analysis, time is regarded as having clear starting and endpoints, and the continuity, systemic and longitudinal-historical aspects of human functioning is left out of the ‘equation’. Engestrøm (1999) emphasize the need for a new unit of analysis in order to capture the complexity of human functioning and development. The unit of analysis in Activity Theory is in the concept of “object-oriented, and culturally mediated human activity, or activity system” (Engestrøm, 1999, p. 9). This complex unit is modelled beneath³

Furthermore he explains the reciprocal elements in such an activity system being explicitly the notion of object, subject, mediating artifacts (signs and tools), rules, community, and division of labor. Moreover, he emphasizes the issue of mediation as the key to bridge the isolated individual and the society and point to the historical basis of the Vygotskian mediation which states that the individual is able to control its own behavior by using and creating artifacts, thus supporting activity systems’ agency when aiming to reveal human functioning and development in social structures (Engestrøm, 1999, p. 29). So, instead of just looking at the individual’s interaction with its context, Activity Theory widenes the scope to look at how human activity is aimed at an object and that the activity is mediated in a broad sense by both mediating artifacts and by the community which in turn is based on rules and division of labour that affect the activity. Furthermore, he makes a careful distinction between activity time and action time. Activity time refers to cyclic and recurrent activity,

³The illustration is retrieved from http://www.informationr.net/ir/12-3/paper313.html
whereas action time is linear and has a finite termination (Engestrøm, 1999, p.33). Ultimately Engestrøm (2011, p 608) emphasizes that when studying the activity systems, the movement between long-term historical aspects of the object-oriented activity and and short-term goal-oriented actions is important because it reveals how activity systems transform. Engestrøm (1999) emphasizes that the internal contradictions in this system are the driving forces behind development and change (p. 9). When addressing formative research interventions, he points to what he calls ‘interconnected activity systems’ (Engestrøm, 2001, p.140) which in turn hold their own internal contradictions. According to him, a minimal constellation of activity systems refers to each stakeholder’s system. The model beneath (Sannino, Daniels & Gutiérrez, 2009, p. 305) illustrates this interconnectedness.

![Figure 19.1. Two activity systems and a potentially shared object.](image)

The model seeks to explicate the individual as an actor in a system, bridging the micro and the macro level of interaction and reciprocal impact, and thus connecting the individual actions to collective activity (Engestrøm, 1999). In other words, in defining an activity system as the unit of analysis in a formative research intervention, the subjects in this system are influenced by their own organized activity systems which are based on their perceived orientations and expectations towards what they hold as mediating tools, subjects, rules, division of labor and objects. In addition, they are actively interacting with and changing this context. When new ways of thinking and/or doing comes in conflict with traditional practice, tensions might give rise to contradictions and these may occur both within and among elements and activities. Extreme contradictions may lead to a breakdown of the activity system, but a much more common result of tensions is negotiation (Engestrøm, 1999).

To make matters even more complex, the actors involved may not always be aware of the existing contradictions or share the same motivation even if they participate in the same activity (Blackler, 1995). Level one of contradictions can be understood as referring to contradictions arising between the elements within the teachers’s own activity system as she is presented with new methodology. When tensions and contradictions occur, this in turn
gives rise to a “need state for change and learning” (Toiviainen, 2007, p 346). When dealing with tensions rather than explicit contradictions, this “need state” often appears as unarticulated, meaning that the individual do not provide alternative strategies for dealing with tensions and cannot readily describe what she needs. At this point the need state still relates to an unchanged object in the individual’s activity system. The second contradictory level refers to tensions and contradictions that might materialize as the individual comes to share the same object as the intervention, but still apply old tools and division of labor (Toiviainen, 2007). Engeström (1999) deals with several levels of contradictions and uses them to show how the process of change is very complex as it depends on several factors and therefore is very time-consuming.

Overall, contradictions are used to illustrate how the different activity systems approach and influence each other over time and thereby leading to change. The different levels of contradictions serve to illustrate the dualistic relationship between internalizing and externalizing new concepts and practices over time. According to Engeström (1999), these dualistic processes require reflective analysis of the existing activity system and understand what one wants to change. This reflective analysis could be related to tensions arising from level one contradiction. As the internalization process proceeds by the appropriation of new principles, rules or practices, some innovative attempts by the participants characterizes a form of externalization. At this point the internal and secondary contradictions arise more frequently and the need for models and tools that offer a way out of these contradictions becomes crucial. The new system emerges as the externalization begins to dominate (Engeström, 1999, p.33). This serves to show how change is both complex and gradual.

It is when the object for the activity is reconceptualized that expansive transformation is accomplished (Engeström, 2001, p. 137) and Vygotsky’s zone of proximal development is thus operationalized on a collective level. He does this by looking at the distance between everyday actions and the new activity that may emerge from a collective effort as a solution to the tensions embedded in these actions (Engeström, 2001, p 137). Furthermore, Engeström (1999) makes it clear that the relevance and appropriation of the Activity Theory needs to be tested in intervention studies “…that aim at the construction of new models of activity jointly with the local participants” (p. 35). It can also be used in descriptive studies in terms of analyzing signs of change. The paramount intervention study provides the framework for my case study, and with my focus on teachers’ evolving understanding of the elements
introduced by the researchers, I find it reasonable to approach this complexity by making use of elements from Activity Theory, which is a relevant theory within the research intervention study as such. In addition, I find it productive to illuminate technology as a specific mediating artifact in an activity system in order to emphasize the Activity Theory’s appropriateness in my thesis. In this thesis the focus is on teachers’ use and understanding of a new digital tool and a set of conversational rules implemented by researchers in an intervention study with the goal of enhancing dialogic teaching and classroom dialogue. Dialogic teaching as presented earlier, is at its core not dependent on the use of technology, which in this particular case would mean that the researchers are introducing signs in forms of the dialogic method as a language but also in terms of a psychological tool, and tools in terms of TalkWall. These mediating artifacts are teachers somewhat familiar with in light of their established practice of classroom talk and their daily access to a variety of digital tools.

When viewing the collaboration between teachers and researchers, in the framework of the intervention study and through the lens of Activity Theory, the phenomena of connecting and making sense of “new” mediating artifacts, while taking into account the different stakeholders’ activity systems and their interactions with and within each other’s, serves as an example of a rich complexity. It is important to acknowledge this complexity in order to respectfully and transparently denote my research focus and present an appropriate and humble status for the findings in this thesis.

2.3.1 Summary of theoretical stance
Teaching and learning through dialogue has its roots in the sociocultural learning perspective. Learning happens in the interactions between individuals and their environments through psychological artifacts such as language and mediating artifacts such as technology, where our interaction is affected by the mediating artifacts’ culturally conditionality. Scaffolding are measures taken to support the learning process and as we have seen, the entry of technology has both created new discussions regarding scaffolding definitions and also provided the term with an extension when promoting the affordance of combining analogue and digital support. In order to account for the specific contextualization of my research questions, it has been regarded appropriate to draw on elements from Activity Theory. Together these theories constitute the theoretical stance for my research questions and the following analyses and discussions.
3 REVIEW

3.1 Technology and dialogue
Following the wake of Web 2.0, discussions concerning how to make and make sense of technological innovations within education seem to be a key concern. Educators, policy makers and educational researchers are constantly confronted with these issues and apply their different orientations and motives when dealing with them. I have chosen to present studies about IWB’s and microblogging as they are directly relevant to the phenomenon I'm studying; the mediated classroom conversation. I also present studies on development of dialogic teaching without technology, as they both compliment the other studies and point to interesting aspects for discussing teachers’ perceptions of the intervention. Finally, I refer to studies and recommendations of technology integration, as these take account for teachers' motives when integrating technology in the classroom.

3.1.1 IWB, scaffolding, collaboration and dialogue
The research effort by Warwick, Mercer and Kershner (2012) may serve as an example of how a digital tool, in this case an interactive whiteboard, can be used to scaffold collaboration in science activities. This study is characterized as a research intervention. Prior to the observations, teachers participated in professional development sessions where they received strategies in order to raise students’ awareness of talk in groups and make them engage in exploratory talk in the classroom. Teachers also designed specific science activities with the use of IWB’s (Warwick et al, 2012, p. 44). The study showed that the teacher was able to support the students’ activities both in terms of ‘direct’ and ‘indirect’ scaffolding and that this in turn led students to develop the ability to reason in a collaborative classroom setting. The ‘direct’ scaffolding is present in relation to the activity presented and interacted with on the board, and the ‘indirect’ scaffolding is characterized by the teacher’s use of structuring the tasks on the IWB and using ‘strategic scaffolds’ in terms of ground rules for exploratory talk related to procedural scaffolding rather than content scaffolding. The results showed how a connection between the cultural tool of spoken language and the cultural tool represented by the IWB provided an effective support for student’s collective learning. The teacher’s introduction of external support of ground rules for discussion in student groups served as a regulating tool not only for the group as a collective, but also for the individual student. The
authors express the potential for future research in studying how teachers organize ‘direct’ and ‘indirect’ scaffolding. They carefully point out that the scaffolding framework was not an embedded part as the IWB as such, but that the support was customized to each activity in addition to the external support of ground rules promoting self-regulation.

A similar research intervention highlights the affordances of the collaboration between teachers and researchers when it comes to take advantage of IWB’s for classroom dialogue. The research effort presented by Warwick, Hennesy and Mercer (2011) presented an implementation of the combination of dialogic methodology and IWB’s as a technology. Their findings suggest that the involved teachers made use of the IWB in a form of synergy with their established practices, thus underlining a more nuanced approach to previous research stating that all teaching needs to be transformed in order to integrate technology successfully.

3.1.2 Microblogging, collaboration and dialogue

TalkWall is a microblogging tool, and in this section I will review studies on microblogging for learning purposes. Microblogging originated as a tool for connecting different networks and for sharing short and instant messages with the rest of the world. The most frequently used microblogging tool today is Twitter (2017), and their official website reports 313 million active users monthly (https://about.twitter.com/company).

As for recent educational research on microblogging the focus has been on how to exploit the tool for educational purposes like increasing participation and collaboration during in-class learning activities. A micro blog intervention effort provided by Rasmussen and Hagen (2015) which aimed to prepare students to engage in rich, whole-class discussions showed that the use of the microblogging tool Socius in the selected group encouraged learning for all students. Overall the classroom conversation was characterized as students’ and the teacher’s elaboration of the blog contents and the result showed that both reluctant and motivated bloggers benefited from the collective discussion in terms of building their blog posts on this activity in a larger extent than on their individual work sessions. The teacher’s elaborations on the students own contributions also seemed to bring the teacher and students’ interpretations and understandings closer together and the shared microblogs displayed the students contributions in a more dynamic fashion in order to elaborate on contributions from several groups than would be possible otherwise, using PowerPoint or exclusively oral one-to-one presentations (Rasmussen & Hagen, 2015, p.159). A crucial point was that the
discussion arose from the students’ own contributions, making the teacher taking on a role of facilitating, and by using the ideas as the source for elaborating, correcting, giving directions and connecting. The researchers argue that the displayed contributions using Socius supported the teacher in distributing the classroom discussion and drawing more on the students’ own contributions. The interaction between students and the texts was characterized as partnerships and the discussion that followed was dependent on the technology at hand. In addition their findings emphasized the need for an appropriate lesson design when including new technology in the classroom.

Mercier, Rattray and Lavery (2015) conducted a design-experiment conducted over three implementations wherein the iterations were subject for reflection and refinement of the use of Twitter in the collaborative classroom. The findings included that microblogging contributed to keeping the students on task, to address specific posts for elaborations, identifying and resolving misassumptions quickly and affecting the traditional interaction between students and teacher by making the teachers attain a more backstage role and providing students guidance and prompts through their follow-ups on the Twitter platform. Furthermore the study points out that the teacher’s role in the collaborative learning activities in the classroom has had limited attention and that digital tools which are meant to help teachers in this area still is a nascent field of research (Mercier et al, 2015, p. 97). In the intersection between the microblogging tool and the students we find the teacher’s rationale for using the technology and their active engagement with it to monitor and support group conversations.

A similar design-experiment study conducted by Luo & Gao (2012) emphasizes the need for a structured use of microblogging as a tool in order to enhance learning outcome, and stresses that the very design of classroom activities when using microblogging remains a challenge for educators. In this study, the microblogging tool Twiduate was used in a small group of graduate students in an instructional technology program dealing with the topic of using Web 2.0 tools in the classroom in order to describe the experience using microblogging and the students’ perceptions about the tool in light of benefits and challenges in classroom settings. The overall results showed that the quantity and quality of their participation in class was improved by using Twiduate. The need for specific structured activity was overall emphasized by the students as the primary concern, and the researchers suggested that a structure consisting of codes for conduct when tweeting, scaffolding provided by the instructor for each tweeting activity and the use of time limits when working with tasks.
3.1.3 Different approaches to dialogic teaching

Researchers seek to change established patterns of talk using different approaches. In the intervention study conducted by Sedova, Sedlacek and Svaricek (2016), they refer to Alexander (2006 referred in Sedova et al, 2016, p. 16) when emphasizing that dialogic teaching requires both making room for students to speak more and teacher intervention as it is the teachers who provide the environment for productive dialogue to occur. In their intervention they focus on the development of dialogic teaching through a development program where the transformation of student classroom talk was documented and measured by characteristics of dialogue such as students’ thoughts and reasoning and teachers’ open questions of high cognitive demand. The results of the program showed a change in these characteristics from before to the end of the development program, and the researchers traced the occurrence of change to teachers introducing open discussions in their lessons, and also that the changes was due to the effect of the development program. In sum they present evidence of a connection between teacher’s dialogic interventions and students’ engagement in the classroom dialogue by participating in richer argumentation. Still they present the need for additional analysis of the mechanism of teacher change, in addition to how teachers perceived and experienced this transformation (Sedova et al, 2016, p.19). This latter aspect is partly related to my two first research questions as they address perceptions of introduced elements and practice change in an intervention-context.

One of the most recent critiques to the dialogic pedagogy presented in the theoretical framework and thus stands in opposition to some of the previous presented reviews on the intersection between ground rules for talk and technology is presented by Segal and Lefstein (2016). The study’s case description included presenting guidelines from the Israeli Ministry of Education, which entailed teaching children statements that are customary in discussion, opening-lines that were suggested making visible to students for them to use during a discussion. Segal and Lefstein (2016) points to the resemblance of such specific discourse moves in dialogic theory stemming from Mercer and Dawes (2008 referred in Segal and Lefstein, 2016) amongst others. Segal and Lefstein’s (2016) findings suggested that there was a real opportunity for the students to speak, reveal explicit reasoning and build on other’s ideas and that they made use of this opportunity as well. But in the conflicting space between co-constructing knowledge and the goal of arriving at the official knowledge, the researchers describe the teacher as “working with two competing epistemologies once” (Segal &
Lefstein, 2016, p. 16) meaning the official knowledge of some phenomenon, and the idea that the teacher is supposed to elicit student ideas and work with them. The official voice is favored in the sense that the students are asked to communicate with a voice they still haven’t made their own. Even though the study also shows students’ own voice, these are not heeded and thus fall out of the dialogue. They argue that the previous approach to dialogue that entails a transformation of classroom talk to academic productive talk is instrumental and rather emphasize the need to empower students’ own voices as a goal in itself. Still, they’re withholding the complex and difficult task of identifying such authentic student voice, because there is no clear cut between one’s own and other’s voices. In accordance with Bakhtin, Segal and Lefstein (2016) suggest creating a space for students to experiment and struggle against curriculum oriented discourse and in turn reproduce in their own accent (p. 5). They question whether the academic discourse is forcefully imposed or presented as one of many alternative ways of speaking and thereby encouraged to be experimented with. The authors promotes the notion of speaking on one’s own terms, and argue that communicative tools such as ground rules may be perceived as obstructive for some students since they do not allow students expression on their own terms. I will return to Mercer’s and Segal & Lefstein’s seemingly colliding perspectives in the discussion.

3.1.4 Technology-integration – empirical findings and recommendation

Taking a more descriptive approach to teacher professional development, the research effort presented by Tondeur, Kershaw, Vanderlinde and Braak (2013) investigated the insides of teachers ‘black box’ in the process of integrating technology and the rationale behind their current practice. The study focused on how and why a sample of teachers in Belgium integrated technology in their teaching, by using observations and stimulated recall in the preceding interviews. Their findings showed that the involved teachers were able to make the technology fit to their respective educational practice demands and to some extent use technology to promote student-centered environments. These findings support Tondeur et al previous studies of teachers choosing technology which already aligns with their selection of other curriculum variables which fits their ideas or beliefs about “good education” (Tondeur et al, 2008 referred in Tondeur et al 2013 p. 436). On the one hand this study could serve to show how the danger of technology taking precedence over pedagogy is not a pressing issue. A successful integration of technology seems however to rely on more than to make technology fit the already well-established practice demands. In their research report, Moss, Jewitt, Leva, Armstrong, Cardini and Castle (2007) their statistical study showed that the
increased implementation of IWB in the British classrooms showed no signs of increased student performance in National Curriculum assessments (p.72). They emphasize the need for a robust pedagogical approach and make it clear that no tool can replace or serve as a substitute. "To a large extent the kinds of changes the technology fosters depend on what the teachers think it’s for” (Moss et al, 2007, p. 6). According to them, the technological tools will not substantially enhance learning if the technology itself takes precedence over a clear understanding and pedagogical purpose. Verenikina (2010) stresses the need for a highly interactive teaching style or methods to take advantage of the interactive elements in digital tools and points to the journal of Computers and Education referencing to a number of studies which stated that a majority of teachers use technology as an extension of their established practice instead of transforming their practice. In a similar vein, the study of IWB’s conducted by Gillen, Kleine Staarman, Littleton, Mercer and Twiner (2007) also suggests that such interactive technology will not automatically transform teaching in terms of enhancing classroom dialogue just by providing teachers with an opportunity to support conventional teaching styles more efficiently. As an extension of these studies, and in reference to Warwick et al (2011) it seems appropriate to note that researchers have different approaches to teachers’ practice transformation and what they call a successful technology integration.

In light of these studies, there have been put forward principles, frameworks and recommendations that point to success criteria for technology integration in the classroom. Ertmer and Ottenbreit-Leftwich (2010) presents a normative framework based on various theories in which they approach the need for changing teachers’ mindset when it comes to technology. In the pursuit of teacher technology change they recommend to take account for the intersection between knowledge and skills, self-efficacy, pedagogical beliefs and School/Subject/Culture. These recommendations relate to both preservice teacher education and inservice professional development. I will focus on the latter, which is perceived as most relevant for my research questions. Teachers in inservice professional development need to be exposed to new technological tools which are directly related to their existing pedagogical knowledge and content knowledge or PCK (Shulman, 1986) and to practice technological skills situated in their own classroom. They also need opportunities to experience community support when taking small steps towards teacher change and participate in discussions with co-workers addressing how the technology can be used in specific ways to enhance student learning. Self-efficacy is important for teachers to feel confident when using technology in
order to actually implement technology in their practice. For this to happen they need time to gain personal successful experiences when interacting with a new technological tool and to experience real evidence of what affordances it has for student learning. In addition they also need to be a part of a knowledge-sharing community which provides access to suitable models of use and a culture which encourages experimentation. Teachers’ pedagogical beliefs seem to assume an important role because it seems to determine whether or not they find technology useful in the work with what they regard as most important instructional goals. With reference to Hughes (2005, referred in Ertmer & Ottenbreit-Leftwich, 2010) it’s important that teachers receive content-specific examples of how to use the new technology and that teachers need to experience that the use align with their already existing beliefs. If teachers experience technology as a support in meeting student needs it will be a greater chance for teachers to integrate the given technology. As teachers’ decisions and actions are dependent on school culture and accessibility to resources, it is important to take these aspects into account. Some success criteria entail shared vision for technology use, shared definition of “good” teaching, expected inclusion of technology in professional development, regular monitoring of technological use, sharing of experiences and providing support and encouragement (Ertmer & Ottenbreit-Leftwich, 2010, p. 266). It will be interesting to view these recommendations in light of how teachers perceive and make use of the DiDiAC-intervention.

