

Heli Muhonen

Educational Dialogue in the Classroom

Scaffolding, Knowledge Building and
Associations with Academic Performance



JYVÄSKYLÄN YLIOPISTO

Heli Muhonen

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Scaffolding, Knowledge Building and Associations with Academic Performance

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ABSTRACT

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The present thesis focuses on patterns of educational dialogue, their quality with respect to forms of teacher scaffolding and shared knowledge building, and the association between the quality of educational dialogue and students' academic performance. The specific questions of interest are as follows: (1) to examine how teachers scaffold students in learning situations through dialogic teaching, (2) to identify patterns of shared knowledge building in educational dialogues, and (3) to investigate how the quality of educational dialogue is associated with academic performance. The data were drawn from the audio- and video-recorded lessons of the First Steps longitudinal study, which were collected from preschool (n = 16), Grade 1 and 2 (n = 70), and Grade 6 (n = 158) classrooms. Subsamples of transcribed lessons were employed in the qualitative analysis. The classroom observations were rated by the Classroom Assessment Scoring System (CLASS), and these scores and students' grades in academic subjects were utilised in the quantitative analyses. First, two teacher-initiated and two student-initiated patterns of dialogic teaching were identified, in which the quality varied from moderate to high. The findings indicated that the quality of educational dialogue varies depending on teachers' scaffolding strategies and on the extent of student initiation and participation in discussions during the early school years. Second, the sharing of three types of knowledge was identified in Grade 6 classrooms: facts, views, and experiences. The sharing of these three types of knowledge was identified as forming six knowledge-building patterns in educational dialogue. Finally, the quality of educational dialogue was found to be positively associated with students' performance, measured by grades in academic subjects, in language arts and physics/chemistry in Grade 6. The qualitative analysis showed further that patterns of dialogic teaching characterised the quality of the language arts and physics/chemistry lessons. Overall, the results add to our understanding of the variation in the quality of educational dialogue and its associations with students' academic performance.

Keywords: educational dialogue, dialogic teaching, teacher-initiated, student-initiated, scaffolding, knowledge building, academic performance

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I dedicate this thesis to my supervisor Professor Helena Rasku-Puttonen and her inspiring academic career. You have shown me what dialogue really is about.

Jyväskylä, February 2018
Heli Muhonen

LIST OF PUBLICATIONS

This study is based on the following publications, which are referred to as sub-studies in this doctoral study. The research articles are reprinted with the permission of Elsevier. Copies of the articles are appended to the thesis.

- Article 1** Muhonen, H., Rasku-Puttonen, H., Pakarinen, E., Poikkeus, A.-M., & Lerkkanen, M.-K. (2016). Scaffolding through dialogic teaching in early school classrooms. *Teaching and Teacher Education, 55*, 143-154.
- Article 2** Muhonen, H., Rasku-Puttonen, H., Pakarinen, E., Poikkeus, A.-M., & Lerkkanen, M.-K. (2017). Knowledge-building patterns in educational dialogue. *International Journal of Educational Research, 81*, 25-37.
- Article 3** Muhonen, H., Pakarinen, E., Poikkeus, A.-M., Lerkkanen, M.-K., & Rasku-Puttonen, H. (2018). Quality of educational dialogue and association with students' academic performance. *Learning and Instruction, 55*, 67-79.

The author of this thesis is the first author of all three research articles. She was responsible for the study design, searching and reviewing the literature, writing the manuscripts, and carrying out all qualitative analyses. She also contributed to the statistical analysis and coding of the video-recorded lessons with CLASS-S for studies 2 and 3. The co-writers had advisory roles in interpreting the results and commenting on all three manuscripts.

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1 INTRODUCTION

There is a rich history of research into classroom talk; wide agreement prevails on the benefits and importance of interaction and talk in the classroom. It is acknowledged that learning is most effective when students are engaged in cognitive restructuring of their own understanding and knowledge through dialogue that allows them to reflect on their thinking (Wells, 2007). Educational dialogue can be called “shared thinking,” in which the participants are open to one another’s ideas and seek to reach understanding of each other (Phillipson & Wegerif, 2017). Educational dialogue between teacher and students or among students contributes to students’ development (e.g., Kiemer, Gröschner, Pehmer, & Seidel, 2015; Nystrand, Wu, Gamoron, Zeiser, & Long, 2003), and skills for dialogue and shared knowledge building can impact students’ lifelong learning and the quality and meaningfulness of their lives (Kumpulainen & Lipponen, 2010; Rasku-Puttonen, 2008). Of particular interest to the present study is an examination of the quality and outcomes of effective educational dialogue in classrooms.

Despite the importance and benefits of dialogue or exploratory talk, this kind of discussion is rare in the classrooms, and interaction between students is often unproductive (Blatchford & Kutnick, 2003; Galton, Hargreaves, Comber, Wall, & Pell, 1999). Especially in whole-class situations, discussions typically consist of teacher-controlled talk through scripted patterns taking the form of initiation–response–feedback (IRF; Sinclair & Coulthard, 1975) or initiation–response–evaluation (IRE; Mehan, 1979), in which a teacher asks questions and provides feedback or evaluation of the correctness of students’ answers. However, exchanges between teacher and students following the IRF or IRE patterns do not meet the criteria for effective and reciprocal educational dialogue (see, e.g., Alexander, 2006). Rasku-Puttonen, Poikkeus, Lerkkanen, and Siekkinen (2012) found the IRF pattern (pattern 1) to be the most typical form of teacher–student interaction in preschool. They also found two other types of patterns that occurred more rarely but did reflect the dialogic nature of educational dis-

cussion: teacher-initiated (pattern 2) and student-initiated (pattern 3) patterns. These two patterns were used as a starting point for the studies in this thesis.

Classroom interaction should fulfil certain prerequisites to support students' learning and benefit students' shared knowledge building. Observed high-quality teacher-student interaction and teaching practices have been shown to enhance students' motivation to learn (Lerikkanen et al., 2012; Pakarinen et al., 2011), and contribute to their academic and social development (e.g., Cadima, Verschueren, Leal, & Guedes, 2016; Howes et al., 2008; Pakarinen et al., 2017) and peer relations (Peisner-Feinberg et al., 2001). Through teacher-child interaction and active scaffolding, teachers can provide support for students' conceptual development, communication, and language skills (La Paro, Pianta, & Stuhlman, 2004). However, it has been shown that teachers relatively rarely encourage their students to explain and verbalise their thinking or ask questions of each other (Webb et al., 2009). In addition, Myhill (2006) claims that students seldom engage in educational dialogue if there are no requirements for reasoning or justification of their thoughts and answers, which is why the teacher should support students by being open to their initiatives and use reciprocal talk to accumulate shared knowledge. By supporting this type of discussion in the classroom, the teacher can open a dialogic space where students can learn from one another, not just the teacher (Rogoff, 2008). In order for teachers to be able to support students and their discussion in the classroom through dialogue concrete, specific training is needed (Scott, Mortimer, & Aguiar, 2006).

There has been a gap between the theorisation of interaction and language and what is actually happening in actual classroom settings (Littleton & Howe, 2010). Therefore, observational classroom data are needed to conduct a rigorous analysis of effective educational dialogue (Mercer & Howe, 2012). The literature indicates that training of teachers' dialogue skills not only increases both whole-class and peer dialogue in the classroom but also enhances students' learning and reasoning (e.g., Alexander, 2017; Mercer & Dawes, 2008). However, there are still very few studies on authentic classroom interaction in which no interventional approach has been applied. Research-based evidence is needed on the quality and effectiveness of educational classroom dialogue, as well as concrete indicators of teaching practises that provide social and cognitive challenges for the students (Hodgkinson & Mercer, 2008).

The goal of this dissertation is to examine both the quality and outcomes of educational dialogue in Finnish preschool and primary school classrooms. The study relies on the sociocultural approach to learning (e.g., Vygotsky, 1978), in which learning is seen to happen through social interaction. *Educational dialogue* is the study's central concept (Figure 1 presents the main concepts of the study and their relations to each other), but since the focus of the study is on whole-class dialogue between teacher and students, the concept of *dialogic teaching* is used to describe the interaction process in which the teacher has an active role in supporting and *scaffolding* students' participation and shared understanding through dialogue. This active participation and sharing of information is required for *shared knowledge building* to occur.

The first aim of the dissertation is to examine how teachers scaffold students in learning situations through dialogic teaching. Data-driven content analysis of transcribed episodes of educational dialogue was used in the analysis. The second aim is, by applying functional analysis of classroom talk (see Kumpulainen & Wray, 2002), to investigate patterns of knowledge building in educational dialogues. Finally, the third aim is to analyse how the quality of educational dialogue is associated with students' academic performance. In the third sub-study, a mixed methods approach was employed first to analyse the associations between the quality of educational dialogue and students' academic grades with multilevel modelling, and then to identify patterns of dialogic teaching from transcribed classroom lessons, using qualitative analysis. In its entirety, the thesis aims to contribute to our understanding of effective teaching practices of educational dialogue in the classroom and provide evidence on their relation to students' academic performance.

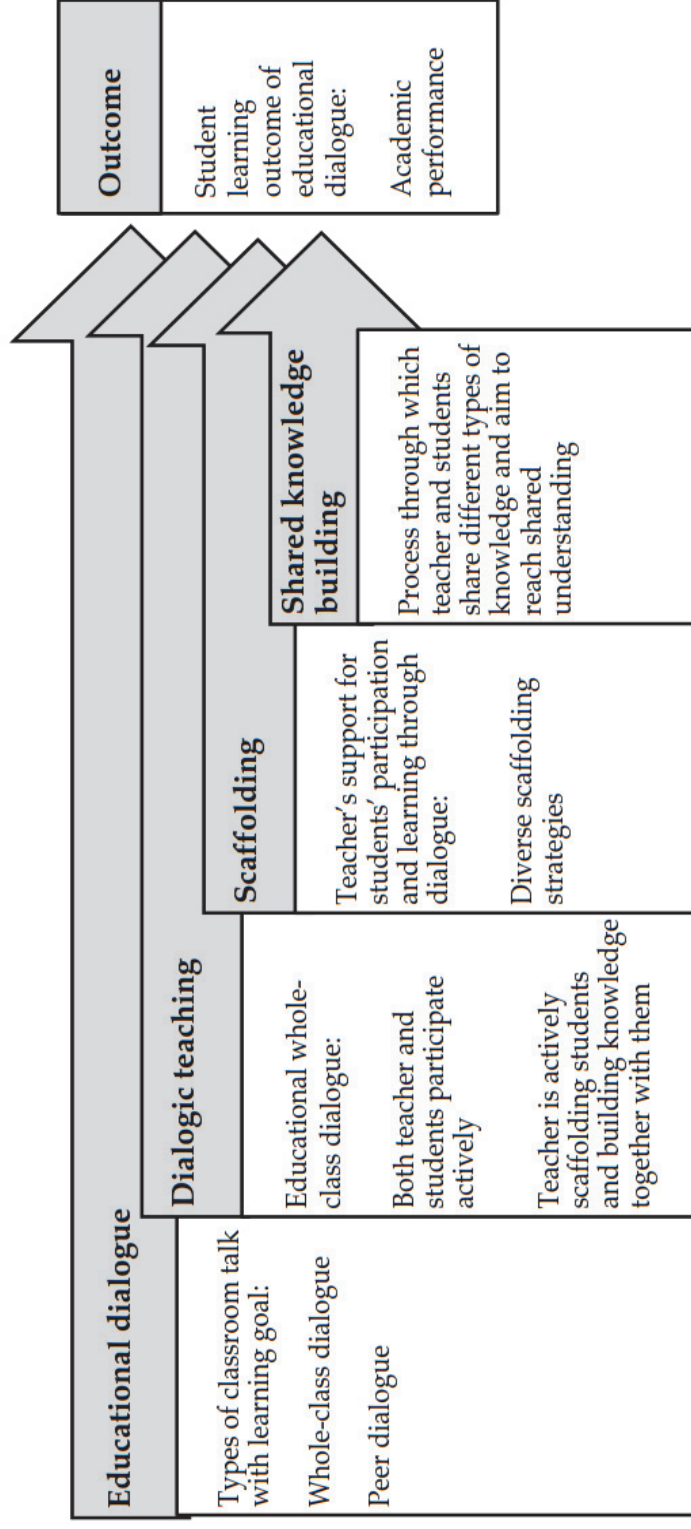


FIGURE 1 Main concepts of the study

2 THEORETICAL BACKGROUND

2.1 Sociocultural approach to learning and scaffolding

The theoretical foundation of this study derives from the sociocultural approach to learning, the origins of which rely mainly on Vygotsky's work (1978). Though the research field of this approach is not completely unified, there is firm agreement on the vital role of culture for the process of children's communication, thinking, and learning. Thinking, development, and learning cannot be properly understood without acknowledging their social and communicative nature. According to Vygotsky (1978), learning is a highly social process in which language has two important functions: a cultural tool for sharing and developing knowledge among members of a society and a psychological tool for structuring individuals' thought processes and content for learning. These two functions' employment of language is also interconnected. Learning usually happens in interaction with a more knowledgeable person and is first seen to occur in the intermental, i.e. social level and is then transferred to the child's intramental level of understanding.

The sociocultural approach has been applied to interaction between teacher and students and among peers in school. According to Mercer (2004), from the sociocultural approach education can be considered as a dialogic process. Teachers and students study and discuss phenomena that reflect the social practices and values of schools, which are themselves cultural institutions. The sociocultural approach holds that students' educational achievements and failures should not necessarily be explained based on their capability or the teacher's skills, but more on the quality of the educational dialogue (Mercer 2004; Rojas-Drummon & Mercer, 2003). This shows the need for increased research into the relation between language and thinking, but even more on the quality of effective educational dialogue. Of particular interest is the kind of qualities of educational dialogue that can be identified and the relation between the quality of educational dialogue and student learning.

In the context of the sociocultural approach to learning, educational dialogue is linked to *scaffolding*, a concept that refers to active support for students'

development and learning. Vygotsky's (1978) interest was both in children's current levels—what they can do on their own—and in their potential levels, meaning what they could do with the help of a more experienced person. Vygotsky himself did not use the word scaffolding but it is connected with his concept of “zone of proximal development” (ZDP). This means that the teacher, parent, or another more experienced person sensitively perceives the current level of the child's competence (real level), but at the same time is expanding the level for the child to achieve more advanced performance or thoughts that he or she could not reach without the support (potential level). The word “scaffolding” was introduced by Wood, Bruner, and Ross (1976). By scaffolding, they referred to an interactional process of gradually transferring more responsibility to the child in order to increase his or her abilities, knowledge, and self-regulation. Van de Pol, Volman, and Beishuizen (2010) propose three features to describe the process of scaffolding in the interactions between teacher and student: a) contingency: responsive, tailored, or adjusted support; b) fading: gradual withdrawal of support; and c) transfer of responsibility: handing over responsibility for task performance to the student.

After the original work of Wood et al. (1976), the concept of scaffolding has been utilised to examine and explain many learning processes, such as distributed cognition (Cole & Engeström, 1993), problem solving (Kajamies, Vauras, & Kinnunen, 2010), interpersonal regulation (Vauras, Kinnunen, Kajamies, & Lehtinen, 2013), and domains of knowledge (Palinscar & Brown, 1984). Recently, the focus of scaffolding research has emphasised classroom interaction in both its whole-class and peer group forms (Rojas-Drummond & Mercer, 2003; Rojas-Drummond, Torreblanca, Pedraza, Vélez, & Guzmán, 2013). The literature indicates that students need support and scaffolding in their interaction in the classroom in order to explore their thinking and understanding (e.g., Alexander, 2006; Mercer & Dawes, 2008).

The teacher has a vital role in facilitating and creating effective learning experiences for students. This kind of scaffolding process can be built within educational dialogue (Brown & Kennedy, 2011). Students adopt active roles by participating in meaningful activities and sharing their thoughts (Rogoff, 2008), which is also the requirement for an effective educational dialogue. In their ethnographic research, Forman, Ramirez-DelToro, Brown, and Passmore (2017) observed that when teachers used extensive scaffolding strategies, students' participation increased, whereas in response to increased student participation, teacher scaffolding ebbed. The effectiveness of scaffolding for student learning is based on determining the appropriate degree of challenge (Hammond & Gibbons, 2005), but for scaffolding to occur, the teacher needs to be fully aware of the students' existing understanding so as to provide the correct level of support and educational discussion (Van de Pol, Volman, & Beishuizen, 2012). For example, in a professional development programme for teachers, Brown and Kennedy (2011) focused on teachers' classroom discussion and how to involve students in the dialogue. After the programme, positive

changes were found: within educational dialogue, teachers followed more students' ideas and scaffolded students with diverse strategies.