3.1.5 Summary of relevant research literature

Design-based intervention studies highlight how to take advantage of a combination of technology and dialogic methodology, or how dialogic methodology in isolation promotes classroom talk. They all seem to emphasize the significance of lesson design. In this we recognize key issues such as dialogue, mediating artifacts, scaffolding and synergy and practice change. We also recognize problematizing aspects of dialogic teaching and learning in itself. The descriptive studies of teachers’ technology integration emphasize that teachers’ technology use correspond to their beliefs about good education, and studies and recommendations underline that simply implementing technology does not provide cognitive added value. The intervention studies that include methodology and technology, do not take account for teachers’ perception of the given intervention. In light of both theory and review, the combination of my research questions may provide beneficial insight into how teachers in the DiDiAC-project understand the intervention and how they make use of it.
4 DESIGN AND RESEARCH METHOD

4.1 Case study and the paramount intervention study

According to Yin (1981) a case study is appropriate when “an empirical inquiry must examine a contemporary phenomenon in its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 98). In line with this definition my thesis is characterized as a single qualitative case study as I study the phenomenon of teachers’ interaction with students and Talkwall, thus presenting the mediated conversation as my case. My research questions have been formulated to answer the case that I investigate.

The DiDiAC-project is a design-based research project, which makes up the context for my case study, and in order to present my thesis in a meaningful way, it’s important to explain what type of rationale for the study. Firstly, design-based research is commonly used in the learning sciences and it’s distinguished from other kinds of research in the field by the focus on an iterative methodology that seeks to capture the complexity of studied phenomena in their contexts and emerging properties as a result of the interaction between the design and the participants (Brown, 1992). It examines the process and product of implementing a new design into a practice it seeks to change. In the field of educational research this has been conducted using both qualitative and quantitative methods. The designs have varied from being conducted as design-experiments in real practice and in collaboration with practitioneers which constitutes formative interventions (Engestrøm, 2011). The DiDiAC-intervention is a research project in collaboration with teachers, and seeks to investigate whether the implementation of a digital tool and a pedagogical method may promote classroom dialogue that enhances collaboration and critical thinking (Rasmussen et al, 2016). This project relates to Snow’s (2015) presentation of the shift to Practice-Embedded Research. Whereas previously educational research assumed that their valuable insights would be applied to the educational practice through a translation process (Snow, 2015, p.460), the aim of Practice-Embedded Research is to bridge the gap between the different, but equaled valued knowledge of practitioners and researchers. According to Snow (2015), the establishment of structured, supported and sustained research-practice partnerships is a key proposal in order to improving educational outcomes (p.461). She emphasizes that improving practice requires introducing innovations and evaluating their effectiveness. In “normal educational science”, rather little attention is paid to examining the nature of the innovation or analyzing its
capacity to solve problems that educators actually care about (Snow, 2015, p.461). The issue of dialogue is a phenomena well appreciated and addressed in the field of both practitioners and researchers, and proves to be rated as continuous important amongst practicing teachers. In this sense, the DiDiAC intervention-project addresses relevant areas of interest for the involved teachers. The introduction of the digital tool designed by the research team in the project, and the methodology of combining dialogic teaching, ground rules for talk and TalkWall reflects the innovative perspective in respect to improving classroom dialogue to enhance collaborative skills and critical thinking.

4.1.1 Case study and validity

In line with the chosen sociocultural stance to my case study, the context-bound interactions points to what type of validity I operate with. Accordingly to Yin (1989) my case study seeks analytic generalization in terms of seeking to generalize my findings to theory and review. This form of generalization is placed within design-based research, which aims to generate hypothesis and theories.

Reliable and valid accounts for my study also have a broader concern than the immediate case study. Donovan and Pellegrino (2004, p.147), carefully point out the importance of the explanations and conclusions to be a coherent and explicit chain of reasoning as it is a critical characteristic for educational research in order to make an impact on teachers who often have strong opinions about their field of expertise. As Rasmussen (2005) underlines, it is important to acknowledge that every studied event relates to a larger trajectory. In this case study I examine a few events out of a selected sequence of the teacher-researcher project I have been following, which in turn relates to the larger time-perspective of the research-project as a whole. The structured DiDiAC environment creates the basis for my case study, and its selected events and interviews analyzed relates to a larger chain of sequences than I’m able to analytically account for in this thesis. My focus will be on accentuating a thick description. A thick description gives indepth insight in complex issues and emerging phenomenon (Silverman, 2014). Considering the structure and time limits in this case study, the implications of the thesis will serve as to inform about particular observed dynamics in the selected events and illuminated perceptions from the interviews. Credible research requires transparency about how findings are stable and trustful (Silverman, 2014, p.83). In the following I will account for how the phenomenon I study is representative for my research questions, in order for my findings to be considered valid.
4.2 Method and ethics

4.2.1 Researcher Role

Regardless of what research methods one chooses to make use of, the researcher reflexivity and transparency is significant in every stage of the given study. Considering my background as a teacher, I have had to constantly reflect upon how I am influenced by my pre-understanding, presumptions and experiences of the given theme, which I perceive to be interesting (Silverman, 2014, s.152). Reflections have occurred alongside reading and processing the theoretical framework and review, and in discussing observations, field notes, interview-transcriptions and other data material with other researchers involved in the project. The work with my research questions has been an iterative process, and throughout the whole process I have strived to continuously reflect on how my background affects my perspectives in order to minimize bias.

4.3 Research techniques

Because my research questions address both teachers’ perceptions and their actual use of the digital tool and the methodology, it has been reasonable to choose both interviews and observation as methods for approaching these phenomena. To the extent that my methods may be considered as triangulation, it is in terms of an approach to gather deeper understanding of a studied phenomenon, rather than using it as a strategy to confirm findings from one type of approach with another type of approach (Denzin 1989, referred in Flick, 2016). In this case study, classroom observations and interviews will firstly answer different research questions. Secondly, the data from each approach will be treated with respect to the context they belong to before pointing to how their individual analyses support each other when studying the phenomenon from different angles.

4.3.1 Data collection and targeted selection

The issue of reliability is of major significance in order to address the research questions in a fashion that makes my conclusions valid and credible (Silverman, 2014) in order to point to possible further research both within the research project as such, and in the field more general. This section will first and foremost explain the reasoning behind the process of deciding relevant collecting strategies in order to study the most relevant data to the research questions at hand. The data corpus has been collected as a combination of the qualitative methods observation and interviews. Much of the collection work has been done in
collaboration with the research project and thus stands to present the basis for my selections in data collecting. I chose do a targeted selection by following and interviewing three teachers as these informants were regarded as appropriate contributors to illuminate my case (Elo, Kääriäinen, Kanste, Pölkki, Utriainen and Kyngäs, 2014). The teachers give in-depth insight and some variation in the way they work with the intervention and how they teach.

**Classroom observation – collecting in a project-context**

All the observation data collected through audio and video recordings, and field notes, was obtained legally as a collective effort. As I developed an early interest in how teachers used TalkWall and perceived the intervention-project in these initial phases of the intervention project, my data collection started by participating in observing classrooms, writing field notes and making provisional analysis of these. In addition I participated in and took part in documenting the initial workshops, a teacher team planning session, plus one lesson study. As my role in the classroom observations predominantly was related to writing field notes I consider my observation as direct in line with Patton (1990) thus providing me with a more in-depth experience of the lessons I otherwise would not have access to. I occasionally participated in the teacher-researcher discussions and this can be considered as more participatory observations (Patton, 1990). During the observations and working with the theory and review, I constantly revisited my research questions to ensure that they were adjusted with an aim to address the actual field of study. Collecting observation data from Claire and Pete was conducted in line with the research groups’ planned data collecting. In addition, I made a request for an observation of a specific teacher at another school in the pursuit of capturing variation. Because of considerations in regards to the intervention impact on daily teacher workload, and circumstantial concerns such as organization of class in small classrooms, it was decided at a researcher meeting that I would have access to one observation of this additional teacher, Jack using TalkWall, and at the same time being present for support as the new version of TalkWall was recently launched. As this data later was perceived as being too influenced by the teacher’s testing the software, I decided to use video-data collected by the other researchers prior to my own observation of him.

**Collecting interviews**

Through this structured observation over a time period of 5 months, I was able to formulate interview questions relevant to the research questions 1 and 2. In accordance with the research projects’ accepted the application from Norwegian Center for Research Data, I
collected interview-data independently at the end of the first implementation phase. In
addition to the formal given consent in the DiDiAC-context, the teachers consented to my
interviews orally. The interview of Jack was conducted a few weeks after my observation of
him. As for setting dates for interviews of Claire and Pete from the first school, I decided that
observation from a lesson plan session would give my interview guide a more clear direction
in order to answer my initial research questions. In this context a lesson plan session is where
teachers in collaboration with researchers conduct a structured review of their video-taped
lessons and engage in feedback and reflection to improve their teaching. In this intervention
project, the researchers offered structured themes for the lesson study in order to stimulate
teachers’ reflections on the classroom conversation. Jack’s interview was conducted prior to
the lesson study at his school due to pragmatic time issues. Initially I had planned to use
video eliciting to support teachers recollection of their use of TalkWall up until this point, but
because the lesson study involved video eliciting and was conducted a few days prior to my
interviews, I decided to focus exclusively on audio-recordings.

**Semi-structured interview**

In order to answer my two first research questions my aim has been to go in depth when
working with RQ1 and RQ2 by conducting three semi-structured interviews where the
conversations has been directed both by prepared questions and questions emerging from the
interviwes responses a long the way (Kvale, 1996). This method was considered
advantageous when being able to follow up on the teachers’ responses in order to reveal
teachers perceptions and reasoning and in line with Kvale (1996) I argue that this form of
interview appreciated the perceptions as constructed by an ‘inter-change of views’ (p.2). I
have engaged in systematic systematized observations of the teachers prior to the interviews
(Silverman, 2014), through workshops and classroom interactions which have been supported
by field notes and access to video recordings in addition to provisory analysis along the way.
My interview questions were formulated in order to answer research questions and thus
aimed to address their perception of the introduced ground rules for talk and its relation
TalkWall and dialogic teaching. I decided to structure my interview guide in terms of five
Technology and pedagogy, 4. Knowledge sharing with collegues and 5. Experience of the
workshops and being a part of a research project (appendix 2). The sub-questions in italic
differed in each interview in order to prepare for appropriate follow-up questions for each
teacher. I sent the teachers an email beforehand with information about the interview,
containing my background and interview themes, adding that they could bring their devices if they wanted to use them in exemplification. The initial information from the interview guide was in line with Kvale’s (1996) recommendation, presented for the interviewees at the beginning of the interview and all the interviews were audio-recorded. The teachers were interviewed at their respective schools at the end of their workday, and they decided where to conduct the interview. When interviewing the teachers my initial goal was to let them speak as much as possible and I encouraged them to elaborate on their responses and gave them time to think in order not to intervene the process too much. This resulted in rich and elaborated responses and they did not seem to be impatient to end the interviews, which I interpreted as a sign of them being comfortable in the situation.

**Reliability, validity and generalizing**

In order for my findings to be considered as valid, I need to account for the terms under which my research has been carried out. In order to present my study as credible in the pursuit to seek analytic generalization, I need to highlight potential threats to reliability and validity when collecting and analyzing the data corpus from a qualitative standpoint, in addition to show transparency in regards to what measures I have applied in order to strengthen the validity. Accordingly to Derry et al (2010) focus on the issue of selection having a great impact on the analysis, and that it is a concern in the earliest phases of data collecting, I have had access to a well-documented period of the intervention. Decisions about camera angle and singular audio recordings were discussed in forehand in addition to pragmatic decisions in the actual field in order to capture relevant interactions between the teachers, students and TalkWall. Using video-recordings to collect qualitative data has shown much strength as to capture more of the complexity than what field notes would have done alone and can therefore be considered to strengthen reliability. It’s important however, to acknowledge the limits of video recordings as they do not display the reality, but rather serves as a record of an activity (Jordan & Henderson, 1995). Both video-recordings and field notes were used in collecting the observation data. To avoid being too influenced by my background as a teacher I used DiDiAC’s templates for field notes and also made provisory analysis of the field notes in accordance with Silverman’s (2014) recommendation in order to increase the reliability. Another threat to reliability is related to what impact it might have on the teachers and the students to place cameras and researchers in the classroom (Silverman, 2014). I have discussed this issue with other researchers in the same field and this has also been discussed during the work with interpreting video-transcripts.
Interview-data has been characterized as self-reported data which in turn has its affordances and limitations. The biggest affordance with interviews is that it addresses individuals’ contextualized experience which is not available through other methods (Kvale, 1996). It’s still important to reduce the threat to reliability in order to pursue access to the experiences of interest and thereby also to strengthen the validity of the analytic findings (Silverman, 2014). I worked with the interview questions both independently and jointly with co-students and my supervisor to avoid having either too open or too narrow questions, to avoid misinterpretations and to secure their accuracy and reliability towards my research questions.

4.3.2 Data reduction and trajectory of analysis

In order to avoid too large amount of data, resulting in thick description too thin for analysis (Jewitt, 2012), I took measures to conduct a data reduction appropriate to my research questions. I approached the data reduction on several levels. After the workshop period and parallel to classrooms observations, I watched the video-tapes, listened to the audio-recordings from workshops making a provisory analysis in an exel-document to list relevant themes and quotes both for my initial research questions and otherwise interesting themes in order to keep my mind open. I strived to stay in dialogue with my research questions as to not make them overriding the actual field of observation. I highlighted the relevant contributions from the three candidates I had developed an interest for both related to initial emerged interest from the first workshop and because two of these teachers belonged to the school I had participated in structured observations from the start. Some of the highlighted segments were in addition commented upon as concrete pointers for my interview-guide. It should be noted however, that the one lesson study Claire and Pete participated in might have affected their interviews in ways which was not yet available to Jack at the time of collecting the interviews. After having collected the interview data I used the findings as pointers back to the observation data, and then proceeded with repeated viewings of video in addition to revisiting and comparing video-data with the associated field notes. My process model:
The original dataset from interviews and observation was in Norwegian and was treated in Norwegian throughout the template and interaction analysis before translating it to English in order to avoid essential aspects or important details to get lost in translation. In this thesis I have strived to translate the selected transcripts in order to capture their exactness and their appropriateness to context.

4.3.3 Template analysis

The interview data was transcribed verbatim in full length, they were made anonymous and were re-read several times before co-reading with other researchers and co-students in order to minimize the amount of bias and to establish relevant codes for a template analysis (King, 1998). The initial codes derived from the themes in my research questions and were then reflected upon when dealing with the interviewees’ responses. The selected codes used to code the responses were: Dialogic teaching and exploratory talk, ground rules for talk, TalkWall, Continuity and change, and Workshops. In the face of a comprehensive data set, it’s important to be selective. Transcription was fully coded, but codes that did not involve the most central issues of concern were not accounted for in detail in further analysis, as parts of the analysis provides context and the rest targets answering my research questions. It’s important to rule out any pursuit of a complete picture as I purposely have limited my research in order to answer the research questions. This serves to illustrate the need for a thick description in order to make account for the specific context in which the interview stands in order to be transparent about selection in the field of study and some of the premises that lies behind the findings in the conducted research.

4.3.4 Transcription style for interviews

(... ) Partition i utterance
( ) Non-verbal responses
… Pause in utterance
[ ] Added for clarity

Bold – Emphasis on word

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4 Transcription style is a modified version of the version applied in Rasmussen (2005)
4.3.5 The rationale behind using NVIVO

Developing the template took a great deal of time, as new codes emerged when testing the template on each transcript. This initial testing was done by using comments in Word to code all text segments. After I believed I had a final template I tested it again by importing the transcripts to the coding-program Nvivo where I manually included my template hierarchy. I found it productive to work with the data thoroughly and manually before running it through Nvivo, to experience its complexity and avoid making hasty assumptions about visual affordances in the coding program (Bazeley & Jackson, 2013). The template I manually imported to Nvivo was however subject for iterative work before I proceeded to make visualizations. Firstly, Nivivo provided me with an overview over frequency of codes used and made me go through the transcripts again to make sure everything was coded, and to re-reflect on the description-accuracy of codes to each text-segment and whether or not codes overlapped. Secondly, I exported the codebook in order to look for frequency of codes, which gave me a visualization of the most common themes from the transcripts and at what level they were located. Third, I went through the template again to modify and reconsider the relationship between the main-categories and sub-categories, as some of the sub-categories’ frequency indicated that they should be classified as higher-order codes.

Next, I made a word cloud to visualize the most frequent word use (minimum 7 letter words) from the coded sources. The most frequent word use in the transcripts combined was “perhaps”. I thought this was interesting as it could be interpreted as both uncertainty and potential in light of my research questions. I printed the word cloud and decided to return to it after having analyzed the interviews.
4.3.6 The final template

My final template was a result of treating the transcripts on a detailed level to explore and reveal the content in all the coded text segments. Writing up the interviews was a parallel activity and was an additional support in settling on a final template containing five main categories: Dialogic teaching and exploratory talk, Ground rules for talk, TalkWall, Continuity and change and Workshops (appendix 3). I worked with sub-categories on second and third level in order to approach the complexity and reveal empirical variations within the main categories. Sub categories were useful in terms of guiding me when returning to my initial research questions and finalizing the interview analysis in order to answer these. Final template is available as an attachment in this thesis. I have referenced to sub-categories in the analysis in cases where it’s beneficial as structuring the findings to address the research questions.

4.3.7 Categories and sub-categories

The first main category has a duality because the teachers’ mention dialogic teaching and exploratory talk in a complementary manner, which may be both related to the overlapping use of them in the interview questions and the teachers’ answers. The empirical variations within this dual theme may be interpreted as teachers using the phrase ‘dialogic teaching’ more as an everyday assumption about their practices and less as systematic dialogic markers as in exploratory conversations. However, teachers have a great deal of experiences when it comes to having conversations that promotes students’ development in their subjects. Overall, the main categories relate to each other, but are systemized in this manner in accordance with the semi-structured interview guide, and in order to highlight sub-categories revealing empirical variations. Furthermore sub-categories also tend to overlap as teachers alternate between what they perceive and what they have experienced. It’s important to emphasize that my analysis of the interviews seeks to reveal variations and when comparing and contrasting findings from each teacher it will by no means entail normative classifications as to right or wrong practice.

4.4 Interaction analysis of observation data

Because of the complex classroom environment, involving naturally occurring talk (Jordan & Henderson, 1995), in interactions between teachers and students and the digital tool TalkWall, I considered it appropriate to use interaction analysis to study the research
question. In alignment with what both Jordan and Henderson (1995) and Derry et al (2010) promotes as an essential part of working with video-data as a source for data-analysis, I have been reviewing the videos several times with the support of field notes and provisory analysis related to these, and the transcripts have been discussed with co-students and my supervisor. Sampling of video is important for the analysis in order to make selections transparent and what criteria they are based upon and for what purpose (Silverman, 2014). The focus has been how content in interaction emerge, and less on technical linguistic aspects of how language is used (Furberg & Ludvigsen, 2008). First, I looked for patterns in the lessons, arising from the data and whether or not these supported or/and added to my field notes and provisory analysis. My method for selections from the video corpus has been made based on themes arising from the interview-data. Inspired by the teachers’ answers in the interviews, I looked for examples capturing the themes: *Employment of TalkWall in lesson designs, students’ contributions’ role for classroom conversation and types of ground rules for talk applied in conversations.*

A parallel method for selections was based on what Derry et al (2010) characterize as macro level coding. This systematic way of approaching the video-corpus provided me with video-segments based on significant events that included a clear start and end-point, a segment of conversation over time and which integrated different sources to knowledge and involved investigative strategies such as questioning, conclusions and prediction (Derry et al, 2010, p. 19). Subsequently, I studied the selected segments on micro level by transcribing them verbatim by using InqScribe (https://www.inqscribe.com/) and using both transcripts and video to analyze the interaction to be able to move between the analytic distance and the dynamic nature of interaction.

I found it productive to look at turn-taking and artifact (Jordan & Henderson, 1995). Turn-taking was considered appropriate because it served to mark turns between teachers and students which involved turns with the use of language and artifacts and how these related to prior and subsequent turns in a sequence. Approaching artifacts was considered relevant because of the focus on teachers’ appropriation of the TalkWall for structured student interaction. Analyzing the transcripts was then conducted by the codes/categories for exploratory talk from the DiDiAC-project, inspired by Mercer and Dawes (2008). Writing up the interaction analysis was structured by the use of description level and analytic/interpreted level of the presented excerpts. Level one is presented in two sections, by first describing the
actual extracts and then by connecting it to codes for dialogic markers inspired by dialogic codes used in the paramount research project such as inviting ideas, asking for elaboration, justification, reasoning, rephrasing responses and building on students ideas. The subsequent and secondary analysis is located in the discussion and presents connections between empirical findings from level 1 to relevant theory and review.

Recognizing that a complete transcript does not exist (Derry et al, 2010) and that the complexity cannot be captured in its full entity, I strived to make my transcriptions sufficient in order to represent the unit of analysis in order to answer the research question related to this part of data corpus in the period of time that was available. Teachers’ and students’ names are pseudonyms. In order to avoid threats to reliability in the transcripts both in regards to methodical faults such as ignoring critical pauses and overlaps, and in regards to the consistent possibility of bias when using analytic categories (Silverman, 2014, p.88), I discussed the transcripts with my co-students and my supervisor. I have also to the best of my ability tried to make my interpretations accountable by providing sufficient context description. As part of the iterative work, I tested the revealed patterns on other parts of the data (belonging to each teacher) in order to point to a tendency beyond the selected extracts and to strengthen the validity. Accordingly to Derry et al (2010) I argue that the chosen extracts were chosen because they were informative in regards to answer the third research question about how teachers use ground rules for talk and TalkWall in the classroom. When comparing these extracts I re-emphasize that I aim to reveal various forms of teaching.

4.4.1 Transcription method⁵:

<table>
<thead>
<tr>
<th>“[]”</th>
<th>Crosstalk</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>italics</em></td>
<td>Gestures or interaction with artifacts</td>
</tr>
<tr>
<td>“...”</td>
<td>Shorter pauses</td>
</tr>
<tr>
<td>[[]]</td>
<td>Intangible speech</td>
</tr>
</tbody>
</table>

In the next chapter I will start by presenting the template analysis from the interviews before proceeding to the interaction analysis.

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⁵Transcription method for interaction analysis is a modified version of the version applied in Rasmussen (2005).
5 TEMPLATE ANALYSIS

In this analysis I return to the teachers presented in the initial case description (1.3). Claire and Pete are co-workers and belong to the same teaching team for students in 8th grade, which is the first year in secondary education in Norway. Claire teaches social science and has 17 years of teaching experience at the current school and Pete teaches natural science and has 8 years of teaching experience. Jack belongs to another school where he teaches natural science for students in both first and secondary education, and has taught for approximately a year. The school contexts are elaborated on in chapter 6.

5.1 Dialogic teaching and exploratory talk

These sub-categories reveal how the teachers perceive dialogic teaching and exploratory talk in terms of highlighting premises through concrete examples from their established practices. Even though they have different motives for reflecting about teacher responsibility, they illuminate the themes teachers questioning and distributed talk. Student positioning reveal the themes subject-matter interest and project work attitudes.

Teacher responsibility – teachers questioning

Claire describes exploratory talk by Teachers’ responsibility of posing questions without correct answers and making students think and provide reason for their answer:

“(...) that they are challenged in regards to possible alternative answers to the question and why they possibly answers like they do (...) I think it’s a very big point in social science to highlight that we very often don’t have a correct answer (...)”

Even though she states that it’s important that the teachers don’t think they have the answers all the time, questions without a correct answer is further problematized, as she notes:

“(…) you have curriculum goals you need to relate to (…) but the thing is, it is hard to pose questions without being too leading. At the same time we kind of need to lead them where we want, to a certain degree, or perhaps we don’t have to (…)”

Claire refers to her social science subject where questions demanding justification and alternative reasoning is further related to large student groups and student diversity: “(...) it’s a little hard to know if one gets everyone to follow, knowing where to put the bar, so it could perhaps become a little much like, it can become too difficult for some (…)”. This indicates that Claire associates exploratory talk to making students reveal their reasoning in order to reach a higher level of content knowledge in her social science classes, which is also
expected in terms of curriculum goals. The dilemma between open and closed questions creates the foundation of conversational patterns, but she seems to treat curriculum goals in forms of action and not as an abstraction of her questioning. Claire also refers to the challenging practice of constantly readjusting the bar when alternating between students on higher and lower grades. The fact that students are also dealing with demanding tasks in their project based lessons in every grade, calls for measures in order to deal with diversity:

“(…) in the startup of a lesson perhaps picks those hands or pose direct questions to those you think can answer those questions. And then it becomes more and more advanced and then you can choose those who you think are a little better gradually.”

Claire’s statements show tensions between teachers’ responsibility to pose open questions and elaborative follow-up questions for students to think and reveal their reasoning, and at the same time recognizing the diverse student group. Justification in exploratory talk is closely connected to content knowledge which calls for a differentiation. Her expressed ambiguity about providing directions and could point to the general accepted difficulty in maintaining a balance between exploring and achieving the curriculum goals (Mercer, 1995, p. 29).

Pete also refers to both teachers’ questioning and differentiation, but he differs from Claire when he describes exploratory talk as starting somewhere by creating student engagement and not knowing where it ends. Pete’s description of exploratory talk shows an overlap between teachers’ responsibility and student positioning and this is evident when talking about different trajectory of themes depending on:“(…) How groups function together and how much they ask, how interested they are and how good questions I manage to pose”.

Pete describes the good questions as questions without an exact correct answer, and that the teacher needs to be open for several correct answers. The goal is to make the students think:

“(…) Provide suggestions, wonder a little and discuss to find the, at least like, should of course turn out correct, but that it’s not one answer you want, because you, some, or sometimes you have a tendency to pose questions where ‘I know, I want that exact answer’ and then you wait for it, and that does not create much wondering, it only turns into “guessing what the teachers wants”-thing so, it is to avoid those (…)”.

Curriculum goals are revealed when he nuances his open-endedness in lessons by turning to the need for accuracy when students are responding to teacher’s questions. Together with his focus on student subject-matter interest and engagement, this could indicate that he would like them to actively involve themselves with the content driven by some internal interest or
motivation in order to avoid acting on external motivation such as figuring out the teachers’ blueprint. Pete addresses the need for differentiation towards a collective group and presents students’ expressed wondering as a source for his further questions:

“(…) take account for the audience and see that here you can pose these questions (…) but I think a lot comes up as you go and when you listen to their responses and what they’re wondering about, and then you can pose contra questions and then you get a good, perhaps you get a good conversation there (…) You are always planning, but a lot is on the fly anyway. But that’s planned (laughter)”

Pete’s statements serve to show some similarities to the tensions presented by Claire when it comes to giving students some directions. Experienced teachers are accustomed to improvising (Richardson, 1990) and Pete addresses differentiation when talking about planning good questions versus planned improvisation during a lesson depending on the students in the group. Unlike Claire, he does not emphasize the level of difficulty when addressing differentiation, but rather assumes that good conversations seems to occur when responding to the students and acting on the right momentum.

Jack promotes questions from the students instead of the teacher and further connects this to giving him as a teacher an overview of what kind of knowledge the students possess:

“(…) because it’s hard for me to know what they know and don’t know, but more if they ask, but then it’s a little dependent on the students. [If] they actually ask “what is this?”, and then one can try to figure it out together (…) then I perhaps ask a couple of minutes to figure it out from the book or something and then we can discuss it later, or that they discuss with each other, not just with me.”

Jack further describes the collective work of finding the answer by searching together or alone, working in pairs, writing notes and contributing with these notes in class:

“(…)And then try to find the answer so they don’t forget it, because it’s something they’ve been wondering about (…) They figure it out and then write it down a little perhaps and then pulls something out and then kind of make an answer in common.”

In Jack’s case it could be conceived that he aligns exploratory talk with student engagement or interest towards finding the answer and thus having bigger incentives for remembering it. Activities such as students discussing and making a collective answer could indicate Jack’s focus on co-construction of knowledge. As teachers assign students with different positions in the conversation which in turn creates the terms for students’ participation, Jack does not make the tension between open and closed questions explicit to the same extent as Claire and Pete. However, his claim that the students’ communicated interest will support him to
achieve an overview of what kind of knowledge students possess in order to figure out the answer, reflects his overall perceived responsibility to lead the students towards relevant answers.

**Teachers’ responsibility - Distribution of talk**

Students need different support and Claire states that one-to-one dialogues with several turns is needed and occurs frequently as part of teachers’ practice. She uses the analogy of passing a ball between her and her students in fear of not involving enough students and that this kind of dialogue is desired because: “(…) it’s easier to control it when it goes through oneself all the time”. She further goes on to stress the challenge to this kind of distribution:

“(…) and that’s hard because there are some students who you think are fun to talk to or students who are good at taking your attention and then it runs on the expense of the ten others sitting there not saying a word. So that’s the big danger with a like…like dialogic and advanced exploratory talk, that there is someone who’s just sitting there and does not get anything out of it.”

Claire seems self-aware of the advantages and disadvantages of her one-to-one dialogues. The lack of other strategies beyond broad distribution and differentiation in questioning, might express a belief that the lack of control of the students’ ‘login status’ is a continuing inevitable aspect of teaching. An unarticulated need state (Engestrøm, 1999, Toiviainen, 2007) seems evident as teachers’ constant assessments of students whereabouts in the learning process to meet the students where they are, only to a limited extent serves to remedy the feeling of inadequacy when dealing with large student groups. This unarticulated need state seems to occur both explicitly through her reasonings but also implicitly through her actions which will be returned to in the interaction analysis. Claire’s references to demanding questions in social science, could indicate that she focuses on the advanced content of the dialogue rather than how the students are expected to use their language when participating in or listening to a dialogue.

The concern of distribution of talk leading to students falling behind is also present for Pete. He finds it fun to talk to students that shows curiosity and poses many questions, and that this could function as a starting point for a lesson in order to involve other students. Sometimes he finds increased involvement, but other times he experience students falling behind or logging off by the sound of background noise and lack of focus. Maintaining a balance when distributing the classroom talk is presented as a challenge:
“(…) it’s a little hard to know exactly when to stop, or when to turn or end or go forward or involve more [students] (…) it gets easier the better you know the students (…) that you know who you need to park a little before it’s too late.”

Pete seems to problematize his use of one-to-one dialogues with students and how this could serve as a momentum to create good conversations in class. In order to not surpass the momentum he turns to the strategy of ‘parking’ students as a measure to respond to the general group temperature. Unlike Claire, he doesn’t talk about why student’s log off, but it’s conceivable that he refers to advanced content being inaccessible for some students.

When explicitly asked to make a comparison between distribution of talk with and without the use of TalkWall, Jack makes a calculation of potentially including ten students in a conversation without TalkWall:

“(…)Then you’re pretty lucky if you manage to involve that many, in the end it becomes very like only one way with a student, perhaps two three, but when you get to involve everyone and then everyone need to think too (…)”.

He addresses the activity of writing when using TalkWall to avoid students logging off:“(…) that everyone writes down and then one can pull out different things, that you perhaps ask them discuss those things which are there and such, then they become more involved”. Jack doesn’t reflect on his distribution strategy in the same way as the others, perhaps because of focusing on comparing distribution of talk with and without the use of TalkWall, but his term “lucky” could indicate that he does not yet operate with a reflection repertoire confirming his unarticulated tension between his own and students’ conversational positions. He claims however to notice when students are logging off, and connects the activity with TalkWall to be a strategy in order to preventing them from doing so.

**Student positioning**

According to Claire, students need time to think and in addition to her responsibility of posing good questions, she’s also responsible for taking time training them to accept an insecure landscape when working on established project tasks and being in a “learning-pit”:“(…)and then they will struggle a little before they get up (…) can take a standing point or become enlightened, a little more enlightened than they were (…)” She also refers to her practice of addressing the students’ attitudes towards each other in her class, and that there is a distinction between what they know and what they do:
“(…) to listen to everyone’s opinions and um…respect what they say and listen to the arguments and maybe you can change opinion if you hear that someone else thinks about something else so (…) that’s those things you really know, but which you, you perhaps don’t have time for or don’t bother, or think about something else which is the first thing that comes to mind (…) they need to have time for their projects (…)”.

Claire seems to align exploratory classroom dialogue to established practice and their project based lessons. She does not mention the ground rules for talk explicitly when referring to how students are supposed to conduct their collaboration, but in light of her occasional alignment of ground rules to established practice, it’s conceivable that this is what she refers to here as well. She addresses time as a means for students to collaborate, but she does not address the potential of students not bothering or lacking a joint focus.

According to Jack, the main challenge to exploratory talk is students’ passive attitudes and if the students are a silent group, arguing that the talk is not dependent on his own wondering:

“(…) because I know it already. Then it’s a little difficult for me to pull it in order for them to get something exploratory out of it…if they themselves have some interest for it and wonder about it themselves, then it’s a little easier than if you have to pull the whole crowd”.

He experiences the students as only concerned with getting the correct answer, commenting that: “(…)it’s the only thing they ask if I want” But, states that students’ fear of getting it wrong might be dealt with by utilizing peer-work:“(…) Then it’s not necessarily just your own [response] that’s presented which is wrong, then it’s perhaps both yours. Then it’s not just you who is exposed.”

Jack’s role as the expert becomes very evident through the phrase: “I know it already” and could indicate that he perceives exploratory talk as students being internally driven by their subject matter interest in order to discover the relevant answer. However he finds students externally motivated when seeking a short-cut. This could confirm an unarticulated tension. Furthermore it could be interpreted that Jack is unconsciously applying the strategy of peer-work as a measure for students to continue their quest for ‘right’ and ‘wrong’ answers in a more comfortable manner. The teachers describe exploratory talk in light of their established practices, which indicate that they believe dialogic teaching to be a part of their practice already. It’s evident that they are concerned about exploratory talk for subject-matter content and teachers’ responsibility seems related to how teachers’ in different ways scaffold students in dealing with this content. Tensions arise between promoting questions without a
correct answer while also taking curriculum goals into account. Safeguarding differentiation by distributing talk as one-to-one interactions could however lead other students falling behind, revealing a higher order contradiction between orchestrating a collective group while also accounting for students’ legal right to adaptive education stated in the national curriculum. Apart from Jack’s additional proposed strategy of using TalkWall to sustain student focus, the overall tensions seem to relate to an unarticulated need state. Students’ positioning is dependent on both teachers and students, and teachers can attribute students with both too much and too little responsibility in the conversation. Teachers also emphasize that exploratory talk relies on students’ positioning in the dialogue, but they don’t discuss whether students make the same dialogic moves as the teacher when talking with each other, possible because their object is not to use exploratory talk as a means to equip students to participate in the educated discourse (Mercer, 1995), but as a familiar but challenging strategy to scaffold students in obtaining more advanced and specific content knowledge which they as teachers are responsible for.

5.2 Ground rules for talk

Empirical variations in this category relates to overlapping sub-categories

Comparing principles and ways of working to established practice. The teachers’ reasoning show that they compare ground rules for talk to established practice in different ways.

Claire reports that they’ve always had a focus on ground rules for talk, but that they haven’t used the ground rules for talk provided by the researchers. In addition she seems appreciative of them being presented as a suggestion:

“(…) nice that you have some rules that…or that you don’t just get a kind of: “Here are the ten rules that counts” kind of, but “here are thirty sayings which are more or less good and then you can talk about them””.

She finds the introduced ground rules similar to their classroom rules and established work on collaboration since the students are always organized in groups:

“(…) so we have never called it ground rules for talk, haven’t been concrete about conversation, but it involves more collaboration in general. So, but I think they’ve been a very nice starting point (…)”

Claire seems to appreciate the flexibility of the introduced ground rules and it’s conceivable that she is comfortable with suggestions rather than mandatory work, because she believes that her established collaborating practice already holds many of the same principles. Her nuanced contrasting when saying that they “have never called it ground rules for talk”, also
seems to indicate that she’s aligning the principles to established practice. It’s hard to know what she means by ground rules being a “good starting point”. However, considering that people leave out connections to the context which is given and communicating only what is needed to make themselves understood, it could be perceived that she’s finds ground rules as a “good starting point” for conversations. Furthermore she reports that they haven’t worked concretely with the introduced ground rules, other than discussing in groups to make them:

“(…) so that’s something we possibly have to think about doing (…) working concretely, like what was mentioned upstairs that; “these are formulations you can use when you talk together” and then you get like: “I think this is important, what do you think?” If they get such templates, which they shall use when they talk, we have never worked with that.”

However, Claire seems insecure about students’ appropriation of these “templates” and whether or not it’s corresponding with her established practice:

“(…) I, I don’t know…I’m a little in doubt if that’s really…um…my…um…way of doing it….um….you can probably do it in some kind of isolated, in some kind of isolated context and then “Now you’ll only deal with this” but I…think that it can easy become a little like artificial, I probably have more faith in a little kind of freer approach, um, but which perhaps takes a little longer time, and that one perhaps work a little more long-term with it (…)”

It seems distant to Claire, to work with formulations on such a concrete level with what she perceives to be: “lines almost”. Still, she does not rule out the potential of it being awareness raising and she’s open to try it out, but not on a permanent basis. At first, it seems like she reveals a potential of change in the future when she carefully states that working concretely is something they “possibly have to think about doing”. However, she seems very uncertain to use sentence-openers, which was presented to her by another researcher prior to the interview. The fact that she’s in doubt of these opening-sentences corresponding to her “way of doing it” might be interpreted as how her established practice is affecting her rejection of the detailed work on ground rules for talk. According to the normative theoretical perspective, she seems to reveal more understanding than she knows when rejecting to make the “lines” permanent, as dialogic teaching is not meant as to replace all other forms for teaching. Additionally, her perception about them being “artificial” might refer to them being more strictly regulatory than guiding and proposed, the latter being what she feels more comfortable with in her established practice. Her claim about a “freer approach” which entails working more long-term could point to the same, but could also indicate that she perceives the rules as forced and short-lived.
According to Claire, Pete also compares the common established practice of students sitting in groups with the introduction to ground rules for talk:

“(…) we work with that they kind of shall listen to each other, have respect for each other and kind of…have…or like…yeah, that conversation on groups is very important on the groups (…) but now it’s perhaps more that we have put it into words, or students have also put it more into words what we need to think about (…)”

Pete expresses a form of collaboration with Claire and the rest of the team due to their project based lessons, and that they’re dependent on having a common understanding. As Claire has been in charge of working with the rules, he believes it’s in the plan that she will update the team in order to achieve a common understanding of ground rules for talk:

“(…) or try to have the same understanding as she does, then it becomes like a common class thing where we…um…at least like in the projects then I’ll also mention it to the students when we sit and discuss and in science and mathematics and everything else (…)”

In relation to the group size as a challenge for whole-class conversations, Pete thinks the dialogue in smaller groups before whole-class settings, will promote participation: “(…) They all get to be a part of a discussion or a dialogue during a lesson, even if they’re not heard out loud, then they’re heard by someone else during the lesson.”

Similar to Claire, Pete’s perception about ground rules for talk highlights a form of alignment to established practice where he seems to exemplify principles of ground rules for talk when referring to their work on collaboration in groups. He points out how ground rules have made them “put it into words” and this could refer to students and teachers articulating what is needed in their established work on collaboration. He seems to assume a rather passive role in working with the ground rules both in regards to division of labor and his plan to “mention” it for the students. Pete doesn’t mention ground rules for talk when explaining his rationale for making the students talk in groups prior to whole-class dialogues, but it could indicate that his focus on increased distribution of talk is related to the product of using ground rules for talk.

Jack highlights the importance of subject matter content when students talk and that everyone’s allowed to participate:“(…) as long as they talk about my subject it’s fine (…) and then everyone shall be allowed to say something. That’s important to me at least (…)”

Moreover he assumes a passive role when it comes to working on the ground rules for talk because of his limited amount of time spent with his classes and that contact teachers have
been in charge: “(…) Really them who have been taking care of it because I’m like there only two hours and then I don’t have time for so much of that.”