2.2 Educational dialogue and dialogic teaching

There is no clear consensus on what *educational dialogue* precisely means. Educational dialogue is construed somewhat differently if the focus of attention is on a whole-class dialogue between teacher and students or small-group peer dialogue and if the focus is on the actions of the teacher and his or her scaffolding, the students' involvement or the whole-class process of exchanges. Several terms are used parallel to educational dialogue, such as dialogic teaching (Alexander, 2006), dialogic pedagogy (Skidmore & Murakami, 2016), dialogic instruction (Nystrand, 1997), dialogic inquiry (Wells, 1999), exploratory talk (Banes & Todd, 1977; Mercer & Dawes, 2008), and accountable talk (Wolf, Crosson, & Resnick, 2006). There are also links to other constructs like collaborative reasoning (Reznitskaya et al., 2001) and cooperative learning (Gillies, 2016). For instance, when engaging in exploratory talk, students comment critically and constructively on one another's ideas, challenge propositions, and present alternative hypotheses (Wegerif, Mercer, & Dawes, 1999). In accountable talk, defined by Wolf et al. (2006), the focus is on both the teacher's and students' talk but also involves their relationship in terms of participation, linking ideas, asking and providing for knowledge, and asking and providing for rigorous thinking.

Vygotsky's sociocultural theory and notions have shaped the concept of *dialogic teaching*, which is associated with the view that spoken language should play the key role in teaching (Alexander 2006), because students' participation in educational classroom discussion is the strongest means of influencing their thought processes. In educational dialogue, questions give rise to elaborate answers that can lead to new thought-provoking questions. Alexander (2008) suggests that teachers require a pedagogical repertoire to promote talk for both teaching and learning. Through interaction, the teacher engages students in dialogic exchanges through which they learn to ask questions, explain their thinking, reason, negotiate, justify, and evaluate and negotiate outcomes.

Alexander's (2009) work has strongly influenced the current view of the relationship between dialogic teaching, forms of interaction, and benefits for student learning. Alexander (2000; 2006) has introduced a set of five principles describing critical features of dialogic teaching, which contribute to the growth of students' learning, thinking, and understanding. According to these principles, educational dialogue should meet the following criteria: 1) collective, with teacher and students addressing learning tasks together; 2) reciprocal, with teacher and students listening to one another, sharing ideas, and considering alternative viewpoints; 3) supportive, so students can articulate their ideas freely without fear of embarrassment and help one another to achieve shared understanding; 4) cumulative, with teacher and students building on their own

and others' ideas and linking them to coherent lines of thinking and enquiry; and 5) purposeful, with the teacher planning and steering discussion with specific learning goals in mind. In addition to Alexander's five principles, other features have been suggested. For example, according to Lefstein (2006), dialogue should also be meaningful, with the teacher and students bringing their own views to the discussion of a topic of mutual interest, and critical, with the teacher and students identifying different points of view and related questions.

In describing the principles of dialogic teaching, Alexander (2017) suggests that collectivity, reciprocity, and supportiveness represent the classroom culture of relationships in which dialogue is likely to emerge and facilitate students' sharing their ideas. The principle of cumulation highlights the dialectic nature of the discussion and gradual growth of understanding built on previous knowledge. The last principle, purposefulness, indicates that although any kind of classroom dialogue is important in itself, it needs to embrace educational content or goals to be developmentally meaningful.

The teacher's crucial facilitating role in educational dialogue does not preclude the value of students' initiatives and the responses to them that they receive from the teacher or other students (Lemke, 1990; Nassaji & Wells, 2000). The teacher has the key role in terms of reacting to student initiatives. By allowing openings and time for further elaboration, the teacher can allow a dialogic space to emerge for reciprocal interaction between teacher and students and among students (Cazden, 2001). Nystrand (1997) proposes that the teacher's actions can shape the quality and approach of educational dialogue through various student-centred strategies, such as a) allowing students' initiatives and answers to modify the topic of discussion, b) including students' answers in subsequent questions, and c) using authentic questions about which students have concrete experience. Regardless of whether interaction is teacher- or student-initiated, teachers should balance their efforts and actions with the needs and interests of the students in order to scaffold students' active participation in the learning activity (Rasku-Puttonen, Eteläpelto, Arvaja, & Häkkinen, 2003).

2.3 Knowledge building in educational dialogue

The core intent of dialogic teaching (Alexander, 2006) is to exchange ideas that raise further questions. This cumulative nature of dialogue and teacher's scaffolding can be seen to form the base for *collaborative knowledge-building* process (e.g., Brown & Duguid, 2000; Sawyer, 2007; Scardamalia, 2002). Brown et al. (1993), for instance, demonstrated that the use of educational dialogue in reading comprehension tasks was associated with student growth in knowledge building and comprehension. Research on knowledge building within educational dialogue highlights the vitally important role of peer group interaction (e.g., Mercer & Littleton, 2007; Salisbury, 2012), while the teacher's role has been seen to be somewhat less central and more facilitative than that of peers in stu-

dent's knowledge building (e.g., Hämäläinen & Laine, 2015; Hämäläinen & Vähäsantanen, 2011).

The concept of collaborative knowledge building was introduced by Harasim (1989) to describe the process of joint exploration involving participants' arguments, questioning, agreements and disagreements, dynamic interaction, and building ideas on one another (Harasim, 1989; Kaye, 1992). Stahl (2000) examined knowledge-building processes through a model in which knowledge is considered a socially mediated product. Participants in a dialogue initially enter the discussion with their own views and beliefs, based on shared language, sociocultural knowledge, and actions. Through dialogue and social interaction these beliefs can generate novel joint knowledge if the negotiation of the participants' perspectives leads to shared understanding.

According to Myhill (2006), classroom dialogue is largely concentrated on factually based questions, due to pressure on teachers to manage multiple curriculum objects. However, not all knowledge shared in the educational discussion is factual. The teacher has a vital role in supporting students in explaining and justifying their views, ideas, opinions, and experiences and helping them link their previous experiential knowledge to their conceptual understanding (Gillies, Nichols, Burgh, & Haynes, 2013; La Paro et al., 2004; Mercer, 1995).

Learning through collaborative knowledge building is defined by Mercer and Littleton (2007) as a process which requires both students and teacher to be involved in continuing and coordinated attempts to build a shared understanding or solve a problem. Based on evidence of studies on exploratory talk, Mercer (2008) states that not only the content but also the functional structure of educational dialogue contributes to students' learning: focused, sustained, and reasoned educational dialogue, with the open sharing of ideas and constructive conflict, has been documented to support students' problem solving and develop their conceptual understanding.

Although previous research has generally used the term *collaborative knowledge building*, the term *shared knowledge building* has been used in this thesis. The latter term was chosen, because it makes direct reference to sharing different types of knowledge. It also refers to building shared understanding in various classroom situations. Such shared understanding may be built through collaboration or during spontaneous teacher-initiated or student-initiated whole classroom exchange. In the present thesis, excerpts of educational dialogue that took place during whole class situations were analysed. Thus, the sharing of knowledge and opinions in this study always involved the teacher as well as the students, rather than taking place when groups of students were working together or engaging in collaborative tasks.

2.4 Educational dialogue and learning outcomes

Although educational dialogue in the classroom has been widely acknowledged to be important for students' development and learning, there is still relatively

little evidence on the learning outcomes that can be directly and causally linked to educational dialogue (Howe & Abedin, 2013). Some studies do provide evidence to support the effect of educational dialogue on learning gains, especially in science (Littleton & Howe, 2010; Mercer & Littleton, 2007). Several decades ago, Nystrand and Gamoran (1991) showed that classroom talk that includes discussion and open questions was favourably associated with students' learning. More recently, Hattie's (2008) synthesis of meta-analyses relating to students' achievement and development shows a positive effect of teaching strategies in which the quality of, talk such as feedback, scaffolding, and reciprocal teaching, has a vital role for learning.

With respect to students' development and learning, diverse educational outcomes have been studied, including academic learning by subject, language learning (interaction skills and oral communicative competence), reasoning and shared knowledge building, and identity formation (van der Veen & van Oers, 2017). It is also important to acknowledge that benefits for learning can be associated with educational dialogue involving either whole-class discussion or peer group interaction (e.g., Howe et al., 2007; Mercer, 2000; Nystrand, 1997). In fact, the predominant focus to date has been on the effects of productive peer group dialogue (e.g., Barnes & Todd, 1977; Howe, 2010; Underwood & Underwood, 1999).

In their school-based interventional research, Mercer and others (e.g., Dawes, Mercer, & Wegerif, 2000; Mercer, 2008; Mercer & Littleton, 2007) have integrated teacher-led whole-class dialogue, talk between a teacher and small groups, and peer group discussion within a pedagogic design. This design was developed to promote children's understanding and use of dialogue as a tool for learning. In the Thinking Together programme conducted in several studies in the UK and Mexico, groups of students were asked to solve Raven's non-verbal reasoning tests before and after the intervention to measure both individual and group performance. The results of the interventions provided evidence of the effectiveness of exploratory talk on the development of students' individual and group thinking and their performance on math and science tests. Also Azmitia and Montgomery (1993) demonstrated that engagement in educational dialogue was an important predictor for problem solving. Students who expressed their opinions, ideas, agreement, disagreement, and contrasting views were found to manifest intellectual growth (Howe et al., 2007; Underwood & Underwood, 1999).

In Alexander's (2017) large-scale intervention study involving 76 British primary schools, teachers were encouraged to expand their own and their students' knowledge and skills in classroom talk, concentrating on dialogue and argumentation. The professional development training process was conducted with print materials, in-school mentoring, and audio-video analysis. When compared to a randomised control group, the students of teachers participating in the intervention group were found to be two months ahead in English, science, and mathematics, as measured by standardised tests. The productive dialogue skills of both teachers and students also improved significantly.

Intervention using educational dialogue in the classroom has also been found to improve students' social skills. Using a study period of three months, Doveston (2007) discovered that employing dialogic practices like active listening and cooperative activities, students' social and listening skills improved. In their intervention-based study, van der Veen, de Mey, van Kruistum, and van Oers (2017) showed that productive classroom talk had a positive effect on the development of students' communicative competence. In addition, dialogic teaching in elementary science lessons has been shown to create varied opportunities for discursive identity negotiation among students (Kumpulainen & Rajala, 2017). O'Connor, Michaels, Chapin, and Harbaugh (2017) explored the participation of vocal and silent students in whole-class mathematics discussions in relation to learning outcomes, finding that both groups of students learned equally well regardless of how vocally they participated in discussions.

Previous literature has linked teacher scaffolding of educational dialogue to positive student outcomes. The quality of teacher interaction is associated with student achievement (Praetorius, Lenske, & Helmke, 2012). Contingent continuous support will likely support students to perceive learning tasks as manageable (Wood & Wood, 1996). According to Rojas-Drummond and Mercer (2003), teacher scaffolding in both whole-class and peer group dialogue can promote students' reasoning, understanding, and learning. For example, teachers' encouraging students to express their knowledge and thoughts in their own words has been found to be linked with their development in reading comprehension (Wolf et al., 2006), and teacher requests for explanations and reasoning have been positively related to students' skills in mathematics (Kyriacou & Issitt, 2008).

Finally, it should be noted that learning gains of educational dialogue typically extend the sphere of content knowledge. For instance, Alexander's (2017) teacher professional development intervention showed transfer effects on students' improved skills in English, mathematics, and science, as assessed by standardised tests, after a 20-week intervention. Resnick (2015) argues that dialogic teaching not only produces learning transfer but also contributes to a broader and more general intellectual ability to learn. Students engaging in dialogic teaching have been shown to retain their acquired knowledge for a longer time and to transfer their intelligence to other learning contexts (Resnick, Asterhan, & Clarke, 2015). In light of this evidence, there is firm backing for claims of the importance of educational dialogue for students' short- and long-term learning gains.

3 THE AIMS OF THE THESIS

This thesis was designed to contribute to the discussion on the importance of the quality of teacher-student educational dialogue. The claims made in the theoretical literature on the critical role of dialogic interaction for students' intellectual growth and learning call for research into the nature and benefits of dialogue in authentic classroom settings. The general aim of the thesis is to investigate the quality of educational dialogue from the viewpoints of scaffolding and knowledge building and the links between quality of educational dialogue and students' academic performance.

The more specific aims of the thesis are:

1. To examine how teachers scaffold students in learning situations through dialogic teaching. (Studies 1 and 3)
2. To identify patterns of shared knowledge building in educational dialogues. (Study 2)
3. To investigate the associations between the quality of educational dialogue and students' academic performance. (Studies 1 and 3)

These three aims were addressed in three sub-studies. Study 1 examined teacher-initiated and student-initiated patterns of dialogic teaching in early school classrooms by focusing on the kinds of scaffolding strategies teachers used during both teacher-initiated and student-initiated educational dialogues. Study 2 focused on shared knowledge building in teacher-student educational dialogue with the purpose of identifying knowledge-building patterns in Grade 6 classrooms. Study 3 employed a mixed methods approach. First, it investigated the extent to which the quality of educational dialogue was associated with students' grades in academic subjects in Grade 6. Lessons from the subjects with statistical significance were then analysed to determine how the kinds of dialogic teaching patterns of different levels of quality can be identified.

4 METHOD

This chapter presents the participants, data collection, measures, and analytical approaches of the studies. It concludes with Table 2, which presents an overview of the three sub-studies.

4.1 Participants

Data for all three sub-studies were drawn from the First Steps longitudinal study, which began in 2006 in four Finnish municipalities to follow the age cohort of children born in 2000 (Lerkkanen et al., 2006–2017). Approximately 2,000 children, their teachers, and parents participated in the study, starting from the year the children entered preschool (a pre-primary education year at the age of six). The follow-up continues and will conclude with upper secondary level education. The overall aim of the follow-up is to examine developmental paths of these students' academic skills, motivation, and well-being, along with their links to factors such as teaching and parenting practices and quality of classroom interaction.

The sub-samples of the present thesis consisted of teachers and their students who participated on a voluntary basis in classroom lesson observations (either live observations or through video recording). The teachers gave written consent, while parents were asked to consent to participation for themselves and their children. Information on family demographics and parental education was obtained from parental questionnaires. These data indicated that the participating parents represented Finland's general population (Statistics Finland, 2007). The teachers were also asked to complete a questionnaire on their demographics (e.g., education, work experience).

Data for Study 1 were collected during 2006–2008, when the students were in preschool (i.e., the term used in this thesis for pre-primary education, a year before entering school), and Grades 1 and 2. Classroom observations were con-

ducted in preschool spring (49 teachers; 47 female, 2 male), Grade 1 fall (16 teachers; 15 female, 1 male), Grade 1 spring (33 teachers; 29 female, 4 male), and Grade 2 spring (21 teachers; 20 female, 1 male). On average, there were 10 children in the preschool classrooms and 18 in the primary classrooms.

The sample for Studies 2 and 3 was collected in 2013, when the students were in Grade 6 (12 years old). A total of 46 Grade 6 teachers (24 female and 22 male) participated in the classroom observations. 608 students (278 girls and 330 boys) in their classrooms participated in the follow-up. There were 20 students on average in each class, with individual class sizes varying from 3 to 30 students. In both preschool and primary school classrooms teachers' work experience ranged from a minimum of 1 to 5 years to more than 15 years (*Mode* = more than 15 years). All classrooms were Finnish speaking.

The Finnish educational system. In Finland, it is compulsory for children to undergo nine years of comprehensive education, beginning when they turn seven years of age. The primary school phase comprises Grades 1 through 6, followed by lower secondary school (Grades 7 through 9). The qualification for preschool teachers is a bachelor's degree in early childhood education. For primary school teachers, it is master's degree in education.

Before primary school, at the age of six, children attend one year of mandatory pre-primary education ("preschool") in either day care centres or school settings (in 2015, more than 80% of children attended preschool in day care centres). The recently renewed national core curriculum for pre-primary education (Finnish National Agency for Education, 2014a) emphasises children's individuality and their need to engage in active learning as individuals and as part of a group. Pre-primary education is organised through integrated thematic activities that encourage interaction, cooperation and joint responsibility. Activities also foster social and emerging academic skills and encourage learning through play and preschool tasks. Both the activities and the learning and growth environment seek to promote children's learning-to-learn skills and to strengthen and improve their self-concept. These aspects also help them to adopt basic skills, knowledge and capabilities in accordance with their abilities. Pre-primary education creates a foundation for the acquisition of academic skills, such as literacy and mathematics. However, children are not explicitly taught how to decode or solve arithmetic problems. Rather, children's emergent literacy and mathematics skills are supported by versatile activities. These include drama, workbooks, worksheets, shared reading, visual arts, playful activities and ICT applications involving letters, phonemes and numbers and counting. In Finland, approximately 30% of children can decode upon entering Grade 1 (Lerkkanen, Rasku-Puttonen, Aunola, & Nurmi, 2004). In pre-primary education, the evaluation and observation of a child's growth and learning take place during daily interactions between teacher and child, and parents are given feedback regularly.

In primary school, studying is organised throughout formal, subject-specific lessons, and integration across subjects and multidisciplinary learning is typical, especially in the early grades. In the early grades, it is also common

for teachers to use playing, gameful learning, physical activities, exploratory and creative working approaches and art to promote creative thinking and learning. In Grades 1–2, pre-primary education learning modules are replaced with subjects, but instruction remains largely integrative. In the transition phase between Grades 2 and 3, there is an emphasis on the development of reading, writing and mathematical skills as well as study skills. In the most recent Finnish core curriculum for basic education (Finnish National Agency for Education, 2014b), interaction, collaboration and the acquisition of transversal competencies are highlighted. The new curriculum emphasises the role of diversity in fostering learning, especially in the design of assessment methods. A report is given at the end of each school year. Depending on the municipality, for Grades 1–7, reports may take the form of either verbal assessments (more typical at the lower grades) or numerical grades. By Grade 8, numerical grades are included in the end-of-year report for every school subject.

4.2 Data and data collection

4.2.1 Classroom interactions

Qualitative data: Transcripts of classroom talk. Classroom interactions between teachers and students were recorded either with MP3 audio-recording devices or with video cameras in preschool and Grades 1, 2, and 6. In the present analyses, only video-recorded lessons were utilised for the preschool classrooms, but for Grades 1 and 2 classrooms, the recording method varied between video and MP3 recording. For Grade 6 classrooms, both MP3 and video recordings were available. In the preschool recordings, two separate learning sessions per teacher conducted on separate days were available. In primary school, the number of each teacher’s recorded lessons varied from two to four lessons, with a maximum of two recorded lessons per day. In preschool, recordings were conducted during the morning assembly, the time for educational activities, while the time of the recorded lessons varied in primary school. The average length of recorded learning sessions in preschool was 53 minutes; it was 45 minutes in primary school. There were a total of 16 video-recorded learning sessions available from the preschool classrooms, 70 MP3- or video-recorded lessons from Grades 1 and 2, and 158 video-recorded lessons from Grade 6. Lessons in several different subjects were recorded. The recorded lessons and preschool learning sessions represented learning activities that took place on typical school days. In primary school, recordings focused on subject-specific lessons. In preschool learning sessions, recordings involved both preschool tasks and play activities used to support children’s learning. Transcripts of interactions were used as the qualitative data for all three sub-studies.

Quantitative data: Observations of teacher-child interactions. The quality of teacher-student interactions in the classroom lessons of the sample was assessed using the Classroom Assessment Scoring System instrument in pre-

school (CLASS Pre-K, Pianta, La Paro, & Hamre, 2008a), Grades 1 and 2 (CLASS K-3, Pianta, La Paro, & Hamre 2008b), and Grade 6 (CLASS-S, Pianta, Hamre, & Mintz, 2012). In Study 1, CLASS Pre-K and K-3 were used to assess the quality of teacher-student interactions with the following three main domains and 10 dimensions: Emotional Support (four dimensions: Positive Climate, Negative Climate, Teacher Sensitivity, and Regard for Student Perspectives), Classroom Organisation (three dimensions: Behaviour Management, Productivity, and Instructional Learning Formats), and Instructional Support (three dimensions: Concept Development, Quality of Feedback, and Language Modelling). In Studies 2 and 3, the CLASS-S (secondary) was used to assess the classroom quality in Grade 6. The CLASS-S consists of the following three domains and 12 dimensions: Emotional Support (three dimensions: Positive Climate, Teacher Sensitivity, and Regard for Student Perspectives), Classroom Organisation (three dimensions: Behaviour Management, Productivity, and Negative Climate), and Instructional Support (five dimensions: Instructional Learning Formats, Content Understanding, Analysis and Inquiry, Quality of Feedback, and Instructional Dialogue), with Student Engagement used as a 12th, overlapping dimension.

In preschool and Grades 1 and 2 (Study 1), the CLASS codings were conducted based on live observations in the classroom, whereas in Grade 6 (Studies 2 and 3), all lessons were video-recorded, and the CLASS-S codings were conducted from the video recordings. Live observations were conducted by trained observers on two separate days. In Grade 6, in 15 classrooms the recording of lessons was conducted over one day and in 29 classrooms over two days. In preschool and Grades 1 and 2, the CLASS codings were conducted in 20-minute observation cycles followed by a 5–10 minute coding period. In Grade 6, the coding took place in 15-minute cycles (based on videotape limits; each 45-minute lesson provided three cycles). Following the CLASS manuals, the dimensions were assessed on a seven-point scale: low (1–2), moderate (3–5), or high (6–7) quality. At least 20% of the lessons were double coded by two independent coders. The inter-rater reliability was high for all data (see the sub-studies for more information about inter-rater reliabilities). The CLASS scores were utilised for the sample selection in Studies 1 and 2 and for the quantitative analyses in Study 3.

4.2.2 Student measures

Grades in academic subjects. In Study 3, students' grades in Grade 6 were utilised for statistical analysis. The scale of those grades varied from 4 (rejected) to 10 (excellent); grades were assigned at the end of the school year (spring) by the class teachers. Students' grades were available for the following five subjects: language arts, physics/chemistry, biology/geography, religion, and history.

Previous academic performance. In Study 3, students' previous academic performance in reading and math skills in Grade 4 was controlled for in the analyses. The nationally normed reading test ALLU (Lindeman, 1998) was used to assess students' reading comprehension in Grade 4. In the test, the students

were asked to read a factual story and answer 12 multiple choice questions; the maximum test score was 12, with 1 point given for each correct answer.

Students' arithmetic fluency was assessed with the Basic Arithmetic Test (Aunola & Räsänen, 2007), which measures both the accuracy and speed of students' arithmetic skills. The test includes 28 tasks: 13 subtraction, 12 addition, 2 division, and 1 multiplication. The time limit for the test was three minutes, and the maximum score was 28 (1 point for each correct answer).

4.3 Sampling and analytical strategies

This section presents the analytical strategies and data selection phases of each of the three sub-studies. First, the strategy for identifying episodes of educational dialogue, which was the same for all sub-studies, is described. Table 2 offers a general overview of the sub-studies. Although the first author was responsible for all qualitative analyses, the research team applied researcher triangulation (Cohen, Manion, & Morrison, 2007) to validate the findings.

4.3.1 Identifying episodes of educational dialogue

The analysis strategy for each sub-study was based on, first, identifying episodes (Jordan, & Henderson, 1995) of educational dialogue. All selected and transcribed lessons were read carefully several times. An episode was considered to be dialogic exchange between the teacher and students when it fulfilled Alexander's (2006) principles of dialogic teaching (see Table 1). The principles of collectiveness, reciprocity, and purposefulness were the three main criteria that needed to be directly demonstrated in an episode for it to qualify and be coded as dialogic. Evidence for the other two principles of supportiveness and cumulativeness was often indirectly inferred based on students' manner of participation and sharing of thoughts (e.g., safety, support and freedom of expression, and building on each other's comments). All five principles guided the process of identifying episodes of educational dialogue.

A new initiative, such as a turn consisting of a question, sharing of opinion, experience, or factual information, started either by the teacher or the students and leading to a new subtopic under the main topic of the lesson would start a new episode. The length of an episode of educational dialogue and the number of participating students could vary, provided that there were several exchanges between the teacher and multiple students.

Simple question-answer sequences (IRF/IRE patterns) that lacked any or all of the criteria for dialogic teaching were excluded from the analysis. Some IRF-type exchanges could, however, be included within an identified episode of educational dialogue. Interactions that did not include any learning tasks or goals (formal or informal) and individual tasks or routines (e.g., test taking, written assignments, taking of attendance), were excluded from the sample.

TABLE 1 Principles of dialogic teaching according to Alexander (2006)

Principle	Description
Collectiveness:	Teachers and children address learning tasks together as a small group or as a whole classroom.
Reciprocity:	Teachers and children listen to one another, share ideas, and consider alternative viewpoints.
Supportiveness:	Students articulate their ideas freely without fear of embarrassment and help each other to reach a shared understanding.
Cumulativeness:	Teachers and students build on their own and one another's ideas and link them into coherent lines of thinking and enquiry.
Purposefulness:	Teachers plan and steer classroom talk with specific educational goals in mind.

4.3.2 Study 1: Identifying and analysing dialogic teaching patterns with respect to functions of talk

Study 1 examined the different types of dialogic teaching patterns and strategies teachers used to scaffold students' participation and shared understanding in early school classrooms. In preschool, eight teachers were available across a total of 16 lessons. In primary school, nine teachers were available at each of the three observation points (the autumn and spring of Grade 1 and the spring of Grade 2) across a total of 70 lessons. Out of the initial pool of 86 preschool and primary school lessons, 30 were identified as having at least one cycle showing moderate- or high-quality instructional support (as assessed by the CLASS scores), and these lessons were transcribed in preparation for analysis.

Transcribed lessons were read carefully several times, resulting in the identification of 25 episodes of educational dialogue. These episodes were classified into two patterns of dialogic interaction on the basis of earlier findings and criteria used in preschool contexts (see Rasku-Puttonen et al., 2012). Pattern 2 indicated a dialogue in which teachers actively supported student's participation and diverse contributions. Pattern 3 indicated a dialogue in which teachers allowed space for student-initiated sharing of ideas. Finally, the episodes of educational dialogue were analysed according to the functions of talk: argumentative comments, initiatives, responses, expansions, feedback, summaries, etc. A unit of analysis varied from one word to several sentences. In this phase, the purpose was to examine the strategies that the teachers utilised to scaffold students' participation and shared understanding through dialogue.

4.3.3 Study 2: Functional analysis of classroom talk

The aim of Study 2 was to examine the kind of knowledge-building patterns that could be identified in Grade 6 educational dialogues. First, latent profile analysis was conducted with the Mplus 7.3 program on a sample comprising data of classrooms recordings of 46 Grade 6 teachers based on scores on the following five CLASS-S dimensions: 1) Positive Climate, 2) Instructional Learning Formats, 3) Content Understanding, 4) Quality of Feedback, and 5) Instructional Dialogue. Latent profile analysis allows for the identification of mixtures of subgroups based on the observed data and provides statistical tests for evaluation of the existence and amount of the subgroups. A subgroup of seven teachers and their 20 lessons identified in the latent profile analysis as having the highest scores in all five CLASS-S dimensions were chosen for further analysis. The purpose of this selection was to optimise the incidence of educational dialogue in the qualitatively analysed data.

By following the strategy described above, 57 episodes from the 20 lessons were identified as fulfilling the criteria for educational dialogue; these were analysed by applying the framework of the Functional Analysis of Children's Classroom Talk (FACCT; Kumpulainen & Wray, 2002). Because FACCT focuses only on the quality of children's language interaction, adaptations were made in the framework to allow for coding of both teachers' and students' talk. New functions of *view*, *supportive*, and *hinting* were added, and the original *informative* function was renamed *factual* to be more compatible with educational learning situations (for more information about the framework and its modifications, see Study 2). A total of 19 functions were applied to the episodes of educational dialogue between teacher and students (the original Kumpulainen and Wray framework consisted of 16 functions). A unit of analysis was defined to be a single word, a sentence, or several sentences where a clear function or several overlapping functions could be identified.

4.3.4 Study 3: Multilevel modelling and identifying dialogic teaching patterns

Study 3 applied a mixed methods approach to examine, first, the associations between the quality of educational dialogue and students' academic performance (i.e., end of school year grades in the selected subjects), and, second, to analyse the quality of teacher- and student-initiated dialogues in the lessons of those subjects which showed a statistically significant association with students' academic grades. Statistical analyses were conducted using the Mplus 7.3 program, based on the following two CLASS-S dimension scores that were utilised to measure the quality of educational dialogue: Quality of Feedback and Instructional Dialogue. Previous skills in reading and math, gender, parental education, group size, and teacher's work experience were controlled for in the analysis. Intraclass correlation coefficients (ICCs) were calculated to estimate the variance in students' grades at the classroom level (i.e., between-classroom variation) and at the individual level (i.e., within-classroom variation). Correla-

tions between students' grades and the quality of educational dialogue were also examined. Multilevel path models (Heck & Thomas, 2009; Muthén & Muthén, 1998–2012) were conducted to analyse the associations between the quality of educational dialogue and students' grades in language arts, physics/chemistry, science, religion, and history, first in a model consisting of a latent variable for academic performance (all five subjects) and then each subject in their own separate models.

Based on the findings of the multilevel modelling, the lessons of subjects indicating a statistically significant association with student grades were chosen for qualitative analysis. Only the lessons of those school subjects that exceeded CLASS-S value 4 in the two dimensions of Quality of Feedback and Instructional Dialogue were chosen for analysis. This cut-off was used to analyse the lessons with the highest likelihood for dialogic interaction. The transcribed lessons in the final sample were read through carefully, and episodes of educational dialogue were identified ($n = 54$) using the same strategy as in the previous studies. Finally, the identified episodes of educational dialogue were analysed and classified with respect to the four patterns of dialogic teaching that had been shown in Study 1 to represent quality differences in teacher- and student-initiated educational dialogues.

TABLE 2 Overview of the sub-studies

Study	Research questions	Selection of data	Analysed data	Analysis
<p>1. Scaffolding through dialogic teaching in early school classrooms</p>	<p>1. What kinds of dialogic teaching patterns can be identified in early school classrooms' literacy, science and mathematics lessons? 2. What kinds of strategies do teachers use when scaffolding children's participation and shared understanding through dialogic teaching in the classroom?</p>	<p>Out of the 86 MP3- or video-recorded lessons available, lessons with at least one CLASS Pre-K or CLASS K-3 (the Classroom Assessment Scoring System; Pianta et al., 2008a, 2008b) cycle rated as showing moderate- or high-quality instructional support were selected into the sample.</p>	<p>Transcripts of 30 MP3- or video-recorded lessons in preschool and Grades 1 and 2.</p>	<p>Phases of qualitative analyses: 1. Identification of episodes of educational dialogue (n = 28) using Alexander's (2006) criteria. 2. Classification of episodes into dialogic teaching patterns using prior coding criteria (Rasku-Puttonen et al., 2012). 3. Content-driven analysis of functions of talk.</p>
<p>2. Knowledge-building patterns in educational dialogue</p>	<p>1. What kinds of knowledge-building patterns can be identified in Grade 6 educational dialogues between the teacher and students?</p>	<p>Selection was based on latent profile analysis of classroom observations of 46 teachers and their 158 lessons using five CLASS-S (the Classroom Assessment Scoring System-Secundary; Pianta et al., 2012) dimensions (Positive Climate, Instructional Learning Formats, Content Understanding, Quality of Feedback, and Instructional Dialogue). A subgroup of teachers and their lessons with the highest CLASS-S mean scores were selected into the sample.</p>	<p>Transcripts of 20 video-recorded lessons of seven teachers in Grade 6.</p>	<p>Phases of qualitative analyses: 1. Identification of episodes of educational dialogue (n = 57) using criteria by Alexander (2006). 2. Functional analysis of children's classroom talk (Kumpulainen & Wray, 2002).</p>
<p>3. Quality of educational dialogue and association with students' academic performance</p>	<p>1) To what extent is the quality of educational dialogue (as assessed by the CLASS-S) associated with students' grades in academic subjects in Grade 6? 2) What kinds of dialogic teaching patterns of different levels of quality can be identified in language arts and physics/chemistry lessons?</p>	<p>158 video-recorded lessons in diverse subjects of 46 teachers and academic grades of 608 students were available for quantitative analysis. For the qualitative analysis, only the lessons of the subjects with the statistically significant association to the quality of educational dialogue and exceeding CLASS-S value 4, were selected.</p>	<p>Data of quantitative analyses: -CLASS-S coding of video-recordings of 158 lessons in Grade 6. -Academic grades of 608 students in five academic subjects. -Academic skills in Grade 4. -Teacher and parent questionnaires.</p> <p>Data of qualitative analyses: -Nine language arts and two physics/chemistry lessons.</p>	<p>Quantitative analyses: 1. Multilevel modelling using the Mplus 7.3 statistical package (Muthén & Muthén, 1998-2012). Phases of qualitative analyses: 2. Identification of episodes of educational dialogue (n=54) using criteria by Alexander (2006). 3. Classification of episodes into dialogic teaching patterns.</p>

5 OVERVIEW OF THE ORIGINAL STUDIES

5.1 Study 1: Scaffolding through dialogic teaching in early school classrooms

The first aim of Study 1 was to investigate the kinds of dialogic teaching patterns that could be identified in early school classrooms. The second aim was to examine what kinds of strategies teachers use when scaffolding students' participation and shared understanding through dialogic teaching. A total of 30 lessons from preschool and Grades 1 and 2 classrooms were analysed. First, episodes of educational dialogue were identified ($n = 28$) and classified into teacher-initiated ($n = 18$) or student-initiated dialogues ($n = 10$). Second, the patterns of dialogic teaching within the episodes were identified according to functions of talk that represented the teachers' scaffolding strategies.