At first, it seems like Jack relates ground rules for talk to institutionalized behavior, which is expected of the students. Then he turns to the concern about the distribution of talk on groups, which could be related to more regular classroom rules and distribution of talk according to collaboration etiquette. This could indicate that Jack does not seem to have a clear idea about ground rules for talk and could in turn be related to both the fact that he assumes a passive role compared to his co-workers who are working on these rules, and to his focus on managing a class as a new teacher. Even though Claire and Pete rate their responsibility as teachers quite high in order to orchestrate and scaffold the classroom talk in the previous section, research suggests that students themselves do not scaffold each other in the same way when discussing in groups (Mercer & Dawes, 2008). In this section, the teachers all make connections between ground rules for talk and the work in groups by talking about respectful interaction for collaboration. Claire and Pete seems both to see ground rules for talk as more or less aligned with their established practice where their main take away at this point is that ground rules potentially be awareness raising in regards to their established practice on collaboration. Considering Claire’s hesitation of opening-lines, it’s possible that this would’ve been received differently by Pete if he was more in charge. Either way, it ultimately seems to depend on where they think ground rules should be applied; as a permanent part of group work or as a part of group work in a specific dialogic teaching sequence. Jack’s alignment of ground rules to established practice indicates that he as a new teacher has a different focus than Pete and Claire, and his distancing from ground rules seems both due to local division of labor and to be in line with him being preoccupied with managing his class and taking care of equal participation in collaboration.

5.3 TalkWall/Talkwall
Alternating between the sub-categories perceived purpose of TalkWall and describing and evaluating use of TalkWall teachers first reveal the general theme starting point for classroom conversation. They also focus on student contributions and comparing to other digital tools, and expressing their understanding of the relationship between ground rules for talk, dialogic teaching and TalkWall.
**Perceived and experienced purpose of TalkWall**

Claire is concerned about reflecting on the importance of placing technology into a pedagogical trajectory rather than the other way around. She reports having used TalkWall several times in the project-period so far. Jack reports an interest and experience in technical and digital tools, and has volunteered to collaborate with the DiDiAC’s programmers. Pete expresses an overall interest in technical or digital tools, but his engagement in keeping updated has lately been inhibited by increased municipal regulations. However, he reports a low user frequency of TalkWall and his perceived purpose of use up until now summarizes the teachers’ common held perception:

“(...) that they can empty themselves of questions as a startup of a theme and then it could be easy to get a lot of view points at the same time without them (...) needing to expose themselves too much (...) then you can pick it up again in the middle of a project and see that this was what we wondered about and this was where we wanted to end up or this was what we wanted to work on (…)”

Even though they all share the idea of using TalkWall as a support in an initiating phase of a new topic Claire states more explicitly its usefulness: “(...)in the startup to arouse curiosity and to initiate thought processes (...) to achieve exploratory conversations.” So while Claire connects TalkWall to nurturing engagement in mobilizing ideas for exploratory talk, Pete and Jack highlights low threshold for increased participation, mobilizing contributions and points to storing functions to support the synthesizing process.

**Student contributions**

Claire talks about the affordances of having a focal point for both individual and collective visualization of contributions. The main affordance is for the students to be able to build on each other’s contributions consciously and unconsciously.

“(…) so it’s a form of building on each other’s things when they see what the others do and then one gets a new idea. Even if it’s not very stated, one perhaps does it unconsciously probably, and then it’s of course sometimes consciously. But it’s clear that you, you can probably use it much more consciously in regards to that they should see each other’s contributions”

She also relates the focal point in TalkWall to the experience of visible individual and collective production: “(…) like in a way you have done together (…)” and to the joint attention in order to follow a common topic of conversation. Furthermore Claire claims that TalkWall is appropriate for both verbal-oriented and literate-oriented students and that it perhaps is a little easier to contribute verbally if having written something first. However, she
perceives the use of TalkWall as a challenge when collaborating on a single contribution in the groups, because even if group contributions are technically tidier on TalkWall, the students can’t contribute equally as long as there is one student writing and posting the contribution. Individual contributions allowing all students to write contributions present the challenge of long filtering-lists hard to manage, which in turn creates a gridlock:

“(…) because I think (…) it’s good that everyone gets to write, because that’s the disadvantage with groups, then one can kind of choose to look the other way and not pay too much attention. No, it’s a little like advantages and disadvantages you could say and eh…but is not like I have some major tips to how it should be done differently, works well.”

Interpreting Claire’s perception, TalkWall’s visual availability seems to scaffold students in their thinking. The fact that she presents teachers’ making the students look at each other’s contributions in this process as a potential option, could indicate an established practice where much of the driving pedagogy behind actions are held implicitly, but it could also be the case that this is highlighted in the early phases of implementing new technology. She also addresses tensions when it comes to organizing contributions in groups when assuming decreased participation due to one student producing a joint group contribution, and she does not address the group conversation prior to this production. Individual contributions seem to function as a limited strategy to promote increased contributions, due to a cumbersome filtering system. Her established practice of controlling participation seems to be transferred into her new practice with TalkWall and not having any “major tips” for alternative use, could point to a missing link between ground rules for talk in students’ conversations before producing contributions.

The use of filtering functions to choose “focus” and “starting point for classroom conversation” is typical for Pete when reflecting on the use of TalkWall. He connects the students’ contributions to increased participation and to a starting point for a conversation in the classroom, by highlighting one or more contributions and building on these:

“(…) that all students in one way or another can contribute by getting their question or their point of view or their opinion on the Wall, and then…eh…you take one or more points of view or answers or what it might be, as a starting point for a classroom conversation (…)”

Increased visual participation is also viewed as an advantage in order to give students recognition for their contributions, which normally is limited because of time constraints. Pete’s connection between students’ contributions to classroom conversations and filtering
out selected contributions as a start of a conversation seems to confirm his perceived purpose of using TalkWall as a scaffold by building on students’ own ideas. He also seems to suggest that increased visual participation scaffolds him in giving students recognition.

According to Jack, starting with the students’ contributions provides him with the affordances of students’ approaches, and that it also provides him with a quicker overview of what kind of knowledge the students possess or what they struggle with:

“(…) then it’s perhaps a way they also want to reveal that’s also perhaps easier. And then I also very quickly figure out what terms they think is difficult, it’s like if there are things they never use or use completely wrong, then I see it right away (…)”

Immediate visual access could also support students elaborating: “(…) you can try fishing up more stuff (…)” Jack’s use of TalkWall and student contributions seems overall to be in line with his previous statements about established practice in regards to check and control students’ knowledge: “(…) to more control whether they know it or not, or also to know for myself how much they know about this, right?” Even if he usually organize for students to work in pairs for support, he highlights the challenge of students not learning when copying and pasting from the web or from other students when using TalkWall: “then they don’t learn anything (…) and then there are probably times too that they see what others answer, right?”

Jack’s seems to perceive TalkWall as scaffolding him in accessing students’ ideas in order to know where and how to assume the role of the competent other. However, unlike Claire, he does not recognize student’s being a competent other for each other when students’ visual access to each other’s contributions are presented as a threat to their independent learning outcome. The teachers overall seem to present several scaffolding affordances such as student contributions leading to increased student participation, giving teacher insight into students ideas, being a starting point for conversations, giving students opportunities to build on each other and receive recognition for their contributions.

**Compared to other tools**

Claire describes TalkWall as a “seasoning app” for occasionally use, commenting that she’s not dependent on it referring to the scope of apps available:

“(…) you could have quickly found something that resemblance if you really needed it and a Padlet solution or you can, yeah, lots of other stuff, use the board for that matter, right? So, eh, yeah”
In a similar vein, Jack notes: “(…) on OneNote, you can make a page in the collaborative section and then just make people writing something there too, right?”

Similar to Claire, Pete also compares TalkWall to Padlet, but underlines the absence of a filtering function in this tool:

“One of the nice things about TalkWall is that you pull out what you would like to focus on especially and I don’t know if that’s just as easy with them, because there it’s probably, or there it’s on the board anyway, while here on TalkWall we can filter perhaps more. So in that way it’s perhaps…more useful there, to reveal it there, or to mark”.

Claire’s and Jack’s comparisons of TalkWall to other tools, seem to highlight that they use TalkWall as an extension of their established practice, which is in line with educational research on implementation of new technology. Jack focuses on the general visual affordance and while Pete seems to connect filtering functions more closely to the scaffolding affordances for conversation, Claire has touched upon filters but seems unwilling to rate TalkWall as being a substantial part of the solutions for tensions related to her reported inadequacy in dealing with challenges in classroom talk. This seems to indicate both a nascent technical experience and conscious use of technical functions towards their problematizing of established practice, which overall confirms the teachers being in an unarticulated need state.

**Perceived relationship between ground rules, dialogic teaching and TalkWall**

Teachers were explicitly asked to make an account for their perception of the relationship between ground rules for talk, dialogic teaching and TalkWall. Claire makes a connection between ground rules and dialogic teaching which she connects to her established practice:

“….Think like, that dialogic teaching and ground rules for talk has a close relation, but I think that it’s fully possible to do that without TalkWall. Um, because that’s something I’ve done for like many, many years.

Pete is the only one of the three teachers who articulates connections between all the elements in the project and emphasizes the importance of ground rules for talk regardless of group size:

“ (…) we use…or we try with these ground rules for talk in groups of four, but then you have to use them when you have those conversations with TalkWall and have that dialogue with the class which perhaps is the goal with it, so I think that ground rules for talk should…be the foundation all along, (…) TalkWall is going to be a means to
Jack compares interactions with the students with and without the use of TalkWall and points to the affordance of TalkWall as a unit for increased participation instead of showing hands:

“(…) Everyone gets to contribute now (…) being a little forced to get it out, then you perhaps see more [students] (…) if you are afraid of getting it wrong right, if you then see that there are many others that gets it [right], then it’s like: “Ok, but then I do have it right, so then I have shown that I know it too””.

Claire’s reasoning seems to confirm that she believes both dialogic teaching and ground rules for talk to be a part of her established practice, but it could also seem to confirm her view of digital tools in general, underlining it as an additional support for pedagogy and “not like a prerequisite”. In addition, it could indicate that she assumes the research project treating TalkWall as a dependent factor. Pete seems to reason the connection between all the elements on a more conceptual level. Lacking knowledge and experience with ground rules for talk, Jack doesn’t mention these, but focuses on his experience of using TalkWall to increase participation for classroom talk and students receiving a sense of achievement.

5.4 Continuity and change

This sub-category deals with the teachers’ perceived changes or perceived potential changes in use of TalkWall in terms of functions or role in the classroom dialogue, or changes in their perceptions of the overall project’s intention.

Claire evaluates her use of TalkWall until now as “traditional” in the sense of it being characterized by a low degree of change in regards to variation, or lack of “revolutionary use”, and that she uses the tool as an extension of her pedagogical approach:

“(…) cram it in somewhere in the course where it can fit, where it replaces for example a mind map, or a, or that we write notes on the board or that I have prepared something on a presentation, that it replaces that a little and I think that has really been, that has been a little similar those times I have used it. I don’t think I have challenged myself so much on it (…)”.

Adding to her focus on low variation, she had intended to present groups’ own filtering of other students’ contributions, but changed her mind because as she notes: “(…) I was like a little in doubt of how I should do it (…)”. However, when given a summary of the settings where she had used TalkWall, she reflects on a possible change:
“(…) it has probably been a change in that I, that I use it a little more exploratory now…um…and as a support to make students think instead of just writing in something and then they’re done with their answer (…)”.

Her statements about TalkWall being an extension of her established practice seems to be related to technicality and is overall in line with her previous statements about TalkWall as an occasional supplemented support. Absence of change is re-evaluated when recapping previous use as she presents a shift from using student contributions as end-station towards a support for students’ thinking. The term “probably” could however refer to a negotiation which could indicate that she does not perceive this change to be of a significant value. Her statement about tensions concerning intended use could be related to research suggesting that implementation of new technology takes time.

Claire underlines the tendency to keep using something the same way when having learned to use it and frequently compares her self-evaluation to presumptions about how researchers expect change: “(…) then I don’t quite know if I have followed through there, because I use it a little in the same way I would’ve used something else”. Claire says that ground rules for talk hasn’t changed her practice, apart from raising awareness and in that sense being a changing factor, but she underlines that it has not been course changing: “(…) perhaps one is, becomes more effective in achieving it [exploratory talk] or that one does it more quickly (…)”. Furthermore she reflects on a perceived low effect of the overall project and she seems worried that the results will be showing that the project had no effect on enhancing classroom dialogue: “(…) because it fits too well, I don’t quite know (laughter) (…) And then it’s very conceivable that there will be a major effect that I’m not able to see (…)”. However, when explaining what she meant by a previous statement about TalkWall being a “talk-tool”, she defines it as a starting point for a conversation initiated by student contributions and thereby different from other tools where the conversation derives from her own content presented in PowerPoint or KeyNote:

“(…) you get the students thoughts up, there and then, and then you can grab a hold of it, and that is perhaps the biggest advantage, or the biggest change from the first time until now. Even if I still think it’s a bit chaotic to um…grab a hold of something students have written and say something about it offhand.”

Claire also reports a development in managing the contributions more easily now than in the beginning by using the filtering system and hashtags, and that it’s important to get to know the software. She is overall positive about using TalkWall for social science classes in the future. She explains low degree of change as related to both her unchanged use of the tool but
also argues that the project’s compliance to established practice could be the reason. This might seem contradictory, but it could also reveal the unarticulated need state in the sense that she assumes that the researchers expect change and so does she, but does not consider herself to have changed, and does not yet know how to change which in turn makes her reclaim the position of aligning the project to her established practice. Rating ground rules as a possibly less time consuming method could indicate a negotiation in her belief in a freer and long-term approach. The notion about unexpected changes could be related to teachers and researchers addressing change towards different objects in their respective activity systems. Her alternation between “biggest advantage” and “biggest change” when starting with students’ contributions could indicate the tensions occurring when dealing with a new tool to mediate the classroom conversation, which is dependent on new ways of practice.

Pete claims that he’s more positive to the tool now than he was in the beginning where lack of experience made him perceive TalkWall more cumbersome than beneficial and explains: “(…) when you start to understand how things are connected, then you see the benefit from it, so I didn’t necessarily miss it, but that’s because I didn’t know that it existed (laughter).” He claims that the actual use of the tool was the result of his changed view of purpose and that he will use TalkWall regardless of researchers telling him so or not, restating his perception of TalkWall being a good support to involve more students. In relation to potential change in the future, Pete talks about working towards good questions beforehand and along the way when using TalkWall. Overall, Pete states that their involvement in the project makes him and Claire more aware of their established practice:

“(…) about how to kind of have a dialogue with the class (…) perhaps think a little more on those questions and perhaps think a little more over how we do things, that that’s just as important, that we go around and think a little more (laughter) (…)”

Pete’s changed perception of tool value due to increased experience seems reasonable even though he does not comment on how he perceives that “things are connected”. Compared to Claire, he does not seems preoccupied with researcher assessment, but rather seems to put greater weight on re-evaluating their established practice by focusing on his responsibility to pose good questions and that the project helps teachers raise awareness of how to conduct classroom dialogues.

Jack would like to talk less and that the students would talk more, but does elaborate on how he perceives changing students’ positions as he rather focuses on the end-product: “(…) don’t know if they learn something right? And then there’s always, you know about those students who the teachers let loose, then they don’t do what they’re asked.” He does
however reflect on the potential use of TalkWall for flipped classroom where students can post their “homework” and reports having intentions of future use and having encouraged other teachers to use TalkWall. He does not consider himself to have changed in regards to the structure of talk when using TalkWall and connects this to the level of activity already existing in his class:

“(…) Perhaps if it had been in a class which had been very quiet and they had started to talk more, then I think I would’ve seen something more. But they, these classes, then it’s like, they are used to talk anyway and no one is afraid of saying wrong there, mostly, so then it’s not, I don’t notice a very big difference (…)”

Even if he does not consider the need for change in his structure of talk, he reports some concern about researcher’s analysis of his lessons to reveal “only bad codes”, and in regards to the established teacher mentoring arrangements he reports to focus on his ability to ask questions and create dialogue in the future:

“How I talk with the students (…) or how I create student dialogues perhaps. If I have good questions for them or not. Or if it’s only like “yeah, yeah, done”. If one actually gets a dialogue or not.”

Jack reports a desired change towards students talking more, but this shift remains a tension as he presents the risk of decreased learning outcome when they’re working on their own which in turn could indicate that he prescribes student talk to group work in which he does not have control over their activity or doesn’t focus on equipping them with tools to regulate themselves. The fact that he does not “notice” a big difference because students already participate to a satisfactory degree, could indicate that he views TalkWall’s applicability to sift out increased participation in whole-class settings and doing so independent of him assuming any specific role in or modelling the conversation. This seems to be in line with his overall object as a teacher; making sure students participate in order for him to achieve control and to guide them. Compared to Claire and Pete, Jack seems to isolate using TalkWall from working on dialogues.

5.5 Workshop

The teachers expressed quite different experiences from the workshops where the researchers tried to balance concepts with procedural sequences of dialogues with and without TalkWall. Claire states several times that she does not recall some of the content in the workshops, but she reports uncertainty concerning both content and intention of the project. Working with analyzing conversations seemed alien and misplaced because she couldn’t connect it to the
rest of the workshop context and that extended time was needed to find the assignment useful. Uncertainty was also revealed in regards to expectations about working with ground rules for talk and to expectations of using both ground rules for talk and TalkWall:

“(…) Are we going to apply TalkWall, how often? Are we going to work with these ground rules, is that something that we must do, is it something we should do or are supposed to do and how often should one do it? And these other resources, what are they about, eh, when are we supposed to work with them and where? (…)”

Moreover, she expresses uncertainty when faced with a question about her experience of researchers assigning her the role of a co-researcher: “I haven’t really thought that you have done that, I’ve just thought that we are the units of analysis, we are being researched I have thought (…)”. This last reasoning bears resemblance to both previous statements about researchers’ evaluation of her use of TalkWall and also reflects strong indications of the asymmetric relationship between teachers and educational researchers as such. Still, Claire evaluates the workshop meetings and collaboration with the researchers with positive notions, experiencing a sense of being included and making clarification available. Her prioritized interest was ground rules for talk, but she doesn’t however report having used any of the resources connected to it, and that even though she has had a look at the project website and perceives a potential use, she has not used these because of time constraints.

Pete does not recall a lot from the workshops either, but reports a good experience with the group discussions and sharing user experiences and being useful as a technical forum. He reports having used the website in support for using filtering-functions and that he hasn’t used the resources for anything else yet, but expects to do so in the next phases of the project: “(…) when new things come along, so then I have to learn it (…) So it will be a natural place to get a little help and support, I think.” Although Pete does not express a clear familiarity with the role of a co-researcher, he’s more open than Claire and Jack, to assuming this role:

“No, you’re a co-researcher kind of because you….you are….or you try out things and um…express your experiences and then there is a development (…) So we do research on what works and doesn’t work and give feedback on it, and we, and that’s regarding both tool and method insofar, like I said earlier, we’re becoming more aware about our practice.”

In this last reasoning, it seems as if Pete is reasoning on the fly and this could relate to his strong conceptual understanding presented in the previous section. This could in turn indicate an overall different approach than the others, to the research project by being more inclined to viewing his participation in the collaboration as more symmetric. This could be argued in
light of the way he focuses on affordances of group discussions, asking for support and independently searching for resources, and contribute with feedback on both TalkWall and ground rules for talk as part of a development in an ongoing project.

Jack expresses a positive experience of the workshops which he connects to his technical interests and meeting others “(…) I think such technical stuff is fun (…) It was a little fun to listen to the other people said and things like that.” He also expressed an enthusiasm towards meeting a highly regarded researcher in the field. Jack has seen but not used the project website, and is more interested in technical functions to make the tool respond quicker and the possibility to insert a picture instead of just text. Even though Jack volunteered to work with the programmers in the project, he does not relate to the co-researcher role:

“Co-researcher? Test bunny I would’ve rather called it (…) [it’s] we who have to test it out and find the things that work and doesn’t work (…) No…co-researcher perhaps, I think that they have more to say. We just come there a few times, right? But we’re sitting…tried it out some times at the school and such and then we couldn’t actually do much about what we got.”

Claire’s and Jack’s perceptions of their given roles in the project serve to express the asymmetric relationship between teachers and researchers in this collaboration. While there seems to be a clear red thread of uncertainty in Claire’s perception of participating in the workshops and her role in the project as a whole, Jack presents a contrast between his positive experience of workshops and his disclaiming of a co-researcher role. His statement of co-researchers having more to say, could both be seen as an argument for not assuming this role by referring to a prepackaged technical tool, but it could also reveal his positioning relative to researchers’ status. Pete’s reasoning indicates that he’s more apt for assuming this role. His way of making sense of the overall project on the fly, could be related to his experience in the field, having left the novice stage but not yet having settled.