Based on the analysis of quality of teacher scaffolding strategies and student participation in classroom discussion, both teacher-initiated and student-initiated dialogues were identified and further divided into two sub-patterns of dialogic teaching (a and b). The distinction between the sub-patterns was based on differences in the quality of teacher scaffolding and student participation, which both varied from high to moderate quality (teacher-initiated 2a moderate and 2b high quality and student-initiated 3a moderate and 3b high quality; see Figure 2). Patterns 2a and 3a represent moderate-quality scaffolding and educational dialogue, which contained less support for students' participation and conceptual thinking and more unitary forms of questioning and guidance compared to the category of high quality. In patterns 2b and 3b, which represent high-quality scaffolding and dialogue, teachers used multiple rich strategies to engage students and support their conceptual thinking, shared understanding, and internalising of the shared knowledge.

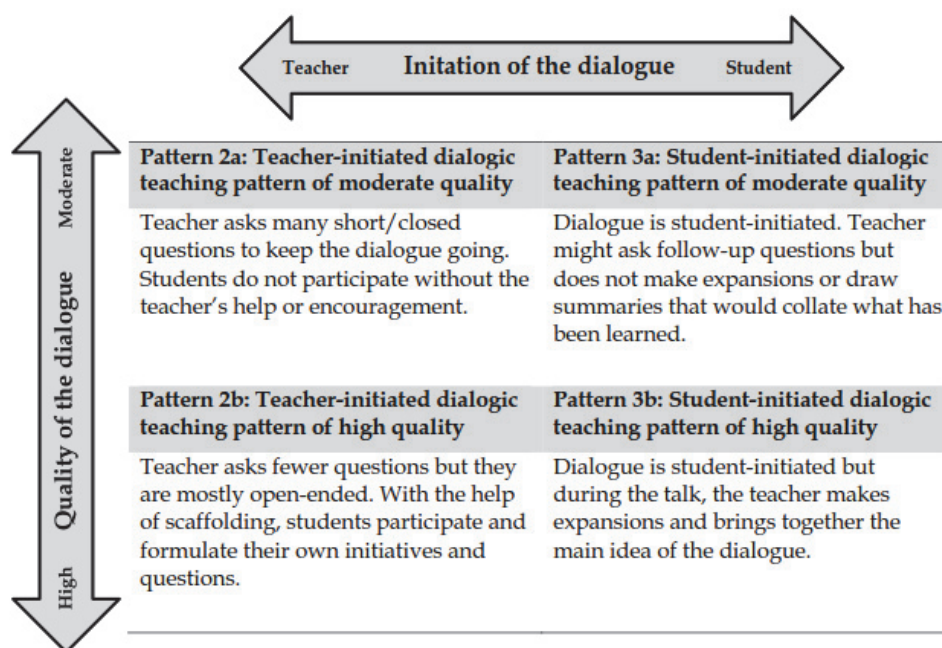


FIGURE 2 Patterns of dialogic teaching

The second aim was to analyse and illustrate in detail the strategies that teachers use when scaffolding students' participation and shared understanding through dialogic teaching. In teacher-initiated educational dialogues, the teacher's role can be described as a manager of interactions to attract students' interest and encourage them to willingly share their thoughts and knowledge. They had a more active role in maintaining the flow of dialogue than the students did. Teachers often asked a question at the beginning of the discussion to open up space for students to share thoughts and ideas. They also conveyed to students that their opinions and views were appreciated and that the goal was not to search for a single correct answer. Teachers also expressed their interest in students' comments and asked follow-up questions to broaden students' thoughts, linking the topics to students' own experiences and everyday lives.

In student-initiated dialogues, the participation of the teacher and students was relatively even, and the teacher's role was more as a facilitator of dialogue. Teacher scaffolding focused more on students' content understanding, since students were already willingly participating in the discussion. Teachers allowed space for students' thoughts and ideas, listened actively, and asked expanding and clarifying questions of students to broaden and explain their understanding. Often, teachers also attempted to connect the discussion and students' thoughts into familiar or new concepts linked to the subject area, societal knowledge, or moral rules. At the end of the dialogue, teachers often summarised the main points and ideas of the discussion and linked them to a broader context.

The results of this study revealed a set of diverse types of educational dialogue with different qualities of teacher scaffolding strategies in early school classrooms. In teacher-initiated educational dialogues, teacher scaffolding was found to be focused primarily on using questions to activate student participation. In student-initiated educational dialogues, on the other hand, teacher scaffolding was more focused on active listening and expanding the dialogue with questions based on students' thoughts in order to support the development of their content understanding. The findings of this study emphasise that a variety of scaffolding strategies can be used to activate students' versatile participation and shared understanding in the classroom. Moreover, the findings suggest that teacher scaffolding is likely to be most conducive to productive dialogue when the teacher sensitively adapts his or her strategies to the level and type of student initiative and participation.

5.2 Study 2: Knowledge-building patterns in educational dialogue

The aim of Study 2 was to examine how shared knowledge can be built in classrooms and more specifically the kinds of knowledge-building patterns that could be identified in educational dialogues in Grade 6. Twenty video-recorded and transcribed lessons from seven teachers were analysed. Within the 20 lessons, a total of 57 episodes of educational dialogue were identified and further analysed by applying an adapted coding scheme based on FACCT (Kumpulainen & Wray, 2002).

Three main functions of talk that served meaning making and shared knowledge building in the dialogue between teacher and students were identified: sharing of *facts*, *views*, and *experiences*. Next, six knowledge-building patterns were identified in educational dialogue, based on these three types of knowledge and their combinations (see Figure 3). Three patterns represented sharing of one of the three main types of knowledge (Pattern A: Sharing of facts; Pattern B: Sharing of views; and Pattern C: Sharing of experiences). The other three patterns represented sharing blended types of knowledge (Pattern A/B: Sharing of views based on facts; Pattern B/C: Sharing of views based on experiences; and Pattern A/C: Sharing of facts based on experiences).

Based on the number of episodes in each type of pattern, it was concluded that the *factual function* was predominant in Grade 6 educational dialogues. However, sharing of factual knowledge was often blended with views and experiences. It is important for teachers to acknowledge and support different types of shared knowledge building in educational dialogue and invite students to participate on their own levels and types of knowledge.

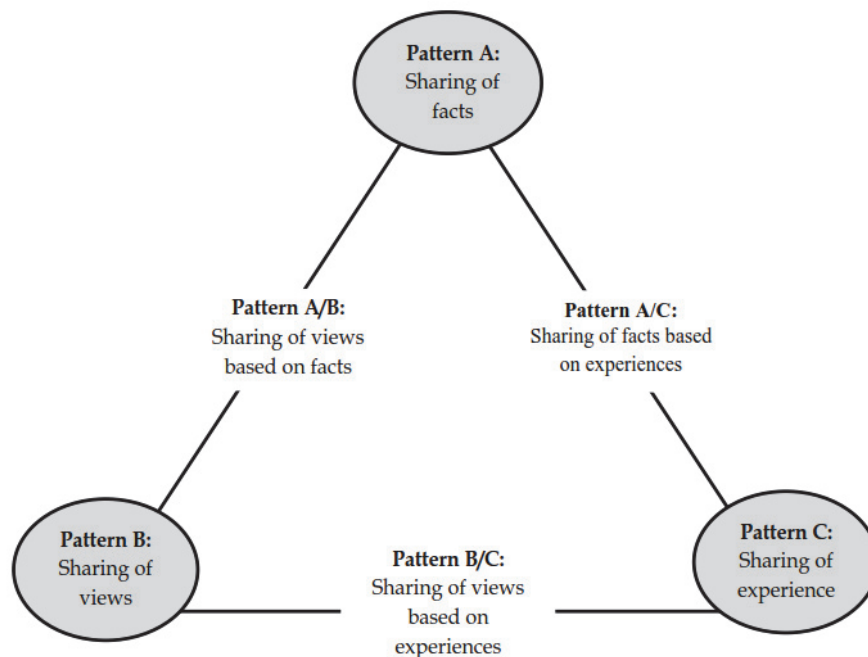


FIGURE 3 Knowledge-building patterns in educational dialogue

5.3 Study 3: Quality of educational dialogue and association with students' academic performance

Study 3 used a mixed methods approach to examine the associations between the quality of educational dialogue and students' grades in academic subjects in Grade 6 and to analyse differences in quality between teacher-initiated and student-initiated educational dialogues in those subjects in which a statistically significant association with students' achievement was found. First, multilevel modelling was used to analyse the associations between the observed quality of educational dialogue (assessed with CLASS-S Instructional Dialogue and Quality of Feedback) and students' grades in language arts, physics/chemistry, religion, history, and biology/geography. The first model was estimated with one latent variable for academic performance including all five subjects; in the next step, each subject was estimated in a separate model. The results of the multilevel modelling indicated that educational dialogue was positively associated with students' grades in language arts and physics/chemistry. Next, the lessons in these two subjects were analysed qualitatively.

A total of 54 episodes of educational dialogue were identified in the lessons (34 episodes in language arts lessons and 20 episodes in physics/chemistry lessons). The episodes were then classified into the four types of dialogic teaching patterns presented in Study 1 that indicate the quality difference in teacher-initiated and student-initiated dialogic teaching. Furthermore, an additional pattern of peer-centred dialogue was found. The findings of the qualitative analysis showed that teacher-initiated educational dialogue was predominant in the lessons in both subjects. Educational dialogue in language arts lessons was characterised by moderate-quality dialogue and scaffolding; physics/chemistry lessons featured high-quality dialogue.

Overall, the results of the study showed an important positive link between the quality of educational dialogue and students' performance through statistical analyses. The qualitative analysis indicated that the quality of the dialogue varied within the lessons and between the subjects.

6 GENERAL DISCUSSION

Current views of learning emphasise the importance of interaction and problem solving (Wells, 2007). Educational dialogue that supports learning includes both sharing views with others and considering multiple alternatives (Mercer, 2008). Despite the acknowledged importance of educational dialogue, the occurrence of teacher-student discussion in the classroom that fulfils the criteria for educational dialogue is surprisingly rare (Mercer, Dawes, & Staarman, 2009). Moreover, research into the quality and outcomes of educational dialogue in authentic classroom situations is scant. The present thesis focused on the Finnish pre-school and primary school context to examine the quality of diverse patterns of educational dialogue and the students' academic outcomes in relation to educational dialogue. Accordingly, the aims of the thesis were to 1) examine how teachers scaffold students in learning situations through dialogic teaching, 2) identify patterns of shared knowledge building in educational dialogues, and 3) investigate how the quality of educational dialogue is associated with students' academic performance. The results showed that in early school classrooms, two teacher-initiated and two student-initiated patterns of dialogic teaching were identified, with quality varying from moderate to high with respect to teacher scaffolding and student participation. In Grade 6, six knowledge-building patterns of educational dialogue were identified which represented sharing of three types of knowledge: facts, views, and experiences. Finally, the findings showed a positive association between the quality of educational dialogue and students' academic performance in language arts and physics/chemistry; patterns of dialogic teaching were identified in the lessons of the two subjects. Overall, the results add to our understanding of variations in the quality of educational dialogue and its association with students' academic performance.

6.1 Scaffolding in teacher- and student-initiated educational dialogues

The first aim of the thesis was to examine how teachers scaffold students in learning situations through the use of dialogic teaching (Studies 1 and 3). The purpose was to identify different patterns of dialogic teaching and to analyse the scaffolding strategies that the teachers use within the educational dialogues. Two teacher-initiated and two student-initiated patterns of dialogic teaching were identified, in line with previous findings of Rasku-Puttonen et al. (2012) examining dialogic patterns in preschool classrooms. In their study, Rasku-Puttonen et al. (2012) identified three patterns of classroom interaction. However, the most typical pattern of teacher-student interaction in their preschool data, which they called *Demonstrating knowledge and competence through question-answer-sequences* represented the classical initiation-response-feedback (IRF) pattern, which does not fulfil the criteria of educational dialogue. The other two patterns of *Supporting children's participation and diverse contributions* (teacher-initiated) and *Allowing space for the sharing of ideas* (child-initiated) did represent the features of educational dialogue. These two dialogic patterns were the starting point for this thesis. In the present thesis, both teacher- and student-initiated dialogues were identified in the data from early school and Grade 6 classrooms. The results, however, indicated a variation in the patterns, based on quality of teacher's scaffolding and students' participation (see Study 1). This finding led to the identification of sub-patterns capturing the variation in the quality of educational dialogue that could be attributed to differences in teacher scaffolding strategies and student participation.

The optimal challenge for student learning forms the basis for teacher's effective scaffolding (Hammond & Gibbons, 2005). The findings of the present thesis suggest that if the teacher's scaffolding does not meet the level of the students' knowledge and potential, the quality of the dialogue remains moderate rather than high. For example, if the level of the teacher's questions is too abstract or too closed, they might not capture all the knowledge and potential that students could demonstrate and do not lead to deeper shared knowledge-building processes. The findings of the present study are in line with those by van de Pol et al. (2012) in indicating that it is critical that the teacher is aware of students' current understanding and skills. In the present study, teachers were found to use a wider variety of strategies in teacher-initiated educational dialogues to encourage students to participate and explain their thinking. In student-initiated dialogues, teacher scaffolding was based mainly on active listening. It has been claimed (Cazden, 2001) that it is only by allowing more time and space for students' elaborations and ideas that interaction can be transformed into a rich dialogic space in which the discussion is not dominated by the teacher. The findings of the present thesis concur with Nystrand's (1997) concept of dialogic instruction in which the teacher has a vital role in shaping the quality of educational dialogue through student-centred strategies, such as

a) allowing students' initiatives and answers to modify the topic of discussion, b) including students' answers in subsequent questions, and c) using authentic questions about which students have concrete experience.

Wells (2009) notes that it can be challenging for students, especially younger ones, to remain latched onto a topic; they often get lost on side tracks. New topics raised by the students do not, however, necessarily lead to side tracks if the teacher knows how to link these topics with larger learning goals and allows time and support for students' own sharing of knowledge. This type of scaffolding of student-initiated educational dialogues is likely to be demanding for the teacher and requires practicing the diverse strategies of communication and scaffolding. The results of Brown and Kennedy's study (2011) of teachers' professional development programme indicate that teachers may not be aware of the importance of effective communication and scaffolding skills and types of questions which effectively facilitate dialogue. The findings of the present study suggest, however, that following students' thoughts and leads fosters educational classroom dialogue. Even when ideas stem from students' interests, the teacher has a critical role in scaffolding and supporting the shared knowledge-building process.

6.2 Knowledge building in educational dialogue

The second aim of the thesis was to identify patterns of shared knowledge building in educational dialogues. The finding of Study 2 showed that knowledge building was concentrated on sharing three types of knowledge: facts, views, and experiences. The results indicated that educational dialogues in Grade 6 classrooms were predominantly focused on sharing of factual knowledge. In the dialogues analysed in Study 1 and based on data from pre-school and Grade 1 and 2 classrooms, the younger students most typically participated actively in discussion when they engaged in sharing personal experiences. Thus, student age may have an impact on what types of knowledge are typically shared in classroom dialogues. The younger the students, the more likely they may be to share personal, everyday experiences rather than factual knowledge during discussions. Active teacher support for pupils sharing their experiences is needed to foster students' ability to utilise diverse interaction strategies and different types of knowledge. In Grade 6, educational dialogues predominantly involved the sharing of factual knowledge, which may be linked to the fact that older students have a naturally larger knowledge base on topics taught in subject lessons. It may also be due to the fact that as pupils increase in age and grade level, a shift occurs towards instructional approaches and goals emphasising scientific principles and factual argumentation as core classroom discourse.

The findings of the present study concur with Myhill's (2006) idea that factual questions and topics have the main role in educational classroom dialogue and are most often introduced by the teacher. Sharing of factual knowledge

takes often place in a linkage with other types of knowledge. The communicative actions, initiatives, prompts, and feedback of the teacher can be critical in encouraging and scaffolding students to explain their ideas, statements, views, and experiences and help them to see the links between existing and new information in order to support their understanding and learning (Gillies et al., 2013; La Paro et al., 2004; Mercer, 1995).

Previous research has shown the importance of the nature of the topic or text on which the educational dialogue is based. The topics and texts should be interesting to students and meaningfully linked to their lives (Almasi, 1995; Clarke & Holwadelin, 2007). Based on the present study, the ideas and topics for educational dialogue could be raised either by the teacher or by students. To fulfil the criteria for genuine dialogue, the topic has to be meaningful to at least some students who are willing to share their knowledge about it, ask questions so as to learn more, or argue their views. According to Pantaleo (2007), students' personal experiences shared in discussions may sometimes raise contradictions among students. Hannula (2012) points out in her intervention study that in order to engage in a genuine dialogue, all participants should have a thought or idea they want to defend. She found, for example, that moral stories were linked with students' experiences, which provides an access to various viewpoints and encourages participants to take a stand. The results of the present thesis show that the different types of knowledge often formed blended patterns: experiential or factual knowledge is often required for the students to build their own opinions about a phenomenon (see Study 2). Nevertheless, different shared views or experiences did not seem to raise strong contradictions among participants. This may be due to the topics that were present in the data (i.e., a low incidence of potentially sensitive issues) or the students' understanding that the goal of the discussion was not to find a correct solution or answer to the teacher's question.

A safe environment is needed for the students to feel comfortable in sharing their ideas and opinions (McKeown & Beck, 1999). Trust must exist among the teacher and students in a safe environment (Fisher & Larkin, 2008), and a democratic and respectful atmosphere (Mcintyre, 2007) has been shown to foster discussion in the classroom. These elements are needed as a basis for educational dialogue no matter what type of knowledge is being shared, although this is especially true when sharing one's personal opinions and experiences. Sharing delicate information and asking questions may be highly sensitive for some students. This requires a respectful atmosphere in the classroom and demands that teachers be sensitive for students' thoughts.

6.3 Quality of educational dialogue and association with learning

The third aim of the thesis was to investigate how the quality of educational dialogue is associated with students' academic performance. The results show that the quality of educational dialogue was positively associated with students'

grades in language arts and physics/chemistry. These subjects include a wide range of topics that might allow sharing diverse types of knowledge and questions, rather than purely factual ones. The findings are in line with previous research (e.g., Alexander 2017; Dawes et al., 2000; Howe et al., 2007) that reports a positive effect of educational dialogue on student learning. Study 3 showed a positive association between the quality of educational dialogue and student performance in both language arts and physics/chemistry. These findings concur with other research (e.g., Alexander 2017; Mercer, 2008) that has shown positive effects of educational dialogue on language arts and science outcomes. However, in the recent literature, there has been a strong interest in the effects of educational dialogue in the field of science, which might explain the concentration of the positive findings. There has been significantly less research related to the effects of educational dialogue in other school subjects.

Prior studies investigating the outcomes of educational dialogue have typically been conducted in interventional settings and designs, whereas the focus in the present study was on authentic and unmanipulated classroom interaction. As implied by the small samples of lessons identified with dialogic episodes in the qualitative phases, the extent of dialogue in the classrooms remains very limited. Through interventional designs, the practice and development of communication skills could be examined more closely.

In the present thesis, the associations between the quality of educational dialogue and student performance at Grade 6 were assessed using students' end-of-year grades. In previous research, gains in students' learning have often been estimated through standardised tests. For instance, in their studies on exploratory talk, Mercer and others (e.g., Dawes et al., 2000; Mercer, 2008; Mercer & Littleton, 2007) utilised Raven's non-verbal reasoning test before and after intervention. Similarly, Alexander (2017) assessed student achievement in different subjects using standardised tests. The use of grades as an indicator of achievement may have both positive and negative aspects. The grades give a broad overview of a student's achievement during the entire school year and cover many different content areas. However, as grades are given by the class teacher, they can also reflect other areas of students' school performance, such as teachability, working habits, etc. (Mullola, 2012). Previous research has also shown variation in students' grades related to factors such as the school, teacher or student's gender (Ouakrim-Soivio, 2013). Standardised tests may, thus, guarantee more objective—if sometimes narrower—information about students' abilities.

In the present thesis (Study 3), three other subjects, religion, biology/geography, and history, were included, but a statistically significant association with quality of educational dialogue could not be confirmed in the separate multilevel models. This is somewhat surprising since religion, for instance, may offer wide, even vast, opportunities for sharing of different views on moral rules and dilemmas. The quality and nature of educational dialogue in religion lessons was also examined in Studies 1 and 2, but to the best of our knowledge,

there are no studies showing the effect of educational dialogue on student performance in religion as a school subject.

Educational dialogue has also been shown to be linked with students' achievement and learning in mathematics (Alexander, 2017; Mercer, 2008). Mathematics was not included as one of the subjects in Study 3, but in Studies 1 and 2, the quality of educational dialogue was examined in some mathematics lessons. In their study, Kyriacou and Issitt (2008) showed that mathematics skills development was more likely when the teacher encouraged students to explain and reason out their thinking instead of simply finding correct answers. Encouraging justifications and explanations is likely to be linked not only with mathematics but also with outcomes in many other subjects.

Mercer and Howe (2012) highlight that analysing classroom discussion is demanding and requires a rigorous and highly systematic approach in order to examine both the quality and learning. The four patterns identified in transition to school and early school years (Study 1) were validated in the Grade 6 data from language arts and physics/chemistry lessons (Study 3). The majority of the identified dialogues in both age groups were teacher initiated, which accords with Well's (2009) suggestion that the teacher has the predominant role in initiating and managing classroom discussion. In Grade 6, an additional pattern was also identified, which represented peer-centred dialogue in the classroom. The finding of peer-centered pattern in Grade 6 suggests that students' ability to take responsibility for initiating and maintaining independently dialogue is more advanced at this age than in the early school years where no peer-centered dialogue was found. The emergence of peer-centred dialogue in Grade 6 appears to be in line with the proposition that different phases exist in teachers' scaffolding, introduced by van de Pol et al. (2010). Maintaining educational dialogue is challenging, and among students attending early grades, the aspect of *contingency* (tailored, responsive and adjusted support) is likely to be emphasised. However, among older students, who have more experience in dialogue, the scaffolding forms of *fading* (gradual withdrawal of the support over time) and *transfer of responsibility* from the teacher to the students may take precedence. The finding of peer-centered dialogue also corroborates earlier literature on the importance of peer dialogue in the classroom for students' intellectual growth and learning (e.g., Howe et al., 2007; Mercer & Littleton, 2007; Underwood & Underwood, 1999).

6.4 Practical and theoretical implications and suggestions

The present thesis has several practical and theoretical implications. It makes a contribution to the scant existing literature on learning outcomes related to the quality of educational dialogue. This is among the first studies conducted in authentic classroom situations (i.e., without an intervention design) to demonstrate associations between the quality of educational dialogue and students' academic performance: a higher quality of educational dialogue in the class-

room was shown to be linked with better student grades. However, the results indicate that the total amount of educational dialogue in the classrooms is scant, which accords with earlier literature (e.g., Howe & Abedin, 2013). From a larger original data pool, only lessons indicating moderate or high CLASS scores in dimensions of instructional support were utilised to capture those lessons that included at least some amount of educational dialogue. Based on the three sub-studies, it can be concluded that there is still very little dialogue taking place in the classroom. Therefore, there is a clear need to train teachers on how to conduct dialogic teaching by supporting students' participation, shared understanding, and development of communication skills, in order to increase the amount and quality of educational dialogue. However, it is acknowledged that this is not an easy task, because dialogue is demanding and time-consuming for teachers (Lehesvuori, Viiri, & Rasku-Puttonen, 2011).

The findings of this thesis suggest that diverse patterns exist within classroom discussions. These findings add to existing literature that indicates variation in the quality of educational dialogue. Patterns are also practical and can guide teachers in everyday classroom interactions with their students. In particular, allowing time for student-initiated dialogue could be an effective tool, which currently seldom takes place in the classroom, as it is normally the teacher who leads and orchestrates classroom discussion (Wells, 2009). This thesis presents a variety of strategies to scaffold students' participation, shared understanding, and meaning making in both teacher- and student-initiated educational dialogues. The importance of scaffolding for an individual's learning has been acknowledged within sociocultural theory, but variation in the quality of educational dialogue according to patterns of initiation and the nature of teacher scaffolding has not been demonstrated earlier.

Knowledge-building patterns identified in this study contribute to existing understandings of how shared knowledge building is fostered in whole class educational dialogue. By acknowledging different types of knowledge-building patterns, teachers can also support a wider variety of educational discussions and invite more students to participate to the dialogue. Sharing views and experiences, for example, may provide an easier route for many students to participate in the shared knowledge-building process than sharing factual information.

The use of dialogue and practicing interactional skills should begin in early childhood education, when the pressure of learning goals is not too high and when there is more time and space for discussion and practicing the skills needed for dialogue. The findings of this thesis indicated that students in pre-school and Grade 1 and 2 classrooms participated in classroom discussion eagerly and enjoyed especially sharing their personal experiences. This natural eagerness and curiosity should be supported and utilised as much as possible in order to build the basis for students' further communication skills and learning.

The recently reformed Finnish national core curriculum guidelines (2014) emphasise the importance of teacher-student interaction in the classroom. To increase and enhance classroom interactions, the importance of educational dia-

logue should be acknowledged in pre-service teacher training by embedding opportunities for discussion in the study courses and both demonstrating and practicing effective educational dialogue in practicum studies. Teacher students should practice demonstrating concrete examples of dialogic episodes and practice ways to scaffold students' participation and shared understanding during their teaching practices in classrooms. The earlier that future teachers experience the powerful effects of dialogue and learn to use it, the more deeply dialogue will become rooted in classroom instruction and interaction. Professional development interventions in in-service teacher training should also be employed, since they have been found to be a successful and meaningful way for teachers to increase educational dialogue in their classrooms (Metsäpelto et al., 2017).

6.5 Ethical considerations

This study was conducted following the ethical guidelines of the Finnish Advisory Board of Research Integrity (2012) and meets the following criteria: 1) respecting the autonomy of research subjects, 2) avoiding harm, and 3) respecting privacy and data protection (National Advisory Board on Research Ethics, 2009). The protocol concerning the First Steps study (part of the data from which were used in the present study) involving children below 15 years of age was submitted for ethical review by the Committee of Ethics in University of Jyväskylä at the outset of that study, and a statement of approval was received concerning the ethics of the study on 15 June 2006.

Participation in the study was voluntary and all participants (the teachers and the children's guardians) gave written consent about their own or the children's participation. Participants were also aware they were free to drop out of the study at any time. Data relating to individuals and schools were made anonymous through the allocation of code numbers. In the transcriptions of the lessons, teachers' and students' names and other identifying information were changed. Children whose guardians did not provide written consent to allow their children to appear on video-recorded footage were offered seats in the room where they could participate in the activities without being on camera. However, a majority of the students in each class usually had permission to be filmed. All study participants were treated equally and fairly, and the results of the study were reported respectfully. The storage of research material and confidential treatment of data was undertaken in accordance with the University's Ethics Committee Guidelines.

6.6 Limitations and future directions

There are also certain limitations regarding the data and research methods that should be acknowledged when considering the findings of the thesis and future research. Firstly, although the samples in all three sub-studies were reasonable enough for qualitative analysis, for quantitative analysis in Study 3 it was relatively small, which could decrease the generalisability of the findings and the power of statistical testing. The sample selection was based on the CLASS scores of the lessons in order to optimise the occurrence of dialogic interaction in the analysed lessons. This reflects the fact that the goal was to identify and analyse the quality of dialogue, not to show the actual amount of dialogue in the classrooms.

It should also be noted that some data used in this thesis are relatively old. The data used in Study 1 were collected during 2006–2008, when the children participating in First Steps were in preschool and Grades 1 and 2. The Grade 6 data, which were collected in 2013 and used in Studies 2 and 3, can be considered more new. In the future, larger, more current and longitudinal data would be beneficial for better capturing the quality and the effects of educational classroom dialogue on various student outcomes.

The teachers and students participating in the classroom observations were chosen on a voluntary basis, which could have had an effect on the findings and generalisability of the study. Regarding the preschool data in the First Steps study, it has already been documented that the teachers who participated in the classroom observations did not differ from other teachers with respect to their work experience, exhaustion at work, interaction style, or number of students in the classroom (Pakarinen et al., 2010). These kinds of control variables are needed because teacher stress or exhaustion has been shown to be associated with lower interaction quality in the classroom (e.g., Caprara, Barbanelli, Steca, & Malone, 2006; Friedman-Krauss, Raver, Morris, & Jones, 2014). In addition, prior research has shown (see the meta-meta analysis of Hattie, 2009) strong links between several process quality variables and students' learning outcomes, such as teacher-student relationship and student engagement and motivation, and these variables should be taken into consideration when examining the effects and quality of educational classroom dialogue in the future.

Only transcriptions of the recorded lessons were utilised in the qualitative analyses, since not all lessons were video-recorded; the focus was thus solely on verbal communication. However, the importance of nonverbal communication, such as gestures and facial expressions, should be acknowledged when assessing the quality of classroom interaction. In future research, video-recorded lessons could be utilised and analysed more rigorously to include the nonverbal interaction of teachers and students in the analysis. New insight into educational dialogue could also be provided by examining teachers' and students' focus of visual attention during classroom dialogue for example by employing eye-tracking technology.

In future research, to ensure accumulation and comparability of research internationally used frameworks (e.g., Hennessy et al., 2016; Michaels & O'Connor, 2011) assessing classroom dialogue can be used parallel to those used in the present study to analyse both teacher-student and peer dialogue. The present sub-studies were limited to whole-class dialogue in which both teacher and students were actively involved, but there is a great deal of research (e.g., Howe, 2010; Mercer & Dawes, 2008; Underwood & Underwood, 1999) showing the effect and importance of peer dialogue. In the future, attention should also be paid to peer dialogue in learning situations.

There are also some certain limitations regarding the quantitative analyses of the thesis. In Study 3, the design of the study was not cross-lagged, which means that caution should be used in making any direct causal or predictive claims. Moreover, students' academic performance was measured with grades, which could be biased by being assigned by the same teacher who led the classroom instruction. Grades should be complemented with standardised test results in the future studies.

The generalisability of the findings to different subjects is limited because the quality of educational dialogue across subjects was only specifically addressed in Study 3. There is a clear need for more research on variation (quality similarities or differences) in educational dialogue across subjects and classrooms with respect to providing support for students' learning and active participation. Moreover, the study was conducted in the Finnish educational system, where children enter school at the rather late age of seven. This might have had some effect on the results that identify certain kinds of dialogues and scaffolding in early school years. Therefore, caution should be used when generalising the results.

Finally, this thesis is one of the first studies to show the significant association between the quality of educational dialogue and students' academic achievement in authentic classroom situations. In the future, more research on authentic classroom situations and dialogue is needed, along with intervention-al studies in different age groups and content areas.

7 CONCLUSIONS

The present thesis focused on examining diverse patterns of educational dialogue and investigating the associations between the quality of educational dialogue and students' academic performance in the Finnish preschool and primary school context. First, the results showed four patterns of dialogic teaching that emerged in the early school years in which quality, initiation, and teacher's scaffolding strategies varied. Second, in Grade 6, knowledge building in educational dialogues was concentrated on sharing facts, views, and experiences. These three types of knowledge were identified as forming six knowledge-building patterns. Third, the quality of educational dialogue was found to be positively associated with students' performance in language arts and physics/chemistry, and the quality of educational dialogue in these subjects varied between the patterns of dialogic teaching.

Based on the findings, it can be concluded that there is a variety of patterns and quality of educational dialogue in preschool and primary school classroom talk. However, the amount and quality of educational dialogue should be increased to support students' learning. Supporting higher-quality educational dialogue that would likely enhance students' learning can be challenging, and specific scaffolding strategies may vary depending on whether a given dialogue is teacher- or student-initiated. Teachers should become aware of the benefits of educational dialogue and the strategies how to scaffold and support both teacher- and student-initiated educational dialogues and the knowledge-building process in which different types of knowledge can be utilised. In this way, teachers would have an opportunity to support a wider variety of educational discussions in the classroom. The development of active utilisation of educational dialogue should begin in teacher training with pre-service teachers and continue in the form of professional development interventions during in-service teacher training. Furthermore, the use of educational dialogue in the classrooms should begin with students as young as possible to sustain and utilise their natural eagerness and curiosity. This early practice of educational discussion can support the development of the communication skills that student will need for active lifelong learning.