5.6 Empirical summary

Teachers’ object for activity seems to be the subject-matter content and they seem to problematize their teaching efforts towards this object without providing alternative strategies to solve inner tensions. They also show signs of both struggling and negotiating with how to make sense and use of the intervention. This could indicate that they have a nascent, but fragmented understanding of connecting the dots between TalkWall and ground rules for talk.
They align **dialogic teaching and exploratory talk** to established practice, and talk about inner tensions in their activity systems such as dilemmas concerning teachers’ questions when interacting with students and distributing classroom talk. Overall the tensions are strongly related to teachers’ responsibility when working on subject-matter content in whole-class settings. **Ground rules for talk** is not regarded as a strategy for dealing with the inner tensions and are also perceived to already be part of organizing students in groups or focus on equal participation. Both Pete and Claire talk about the rules as making them more aware of established practice, and Claire seems to negotiate with ‘sentence openers’.

Teachers report using **TalkWall** to get insight about students’ ideas, to structure their lessons and to start conversations. TalkWall’s support is also illuminated through its visual accessibility that could lower the threshold for student participation and increase students’ opportunities to build on each other, with or without teacher support. In addition, neither Claire nor Jack perceives the tool being needed as they compare TalkWall to other tools they could have used if they really needed one. They also reveal tensions concerning actual participation when students produce a joint contribution, and actual learning outcome in light of students potentially copying from other students’ contributions. These tensions could be indicators of lacking a new pedagogy or learning culture when applying new technology.

Looking at **continuity and change** together with **workshops**, Claire seems to be struggling more explicitly to grasp the intervention. She seems uncertain if the intervention will lead to change and report having struggled to understand both content and process in the workshops. The issue of change is less problematized by Jack. Even though both Claire and Pete recognize the need to develop technical skills, they don’t point to any need for applying other strategies or skills to use in combination with TalkWall, and Pete talks primarily about working on better follow-ups when interacting with students in the future. Overall the workshops illuminate how teachers reflect on their roles in the project in different ways which points to an asymmetric relationship between researchers and teachers.

Two issues will be further elaborated on in the discussion; **Teachers display an unarticulated need state and there seems to be a discrepancy between teachers’ and researchers’ object.**
6 Interaction analysis

We now enter the teachers’ classrooms. Claire and Pete belong to the same teaching-team and are both teaching 8th graders at a junior high school where the students are organized in classes in a landscape that is a mix between open and closed classrooms. Claire teaches social science and Pete teaches natural science. Jack teaches natural science for students in 7th grade, the year before entering junior high school and the school organizes their students in traditional classrooms.

The selected extracts are regarded as informative in terms of how the teachers use ground rules for talk and TalkWall in the classroom (Derry et al, 2010). Inspired by the teachers’ interviews and their reported use of TalkWall for classroom talk, I looked for how they employed TalkWall in their respective lesson designs, how they used students’ contributions for classroom conversation and how they applied ground rules for talk in these conversations. I have looked for following dialogic markers: inviting ideas, asking for elaboration, justification, reasoning, rephrasing students’ responses and building on students’ ideas (4.4).

6.1 Discussing problem formulations and ground rules for talk in social science

Prior to the two video-taped observations wherein the extracts for analysis was selected, Claire’s first use of TalkWall was observed by using field notes. Claire used TalkWall in the very end of a social science class. She introduced TalkWall as a tool for students to answer questions from the teacher and students posted their group contribution on the Wall containing a justification for their choice of theme in their project on the Norwegian constitution. Claire engaged in two short interactions with students, and her role as the lecturer had precedence over students’ verbal participation when she revealed a pattern and stated the importance of recognizing a connection between the themes. The extracts shown here are taken from the video-taped observations of approximately 4 months after her first

Illustration retrieved 05.06.17 from TalkWall Website:  http://digitaledialoger.no/
use and she reported having used TalkWall at least once in between the first time and the video-taped observations which are subject for the following analysis. Claire’s class counted 35 students organized in groups of four as usual. The subject-matter was social science related to a recently started interdisciplinary project-period on social media.

The following extracts presented in an orderly manner presents one extract from Claire’s lesson targeting students’ work on formulations of project themes, and one extract from a lesson on ground rules for talk. The goal for the first lesson was for the students to provide each other with feedback on each groups’ problem formulation for their project on social media. First they produced one contribution with the problem formulation they had worked on in their groups, and afterwards Claire tagged each contribution and giving student groups one minute to talk about the tagged contribution; what they thought about it, what was good or could be improved, and provide justification for their views. In the second lesson students worked on the previously introduced list of ground rules provided by the researcher group. The goal was to talk about their individual chosen rules and then choose a couple of rules they would like to focus on in the next project period.

**Extract 1 – Feedback on problem formulations**

The first extract shows one feedback session in whole-class settings after students have worked in groups to write in their current problem formulation. I have chosen to present this extract in sub-parts. The problem formulation at issue is: How can threats impact the victim’s friends and family?

<table>
<thead>
<tr>
<th>Claire: If we look at, If we look at the first one here</th>
<th>[moving a contribution to the top of the Wall]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claire: Now we only look at that one</td>
<td>[struggling to remove another contribution on the Wall recently tagged by a mistake and students try to help her, but she’s not able to apply the recycle bin from the feed, so she moves on by moving it to the bottom of the Wall and continues to read the problem formulation]</td>
</tr>
<tr>
<td>Claire: How can a threat affect the victim’s friends and family?</td>
<td></td>
</tr>
</tbody>
</table>
The students are asked to talk about the chosen problem formulation in groups for one minute before providing feedback about what makes it good and how it can be improved, including justification on both accounts. Claire walks around in the classroom while the groups talk and when returning the focus to the plenary feedback-session, she nominates Joey to provide feedback first. After having responded to his feedback, Steven raises his hand from another group and is nominated to speak:

2 Steven: We think it’s a little easy.

3 Claire: You think it’s a little easy. Why? Oh, sorry [adjusts the iPad]

4 Steven: Because it’s a little like kind of an easy answer to it [looking at the Wall]. It’s a little like; how can a threat affect[turns to Claire] well, it can have an affect if you’re bullied kind of, it’s a little like that the person gets upset and such. It’s not like…

5 Claire: “[So thinking]”, it is, it’s a little like, you can kind of just drum up the answers then?

6 Steven: Yes.

7 Claire: It’s, there are perhaps more answers, as you point out [looking at Joey].

Claire suggests that they as a group should look at the first contribution as she tags it and moves it to the top of the Wall, repeating it to be the exclusive focal point. She reads the problem formulation out loud (1) Steven has been nominated to speak and responds that they as a group think the problem formulation is a little easy (2). Claire repeats his response and asks why, pardon herself and adjusts her iPad (3). Steven responds by saying that it’s because it’s kind of an easy answer to it. As he looks at the Wall he repeats the formulation, and turning back to Claire, saying that it could affect if you get bullied, if the person gets upset. He starts to say what it’s not (4) when Claire responds in question form that they think it’s possible to just drum up some answers to it (5). Steven replies affirmatively (6). Claire says there might be several answers referring to another student’s previous statement (7).

In this extract Claire seems to use TalkWall as a starting point and as a continuous support for a feedback session concerning students proposed problem formulations at the outset of a new project. Compared to her first use of TalkWall there has been a change from using TalkWall as an end-station and now dwelling on each of their group contributions and thus creating a more dynamic interaction with students’ contributions. This is also in line with her self-
evaluation from the interview. She has some initial difficulties in organizing the first contribution on the Wall as she’s not able to remove a previous tagged contribution, but deals with this by moving the contribution at issue, on top of the Wall and emphasizing that this is the focal point for their first feedback sequence. She reads it out loud and gives students direction for what they should discuss in groups and also what they are supposed to contribute with in whole-class settings afterwards. Steven seems to use TalkWall as a support as he responds. Claire models some dialogic markers when she asks for justification, she rephrases Steven’s answer and builds on a previous student’s answer when opening up for alternative answers.

Claire continues to mobilize more contribution:

1 Claire: Is there anyone who has a suggestion for, or may I hear a little what group 2 thought themselves? (...) What did you have in mind with that problem formulation of yours?

2 George: um...[looking at the Wall].

3 Luke: but, you might [turns and looks at Claire] you might need to think a little to find the answer [Steven raises his hand].

4 Claire: mhm [Steven retreats his hand]. Think a little to figure out the answer, but do you agree in that it might be a little like too easy also, or do you not agree?

5 Luke: No [Steven raises his hand].

6 Claire: um (...) [Steven retreats his hand].

7 Teacher 2: Think, think also about the consequences. That could be something that makes you see if a problem formulation [Claire hushes on Steven and Jeff talking] is good or not, it could be a ton of consequences and repercussions here.

Claire starts to ask if someone has a suggestion, and then switches to asking what group 2 thought about their own problem formulation and after a couple of seconds she asks group 2 directly what they were thinking about their problem formulation (1). George looks at the Wall replying um (2) and Luke looks Claire when he starts by saying that one could in fact need some time to think about it. Steven raises his hand (3). Claire replies affirmatively and Steven retreats his hand. She proceeds to repeat Luke’s answer and then asks group 2 whether or not they agree that it could also be too easy (4) Luke says no and Steven raises his hand again (5). Claire starts to say something. Steven takes down his hand (6). Teacher 2 asks
them to think about the consequences, which also could determine whether or not a problem formulation is good or not and that it could be a ton of consequences and repercussions. Claire hushes on Steven and Jeff who are talking to each other (7).

Claire asks for students in group 2 to reveal their reasoning. TalkWall seems to be supporting students in their thinking as George looks at his group contribution on the Wall when he tries to start answering. Luke, on the same group, takes over and suggests a counter reply to Steven’s previous statement about the formulation being too easy, and states that it could in fact need thorough thinking when trying to figure out the answer. At this point Steven raises his hand, indicating he want’s to respond to Luke, but he doesn’t get a chance. We see that Claire starts the dialogue with an open question by asking for reasoning, but narrows it down in the follow-up. She tries to build on Steven’s feedback to make Luke elaborate, but her question seems to be formulated in a way that offers Luke an easy way out. When teacher 2 takes over, Claire loses the momentum for asking Luke to elaborate. This seems to show how dialogic markers are affected by how the established ground rules are in a negotiation phase. Steven tries to be more involved in the conversation, but takes his hand down twice when realizing that he will not be nominated to speak. The established rules are indeed highlighted when Steven and Jeff talk to each other because they are not nominated and when Claire signalizes them to be quiet as the other teacher is speaking. In the following, George proceeds to speak right after the other teacher’s comment in the previous section:

1 George: You can kind of see how big a threat can be that, if a person gets threatened then it can affect more people, you can kind of see that (…) yeah.


3 Luke: Doesn’t need to be just friends, could also be people around.

4 Claire: Yes, because I think that it delimits your assignment a lot.

Claire goes on to suggest that the group should make this problem formulation as a sub-formulation instead of main formulation.

George says that one can see how big a threat can be thorough seeing one person being threatened than this could affect other people and that one could see this (1). Claire replies affirmatively and starts proceeding with her comment overlapping with Luke, he raises his
hand and Claire says yes and she apologizes (2). Luke says that it doesn’t just apply to friends but could also apply to people around (3). Claire replies affirmatively and says she thinks their problem formulation denlimits their assignment a lot (4).

When George starts to speak he has not been nominated but speaks right after the other teacher’s suggestion about looking at the consequences. Luke seems to try building on what George says, and starts to talk, but raises his hand seemingly to follow the established rules when Claire starts her follow-up. Luke’s comments could indicate that the established asymmetrical relationship between teacher and student is being negoatiated when Claire stops herself when realizing she has interrupted Luke. When she responds to Luke, she seems to connect his comment to her own evaluation of the formulation, and thereby making him a co-owner of her suggestion of changing the formulation.

Moreover, the task for this lesson seems to provide Claire with great opportunities of making students talk directly to each other because the task is highly relevant for students to participate in. It’s conceivable that TalkWall’s visual accessability stimulates students’ engagement. There are also great potentials explicitly highlighting that they’re building on each other to make them aware of what they’re doing. Claire has preparing students to talk about specific issues in groups in order to provide feedback afterwards. At the same time, these extracts reveal the same challenging issue she expressed in the interview, namely the need for control of the one-to-one interactions. The fact that the students seems engaged in the feedback session as it seems purposeful in the following project work, seems to challenge the established distribution of talk and highlightes signs of negotiating the asymmetrical relationship between expert and novices. In turn this reveals potentials for students to talk directly to each other when exploring different viewpoints. It should be underlined however, that nine groups were to receive feedback in 60 minutes, which could be one of the reasons for controlling interactions and also for the other teacher to intervene with a strong direction for the students’ further work.

Extract 2 – Ground rules for talk

In this lesson, Claire reminds the students of their previous work on the list of suggested and numbered rules provided by the researcher group, and has now given the students the individual task of hashtagging rules they find relevant for a conversation, in their contributions on TalkWall. This extract shows Claire’s start of a conversation of one of the
posted rules “providing justification for you opinions”. Even though her question was followed by an interaction with Taylor, I have chosen to highlight what she says and does before presenting a full sequence of talk between Claire and Holly beneath.

1 Claire: Why, who has chosen, let’s see [looking at her iPad] I can see that (…) Taylor, for example? Why do you think that it’s an important feature for a conversation?

Later in the same lesson, Claire moves on to another rule that many students have posted:

2 Claire: Mhm. Another one who that’s quite common [looking at her iPad] here I for example see, five, which says something about being critical of the ideas that come out, but not of the person. What does that mean um [looking at her iPad] for example, um Holly?

3 Holly: Yes, that you have to kind of just [turns to talk to another student]

4 Claire: Yes just try to say it, it’s alright.

5 Holly: Than you kind of have to be like objective? No.

6 Claire: Yes, yes, what are you thinking, what do you mean by objective then?

7 Holly: If you kind of have to, talk kind of based based on the actual idea and not [another student from the same table raises his hand] if for example it’s a person you perhaps don’t like so much.

8 Claire: Yes?

9 Holly: Think that it’s the idea which is good and kind of not that it’s dependent on the person whether it’s good.

10 Claire: Mhm, so you have to distinguish it. If you like the person and like the idea. You might say that. Mhm.

Claire proceeds to go through the highest frequent rules by looking at hashtags and connects students’ selection of rules to their project work in groups.

Claire start by asking why, and then switches to ask who has chosen, says they’ll have a look, before looking at her iPad and stating that she’s able to see it. She says Taylor as an example, and asks him why he thinks this is an important feature of a conversation (1). Claire looks at her iPad when stating another rule being commonly referred to in student’s contributions. She says that she for example sees number five and that this rule says something about being critical to ideas and not the person. She proceeds to ask what this means and looks at her iPad
before suggesting Holly to respond (2). Holly responds affirmatively and starts suggesting what one needs to do before lowering her voice and whispering something to the girl sitting next to her (3). Claire says she should just try to say it and that it’s alright (4). Holly responds in question form that one should be objective. Then she adds no (5) Claire responds affirmatively twice before asking what she’s thinking and then what she means by objective (6). Holly says that one kind of has to talk about the idea and not, if for example you don’t like the person (7). Claire responds affirmatively (8) and Holly proceeds by saying to think about the idea as good and not that it depends on the person whether it’s good (9). Claire responds affirmatively and says that one needs to distinguish between liking the person and liking the idea. She adds that that’s probably a way to say it (10).

In the interview, Claire stated that the biggest change of using TalkWall was that of starting with the students’ ideas and in this extract this becomes evident when Claire starts out with her established distribution of talk, but then regulates herself when thinking out loud and stating how the visual accessibility of students’ contributions makes her distribute the talk differently than before (1). Even though she also stated in the interview that it could feel a little chaotic for her to say something about students’ contributions off hand, in this lesson she shows signs of dialogic markers, when handing over the responsibility to the students. She asks Taylor for justification for something he already has stated with his contribution. Her way of asking Holly to respond also reflects her new distribution by looking at her iPad and choosing from students’ contributions. A deviation from the IRF-structure is noticeable by her use of dialogic markers. First she asks Holly to elaborate and when Holly reveals her uncertainty in two sequences, by first seeking support in another student, Claire encourages her to try to elaborate. Holly reponds but retreats from her own answer, and Claire asks responds affirmatively and asks for Holly’s reasoning and then to elaborate on “objective” (5). Holly proceeds to reveal her reasoning and Claire provides her with a confirming feedback which makes Holly sum up her thoughts in line 8. Claire seems to rephrase Holly’s answer and adding that it’s a possible way of explaining it. This could indicate that Claire’s opening up for others to build on Holly’s explanation.

This extract also is one of several examples in this lesson where Claire first states that students seem to agree upon a rule by commenting that it is commonly referred to in the contributions (2). By explicitly highlighting this observation, she seems to model the goal of
unity, and to her statement in the interview about TalkWall being a focal point for attention and collective production.

Overall Claire seems to be modelling some of the ground rules in lesson 1 and she explicitly discusses them with the students in lesson 2 where the dialogues seem to be more extended than in lesson 1. In both cases, her dialogic moves seems to create a more conversational pattern out of the usual IRF-structure. Normatively speaking, she shows great potential creating dynamic interactions with students and TalkWall when designing relevant assignments that engage students.

6.2 Trajectory and talk in natural science

Pete’s four natural science lessons followed each other in a period of a school day. The class, which in total counted 70 students, was as usually divided into four groups of approximately 20 students. Students sat in groups of four and the lessons took place in a small room between two other classrooms, with glass walls on three sides. The screen and white board was localized on the wall that separated the room from the classroom on the other side.

The subject matter in these four lessons was the particle model. The class had previously worked on this topic, and was supposed to revisit the concept. Pete had not been using TalkWall prior to these lessons and told the researchers present, that he had planned the use of TalkWall right before the lesson start. TalkWall was first used in the beginning when students contributed with definitions of the phases of a substance, namely: solid, liquid and gas. Subsequently they were asked to contribute with hypothesis of how to make a balloon increase in size, using several objects from the lab which was presented on the teacher’s table in the front of the classroom; a flask, balloons, a container with water, a gas burner, a stand for holding the flask and matches. After students had contributed the second time and Pete had gone through some of their contributions with hypothesis, TalkWall remained inactive as the focus proceeded to be on carrying out students’ proposed experiments. Technical errors occurred most frequently in the first lesson, but also occurred briefly in the fourth lesson.

**Extract 1 – Talk about hypothesis**

Prior to this extract, students had first posted contributions with definitions of the phases of the substances; solid, liquid and gas. Then they posted their contributions with hypothesis of how to make the balloon increase in size by using the objects presented on the table in front of the classroom. In line with the first task, students are asked to produce individual
contributions when forming hypothesis. Pete has now tagged contributions, making them visible on the Wall. The conversation between teacher and students proceeds beyond the selected extract:

1 Pete: Um, I have chosen a few, um it does not mean that the others are wrong but they are, but I have chosen a few which have something in common at least. What do these have in common? I have chosen six. What is common to the six statements or the hypotheses? (...)What do these kind of have in common? Um Zoe? [Zoe’s contribution is not on the Wall].

2 Zoe: They say that one can use gas [[Intangible speech]]

3 Pete: Yes, that you can use this gas thing here in one way or another, but it doesn’t say, or they don’t say that you should attach it onto, fill it with gas that way. But what were you thinking? [pointing at Zoe].

4 Zoe: Steam

5 Pete: Steam? Yes. So that means that many of you have the impression that if I fill an Erlenmeyer flask, which are these [holding a flask], with some water, attach the balloon to it and warming up, it will grow bigger.

6 Paige: That’s what I wrote.

7 Pete: Yes, I think I, maybe you are here too [turns to look at the big screen] No, either you were late or I overlooked you.

8 Paige: Was a little late.

9 Pete: Yes, but then I could’ve pulled yours out too.

7 Illustration retrieved from collected video-recordings 18.01.17
Pete starts explaining his choice of tagged contributions and that they have some common features which he asks the students to name. After a few seconds he asks again and addresses the question to Zoe (1). Zoe replies that the contributions say that one can use gas (2), and Pete repeats and elaborates her answer when saying that one should use the gas thing in some way, but that it or that they do not say anything about placing the balloon over the gas bottle to fill it with air. He proceeds to ask her what she was thinking (3) and she replies “steam” (4). Pete repeats in question form before replying affirmative and rephrasing by addressing the contributions in total and using objects on the table when stating that many of the students believe that the balloon will increase in size if he fills the flask with water, puts the balloon on top and heats it up (5). Paige says this is what she wrote (6) and Pete replies affirmative while suggesting that her contribution has been tagged. When he sees that it’s not, he explains this as her being too late or that he had overlooked it (7). Paige replies that she was a little late (8) and Pete replies affirmative and says he could have tagged hers as well (9).