YHTEENVETO

Tässä tutkimuksessa tarkasteltiin erilaisia opetusdialogin malleja ja niiden laatua esiopetuksessa ja alakoulussa. Lisäksi tutkimuksessa selvitettiin opetusdialogin laadun yhteyttä oppilaiden suoriutumiseen eri oppiaineissa. Tutkimus koostui kolmesta Alkuportaatt-seurantatutkimuksen aineistoon perustuvasta osatutkimuksesta. Ensimmäisen osatutkimuksen havainnointiaineisto kerättiin oppilaiden ollessa esiopetuksessa, ensimmäisellä ja toisella luokalla, ja toisen ja kolmannen osatutkimuksen aineisto kerättiin oppilaiden ollessa kuudennella luokalla. Video- ja/tai ääninauhoitettujen oppituntien vuorovaikutuksen laatua arvioitiin käyttäen strukturoitua havainnointimenetelmää Classroom Assessment Scoring System (CLASS; Pianta et al., 2008a; Pianta et al., 2008b; Pianta et al., 2012). CLASS-pistemääriä hyödyntäen kuhunkin osatutkimukseen valikoitui oma osaotos, jonka aineisto analysoitiin joko laadullisia ja/tai määrällisiä tutkimusmenetelmiä käyttäen. Ensimmäisen osatutkimuksen 30 litteroidusta oppitunnista tunnistettiin opetusdialogiepisodeja, joiden sisältö analysoitiin aineistolähtöisellä sisällönanalyysillä keskittyen puheen funktioihin. Toisessa osatutkimuksessa 20 litteroidusta oppitunnista tunnistettiin opetusdialogiepisodeja, joiden sisältö analysoitiin hyödyntäen Functional Analysis of Children's Classroom Talk (Kumpulainen & Wray, 2002) analyysimenetelmää. Menetelmä muokattiin soveltuvaksi sekä opettajan että oppilaiden puheen analysointiin. Kolmannessa osatutkimuksessa tarkasteltiin opetusdialogin laadun yhteyttä oppilaiden arvosanoihin viidessä oppiaineessa (yhteensä 158 oppituntia) hyödyntäen monitasomallinnusta (MPlus; Muthén, & Muthén, 1998–2012). Tämän jälkeen niiden oppiaineiden oppitunnit, joissa havaittiin tilastollinen yhteys, analysoitiin laadullisesti ensin tunnistamalla opetusdialogiepisodeja ja sitten jakamalla ne dialogisen opetuksen malleihin.

Ensimmäisessä osatutkimuksessa selvitettiin, kuinka opettajat tukevat oppilaita dialogisen opetuksen avulla esi- ja alkuopetuksessa. Analyysin pohjalta tunnistetuista opetusdialogiepisodeista löydettiin neljä dialogisen opetuksen mallia. Kaksi malleista oli opettajalähtöisiä ja kaksi oppilaslähtöisiä. Mallien laatu vaihteli lisäksi keskitasoisesta korkeaan riippuen opettajan antamasta tuesta (*scaffolding*) sekä oppilaiden osallistumisesta keskusteluun. Opettajalähtöisissä dialogeissa opettajat hyödynsivät useita erilaisia strategioita aktivoimaan oppilaita mukaan keskusteluun. Oppilaslähtöisissä dialogeissa opettajan tuki sen sijaan pohjautui aktiiviseen kuunteluun, jonka pohjalta oli mahdollista nostaa oppisisällön ymmärtämistä tukevia kysymyksiä.

Toisen osatutkimuksen tarkoituksena oli selvittää, millaisia tiedonrakennusmalleja voidaan tunnistaa kuudennen luokan opetusdialogeissa. Havaittiin, että opetuskeskusteluissa jaettiin pääosin kolmea erilaista tiedon tyyppiä: faktoja, näkemyksiä ja kokemuksia. Nämä kolme tiedontyyppiä muodostivat edelleen erilaisia kombinaatioita, jolloin tunnistettiin yhteensä kuusi opetusdialogin tiedonrakennusmalleja. Kolme malleista keskittyi pääosin vain yhden tyyppisen tiedon jakamiseen (mallit A, B ja C). Kolmessa muussa mallissa kaksi tiedon tyyppiä yhdistyivät toisiinsa keskustelussa (mallit A/B, B/C, ja A/C).

Kolmannessa osatutkimuksessa tarkasteltiin kahden CLASS-menetelmän ulottuvuuden pohjalta opetusdialogin laadun yhteyttä oppilaiden suoriutumiseen viidessä eri oppiaineessa kuudennella luokalla. Tulokset osoittivat, että opetusdialogin laatu oli yhteydessä oppilaiden arvosanoihin äidinkielessä ja fysiikka-kemiassa siten, että mitä laadukkaampaa opetusdialogi luokassa oli, sitä parempia arvosanoja oppilaat näissä kahdessa aineessa olivat saaneet. Näiden kahden oppiaineen opetuskeskustelujen laatua tarkasteltiin oppituntien litteraateista laadullisesti ensimmäisessä osatutkimuksessa löydettyjen neljän dialogisen opetuksen mallin pohjalta. Tulokset osoittivat, että molemmissa aineissa löydettiin enemmän opettajalähtöisiä dialogeja. Äidinkielessä dialogin laatu oli pääosin keskimääräistä, kun taas fysiikka/kemian oppitunneilla dialogien laatu oli useammin korkeatasoista. Myös uusi oppilaskeskeinen dialogimalli tunnistettiin aineistosta.

Kaiken kaikkiaan väitöskirjan tulokset osoittivat, että opetusdialogin mallit ja laatu vaihtelivat luokahuonekeskustelussa riippuen opettajan tarjoamasta tuesta sekä keskustelussa jaetusta tiedosta. Se, millaisin keinoin opettaja tuki oppilaan osallistumista ja tiedonrakentamista oli yhteydessä dialogin laatuun. Tiedostamalla erilaisia strategioita ja tiedon jakamisen tyyppiä opettajalla on mahdollisuus tukea laajempaa keskustelun kirjoa ja mahdollistaa useampien oppilaiden osallistuminen yhteiseen tiedonrakennukseen keskustelun kautta. Tämä tutkimus on myös yksi ensimmäisiä empiirisiä tutkimuksia, joissa on osoitettu dialogin laadun ja oppilaiden suoriutumisen välinen yhteys autenttissa luokahuonevuorovaikutuksessa. Aiemmat tutkimukset ovat osoittaneet opetusdialogin yhteyden pääosin interventiopohjaisen tutkimusaineiston kautta.

Tulokset antavat viitteitä siitä, että dialogin määrää ja laatua olisi tarpeen lisätä, jotta oppilaiden oppimista voitaisiin tukea paremmin. Opettajien dialogitaitoihin tulisi kiinnittää huomiota jo opettajankoulutuksen aikana ja jatkaa dialogisen opettamisen taitojen tukemista täydennyskoulutuksessa. Dialogin käyttö opetusmenetelmänä tulisi myös aloittaa mahdollisimman aikaisin, kun lasten luontainen kiinnostus jakaa ja kysyä asioita on vielä suuri. Näin parhaiten tuettaisiin oppilaiden vuorovaikutustaitojen varhaista kehitystä sekä oppimista yhteisen keskustelun kautta.

Tulevaisuudessa olisi tärkeää tutkia lisää opetusdialogin yhteyttä oppimiseen hyödyntämällä sekä määrällisiä että laadullisia tutkimusmenetelmiä. Pitkittäisaineistolla olisi mahdollista selvittää, miten opetusdialogi edistää oppimista pitkällä aikavälillä. Laadullisesti luokahuonevuorovaikutusta olisi syytä tarkastella lisää käyttäen erilaisia analysointimenetelmiä sekä huomioiden esimerkiksi ei-kielellisen vuorovaikutuksen sekä opettajan että oppilaiden visuaalisen huomion kiinnittymisen merkitys keskustelun aikana. Lisäksi tulisi tarkastella oppilaiden keskinäisen keskustelun merkitystä oppilaiden oppimisen ja ymmärryksen edistäjänä luokahuonevuorovaikutuksessa.

REFERENCES

- Alexander, R. (2000). *Culture and pedagogy: International comparisons in primary education*. Oxford: Blackwell.
- Alexander, R. (2006). *Towards dialogic teaching* (3rd ed.). New York, NY: Dialogos.
- Alexander, R. (2008). *Essays on pedagogy*. London: Routledge.
- Alexander, R. (2009). Towards a comparative pedagogy. In R. Cowen & A. M. Kazamias (Eds.), *International Handbook of Comparative Education* (pp. 923–939). London: Springer Science+Business Media.
- Alexander, R. (2017). *Developing dialogue: Process, trial, outcomes*. Retrieved from <http://www.robinaalexander.org.uk/wp-content/uploads/2017/08/EARLI-2017-paper-170825.pdf>
- Almasi, J. (1995). The nature of fourth graders' sociocognitive conflicts in peer-led and teacher-led discussion of literature. *Reading Research Quarterly*, 30(3), 314–351.
- Aunola, K., & Räsänen, P. (2007). *The basic arithmetic test*. Jyväskylä, Finland: University of Jyväskylä.
- Azmitia, M., & Montgomery, R. (1993). Friendship, transactive dialogues and the development of scientific reasoning. *Social Development*, 2(3), 202–221.
- Barnes, D., & Todd, F. (1977). *Communication and learning in small groups*. London: Routledge and Kegan Paul.
- Blatchford, P., & Kutnick, P. (2003). Developing groupwork in everyday classrooms: An introduction to the special issue. *International Journal of Educational Research*, 39,(1-2), 1–7.
- Brown, A. L., Ash, D., Rutherford, M., Nakagawa, K., Gordon, A., & Campione, J. C. (1993). Distributed expertise in the classroom. In G. Salomon (Ed.), *Distributed cognitions: Psychological and Educational Considerations* (pp. 188–228). Cambridge, MA: MIT Press.
- Brown, J. S., & Duguid, P. (2000). *Social life of information*. Boston, MA: HBS Press.
- Brown, K., & Kennedy, H. (2011). Learning through conversation: Exploring and extending teacher and children's involvement in classroom talk. *School Psychology International*, 32(4), 377–396.
- Cadima, J., Verschueren, K., Leal, T., & Guedes, C. (2016). Classroom interactions, dyadic teacher–child relationships, and self-regulation in socially disadvantaged young children. *Journal of Abnormal Child Psychology*, 44(1), 7–17.
- Caprara, G. V., Barbanelli, C. & Steca, P., & Malone, P. S. (2006). Teachers' self-efficacy beliefs as determinants of job satisfaction and students' academic achievement: A study at the school level. *Journal of School Psychology*, 44(6), 473–490.
- Cazden, C. B. (2001). *Classroom discourse: The language of teaching and learning* (2nd ed.). Portsmouth, NH: Heinemann.

- Clarke, L. W., & Holwadel, J. (2007). Help! What is wrong with these literature circles and how can we fix them? *The Reading Teacher*, 61(1), 20–29.
- Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). London: Routledge/Falmer.
- Cole, M., & Engeström, Y. (1993). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 1–46). New York, NY: Cambridge University Press.
- Dawes, L., Mercer, N., & Wegerif, R. (2000). *Thinking together: A programme of activities for developing speaking, listening and thinking skills for children aged 8-11*. Birmingham, UK: Imaginative Minds Ltd.
- Doveston, M. (2007). Developing capacity for social and emotional growth: An action research project. *Pastoral Care in Education*, 25(2), 46–54.
- Finnish Advisory Board of Research Integrity. (2012). *Responsible conduct of research and procedures for handling allegations of misconduct in Finland*. Helsinki: Finnish Advisory Board of Research Integrity. Retrieved from: http://www.tenk.fi/sites/tenk.fi/files/HTK_ohje_2012.pdf
- Finnish National Agency for Education (2014a). *Esiopetuksen opetussuunnitelman perusteet 2014* [The National Core Curriculum for Pre-primary Education 2014]. Helsinki: Finnish National Agency for Education. Retrieved from http://www.oph.fi/download/163781_esiopetuksen_opetussuunnitelman_perusteet_2014.pdf
- Finnish National Agency for Education (2014b). *Perusopetuksen opetussuunnitelman perusteet 2014* [The National Core Curriculum for Basic Education 2014]. Helsinki: Finnish National Agency for Education. Retrieved from: http://www.oph.fi/download/163777_perusopetuksen_opetussuunnitelman_perusteet_2014.pdf
- Fisher, R., & Larkin, S. (2008). Pedagogy or ideological struggle? An examination of pupils' and teachers' expectations for talk in the classroom. *Language and Education*, 22(1), 1–16.
- Forman, E., Ramirez-DelToro, V., Brown, L., & Passmore, C. (2017). Discursive strategies that foster an epistemic community for argument in a biology classroom. *Learning and Instruction*, 48, 32–39.
- Friedman-Krauss, A. H., Raver, C. C., Morris, P. A., & Jones, S. M. (2014). The role of classroom-level child behavior problems in predicting preschool teacher stress and classroom emotional climate. *Early Education and Development*, 25(4), 530–552.
- Galton, M., Hargreaves, L., Comber, C., & Wall, D., with Pell, A. (1999). *Inside the primary classroom: 20 years on*. London: Routledge.
- Gillies, R. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, 41(3), 39–54.
- Gillies, R., Nichols, K., Burgh, G., & Haynes, M. (2013). Primary students' scientific reasoning during cooperative inquiry-based science activities. *International Journal of Educational Research*, 63, 127–140.

- Hämäläinen, R., & Laine, K. (2015). Classroom orchestration: Balancing between personal and collaborative learning processes. *International Journal of Virtual and Personal Learning Environments*, 5(3), 33–50.
- Hämäläinen, R., & Vähäsantanen, K. (2011). Theoretical and pedagogical perspectives on orchestrating creativity and collaborative learning. *Educational Research Review*, 6(3), 169–184.
- Hammond, J., & Gibbons, P. (2005). What is scaffolding? In A. Burns & H. de Silva Joyce (Eds.), *Teacher voices 8: Explicitly supporting reading and writing in the classroom* (pp. 8–16). Sydney: National Centre for English Language Teaching Research.
- Hannula, M. (2012). *Dialogia etsimässä – pienryhmäkeskusteluja luokassa*. University of Jyväskylä. Jyväskylä Studies in Education, Psychology and Social Research 446.
- Harasim, L. M. (1989). Online education. A new domain. In R. Mason, & A. R. Kaye (Eds.), *Mindweave. Communication, computers, and distance education* (pp. 50–62). Oxford: Pergamon Press.
- Hattie, J. (2008). *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.
- Heck, R. H., & Thomas, S. L. (2009). *An introduction to multilevel modeling techniques* (2nd ed.). New York: Routledge.
- Hennessey, S., Rojas-Drummond, S., Higham, R., Márquez, A. M., Maine, F., Ríos, R. M., ... Barrera, M. J. (2016). Developing a coding scheme for analysing classroom dialogue across educational contexts. *Learning, Culture and Social Interaction*, 9, 16–44.
- Hodgkinson, S., & Mercer, N. (2008). Introduction. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in school* (pp. xi–xviii). London: Sage Publications.
- Howe, C. (2010). Peer dialogue and cognitive development: A two-way relationship? In K. Littleton & C. Howe (Eds.), *Educational dialogues: Understanding and promoting productive interaction* (pp. 35–51). London: Routledge.
- Howe, C., & Abedin, M. (2013). Classroom dialogue: A systematic review across four decades of research. *Cambridge Journal of Education*, 43(3), 325–356.
- Howe, C. J., Tolmie, A., Thurston, A., Topping, K., Christie, D., Livingston, K., ... Donaldson, C. (2007). Group work in elementary science: Towards organizational principles for supporting pupil learning. *Learning and Instruction*, 17(5), 549–563.
- Howes, C., Burchinal, M., Pianta, R. C., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Ready to learn? Children's pre-academic achievement in pre-kindergarten programs. *Early Childhood Research Quarterly*, 23, 27–50.
- Jordan, B., & Henderson, A. (1995). Interaction analysis: Foundations and practice. *The Journal of the Learning Sciences*, 4(1), 39–103.