It seems as if Pete reacts to TalkWalls’ visual accessibility when he tries to implement new ground rules for talk. He notes how his selection of tagged contributions relates to common features and does not suggest that the untagged contributions are wrong. In this extract students involved in the dialogue comments on other contributions than their own. This is quite typical looking at other parts of the data. This could be referenced to his statement in the interview where he talks about giving other students than the usual ones, recognition and if this is the case it could be interpreted that he uses the tagged contributions as mediating competent others when asking other students to comment on them.

In this extract Pete seems to use dialogic markers. When Zoe replies to Pete’s invitation of revealing common features, she mentions gas and in Pete’s follow-up he first rephrases Zoe’s answer before he provides her with a hint. He does this by first addressing the contribution in what could be perceived as a conceptual way by stating: “it doesn’t say…” and then switches to address them as a collective student production: “they don’t say…” (3). This switch could indicate how new technology mediates the conversation in a new way and how Pete responds to this. This also indicates that he’s building on students’ ideas. He proceeds to ask Zoe to elaborate on her thoughts. When she replies “steam”, he confirms and returns to the contributions by rephrasing what many of the students seem to have a common perception about by utilizing the objects on the table in order to demonstrate parts of their hypothesis. This indicates his use of several sources for scaffolding. As he does this, Paige spontaneously adds that this was what she wrote, and Pete looks at the Wall to
check if her contribution has been tagged. When realizing that it’s missing, and clarifying with Paige that she must have submitted a little too late for his review in plenary, it could be interpreted that he confirms that her contribution was correct when saying he could’ve tagged her contribution as well. Paige’s comment stops the evolving dialogue and when she seemingly explicitly reveals her perception of the contract by which in this case she’s entailed to praise or confirmation, Pete’s response could suggest that there were in fact some answers more correct than others.

**Extract 2 – Talk about experiment**

This extract is taken from the first lesson and presents an interaction between Pete and the student James, subsequent to defining phases of a substance and prior to conducting the second experiment guided by a student’s proposed hypothesis. Since the largest flask broke during the first successful experiment, Pete has now fetched another flask from the laboratory and presents to the students two flasks with a balloon attached to each one:

1. Pete: Does it matter how big flask I use? In whose ... if it had not broken then. Which balloon would’ve become the biggest? *Holding one big flask with a yellow balloon and a smaller flask with a pink balloon attached to the top* if I had only air in it, no water, just air in it and then I'd put them over the heat, which balloon do you think would become the biggest? (...) And why James?

2. James: Um, the yellow one.

3. Pete: The yellow one, why?

4. James: Because it has, it, the flask has more air.

5. Pete: Yes, and why, why does that matter?

6. James: Because, then the air expands and blow up into the balloon?

7. Pete: Yes. So the bigger the container we have, the more air is there to expand and the bigger, or the more we can blow up that balloon.

Pete asks if the size of the flasks matters and which balloon would’ve become the largest if the biggest flask didn’t break. Holding up the two flasks with a balloon attached to each one, he says if he only had air in one of them, not water but only air and them put them over the heat, he asks which balloon they think would’ve become largest and why. He addresses the
question to James (1). James says the yellow one (3) and Pete repeats James’ answer and asks why (3). James replies that it’s because the falsk has more air (4). Pete responds affirmatively and proceeds to ask why that is relevant (5). James says in question form that it’s because the air expands and blows into the balloon (6). Pete responds affirmatively before saying that the bigger container they have, more air expands and the more they can blow up the balloon (7). Pete seems to build upon the hypothesis task as students are asked to answer what balloon they think would’ve increased the most and when he addresses the question to James he adds justification as part of the desired response. When James replies the yellow one, Pete repeats this answer and asks him why. This extract shows how it’s possible to create a dialogue with closed questions. In a normal IRF-structure of three-part sequence, Pete would have provided James with a feedback or some kind of evaluation of his response, but instead Pete’s follow-up is requesting justification and thereby applying more dialogic oriented moves. When James replies with reasoning, Pete makes a short notion of positive evaluation before requesting elaboration in terms of another justification. By doing this it could be interpreted that he’s confirming a right direction and when James provides his elaborated reasoning, Pete gives another short and positive evaluation before summing up James’ trajectory of contributions in the conversation.

Overall, Pete’s extracts suggests a variation in conversational patterns. Even though Pete tries to establish new groundrules in extract 1 his tagging of contributions which are in compliance with his own explanation in extract 1, seems to show how he uses students’ contributions as a way of supporting his own lesson. This finding is supported in other parts of the data where he’s monitoring the feed on TalkWall while giving feedback as they write contributions, and also his own elaborating and making connections between students’ tagged contributions on the Wall. In addition he shows signs of dialogic patterns in his conversation with Zoe when rephrasing her first response (3) and mirroring the other voices on the Wall as he proceeds to encourage Zoe’s elaboration of her thoughts (5). In extract 2, Pete has moved on from contributions on TalkWall to objects on the table. He does not return to the contributions after having launched the conversation with James in what could be characterized as IRF-structures with more dialogic features, wherein he asks for justification and synthezes James’ justified explanations. When this happens the functionality of the IRF-structure changes from sustaining control to retrieve more advanced arguments. Both this “take-off” and similar trajectories of interaction between Pete and students in one-to-one dialogues, is supported by other parts in the data.
6.3 Combining student contributions and drawn representations in natural science

These extracts from whole-class interactions belong to a lesson in natural science. The topic for the lesson is serial and parallel battery networks. Prior to his whole-class interaction, Jack has had an introduction to students’ previous work on networks with the help of students when recapping, and students have worked in groups in defining the difference between these two networks subsequent to this recap. TalkWall is projected from Jack’s computer onto a whiteboard. In the former videotaped observed lessons collected prior to this lesson he did not make use of TalkWall, but his statements from the interview indicated that he has been a more or less regular user. These following extracts are taken from the summary phase of students’ group work in whole-class settings and his class counted approximately 25 students.

Extract 1 – Paralel network

There are three student contributions on the Wall and prior to this extract, Jack introduced the plenary activity by saying that there were many good answers and that he had chosen three, even though there were more contributions from the feed having the same content. He reads the contributions and elaborates on these. With help from two other students the networks are drawn on the whiteboard in between the projected student contributions. After establishing the fact that there are no limits of parallel network and that it only depends on the number of batteries available, he asks how they should connect the two drawn batteries on the Wall. He gets one suggestion before he draws connections between the batteries on both sides. When asking for other suggestions he simultaneously proceeds to draw a light bulb on the Wall:

1 Jack: If I have a light bulb up here then, and then, it needs electricity right? 
[[Intangible speech]] How can I make the electricity from the batteries here [pointing at the drawn batteries] up to that [pointing at the light bulb]. Yes [pointing a student]

2 Perry: Have to continue [gesticulating a circle from bottom to top with both hands].

3 Jack: [Looking at the Wall] Have to continue?

4 Perry: Was it supposed to be two batteries? 

5 Jack: Huh?

6 Perry: Two batteries?
7 Jack: I was going to connect these batteries here [pointing at the drawn batteries] to that [pointing at the light bulb].

8 Perry: You can first connect [pointing at the Wall] a little um...[a descrete downward wave]

9 Jack: Ryan? [pointing at Ryan].

10 Ryan: Um, almost the same except that um they both go up to the light.

11 Jack: Ok, so this one then, like this? [drawing a connection from a joint connection of the batteries on the one side] That’s what I’m thinking. Then it goes up like this [drawing the joint connection up to the light bulb and to the joint connection on the batteries on the other side] That’s what I would’ve done, right? Then the electrons would’ve gone in here right? That way, the same here [gesticulating], that way and then around [gesticulating] in an eternal orbit, right?

Jack says that if he has a light bulb, then it needs electricity. He asks how he should get the electricity from the batteries up to it. He then says yes and points to student (1). Perry says have to continue (2). Jack repeats his answer in question form (3). Perry asks if it was supposed to be two batteries (4). Jack replies huh in question form (5). Perry repeats two batteries in question form (6) and Jack replies that he wanted to connect the two batteries to it (7). Perry says that Jack could first connect. He then pauses his explanation and says a little, before he stops (8). Jack asks Ryan (9). Ryan says that it’s almost the same, apart from them both going up to the light bulb (10). Jack responds affirmatively and then says like this in question form. He draws onto the drawing saying that’s what he’s thinking before he

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8 Illustration retrieved from collected video-recordings 29.11.16
proceeds to explain the connection and saying that this is how he would’ve done it. He explains the direction of the electrons in question form (11).

Jack uses drawings as visualizations of the students’ explanations. This could be interpreted as making students elaborate on the definitions provided by the tagged contributions. Students seem to be exercising their understanding by helping the teacher to draw the concepts which they have defined in written form, into drawings functioning as representations. Jack seems to be using both contributions and drawings to check and control their knowledge. He starts out by inviting ideas, and then seemingly asks Perry to elaborate by repeating Perry’s response. Perry seems however to interpret this as wrong and starts checking if he has the right information. When he starts to explain, but stops and discretely waves his hand downward, this could indicate that he wants to withdraw his answer. Jack’s switch to another student could suggest that he doesn’t want to push Perry. In addition, Jack’s expert role seems revealed as he’s looking for a definite answer by only drawing when Ryan’s answer is close enough to his explanation.

**Extract 2 – Why parallel network is preferred**

Jack proceeds to the next task about what configuration they think is the most common used. One contribution is tagged and Jack says this and all the other contributions in the feed have answered the same.

1 Jack: This one pointing at the contribution on the Wall] and then all the others also pointing at the feed have said that it’s this one pointing at the drawn parallel network] the parallel network. Why do you think this one pointing at the drawn parallel network] is more used than that one pointing at the drawn serial network? What do you think is the purpose with that? (...) Why do you think, everyone pointing at the feed] everyone has answered the same and then there’s only to hands up. Why have you answered like you have done? (...) [students raising their hands] Why do you think this one pointing at drawn parallel configuration] is more used than that one? pointing at drawn serial network] Yes, Bobby?

2 Bobby: Because for example, um, if you um use the TV for example, um “[Jack: mhm]” and then turns it off, then it doesn’t mean that all the electricity in the house um…

3 Jack: Turns off?

4 Bobby: Turns off.

5 Jack: Yes, if you exchange this light bulb erases the drawn light bulb] with a TV instead drawing a TV, and then I turn it off, then the rest continues to run right?
Jack says that the one contribution tagged on the Wall and all the others from the feed agree upon parallel configuration. He asks why they think it’s most common and not the other one. He asks what they think is the purpose. After a little pause he asks why they think, and then says that all of them have answered and then it’s only two hands up. He asks why they have answered like they’ve done. After a little pause, he asks why they think it’s more used than the other. He addresses the question to Bobby (1). Bobby says that it’s because if one for example uses the television and then turns it off, then it doesn’t mean that all the electricity in the house. He pauses (2) and Jack adds turns off in question form (3). Bobby repeats turns off (4). Jack responds affirmatively before saying in question form that if Bobby replaces the light bulb with a television and then turns it off, then other things keeps going (5)

In this extract Jack is pointing out that they all have answered the same, implying that they are correct. Then he wants the students to provide justifications for their answers. Jack poses two questions before he directly addresses the low participation compared to the participation in the digital feed. Afterwards he changes his question to ask why they have answered like they have done while pointing at the drewed representations in what seems to be reminding them what they’ve already defined and giving them hints in visual form. This could indicate that he assumes that since all students have provided the correct answer they all know why or that they are all able to articulate themselves in order to show that they’re able to transfer the represented concepts in practical terms. The low participation could however indicate that this is perceived as a more advanced task for the students. He does not choose a student from the feed or the Wall, but rather proceeds with nominating after having stressed that they all should know why they have answered like they have done. This could indicate that his established distribution of talk is intact and not affected by the use of TalkWall.

Jack’s interactions with the students are to a large extent characterized by an IRF-structure. When he occasionally asks students for elaboration or justification in this lesson, it is a part of a three-part sequence which does not evolve into several turns with dialogic patterns. His role as the expert lecturer in these extracts is in compliance to his statements of using TalkWall to control students’ knowledge. In reference to his statement of not needing to change conversational patterns when using TalkWall, because of students being verbally active anyway, the lack of dialogic patterns in the observations could indicate that he doesn’t focus on a dialogic strategy. In addition to this and in light of him not being involved in the local work on ground rules for talk, he seems to apply TalkWall in accordance with his
established practice and applying conversational patterns as a strategy to obtain focus on the subject. On the one hand one could argue that the rather low observed student involvement in his lesson is related to the small classroom making the cameras more intrusive and leading the students to be less active than normal, but students walking around and talking to each other about other issues while Jack is talking in whole-class, suggests that this is not the case.

6.4 Empirical summary

Teachers all seem to use TalkWall as a support for structuring their lessons and they seem to alternate between new and established mediating artifacts. Both Pete and Jack tagged students contributions providing a ‘relevant answer’ and used them to make students elaborate on these in different ways. Claire designed for a feedback session where none of the tagged contributions were either right or wrong. While Jack and Claire both used TalkWall actively in their lessons, Pete used TalkWall to initiate conversations, leaving it in the background as the experiment started. Claire and Pete seem to use TalkWall to mediate the classroom conversation, and Jack’s focus seems to be on using TalkWall as checking students’ knowledge through commenting on written and drawed representations wherein his role as the expert is quite prominent. His interactions with students are characterized by IRF-structures with each student, and Claire and Pete engage in sequences of talk with several turns modelling some of the ground rules for talk as they do so. In addition, Claire more explicitly builds on students’ statements in whole-class conversation than Pete and Jack.
7 DISCUSSION

This chapter will illuminate the findings and discuss their relevance in light of both theory and review in order to analytically address my research questions. As the interviews were the starting point for pointing back to the observation data, I will start with discussing the emic perspective and then proceed to discuss findings from the interaction analysis.

7.1 Discussion of template analysis

In this section I will start by revisiting the two research questions and I will answer these in a combined manner by using two predominant issues that emerged from the template analysis.

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<td>RQ1: How do the teachers perceive the relationship between ground rules for talk, dialogic teaching and TalkWall?</td>
<td>- Teachers display an unarticulated need state towards destabilizing their established practices as they try to make sense of the intervention</td>
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7.1.1 Dialogic teaching and exploratory talk

When talking about the introduced elements in the research project they report that their teaching efforts are characterized by exploratory talk already. While the form of the teachers’ turns in conversations with the students might be considered to be exploratory, studies show that the students do this to a much lesser degree (Mercer & Dawes, 2008). The DiDiAC-researchers investigate how the intervention might lead to a new practice where students’ agency in exploratory talk is enhanced (Rasmussen et al, 2016), but the teachers I have focused on seem to emphasize their efforts to sustain their practice. Overall, both Pete and Claire put a great deal of emphasis on teachers’ responsibility to pose good questions in order to achieve an exploratory conversation in the classroom. They also highlight the balance and struggle between open and closed questions relating it to curriculum goals or providing the students with some kind of direction. This dilemma refers to pseudo-questions in a conversation (Alexander, 2008). Moreover, this dilemma is a commonly accepted challenge, and further relates to the established contract that exists in the asymmetrical relationship between teachers and students which in turn is the foundation for the IRF-structure (Mercer, 1995, Mercer & Dawes, 2008). Differentiation in questions is emphasized and exemplified to
a larger degree by Claire than Pete, when Claire claims that the exploratory dialogue is demanding and advanced and perhaps too difficult for some students. Mercer (1995) underlines that ground rules for exploratory talk is not a set of new and alien rules that are imposed on children seeing how they refer to childrens’ implicit use of language. If following his argumentation that dialogue is deeply situated, then one could in this case argue that ground rules for talk might in fact be new and alien to students because such rules in a school setting is appropriated differently than in their every day lives. Ground rules for talk in learning environments have a specific function as a strategy to make students engage in productive talk in order to enhance a learning outcome. In this sense one cannot align the mandatory setting of a school and childrens’ interactions in their freetime. It’s conceivable that Mercer presents these rules as inherent in order to make teachers understand that they are already cultivated implicitly and that they need to be made explicit to be used in learning processes. However, making them explicit in these settings does not only imply making the previously cultivated rules visible. In educational settings, such previously held rules need to be cultivated differently because of the mandatory aspect and the related subject-matter content. As such, it might not be surprising that Claire connects exploratory talk to advanced content, because her dialogic moves are always related to content which in turn requires more demanding cognitive work than would have been the case if students and teachers were to talk about every day activities.

All the challenges and premises to dialogic teaching and exploratory talk are related to their responsibility of working with subject-matter content. Even though Jack allocates more responsibility to students’ positioning in the interaction, it still is dependent on their interest for subject-matter content. One-to-one dialogues are explained to control and safeguard student involvement but do not account for the inevitable danger of other students logging off. The DiDiAC-researchers view dialogic teaching as only one part of a longer sequence, and students should be explicitly prepared for discussion and use ground rules for talk (Mercer & Dawes, 2008, Littleton & Mercer, 2013). Claire does not report on any immediate tools to use for dealing with the danger of students falling behind when listening to a dialogue. In a classroom consisting of over 30 students, it is more than fair to argue that such a challenge will be present regardless of students being trained in ground rules for talk. The act of synthesizing (Linn & Eylon, 2011) seems therefore to be significant in order to achieve coherent understanding of both content and process. Pete seems to mention this when talking about TalkWall’s available storing functions and re-opening Walls and contributions as a synthesizing measure to keep students on track in accordance with theme trajectory.
Teachers seem to perceive exploratory dialogue as embedded in all established forms of classroom talk and depended on teachers’ improvisation in whole-class settings when striving to balance the dilemmas in their practice. They do not talk about exploratory talk as planned activity in which they prepare students to use dialogic moves and reveal their thinking to co-construct knowledge (Mercer & Dawes, 2008). Neither is it perceived as a specific sequence in the lesson trajectory and as part of a repertoire (Littleton & Mercer, 2013). In the interviews however, the focus appears to be on what the teachers do and to a much lesser extent what the students do in whole-class talk. Talk in groups is not elaborated, as productive talk seems to be perceived better safeguarded in whole-class settings. Teachers do illuminate the students’ positioning in the conversation, but Pete and Claire still put a lot of the responsibility on the teacher in order to make the students involve themselves. The emphasis on the teachers’ responsibility in whole-class settings is not very surprising given the established asymmetric relationship between teachers and students, and diversity in student groups where teachers are responsible for setting the stage for dialogue (Mercer & Dawes, 2008, Sedova et al, 2016).

Looking at how teachers frame exploratory talk into their practice could indicate that they’re in an unarticulated need state. They are problematizing common challenges without presenting any alternative strategies (Toiviainen, 2007, Engeström, 1999). Teachers emphasize tensions in their activity systems such as dilemmas between open and closed questions related to curriculum goals, and dilemmas concerning distributing classroom talk in order to keep all students on track. The function of exploratory talk is displayed as teachers’ strategy to either control or guide students when working on subject-matter content. Although Sedova et al, (2016) focus on teachers providing a context for dialogue to occur, they also emphasize the need for teachers to receive educational support for enabling dialogic teaching. In light of the structured DiDiAC environment, the selected teachers in this thesis seem to some extent struggle to make sense of the educational support; ground rules for talk and TalkWall. New tensions emerge as they try to make sense of the interventions’ purpose. Whereas researchers focus on how the intervention might result in a new practice, teachers try to make the intervention fit their practice. Thus, there seems to be tensions between researchers’ and teachers’ object in the activities. However, following I will explain how teachers seem to apply different strategies as they explore the need state. They negotiate with the intervention in order to make sense of it, and by doing this they show signs of destabilizing their practice, a required aspect of gradual change (Engeström, 1999).
7.1.2 Ground rules for talk

Ground rules for talk were not mentioned as an option to overcome students ‘logging off’ when listening to a whole-class dialogue. This could be related to teachers’ alignment of ground rules to established practice in terms of collaboration, thus it does not seem to count as a relevant or new strategy. In turn this seems to support the argument that they are focused on their efforts in organizing collaborative activities, safeguarding respectful interaction and equal amount of participation. Claire seems to be treating TalkWall isolated from ground rules for talk. Tensions arise when she problematizes the new artifact in group work. When concerned about students looking the other way when producing joint contributions on groups, she does not claim to have any tips to avoid this from happening. She seems to have dismissed ground rules for talk as they already have collaboration rules that are similar, and she does not seem to consider any forms of collaboration skills or conversational skills to be immune to the potentially unbalanced division of labor in group work. Pete and Claire make several references to their established work on collaboration in group work and talk about ground rules for talk as potentially awareness raising or amplifying established practice. They seem to try making the intervention fit their established practice on collaboration. However, Pete argues that group dialogues could provide students with opportunities to be heard and participate more in whole-class discussions, due to the support of a joint perspective the group has agreed upon. This could both indicate an assumption that the students know how to engage in productive talk (Mercer & Dawes, 2008) but it could also indicate signs of moving his focus from established forms of classroom talk towards providing contexts for enhancing students’ dialogic activity (Mercer & Dawes, 2008, Engeström, 1999).