- Kajamies, A., Vauras, M., & Kinnunen, R. (2010). Instructing low-achievers in mathematical word problem solving. *Scandinavian Journal of Educational Research*, 54(4), 335–355.
- Kaye, A. R. (1992). Learning together apart. In A. R. Kaye (Ed.), *Collaborative learning through computer conferencing* (Vol. 90, pp. 1–24). NATO ASI Series. Springer-Verlag.
- Kiemer, K., Gröschner, A., Pehmer, A. K., & Seidel, T. (2015). Effects of a classroom discourse intervention on teachers' practice and students' motivation to learn mathematics and science. *Learning and Instruction*, 35, 94–103.
- Kumpulainen, K. & Lipponen, L. (2010). Productive interaction as agentic participation in dialogic inquiry. In Teoksessa K. Littleton & C. Howe (Eds.), *Educational dialogues: Understanding and promoting productive interaction* (pp. 48–63). London: Routledge.
- Kumpulainen, K., & Rajala, A. (2017). Dialogic teaching and students' discursive identity negotiation in the learning of science. *Learning and Instruction*, 48, 23–31.
- Kumpulainen, K., & Wray, D. (2002). *Classroom interaction and social learning: From theory to practice*. London: Routledge-Falmer.
- Kyriacou, C., & Issitt, J. (2008). *What characterizes effective teacher-pupil dialogue to promote conceptual understanding in mathematics key stages 2 and 3?* (EPPI-centre report no. 1604R). London: Institute of Education, University of London: Social Science Research Unit.
- La Paro, K. M., Pianta, R. C., & Stuhlman, M. (2004). The classroom assessment scoring system: Findings from the pre-kindergarten year. *The Elementary School Journal*, 104(5), 409–426.
- Lefstein, A. (2006). *Dialogue in schools: Towards a pragmatic approach* (Working Papers in Urban Language & Literacies, #33). London: King's College London.
- Lehesvuori, S., Viiri, J., & Rasku-Puttonen, H. (2011). Introducing dialogic teaching to science student teachers. *Journal of Science Teacher Education* 22(8), 705–727.
- Lemke, J. L. (1990). *Talking science: Language, learning, and values*. Norwood, NJ: Ablex.
- Lerkkanen, M.-K., Kiuru, N., Pakarinen, E., Viljaranta, J., Poikkeus, A.-M., Rasku-Puttonen, H., . . . , & Nurmi, J.-E. (2012). The role of teaching practices in the development of children's interest in reading and mathematics in kindergarten. *Contemporary Educational Psychology*, 37(4), 266–279.
- Lerkkanen, M.-K., Niemi, P., Poikkeus, A.-M., Poskiparta, M., Siekkinen, M., & Nurmi, J.-E. (2006–2017). *The First Steps Study* (Alkuportaati). [Unpublished data]. Jyväskylä, Finland: University of Jyväskylä.
- Lerkkanen, M.-K., Rasku-Puttonen, H., Aunola, K., & Nurmi, J.-E. (2004). The Developmental Dynamics of Literacy Skills during the First Grade. *Educational Psychology*, 24(6), 793–810.

- Lindeman, J. (1998). *ALLU – Ala-asteen lukutesti* [ALLU – Reading Test for Primary School]. Turku, Finland: University of Turku, Center for Learning Research.
- Littleton, K., & Howe, C. (2010). *Educational dialogues: Understanding and promoting productive interaction*. London: Routledge.
- McIntyre, E. (2007). Story discussion in the primary grades: Balancing authenticity and explicit teaching. *The Reading Teacher*, 60(7), 610–620.
- McKeown, M. G., & Beck, I. L. (1999). Getting the discussion started. *Educational Leadership*, 57(3), 25–28.
- Mehan, H. (1979). *Learning lessons: Social organization in the classroom*. Cambridge, MA: Harvard University Press.
- Mercer, N. (1995). *The guided construction of knowledge: Talk among teachers and learners*. Clevedon, UK: Multilingual Matters.
- Mercer, N. (2000). *Words and minds*. London: Routledge.
- Mercer, N. (2004). Sociocultural discourse analysis: analysing classroom talk as social mode of thinking. *Journal of Applied Linguistics*, 1(2), 137–168.
- Mercer, N. (2008). Talk and the development of reasoning and understanding. *Human Development*, 51(1), 90–100.
- Mercer, N., & Dawes, L. (2008). The value of exploratory talk. In N. Mercer & S. Hodgkinson (Eds.), *Exploring talk in school* (pp. 55–71). London: Sage.
- Mercer, N., Dawes, L., & Staarman, J. K. (2009). Dialogic teaching in the primary science classroom. *Language and Education*, 23(4), 353–369.
- Mercer, N., & Howe, C. (2012). Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory. *Learning, Culture and Social Interaction*, 1(1), 12–21.
- Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. London: Routledge.
- Metsäpelto, R.-L., Vasalampi, K., Poikkeus, A.-M., Lerkkanen, M.-K., Salminen, J., & Mäensivu, M. (2017). Opettajien kokemuksia dialogisen opetuksen toteuttamisesta perusopetuksessa. *Kasvatus*, 48(1), 6–20.
- Michaels, S. & O'Connor, M. C. (2011). *Coding guide for teacher talk moves*. [Coding manual]. Unpublished Instrument. Pittsburgh, PA: Pittsburgh Science of Learning Center.
- Mullola, S. (2012). *Teachability and school achievement—Is student temperament associated with school grades?* (Doctoral dissertation). Research Report 341, Department of Teacher Education, University of Helsinki.
- Muthén, L. K., & Muthén, B. O. (1998–2012). *Mplus User's Guide*. (7th ed). Los Angeles, CA: Muthén & Muthén.
- Myhill, D. (2006). Talk, talk, talk: Teaching and learning in whole class discourse. *Research Papers in Education*, 21(1), 19–41.
- Nassaji, H., & Wells, G. (2000). What's the use of 'triadic dialogue'? An investigation of teacher-student interaction. *Applied Linguistics*, 21(3), 376–406.
- National Advisory Board on Research Ethics. (2009). *Ethical principles of research in the humanities and social and behavioural sciences and proposals for ethical*

- review. Retrieved from <http://www.tenk.fi/sites/tenk.fi/files/ethical-principles.pdf>
- Nystrand, M. (1997). *Opening dialogue. Understanding the dynamics of language and learning in the English classroom*. New York, NY: Teachers College Press.
- Nystrand, M., & Gamoran, A. (1991). Instructional discourse, student engagement, and literature achievement. *Research in the Teaching of English*, 25(3), 261-290.
- Nystrand, M., Wu, L. L., Gamoran, A., Zeiser, S., & Long, D. A. (2003). Questions in time: investigating the structure and dynamics of unfolding classroom discourse. *Discourse Processes*, 35(2), 135-198.
- O'Connor, C., Michaels, S., Chapin, S., & Harbaugh, A. (2017). The silent and the vocal: Participation and learning in whole-class discussion. *Learning and Instruction*, 48, 5-13.
- Ouakrim-Soivio, N. (2013). *Toimivatko päättöarvioinnin kriteerit? – Oppilaiden saamat arvosanat ja Opetushallituksen oppimistulosten seuranta-arviointi koulujen välisten osaamiserojen mittareina (Raportit ja selvitykset 2013:9)*. [Do the Criteria for Final Assessment Function? Students' Grades and the Evaluation Conducted by the National Board of Education as Indicators of Differences between Schools.]. Helsinki: Finnish National Board of Education.
- Pakarinen, E., Kiuru, N., Lerkkanen, M.-K., Poikkeus, A.-M., Ahonen, T., & Nurmi, J.-E. (2011). Instructional support predicts children's task avoidance in kindergarten. *Early Childhood Research Quarterly*, 26(3), 376-386.
- Pakarinen, E., Lerkkanen, M.-K., Poikkeus, A.-M., Kiuru, N., Siekkinen, M., Rasku-Puttonen, H., & Nurmi, J. (2010). A validation of the classroom assessment scoring system in Finnish kindergartens. *Early Education and Development*, 21(1), 95-124.
- Pakarinen, E., Lerkkanen, M.-K., Poikkeus, A.-M., Salminen, J., Silinskas, G., Siekkinen, M., & Nurmi, J.-E. (2017). Longitudinal associations between teacher-child interactions and academic skills in elementary school. *Journal of Applied Developmental Psychology*, 52, 191-202.
- Palinscar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, 2, 117-175.
- Pantaleo, S. (2007). Interthinking: Young children using language to think collectively during interactive read-alouds. *Early Childhood Education Journal*, 34(6), 439-447.
- Peisner-Feinberg, E., Burchinal, M., Clifford, R., Culkin, M., Howes, C., Kagan, S., & Yazejian, N. (2001). The relation of preschool child-care quality to children's cognitive and social development trajectories through second grade. *Child Development*, 72(2), 1534-1553.
- Phillipson, N., & Wegerif, R. (2017). *Dialogic education: Mastering core concepts through thinking together*. New York, NY: Routledge.

- Pianta, R. C., Hamre, B. K., & Mintz, S. (2012). *Classroom Assessment Scoring System-Secondary (CLASS-S)*. Charlottesville, VA: University of Virginia.
- Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008a). *The Classroom Assessment Scoring System (CLASS). Manual Pre-K*. Baltimore: Brookes.
- Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008b). *The Classroom Assessment Scoring System (CLASS). Manual, K-3*. Baltimore: Brookes.
- Praetorius, A. K., Lenske, G., & Helmke, A. (2012). Observer ratings of instructional quality: Do they fulfill what they promise? *Learning and Instruction, 22*(6), 387-400.
- Rasku-Puttonen, H. (2008). Oppilaiden osallisuus kouluyhteisössä. In M. Lairio, H., L., T. Heikkinen, & M. Penttilä (Eds.) *Koulutuksen kulttuurit ja hyvinvoinnin politiikat* (pp. 155-171). Turku, Finland: Suomen kasvatustieteellinen seura.
- Rasku-Puttonen, H., Eteläpelto, A., Arvaja, M., & Häkkinen, P. (2003). Is successful scaffolding an illusion? - Shifting patterns of responsibility and control in teacher-student interaction during a long-term learning project. *Instructional Science, 31*(6), 377-393.
- Rasku-Puttonen, H., Lerkkanen, M-K., Poikkeus, A.-M., & Siekkinen, M. (2012). Dialogical patterns of interaction in preschool classrooms. *International Journal of Educational Research, 53*, 138-149.
- Resnick, L. B. (2015). Talking to learn: the promise and challenge of dialogic teaching. In L. B. Resnick, C. S. C. Asterhan, & S. N. Clarke (Eds.), *Socializing intelligence through academic talk and dialogue* (pp. 441-450). Washington, DC: AERA.
- Resnick, L. B., Asterhan, C. S. C., & Clarke, S. N. (2015). Talk, learning and teaching'. In L. B. Resnick, C. S. C. Asterhan, & S. N. Clarke (Eds.), *Socializing intelligence through academic talk and dialogue* (pp. 1-12). Washington, DC: AERA.
- Reznitskaya, A., Anderson, R., McNurlen, B., Nguyen-Jahiel, K., Archodidou, A., & Kim, S. (2001). Influence of oral discussion on written argument. *Discourse Processes, 32*(2-3), 155-175.
- Rogoff, B. (2008). Observing sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. In P. Murphy, K. Hall, & J. Soler (Eds.), *Pedagogy and practice: Culture and identities* (pp. 58-74). Los Angeles, CA: Sage.
- Rojas-Drummond, S., & Mercer, N. (2003). Scaffolding the development of effective collaboration and learning. *International Journal of Educational Research, 39*(1-2), 99-111.
- Rojas-Drummond, S., Torreblanca, O., Pedraza, H., Vélez, M., & Guzmán, K. (2013). 'Dialogic scaffolding': Enhancing learning and understanding in collaborative contexts. *Learning, Culture and Social Interaction, 2*(1), 11-21.
- Salisbury, J. (2012). Vocational education and training: Sites for qualitative study. In S. Delamont (Ed.), *Handbook of qualitative research in education* (pp. 143-156). Cheltenham, UK: Edward Elgar Publishing.

- Sawyer, R. K. (2007). *Group genius: The creative power of collaboration*. New York, NY: Basic Books.
- Scardamalia, M. (2002). Collective cognitive responsibility for the advancement of knowledge. In B. Smith (Ed.), *Liberal education in a knowledge society* (pp. 67–98). Chicago, IL: Open Court.
- Scott, P. H., Mortimer, E. F. & Aguiar, O. G. (2006). The tension between authoritative and dialogic discourse: A fundamental characteristic of meaning making interactions in high school science lessons. *Science Education*, 90(4), 605–631.
- Sinclair, J., & Coulthard, R. (1975). *Towards an analysis of discourse: The English used by teachers and pupils*. London: Oxford University Press.
- Skidmore, D., & Murakami, K. (2016). *Dialogic pedagogy: The importance of dialogue in teaching and learning*. Bristol, UK: Multilingual Matters
- Stahl, G. (2000). A model of collaborative knowledge-building. In B. Fishman & S. O'Connor-Divelbiss (Eds.), *Proceedings of the Fourth International Conference of the Learning Sciences* (pp. 70–77). Mahwah, NJ: Erlbaum.
- Statistics Finland. (2007). Statistical database. Available online at http://www.stat.fi/tup/tilastotietokannat/index_en.html
- Underwood, J., & Underwood, G. (1999). Task effects in co-operative and collaborative learning with computers. In K. Littleton, & P. Light (Eds.), *Learning with computers: Analysing productive interaction* (pp. 10–23). London: Routledge.
- Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher-student interaction: A decade of research. *Educational Psychology Review*, 22, 271–297.
- Van de Pol, J., Volman, M., & Beishuizen, J. (2012). Promoting teacher scaffolding in small-group work: A contingency perspective. *Teaching and Teacher Education*, 28(2), 193–205.
- Van der Veen, C., de Mey, L., van Kruistum, C., & van Oers, B. (2017). The effect of productive classroom talk and metacommunication on young children's oral communicative competence and subject matter knowledge: An intervention study in early childhood education. *Learning and Instruction*, 48, 14–22.
- Van der Veen, C., & van Oers, B. (2017). Advances in research on classroom dialogue: learning outcomes and assessments. *Learning and Instruction*, 48, 1–4.
- Vauras, M., Kinnunen, R., Kajamies, A., & Lehtinen, E. (2013). Interpersonal regulation in instructional interaction: A dynamic systems analysis of scaffolding. In S. Volet & M. Vauras (Eds.) *Interpersonal regulation of learning and motivation: Methodological advances*, pp. 125–146. New perspectives on learning and instruction. New York, NY: Routledge.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Webb, N. M., Franke, M. L., De, T., Chan, A. G., Freund, D., Shein, P., & Melkonian, D. (2009). "Explain to your partner": Teachers' instructional

- practices and students' dialogue in small groups. *Cambridge Journal of Education* 39(1), 49-70.
- Wegerif, R., Mercer, N., & Dawes, L. (1999). From social interaction to individual reasoning: An empirical investigation of a possible socio-cultural model of cognitive development. *Learning and Instruction*, 6, 493-516.
- Wells, G. (1999). *Dialogic inquiry: Towards a socio-cultural practice and theory of education*. Learning in Doing: Social, Cognitive and Computational Perspectives. Cambridge: Cambridge University Press.
- Wells, G. (2007). Who we become depends on the company we keep and on what we do and say together. *International Journal of Educational Research*, 46 (3-4), 100-103.
- Wells, G. (2009). Instructional Conversation in the Classroom: Can the Paradox be Resolved? Retrieved from https://people.ucsc.edu/~gwells/Files/Papers_Folder/documents/ICAERA09.pdf
- Wolf, M., Crosson, A., & Resnick, L. (2006). *Accountable talk in reading comprehension instruction*. CSE technical report 670. Pittsburgh, PA: University of Pittsburgh: Learning and Research Development Center.
- Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, 17, 89-100.
- Wood, D., & Wood, H. (1996). Commentary: Contingency in tutoring and learning. *Learning and Instruction*, 6, 391-397.

ORIGINAL PAPERS

I

SCAFFOLDING THROUGH DIALOGIC TEACHING IN EARLY SCHOOL CLASSROOMS

by

Heli Muhonen, Helena Rasku-Puttonen, Eija Pakarinen,
Anna-Maija Poikkeus, & Marja-Kristiina Lerkkanen, 2016

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Scaffolding through dialogic teaching in early school classrooms



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HIGHLIGHTS

- Two teacher- and two child-initiated dialogic teaching patterns were identified.
- Teacher-initiated dialogues involved intended scaffolding and clear learning goals.
- In child-initiated dialogues teachers' scaffolding included listening and inquiry.
- Quality of scaffolding was linked with shared content understanding.
- Activeness of scaffolding promoted children's active participation.

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ABSTRACT

The present study examines what types of dialogic teaching patterns can be identified in the early school years, and how teachers scaffold children's participation and shared understanding through dialogic teaching. Thirty recorded lessons from preschool to Grade 2 in Finnish classrooms were analysed using qualitative content analysis. Two teacher-initiated and two child-initiated dialogic teaching patterns were identified. Teacher's scaffolding in teacher-initiated dialogues was characterised by high responsibility in maintaining the interactional flow and utilisation of diverse strategies. In the child-initiated dialogues, the teachers' scaffolding consisted of listening and inquiry, and the teacher thus served more as a facilitator of dialogue.