Furthermore, Claire seems to be negotiating with the suggested ‘sentence openers’ as an example of putting ground rules for talk to work. It is conceivable that the approach to dialogue and ground rules for talk used by Mercer and Dawes (2008), operates with a set of premises that Claire does not obtain in her repertoire in such explicit form, or agrees with for that matter. However, she reported being open to try them, although not as a permanent strategy. This seems to support the perception about exploratory talk being embedded in regular practice. Claire’s expressed tension points to Mercer’s (1995) claim that teachers might experience a conflict between the detailed way of guiding students and their established pedagogical beliefs. The fact that Claire perceives the ‘sentence openers’ as artificial and describes them as “lines” could point to a desire to promote and empower the students’ own voices, meaning that the use of explicit phrases of ground rules might seem forced and resulting in undermining the students’ own voices for the benefit of a certain
academic discourse (Segal & Lefstein, 2016). Segal and Lefstein argue that ground rules for talk are forcefully imposed as the official voice is favored, but they cannot account for the separating lines between one’s own and other’s voices. In light of the discussion in the previous section (7.1.1), it seems evident that what is truly forcefully imposed is the mandatory education, and any attempt to build on students’ implicit ground rules for talk will result in differently cultivated rules once they are made explicit in the educational sphere. In this perspective, one could problematize teachers’ opportunities to empower student voices for their own sake exclusively as the school’s responsibility is to train students in different types of conversations (Mercer, 1995). On the other hand it seems over simplified to suggest that the educational cultivated ground rules are exclusively technical and rigid. On a metalevel it is meant to inform what language does and what it can do and in that sense make individuals capable of heeding their own opinions when ‘interthinking’ in a collaborative activity (Littleton and Mercer, 2013). Even though she advocates for a “freer approach”, it seems more likely that Claire’s expressed tension is a result of having worked in established structures over several years. She reports uncertainty about whether the detailed way of working corresponds to her “way of doing things”. This could refer to teachers’ changing barriers such as habits, failure to recognize need for change and professionals’ lack of desire to go back to a detailed approach as this could be a threat to their expertise (Zimmerman, 2006). Training in order to internalize a new repertoire requires following rules in a transmission period (Ericsson, 2006) and her willingness to try ‘sentence openers’ could be regarded as a compromise between established practice and practice change. Thus, Claire seems to reveal signs of destabilizing her established practice.

7.1.3 TalkWall
The teachers make several connections between TalkWall and dialogic teaching/exploratory talk, but Pete is the only one making a conceptual connection between TalkWall, ground rules and dialogic teaching/exploratory talk in the classroom. I have interpreted this as a conceptual connection because I argue that he has recognized an expected connection in terms of my question. Being less involved in the work on ground rules for talk than Claire, he has an opportunity to approach it from a distance. However, his conceptual reasoning is related to enhancing classroom dialogue, and does not illuminate any clear object in terms of his teaching efforts towards subjectmatter content. This might serve as a sign of approaching researchers’ object. Both Jack’s and Claire’s comparison of TalkWall to other tools and their claim about finding resembling tools if needed, could indicate that they apply TalkWall with
similar cultural conditionality (Wertsch, 1991) as other mediating artifacts they use. They do not experience the need for TalkWall in their established practices. When Claire clearly expresses that TalkWall is not a prerequisite to perform dialogic teaching, she relates this to her own practice with dialogic teaching over several years. She seems to evaluate TalkWall’s role for her established teaching efforts, thus underlining her object being just this. Even though researchers don’t present dialogue as dependent on the given technology either, Claire does not address TalkWall and ground rules for talk as a support for students to have dialogues as demonstrated by the one-to-one interactions with the teacher. Claire does however make the visual focal point of TalkWall relevant in order for students to get a sense of achievement of a collective production, and relevant in order to have a joint focus in the conversation. This could indicate a sign of exploring the need state as she seems to point to TalkWall’s affordance in terms of distributed cognition (Pea, 2004). When referring to TalkWall as being a focal point for joint attention, she does not however elaborate on this or express this as a form of measure to keep students on board when she has dialogues containing several turns with one student.

They are all positive about using TalkWall in the future. Overall the teachers describe the usefulness of TalkWall, reflecting the tool’s scaffolding affordances in enabling teachers and students to sustain a visible joint focus and teachers’ opportunity to monitor and build on students’ contributions when starting a conversation (Warwick et al, 2012, Luo & Gao, 2012, Mercier, et al, 2015, Rasmussen & Hagen, 2015). Claire characterizes the potentials for building on each other’s contributions as not necessarily very conscious or stated. In her view, the students are not automatically aware of what they’re doing on their own and together when they have access to a collective visualization of contributions on TalkWall. Furthermore, Claire’s description might reflect a sign of ‘indirect’ scaffolding (Warwick et al, 2012) and a synergistic scaffolding (Tabak, 2004) by turning to the teacher’s responsibility of making students aware of each other’s contributions on the Wall without giving any examples of ways of doing this. This might serve as an example of how she negotiates with how to make use of the distributed cognition. The fact that she does not connect this to ground rules for talk, could point back to her considering these rules to be part of her existing repertoire. The affordance of TalkWall’s distributed cognition seems to be cued implicitly by the teachers. However, teachers do not elaborate on this added support, or perceive this added support as needed. Contrasting perspectives on the need for TalkWall suggests that they are exploring the need state (Toiviainen, 2007, Engestrøm, 1999) as they are negotiating whether the tool is useful.
7.1.4 Continuity, change and workshop

Previous research has pointed to the value of studying the details of teachers’ changing mechanisms towards dialogic teaching (Sedova et al, 2016). According to Engeström (1999), the expansive cycle of learning starts when subjects start questioning their established practice. Inspired by Activity Theory, this thesis has argued that the participating teachers appear to be in an unarticulated need state where they problematize their established practices, without pointing to alternative strategies to overcome tensions. Even though there are a few signs of teachers approaching the researcher’s object, they are primarily exploring the need state and showings signs of destabilizing their practice.

Pete reports a positive change in perceived value of TalkWall due to applying it in practice, but he does not elaborate on how his perception changed after realizing how things were connected. Jack seems to treat the use of TalkWall and classroom dialogue separately when talking about potential change in his interactions with students in the future. Claire reports that she does not consider her use of TalkWall in the classroom to have changed, that she has used it the same way most of the time and that she does not consider to have challenged herself to a large extent. She exemplifies her use as being a replacement of other methods (Tondeur et al, 2013). She is also concerned that the effect of TalkWall and ground rules for talk, will not turn out big and suggests that this might be due to the fact that it fits too well, but she also find the rules to potentially be more effective for exploratory talk. In any case, Claire seems to struggle to make sense out of the intervention. This indicates that she’s trying out different explanations as part of exploring the need state (Engeström, 1999). Claire does however consider the biggest change in her practice to be starting with students’ contributions instead of using more established tools such as PowerPoint or Keynote, where she as a teacher has decided the content. She seems to address TalkWall as supporting students’ agency in the classroom, but she still emphasizes the teachers’ responsibility of making sense and use of the distributed cognition (Pea, 2004), rather than equipping students with tools they can apply in addition to her support. Claire also report uncertainty about both content and intention in the workshops, and it might not seem logical for Claire to regard herself as a co-researcher if she perceives herself to be the research object. She makes an interesting comment about being open for a future effect of the project that she herself is not able to grasp. This might reveal a form of passivity and can be connected to her perception of being a research object in the project. It could also serve to highlight an expressed uncertainty about the researchers’ object. Teachers’ overall positioning in the project in terms of either explicitly problematizing the point of the project, assuming the role of a test bunny or
expressing an acceptance to follow a given program, reflects the asymmetric relationship between researchers and teachers in such collaborations (Cochran-Smith & Lytle, 1990).

In a normative sense, one could argue that ground rules for talk needs to be defined as a prerequisite for the teachers in the following stages of the research project, in order to make use of the distributed cognition (Pea, 2004) for synergistic scaffolding (Tabak, 2004) that the combination of ground rules for talk and TalkWall potentially affords. A part from Pete’s conceptual connection of the intervention, the teachers are still trying to make sense of the elements in light of their established and implicit efforts in classroom talk (Mercer & Dawes, 2008). This could indicate that they are not looking for how this combination of methodology and technology might be used to change their practice towards increasing students’ agency in classroom talk, because this do not seem to be their main object as of now. Moreover, they do not seem aware of how they are affected by their implicit use of language (Edwards, 1997) and rightfully so seeing how tacit knowledge is often hard to make explicit (Polanyi, 2009). Implicit knowledge about talk needs to be explicitly scrutinized in order to become aware of how talk can be used as a tool for teaching and learning (Edwards & Mercer, 2012) and how meaning is co-constructed through dialogue (Linell, 2009). It seems necessary for teachers to make their implicit efforts explicit in order to recognize how the intervention differs from their established practices. Seeing how experienced teachers are less prone to return to a detailed approach in their practices (Zimmerman, 2006), the move from implicit to explicit could be a challenge.

On the surface it might have looked like ground rules for talk was the missing link between TalkWall’s distributed cognition and enhancing students’ agency exploratory classroom talk. Through analysis and discussion however, it turns out that this was just a symptom of the greater discrepancy which at this point in the research project, is localized between teachers’ and researchers’ respective object for activity. It’s also a possibility that if the teachers should transform into an articulated need state, they will not define ground rules as a prerequisite, but rather point to other aspects in need of change in their established practice. Intervention studies seem to cultivate the affordances of a co-inquiry (Engestrøm, 2011). However, like pointed out by Cochran-Smith and Lytle, (1990) teachers and researchers tend to hold different perspectives on issues’ relevance. As long as ground rules for talk are directed towards different objects for teachers and researchers, it could be an arguable possibility that teachers will perceive the given technology as a tool with limited support. The main object for the researchers is to investigate how the intervention might result in a change for the
students’ dialogic practice towards critical thinking and collaboration across subjects. The main object for the teachers seems to be to figure out how to make the intervention fit with their efforts to guide the students towards more advanced content knowledge. Thus, there are obvious tensions in the interconnected activity systems (Engestrøm, 1999). In addition, these teachers do not seem to be fully aware of this discrepancy and the fact that they are driven by different motivations because of different objects (Blackler, 1995). In light of recommendations to make the content of professional development familiar in order for teachers to approach a new practice willingly (Ertmer & Ottenbreit-Leftwich, 2010), the findings in this thesis offers a more complex picture. The teachers in this thesis participate in an intervention-program on a voluntary basis. At this point, the content of the professional development seem familiar to them in terms of their attempts to align the intervention with their established practices. The researchers target an object beyond changing teachers’ mindsets to include that effective teaching is dependent on appropriate use of technology. They implement technology and methodology in certain ways to investigate how this might transform practice to improve the quality of teaching and learning (Rasmussen et al, 2016).

In closing this part of the discussion I would like to return to the word cloud from the initial phases of working with the interview transcripts illuminating the word “perhaps” as the highest frequent word (4.3.5). This could indeed be a figure of speech. However, in light of my interview analysis and the subsequent discussion, I argue that the word supports teachers being in an unarticulated need state and exploring the need state at this point in the research project, as they try to make sense of the intervention. In this sense, the word “perhaps” refers both to dilemmas in teachers’ activity systems and to dilemmas and tensions that arise when their practice is intervened. The model underneath illustrates how teachers are in the initial phases of problematizing their practice and how they negotiate with the DiDiAC-intervention of ground rules for talk and TalkWall, thus resulting in signs of destabilizing their practices. It is worth noting that Claire seems to struggle more with grasping the intervention, which could indicate that she is destabilizing her practice to a greater extent than the others so far.
7.2 Discussing findings from the interaction analysis

I initially asked how teachers use ground rules for talk and TalkWall in the classrooms. The first order analysis suggested that empirical findings illuminated TalkWall’s mediating function and dialogic patterns in the interactions between teachers and students. In this last part of the discussion, I will conduct a second order analysis (Linell, 2009) and elaborate on these findings through contextualizing their relevance to teachers’ different lesson designs in order to discuss how their use of TalkWall and ground rules for talk relates to their pedagogical intentions and actions. Seeing that interview data and observational data needs to be treated respectfully to their given contexts, I emphasize that teachers pedagogical intentions when dealing with interactional data is a highly interpretative issue (Jordan & Henderson, 1995, Furberg & Ludvigsen, 2008). I would also like to underline that I will not approach their lesson designs in a normative evaluation, but rather discuss them in relation to theory and review. Finally I will discuss my interpretations of how findings from interviews and interaction analysis correspond.

The interaction analysis illuminates two predominant findings

- Signs of teachers negotiating with a new mediating artifact and destabilizing established practices.
- Signs of teachers modelling ground rules for talk/ using dialogic makers when interacting with TalkWall and students.

7.2.1 TalkWall and ground rules for talk – in a lesson design context

I will first interpret how these predominant findings seem to relate to each other and then I will proceed to view this connection in light of their lesson designs. Previous studies have shown that implementing new artifacts disrupts the established practice, which leads to teachers negotiating between old and new tools (Rasmussen & Ludvigsen, 2010). However, studies also underline the commonality of teachers using technology as an extension of their established practices or not taking the full advantage of their interactive capacities (Gillen et al, 2007). This might seem contradictory, but my findings suggest that both these aspects co-exist. If we look at Jack for example, the extracts suggest that he negotiates with the new tool when he adds drawings of representations in between students’ contributions, which also could indicate that he’s using TalkWall as an extension of his practice of using the whiteboard as part of his lecturing. If we address his pedagogical intentions and actions
through his lesson design, it could be interpreted that Jack’s use of TalkWall provides him with insight into students ideas and in a quicker way check and evaluate their conceptual understanding before moving on to testing its transferability in practical terms by using drawn representations. In this way the findings suggest that TalkWall as a sociocultural tool mediates teachers’ conversation with the students by giving them insight into what ideas students hold and to provide teachers with information about how to structure their lessons (Wertsch, 1991). This support the findings by Mercier et al (2015) referring to addressing specific posts for further elaborations. Jack’s IRF-structures when interacting with students seem to be a coherent strategy related to the overall design of his lesson. Students are asked to collaboratively complete the task of defining and comparing serial and parallel networks, and afterwards contribute individually in demonstrating what the concepts mean for the light bulb and explaining why parallel network is more common than serial. With the risk of taking an evaluative stance here, it’s important to emphasize that in light of his pedagogical intention, he seems to be using technology in accordance with this. Thus, he seems to be negotiating with the tool and not with his pedagogical intention. Jack seems to be in the initial phases of problematizing his own practice withholding his established object for the activity at hand (Engeström, 1999, Toiviainen, 2007).

Claire shows signs of destabilizing her established classroom talk when using TalkWall (Engeström, 1999), and I suggest that the implementation of TalkWall in her lesson design partly promoted this to happen. Extract one (6.1) was taken from a context where she had designed for feedback sessions, students were prepared to talk (Mercer & Dawes, 2008) and both content and structure seemed to motivate the students to participate. The way she included TalkWall, illuminates how the tool has a clear function in her lesson and seem to correspond to her pedagogical intention, both connected to the pedagogical structure and content. Claire limits the degrees of freedom (Wood et al, 1976) by tagging each group’s contribution in order and each problem formulation is localized on top of the Wall making it a focal point for discussion. The use of TalkWall in this lesson corresponds to the content in the sense that problem formulations are within the limits of allowed letters in each contribution and the content corresponds to pedagogical intention which is for students to provide each other with feedback. Furthermore, the extract suggests that students are supported by the contributions’ visual accessibility as they provide their responses.

According to the IRF-structure (Mercer & Dawes, 2008), the tagged contributions could be viewed as the first initiation, whereas Claire’s second initiation occurs when she instructs the students to talk in groups and make justifications for their opinions of the given problem.
formulation. Students discuss the contribution in groups and respond to Claire who expands the structure by showing dialogic patterns when she in her feedback asks for justification or elaboration (Nassaji & Wells, 2000, Mercer & Dawes, 2008). The extract suggests that students are eager to participate and that Claire to some extent shows signs of negotiating with her traditional nomination of students. It also shows how she seems to have set the stage for students to discuss with each other in whole-class settings, but that this does not happen. The second extract shows (6.1) that she’s also affected by the new tool and explicitly expresses how this changes her distribution of talk. As students already have responded through their contributions, this extract shows how Claire explicitly adjusts to this affordance thus making it clear to the students that she expects them to elaborate when nominated. In addition, she uses TalkWall and the highest frequent hash tagged contributions to reveal agreement which could indicate her attempt to highlight the need to establish ground rules in terms of a common ground, which is needed to achieve ‘interthinking’ (Littleton & Mercer 2013). The fact that she makes students choose rules and make them elaborate on these decisions seems to be a strategy to make students take ownership in them. Throughout this lesson she also connects the ground rules to collaborative work in groups when working on their project and in this way she seems to be connecting ground rules to both process and content.

In comparing Pete’s and Clair’s lesson designs, the findings show they are organized differently. Looking at Pete’s lesson design, he organizes for students to post contributions individually and uses students’ contribution both as to connect them to his own explanations by elaborating on them and as a springboard into one-to-one interactions with students by making students elaborate on their own contributions. He also uses contributions as a springboard into interactions with students before conducting experiments. Whereas in Claire’s case these dialogic markers seem to occur in close relation to her lesson design, appearing less structured in Pete’s lessons. In accordance with Wells’ (1993), one could argue that Pete’s variation of conversational patterns is connected to the different elements in his lesson trajectory as a whole. Pete varied between giving the students’ contribution and the lab-objects a prominent role in the discussion, but to a greater extent than Claire, he seemed to use student’s contribution as more of a ‘take-off’ for the subsequent dialogues. On the one hand one could argue that his use of TalkWall could be conceivied as redundant. On the other hand it seemed to be contigent with his pedagogical intention in his lesson design as he used the tool to elicit students’ responses and making them elaborate and justify them and thus demonstrating conceptual understanding. The closed question in extract 2 (6.2) was
dwelled upon and served to extend the IRF-structure (Nassaji & Wells, 2000). Whereas Claire’s use of TalkWall could indicate a distributed cognition, Pete’s use seem more in line with scaffolding with fading (Pea, 2004). I have not observed the teachers without the use of TalkWall, but my interaction analysis indicates that TalkWall makes the teachers more inclined to build on students’ ideas in their respective lesson designs, than they might have been without TalkWall (Rasmussen & Hagen, 2015). Dependent on their lesson designs, TalkWall seems to contribute to the ‘dialogic space’ (Wegerif, 2007) as it allows teachers to extend their interactions and thus providing space for dialogic markers to occur, and a space for students and teachers to act as “co-authors” (Linell, 2009) to achieve meaning.

7.2.2 Signs of synergetic scaffolding

Teachers’ use of TalkWall seems to illuminate both a ‘direct’ and ‘indirect’ scaffolding (Warwick et al, 2012) in terms of structuring the tasks on the wall, interacting with contributions and to various degrees supporting students by modelling ground rules for talk. To some extent they seem to use it in a synergy with their established practices (Warwick et al, 2011). Pea (2004) highlighted that identifying synergistic scaffolding needs to be tested by an examination of whether both software scaffolding and teacher scaffolding can be achieved by the software or the teacher alone. In light of Tabak’s (2004, p. 319) model, one could view the researchers’ motive for combining ground rules for talk and TalkWall in order to meet the need of exploratory talk for enhancing critical thinking. On the one hand one could argue that the very activity of dialogue is not dependent on technology thus making psychological artifacts such as language stand alone as the teachers’ ways of scaffolding the classroom talk. On the other hand this might also be debatable seeing how teachers in different ways seem to take advantage of the ‘dialogic space’ afforded by the use of technology (Wegerif, 2007). Even though similar findings of dialogue could be found in other contexts without the use of technology, Rasmussen and Hagen (2015) state that such findings are rather uncommon. TalkWall as a physical artifact seems to equip students and teachers with affordances which would not have been available otherwise. One could argue that building on students’ ideas for discussion takes longer time, and lacks a focal point for focus and sharing without using TalkWall. Ultimately, the data
showcases signs of software and teacher scaffolding together. Claire’s use of TalkWall could be interpreted as signs of a synergistic relationship between her way of structuring the task by using the tool and how she’s applying dialogic markers when appropriating students’ contributions in whole-class interactions with students (Warwick et al, 2011). TalkWall and students’ contributions seem to have mediated the teachers’ scaffolding in creating closeness between the students ideas and the teachers own explanations or directions (Rasmussen & Hagen, 2015). Signs of synergistic scaffolding seem dependent on teachers’ paramount deployment of TalkWall in their lesson designs, and to what degree their pedagogical intentions and actions could be interpreted to illuminate an interactive teaching style.

7.2.3 Interaction and interview analysis

Teachers’ extracts show use of TalkWall that could be interpreted in light of their lesson designs and interpretation of teachers’ pedagogical intentions and actions. This does not only serve to illuminate teachers appropriation of TalkWall in the classroom, but it could serve as to indicate which object they address for their activities. Even though some of the findings from the interviews are coherent with findings from the interaction analysis, such as teachers using TalkWall in line with what they perceive its purpose to be, either creating conversations about the subject-matter content or checking students’ knowledge, there are also findings from the interaction analysis that illuminate other things they do not articulate. It seems quite prominent in Claire’s case how she sets the stage for students to participate in the classroom conversation reveals her object for the activity as not exclusively being her efforts to guide students in a certain direction. Rather she seems to negotiate between focusing on two objects in extract 1; process and content, as she seems hesitant to let go of her one-to-one interactions and to let students talk directly to each other in whole-class (Engeström, 1999). It’s conceivable that TalkWall’s distributed cognition made students even more engaged to participate in the feedback session, seeing how they used TalkWall as a support when talking. If so, I argue that even though Claire assigns meaning to TalkWall in accordance with her teaching efforts and distribution of talk, it seems more challenging to respond to students’ increased engagement. It could suggest that she negotiates with the meaning of TalkWall and thus what mediating function it should have (Wertsch, 1991).

Pete’s use of TalkWall in his lesson suggests that he first and foremost is using it as one of several mediating tools. He seems to negotiate with the new artifact in terms of trying to apply new ground rules for talk in connection to explain his choice of tagged contributions on the Wall, and in terms of referencing to the contributions when interacting with students.
Engeström, 1999). He also seems to withhold his object on his efforts to guide students towards conceptual understanding. His interactions suggest extended one-to-one interactions with dialogic markers (Nassaji & Wells, 2000, Mercer & Dawes, 2008). Students are not working together even though they are organized in groups. They were asked to work individually and when students contributed in whole-class, Pete did not refer to or build on other students’ replies or ask them whether or not they agreed with each other. It is conceivable that even if Pete has a strong conceptual awareness of the introduced elements in the project, the gap between this awareness and his established practice can be regarded as a typical gap between theory and practice, which he as of now may not hold to be very critical, seeing how he achieves student engagement and activity in his one-to-one interactions. They all seem to use TalkWall accordingly to Tondeur et al (2013, p. 436-437) findings of teachers applying technical tools that support their beliefs about “good education”. In this case it could be argued that teachers’ pedagogical intentions and actions relate to their belief about good education and that this in turn serves to reveal the object for their classroom activity.

In summary, the teachers are nudged by the new technology and they do show signs of using it to create and take advantage of dialogic spaces (Wegerif, 2007, Littleton & Mercer, 2013). This is ultimately dependent on their employment of the technology in their lesson designs and what they think TalkWall is for (Rasmussen & Hagen, 2015), thus illuminating their respective objects for the given activity. The interview data and interaction data viewed together could serve to illustrate how teachers in different ways are starting to destabilize their established practice, but there’s still a discrepancy between teachers’ and researchers’ object (Engeström, 1999). It also seems to illuminate how teachers are destabilizing in different ways and in different degrees in line with their involvement in or exposition to the introduced elements in the research project. And even though they seem to be unaware of this discrepancy at this point, one could question whether or not teachers would be willing to restructure their objects in light of their achieved outcome if they were aware of the discrepancy. What motives do teachers have for changing their objects if their trained skillfulness that has been put to use to maintain a balance between all the inner tensions and contradictions provides a sufficient outcome? It needs to be noted however, that teaching is a profession in an environment that offers certain stabile structures which form the foundation for constant adjustments and changes (Richardson, 1990). The reported improvisation is a legit and natural part of this profession, and constitutes change over time. As such, this could serve to illuminate how difficult it is to drive changing processes in a field where professionals rightfully consider change to be an implicit part of what they already do.
8 Conclusion and possible implications

My research project was conducted through a qualitative case study examining teachers’ perceptions and use of ground rules for talk and TalkWall in the early phases of the DiDiAC intervention project. Through structured observations and collecting interviews, I have described their perceptions and utilization of the introduced elements which also have been analytically accounted for. They both try to align the intervention with their existing practices on classroom talk and they also explore and negotiate with the new principles and technology. I cannot exclude the impact of cameras in the classrooms. However, through structured observation over an extended period of time, it’s hard to point to specific examples of how this would have affected teachers’ and students’ daily work. But, teachers have reported that they used TalkWall more when researchers were present. I do not claim that my findings can be generalized to reflect either the teachers’ general practice or other teachers’ practice as no two contexts are exactly the same. Talk as dialogue and action is culturally bounded and rooted in a much larger time span than I have studied here (Rasmussen, 2005). Yet, the discussion has revealed that my findings correspond with aspects accounted for in theory and review. Inspired by Activity Theory my analytic conclusion suggests a discrepancy between the teachers’ object and the researchers’ object, and that teachers in different ways appear to be in an unarticulated need state towards destabilizing their established practices. When seeking analytical generalization my findings suggest that there is evidence for signs of a gradual change (Engestrøm, 1999). Following I will sum up how my findings relate to theory and review. Then I will relate my findings to aspects which could be regarded as beneficial for practitioners and for further research.

8.1 Teachers negotiating mediated classroom talk in interviews

Teachers seem to align dialogic teaching and exploratory talk to their established teaching efforts in the classroom. In doing this, they addressed inner tensions in their activity systems, and problematized established efforts by highlighting dilemmas without pointing to alternative strategies. Challenges are either linked to the teachers’ capacity to facilitate classroom conversations with all the conditions it implies, or to the teacher’s focus on enabling students to explore based on their own interest that the teacher can reveal and thereby control the students’ knowledge. The teachers thus show two agendas on this topic: either to work with classroom conversations in a way to advance the students’ in-depth understanding of the subject, or to work on mapping the students’ knowledge to associate it
with expert knowledge. These agendas show what kind of status and functionality such conversations have. Conversations in the classroom are related to subjects where the teachers in an implicit assymmetric relationship are concerned with providing a common understanding of subjects (Edwards, 1997, Alexander, 2008, Mercer & Dawes, 2008). When teachers talk about ground rules for talk, they understand this as part of the existing practice or as potentially raising awareness of practice. However, detailed work with conversations in terms of sentence openers seemed to have stimulated new tensions that both displayed change barriers (Zimmerman, 2006) but also negotiation with new forms of practice.

Teachers’ link between classroom conversations and TalkWall shows that they talk about the tool as a support for both their own teaching and as a support for starting classroom conversations. They point to the benefit of visual support that indicates a common focus and the ability to build on student ideas and that students can build on each other’s ideas. This suggests that TalkWall is understood as a support in the form of distributed cognition (Pea, 2004). Claire’s statement about potentially making students aware of seeing and building on the visualized contributions can indicate a potential synergistic support (Tabak, 2004). At the same time, neither Claire nor Jack thinks TalkWall is necessary as they seem to ascribe the same cultural conditionality as other tools they use (Wertsch, 1991). This may indicate that they are uncertain about how to make use of the distributed cognition that TalkWall potentially offers. It can also indicate that distributed cognition is not perceived as relevant beyond supporting the type of function they primarily associate with established classroom conversations. TalkWall helps teachers increase participation, makes students’ ideas more available to teachers and can be a support for students when they are talking, but affordances for students are not elaborated further. Contrasting accounts for TalkWall’s applicability suggests teachers exploring the need state and negotiating with the tool’s usefulness (Engeström, 1999, Toiviainen, 2007). Teachers seem to make connections between ground rules for talk and exploratory classroom talk, and between exploratory classroom talk and TalkWall. Common to these links is that teachers emphasize how they fit into or challenge existing practice as they focus on their roles in classroom conversations. The link between TalkWall and ground rules for talk is not clear for the teachers, and this gap seems to highlight the tension between the teachers’ and researchers’ object at this point in the intervention-project (Engeström, 1999). Researchers focus on how this combination might lead to a new practice where students’ agency in classroom talk is enhanced. Teachers do not seem to recognize this combination as they are focused on their established practices where
their role in the classroom talk is essential. However, teachers are in the starting phase of problematizing their own practices and explore the need state. They negotiate with the intervention, indicating signs of destabilizing their established practices (Engestrøm, 1999).

8.1.1 Teachers negotiating in terms of positioning in the project
Teachers illuminating tensions between the stakeholders in the research project and negotiating their positions reveal an asymmetric relationship between teachers and researchers (Cochran-Smith and Lytle, 1990). In this, there seems to be an expressed uncertainty when it comes to what the teachers are expected to do in this collaborative intervention project. Teachers join with different sets of expectations of what they will contribute with and what the project as a whole will result in. They also differ in how they experience being part of a process. Part of this uncertainty has been discussed in relation to teachers and researchers holding partly different objects for the mediated classroom conversations. A part from Claire’s exploring and problematizing change, the tension between teachers’ and researchers’ object is not addressed explicitly by the teachers themselves. So at this point in the research project the asymmetric relationship between teachers and researchers also seems to exist on a more metalevel. Researchers, who are the initiators of intervention studies, expect uncertainty to be a part of the changing process accordingly to the dualism between internalizing and externalizing (Engestrøm’s 1999).

8.2 Teachers negotiating mediated classroom talk in action
Consistent with findings from the interview analysis, the interaction analysis show teachers’ both making the intervention fit their practices and also negotiate with new forms of mediation. They use TalkWall in line with previous studies (Warwick et al, 2012, Warwick et al, 2011, Rasmussen & Hagen, 2015, Mercier et al, 2015) when using the tool for ‘indirect’ and ‘direct’ scaffolding, for structuring their lessons, to start classroom conversations and as a support to create expanded conversations with students (Wells, 1993, Nassaji & Wells, 2000, Littleton & Mercer, 2013). Both signs of using dialogic markers associated with exploratory talk (Mercer & Dawes, 2008) and the use of TalkWall in synergy with established practices seem depended on lesson design (Tabak, 2004, Warwick et al, 2011, Luo & Gao, 2012, Rasmussen & Hagen, 2015). Findings show that TalkWall as a mediating tool overall disrupts established practice as teachers’ use of the tool reveal a negotiation with how to assign meaning to it (Rasmussen & Ludvigsen, 2010). To some extent these negotiations indicate signs of destabilizing established practice (Engestrøm, 1999).
8.3 Possible implications for practitioners

The relationship between process and content in teaching in today’s school and with the current national curriculum, still implies a tension that most teachers consistently work to balance as well as they can. Against this background, the findings from this thesis could possibly be a contribution to teachers’ continuous reflection work that’s already established in their own practice. The findings could support school leaders to create or sustain an environment for making the highly valuable implicit knowledge explicit and for encouraging teachers to consider themselves as researchers of their own field.

8.4 Possible implications for DiDiAC and future design-based intervention studies

In light of the DiDiAC-project my case study could potentially provide thick descriptions of the early phases of the intervention project, and potentially be a part of a provisory analysis at this point. Educational researchers seek to develop new models for intervention and change, which are assumed to be a far more advantageous method than previous assumptions about the value of the research being a pure transfer or translation of results (Snow, 2015). The empirical findings in this thesis seem to support studies claiming that a teacher-researcher’s collaboration is complex and challenging (Engeström, 1999, Cochran-Smith and Lytle, 1990). In light of the Activity Theory with emphasis on the unarticulated need state (Engeström, 1999, Toiviainen, 2007), the teachers in my case seem to be exactly where they are expected to be; in the initial phase of problematizing their own practice, and it takes time to make the objects in each activity system harmonize (Engeström, 1999, Zimmerman, 2006). I have not analyzed the workshop stage in this research project apart from participating in structured observations as a source of my interviews, but I support studies that argue that further research in the start-up phase of such collaborative projects is necessary (Sedova et al, 2016). This is especially since my interviews to an extent show an expressed uncertainty related to teachers’ understanding of what they are participating in. How is the implicit asymmetric relationship between teachers and researchers in such projects illuminated, and how are the coherent but also different agendas and orientations articulated?

The DiDiAC- project introduced essentially two simultaneous elements that eventually seek to contribute to increase student talk and exploratory dialogues that based on research, promote critical thinking. Further research can also compare intervention projects where pedagogical methods and digital tools are implemented successively versus simultaneous. It may be interesting to compare how they each affect the gradual change in teachers’ practices and what this means for students’ learning outcome.
Literature


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**Illustrations**

Illustrations of TalkWall:


Footnote 6 - Illustration retrieved 05.06.17 from TalkWall Website: http://digitaledialoger.no/

Model of Activity Theory

Footnote 3 - Model retrieved 06.06.17 from http://www.informationr.net/ir/12-3/paper313.html

**Model of synergistic scaffolding**


**Illustrations from the classroom**

Footnote 7 – Illustration retrieved from collected video-recordings 18.01.17

Footnote 8 – Illustration retrieved from collected video-recordings 26.01.17
APPENDIX

Appendix 1
Appendix 2

INTERVIEW GUIDE

Setting the frame

I am a student at the Master's Program in Education: Communication, Design and Learning, and writing a master thesis in connection with the DiDiAC project. My focus is on the teachers' understanding and use of TalkWall in the time between the workshops and the first implementation phase.

Theme

*Teachers’ understanding of using TalkWall as a partner in the exploratory classroom dialogue in the first stages of the DiDiAC intervention project.*

I'm interested in hearing about what you think is the purpose of TalkWall for Exploratory Dialogue in the classroom, what experiences you have done so far through the use of TalkWall in teaching and how you have experienced the collaboration with the researchers so far in the project. As a teacher, I am aware that we carry on a lot of silent knowledge that forms the basis of our practice and therefore I would like to get insight into what kind of educational reasoning you follow and have followed through your experiences with TalkWall and the project as a whole.

Information about the interview form and time use

I am using qualitative method and this is a semi-structured interview. That means I have prepared questions I would like to pose, but the order is not relevant. It is open for questions and information from you along the way that goes beyond the specific questions. The interview will last approximately one hour and finally you will be able to ask questions or comment on the project or the interview.

Information about anonymity and data retention

The data from this interview in the form of audio recordings and notes will only be available to me and formally involved researchers in the project and the material is stored on password-protected devices that only we have access to. Anonymized data from this interview will be used to illuminate the theme in my master's thesis and may also be used in other publications within the DiDiAC project.

Audio recording ends only when we are not together.

Do you have any questions?
QUESTIONS

History regarding the implementation and use of technology in the classroom /
classroom

1. How did you work with iPad implementation in the classroom?
   - *Assessment of own teaching practice?*

2. How long have you used technology and digital tools in the classroom?
   - *How much have you used TalkWall in the classroom?*

3. Is there a personal technical interest related to how much you use technology in the
classroom?
   - *Examples?*

Dialogic teaching

4. What do you think is an exploratory dialogue?
   - *What do you think is the goal of exploratory dialogues?*
   - *What is needed to get such a dialogue in the classroom (whole class / group)?*
   - *Compared to a conversation*

5. What do you think about conducting an exploratory dialogue in the classroom?
   - *You have said it can be difficult to ask good questions. Can you tell me more about this?*
   - *You have mentioned that time spent in connection with how long your students are staying - can you tell me more about this?*

6. What are ground rules to you?
   - *You have said that working on dialogue on smaller groups may be useful before you work on it in full class. Can you tell me more about this?*
   - *How have you worked with the rules in the classroom?*

Linking technological functionality and pedagogy

7. When do you think it is most appropriate to use the TalkWall in the classroom?
   - *Subject-specific situations related to specific technological functions?*
   - *Is this something you've done or something you could potentially have done?*
   - *Whole-class / group?*

8. The researchers have designed TalkWall with the aim to support the exploratory classroom
dialogue. What do you think are concrete strengths and challenges of using TalkWall to
support exploratory classroom dialogue?

   - *Yesterday you mentioned “focal point” in connection with TalkWall - is this something you
   have experienced when you have used TalkWall in the classroom? Please elaborate.*
   - *Reasons*
   - *A tool you've missed to support the dialogue in the classroom?*
9. What do you think about the relationship between ground rules for talk, dialogic teaching and TalkWall?

10. The researchers have emphasized that TalkWall gives us little direct support beyond the automatics already embedded in the tool and that much is still dependent on the teacher's practice in connection with the technology. Based on your experience with the use of the TalkWall so far (from the first time to the present), do you experience that you have changed the use of TalkWall in this period or do you perceive a need for change in the future?

- The first time you used TalkWall, you used the tool at the end of lesson, and you have previously mentioned that it may be useful to use TalkWall at the start or summary of a lesson. The second hour we filmed the use, the tool was used all the time in connection with problem formulations. What do you think about this?
- What do you think has contributed to change?
- Do you think there is a need to make any changes to your teaching practices when using TalkWall in the future? Why/Why not?

11. Have you changed your view of the purpose of using TalkWall from when you joined the project and to today?

- Examples - What do you think is the reason for it?
- Yesterday you said you have been used to other tools, but not been used to a conversation tool like TalkWall, what do you put in conversation tools?
- Do you consider using TalkWall beyond the project period? Why / why not

Knowledge sharing in the colleague community

12. Have you as teachers on teams collaborated on ground rules for talk, dialogic teaching and TalkWall so far in this project?
- How?
- Have you or you as a team used digital and paper-based resources from the research group?

Experience of the workshops and participation in the project

13. How did you experience the workshops in the autumn of 2016?
- ground rules for talk and dialogue
- the connection between dialogue teaching and the use of TalkWall

14. In this project you have been a researcher. How have you experienced it so far?
- Is there something you think would be useful to get more support?

Comments / Question: Is there something you would like to add?
Appendix 3

Dialogic teaching and exploratory talk
- Teachers responsibility
  Teachers questioning
  Distribution of talk
- Student positioning
  Student positioning in the conversation depending on subject-matter interest
  Student positioning in collaboration activities

Ground rules for talk
- Comparison to established practice
  Comparing principles and ways of working to established practice
  Comparing to established collaboration etiquette
- Described work with ground rules for talk received from the research-project
  Active involvement
  Passiv involvement

TalkWall
- Perceived purpose of TalkWall
  Starting new themes
  Increased participation
  Starting conversations
  Tracking theme trajectory by storing functions
- Described use and value of TalkWall
  Student contributions’ role for the classroom conversation
  Student contributions’ role for structuring lessons
  Comparison to other tools
  Perceived relationship between ground rules for talk, dialogic teaching and TalkWall

Continuity and Change
- Perceived change of using TalkWall
  Comparison of self-evaluation and perceived researcher expectations about change
  Change in terms of awareness raising and amplifying established practice
  Need for change in the future related to technical functions
  Need for change in the future related to teachers questioning

Workshop
- Described experience
  Constructive
  Unclear
- Perceived role in the research project
  Co-researcher vs unit for analysis