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1. Introduction

The current views of learning emphasise the development of knowledge and understanding through talk and inquiry (Wells, 2007). While the quality of classroom educational dialogue is acknowledged to be critical for fostering deep learning and shared understanding among students of any age, dialogic exchanges take place very infrequently in most classrooms (Howe & Abedin, 2013). In addition, the literature on successful teacher strategies for facilitating dialogic interactions is scant.

Classrooms with high-quality instructional interactions are characterised by high levels of scaffolding and support for learning

and thinking on the part of the teacher (Yates & Yates, 1990). The teacher plays a key role both in creating opportunities for students' conceptual development and participation through inquiry, open questions, answers and feedback, and in assisting students in explaining their own thinking, seeking consensus and solving problems together (Gillies, 2013; Gillies, Nichols, Burgh & Haynes, 2012; LaParo, Pianta, & Stuhlman, 2004). In line with Rogoff's conceptualisation (2008), we use the term 'scaffolding' to refer to the practise of providing students with support for meaning-making and independent thinking. In order to become active learners, the teacher needs to support children by fostering classroom dialogue which allows them to build on each other's ideas (Littleton & Mercer, 2010). The teacher's role is, thus, that of a facilitator of guided participation (Rogoff, 1990) where children assume active roles through their participation in meaningful activities assisted or supported by adults.

However, surprisingly little is known about the concrete

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teaching practises that facilitate high-quality classroom dialogue in different age groups, especially among younger children. Empirical studies on the dialogic interactions taking place in the early school years are scant; slightly more information in the literature is available from the secondary school years (e.g., Lehesvuori, Viiri, Rasku-Puttonen, Moate, & Helaakoski, 2013; Littleton & Mercer, 2010). Thus, the present study focuses on preschool and the first two years of primary school to examine what kinds of strategies teachers use when scaffolding children's participation and shared understanding through dialogic teaching.

1.1. Sociocultural approach and scaffolding

Vygotsky's Sociocultural Theory (1978) emphasises the importance of social interactions for development and learning, and the central role of language as both a cultural mediator and a tool for thinking. Vygotsky did not actually use the term 'scaffolding', which is often linked with his concept of the 'zone of proximal development' (ZPD; 1978). According to Vygotsky, it is highly informative to find out not only what students can do on their own, but to discover what they can do with the help of a more knowledgeable partner. Several researchers have used the term 'scaffolding' (first introduced by Wood, Bruner, & Ross, 1976) to describe the process in which a teacher, a coach or a more experienced peer supports a child's learning with an interactional framework. In instructional scaffolding, the teacher may, for instance, guide the student's language learning and construction of the ideas and concepts by leading or asking probing questions that build or elaborate on the knowledge that the learner already possesses (Applebee & Langer, 1983).

In the current research literature, 'scaffolding' has often been used as a synonym for the support provided to learners (Mercer & Littleton, 2007). Van de Pol, Volman, and Beishuizen (2010) suggest that scaffolding consists of three main domains: 1) *contingency*, which includes tailored, responsive and adjusted support; 2) *fading*, which refers to the gradual withdrawal of the support over time and 3) *transfer of responsibility*, meaning that the teacher eventually transfers the responsibility of performing the task to the student. There is widespread agreement on the crucial role of scaffolding in different educational contexts, including in distributed cognition (Cole & Engeström, 1993), various domains of knowledge (e.g., Palinscar & Brown, 1984; Rojas-Drummond, Hernández, Vélez, & Villagrán, 1998) and in both whole classrooms and small-group interactions (Elbers, 1996; Rojas-Drummond & Mercer, 2003).

Since language plays a key role in children's cognitive development, the dialogue between teacher and student can be seen as a form of scaffolding (Sedova, Salamounova, & Svaricek, 2014) and a key part of the process of 'handing over' knowledge and skills (Wolfe & Alexander, 2008). Recent research has highlighted the key role of dialogic interactions between teachers and students in students' learning, development and reasoning (e.g., Littleton & Howe, 2010; Mercer & Littleton, 2007). Teachers can also use dialogue for scaffolding students' peer group interactions and talk (Fernández, Wegerif, Mercer, & Rojas-Drummond, 2001; Howe, 2010). Scaffolding through dialogue allows students to develop ideas they most likely would not have had on their own, while still being able to recognise them as the result of their own thinking (Game & Metcalfe, 2009).

1.2. Dialogic teaching

Various terms have been used to refer to different forms of educational dialogue or teaching, including dialogic teaching (Alexander, 2008), dialogic inquiry (Wells, 1999) and dialogical pedagogy (Skidmore, 2006). Researchers studying classroom talk

are particularly interested in the nature, quality and facilitating structures of productive educational dialogues (Littleton & Howe, 2010). The meanings of the abovementioned terms are considered to be very similar. The present study draws from some of the key principles of dialogic teaching described by Alexander to demarcate the characteristics of classroom interaction.

According to Alexander (2000), dialogic teaching harnesses the power of talk to stimulate and develop students' thinking, learning and understanding. Alexander (2006) defines 'dialogic interactions' as exchanges where students ask questions, explain their points of views and make comments about each other's ideas. The crux of dialogue is to exchange ideas that prompt further questions. Alexander proposed the following five key principles for identifying the features of dialogic teaching: 1) collective (teachers and children address learning tasks together as a small group or as a whole classroom); 2) reciprocal (teachers and children listen to each other, share ideas and consider alternative viewpoints); 3) supportive (children articulate their ideas freely and without fear of embarrassment and they help each other to reach shared understanding); 4) cumulative (teachers and children build on their own and each other's ideas and link them into coherent lines of thinking and enquiry) and 5) purposeful (teachers plan and steer classroom talk with specific educational goals in mind). He divides these principles into two groups where the first three principles are seen to describe the form of discourse, whereas the last two principles describe the content.

Lefstein (2006) has suggested two more criteria as important features of dialogic teaching: dialogue should also be critical (participants identify and investigate points and explore questions inside the group) and meaningful (teachers and students relate to the topic and bring their own horizons to the discussion). A number of other researchers have also described the indicators of dialogic teaching. According to Reznitskaya, Kuob, Clark, and Millerd (2009), teachers should 1) provide their students with a shared responsibility for discussion; 2) ask challenging and open questions and 3) provide feedback that will prompt further exploration. The teacher should also connect the teaching to students' ideas, request explanations for ideas and support collaboration. In addition, dialogic teaching has been linked to the fostering of collaborative interaction through classroom exploratory talk (Mercer & Dawes, 2008), working with mistakes (Myhill & Warren, 2005), nurturing students' questions (Nystrand, Wu, Gamoran, Zeiser, & Long, 2003) and using heteroglossia as a discursive voice (Mesa & Chang, 2010). However, researchers should be critical in their idealistic thinking on the power of dialogue in classrooms. This kind of idealism can promote a situated approach to dialogue, sensitive to the tensions inherent in dialogic interaction and grounded in the realities of the school's context (Lefstein, 2010).

1.3. Scaffolding in dialogic teaching

In order to engage all students in a classroom in exploratory behaviour teachers typically need to provide encouragement by asking the children thought-provoking questions and allowing them to share their knowledge and experiences (King, 2002). According to Chinn, O'Donnell, and Jinks (2000), students participate and engage in high-quality classroom dialogue only if they are specifically asked to give reasons and justifications for their conclusions. Alexander (2000) proposes a definition of scaffolded dialogue, which refers to achieving common understanding through structured and sequenced questioning, and through 'joint activity and shared conceptions'. Alexander's conceptualisation of scaffolding thus involves guiding and prompting students with reduced choices, which expedites the transfer of concepts and principles. This conceptualisation can also be seen as problematic

in terms of building student autonomy and agentic action. Dialogue in the school is typically strongly guided by predetermined learning objectives and contents (Lefstein, 2006), which may leave little space for joint goal setting and shared construction of ideas among the students. As a result, students must follow the lead set by an authority (i.e. the teacher or more experienced peers). According to Lyle (2008), the role of dialogue in students' learning is more than simply promoting better thinking and raising standards; it has the potential to enable students' voices to be accessed and legitimised. When examining teachers' means of scaffolding young children's participation during preschool and primary school, Hännikäinen and Rasku-Puttonen (2010) stressed that one key method for enhancing children's participation is for teachers to convey their respect for children as worthy members of a community by listening to their proposals, posing questions and expressing interest in their views and experiences of the world. In the present study, the term scaffolding is used to refer to the process of supporting the two intertwined aspects of educational classroom dialogue: children's active participation in classroom talk and shared understanding. In our view support for children's active participation is a prerequisite for shared understanding, which, in turn, is associated with children's learning. By children's participation we mean active participation in joint activities and classroom talk which are targeted at sharing ideas and experiences and exploring and challenging each other's understanding.

An initiation-response-feedback pattern (IRF) (Sinclair & Coulthard, 1975), in which the teacher provides an initiation, the students respond and the teacher gives feedback, is a dominant script in many classroom interactions (Wells & Arauz, 2006). This can be seen as the most common (and, typically, rather perfunctory) way of scaffolding students' participation and understanding through interaction. In 'spiral' or 'cyclical' IRF sequences, the teacher capitalises on students' responses or initiations in order to continue classroom talk and to create a learning context for the joint construction of ideas (Edwards & Mercer, 1987). Teachers can use students' initiations for guiding students' understanding by using follow-up questions, clues, elaborations, reformulations, confirmations or recaps to build a continuum of thoughts in which students remain active (Rasku-Puttonen, Eteläpelto, Häkkinen, & Arvaja, 2002; Joiner, Littleton, Faulkner, & Miell, 2000; Murphy, 2008).

The construction of classroom talk that is both dialogic and open requires careful planning and a structure in which learning goals are clearly identified (Gillies, 2015). Gillies (2015) examined how teachers engaged in dialogic teaching and provided examples of dialogic interactions that students consequently used when working cooperatively together. The teachers, who had participated in a workshop on dialogic teaching, listened attentively to the students' questions and challenged and probed their thinking, while providing them with enough time to respond. The teachers also scaffolded their students' thinking by helping and encouraging them to connect prior information to the current topic, focus their attention on the main points and explicate their thinking and reasoning processes.

Other studies have examined teachers' scaffolding of dialogic talk in primary school lessons. For example, Reznitskaya et al. (2009) conducted a longitudinal study on using dialogic group discussions, whereas Haworth (2010) conducted a small-scale research study that attempted to disentangle the dialogic and monologic threads in teachers' talking with third graders. The existing evidence, however, indicates that student talking in the classroom often fails to involve challenges or provide evidence of what Habermas (1991) referred to as 'communicative rationality' (Fisher, 2003, 2005). More fine-grained studies that look at the concrete elements of scaffolding are thus needed to inform

educators about the means of fostering effective classroom dialogue that will support students' participation and shared understanding.

1.4. Aims of the present study

The aim of the present study is to investigate the ways in which teachers scaffold children's participation and shared understanding in terms of dialogic teaching in the early school years. Specifically, we attempt to answer the following research questions:

1. What kinds of dialogic teaching patterns can be identified in early school classrooms' literacy, science and mathematics lessons?
2. What kinds of strategies do teachers use when scaffolding children's participation and shared understanding through dialogic teaching in the classroom?

2. Methodology and methods

2.1. Education in Finland

In Finland, compulsory nine-year education starts the year a child turns seven, but it is preceded by mandatory attendance in preschool at age six. The preschool is arranged in day care centres or in school settings. Preschool teachers must have at least a bachelor's degree in education while primary school teachers must have a master's degree. The national curriculum emphasises the significance of children's active learning and the importance of social interaction groups and shared classroom interactions in both pre- and primary school. While studying in preschool is conducted through integrated thematic learning activities, studying in primary school takes place in subject-specific lessons.

2.2. Participants and procedure

The present study was drawn from Finnish preschool, Grade 1 and Grade 2 classrooms (6–8-year-olds). The children represent a subsample of a large population-based follow-up study of learning and motivation (Lerkanen et al., 2006) of 2000 children, their parents and teachers from three municipalities located in different areas of Finland. The teachers and parents gave their written consent for their own and their child's participation in the study. The backgrounds of the parents represent the general Finnish population. In all classrooms, Finnish was used as the language of instruction. There were 10 children in the groups in preschool classrooms and 18 children in the primary school classrooms on average.

Table 1 represents the selection procedure of the lessons included in the analysis. The bigger data pool, collected in 2007–2009, consisted of live observations of preschool and primary classrooms. The teachers were selected for the live observations on a voluntary basis. Data of the present study consisted of lessons which were also audio- or video-recorded at the live observations. In the preschool, recordings were available for two separate learning sessions for each of the eight preschool teachers (a total of 16 sessions). In the primary school, nine teachers who had recordings at all three observation time points (Grade 1 autumn and spring and Grade 2 spring) were selected. The recordings of the primary school teachers varied from two to four lessons at each of the three observation times (a total of 70 lessons). At this stage of the sample selection, a total of 86 lesson recordings (preschool and primary school classrooms) were available. In order to identify those classroom sessions with the highest likelihood of containing dialogic exchange, a further selection was made for the

Table 1
Selection procedure of the lessons included in the analysis.

Classrooms, teachers or lessons at each selection stage	T1 Preschool spring 2007	T2 Grade 1 fall 2007	T3 Grade 1 spring 2008	T4 Grade 2 spring 2009	Total
Classrooms with live observations (including CLASS ratings)	49	16	33	21	119
Teachers with video or audio recordings (simultaneously with live observations)	8 ^a	9 ^b	9 ^b	9 ^b	17
Number of lesson recordings	16	34 ^c		36	86
Recordings of lessons with at least one CLASS cycle rated as showing moderate- or high-quality support	7	12		11	30

Notes:

^a There were 2 video- or audio-recorded learning sessions available for each preschool teacher.

^b Only those Grade 1 and 2 teachers were selected who had 2 to 4 video or audio recordings on all three time points T2, T3 and T4.

^c The total number of lesson recordings of the 9 teachers at Grade 1 fall and spring.

present analyses based on the classroom teacher–child interaction quality, as assessed by the live Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008a, 2008b) codings for each lesson.

2.3. Classroom observations

The teacher–child interaction quality was assessed by using the Classroom Assessment Scoring System (CLASS Pre-K or K-3; Pianta et al., 2008a, 2008b). The live codings took place in cycles of 20 min of observation, and a 5–10-min period was used for assigning the codes. A typical 45-min lesson thus provided two coding cycles. Each classroom was observed on two different days (a total of 6–12 cycles per classroom). All lessons were coded by two independent, trained observers, who assigned their CLASS ratings independently of each other (for details, see Pakarinen et al., 2010). The inter-rater reliabilities between the two observers in preschool varied between .76 and .96, in Grade 1 between .69 and .96 (autumn and spring combined) and in Grade 2 between .79 and .91.

The CLASS includes 10 observable dimensions measuring three broader domains of classroom quality: emotional support (four dimensions), classroom organisation (three dimensions) and instructional support (three dimensions). Each dimension was rated on a 7-point scale measuring the teacher–child interaction quality: low (1–2), moderate (3–5) or high (6–7). In order to be able to identify the scaffolding strategies used in classroom episodes involving dialogic interaction, the selection of video and audio recordings was restricted to teachers with observed cycles with moderate- or high-quality CLASS ratings of instructional support (ratings 5, 6 or 7). Based on this criterion, the sample pool was comprised of recordings of eight preschool classrooms and five primary school classrooms. From these classrooms, the lessons that had at least one cycle with high or moderate quality of instructional support were selected for the analyses based on the assumption that they would potentially contain frequent exchanges between the teachers and the children. Based on this criterion, the final data for the analyses consisted of 30 recordings (see Table 1).

2.4. Data analysis

There were three major phases during the analysis of the 30 transcribed lessons:

- 1) Identifying dialogic teaching episodes.
- 2) Dividing the identified dialogic teaching episodes into two types of dialogic teaching patterns in line with earlier findings of typical preschool classroom dialogue (Rasku-Puttonen, Lerkkanen, Poikkeus, & Siekkinen, 2012) indicating a qualitative difference between teacher- and child-initiated patterns.

- 3) Analysing the dialogic teaching patterns with respect to functions of talk in order to identify different scaffolding strategies.

2.4.1. Identifying dialogic teaching episodes

The first step of the analysis consisted of a careful review of the transcribed lessons. This meant reading the transcribed lessons several times in order to identify possible dialogic teaching episodes and to determine their boundaries. A dialogic teaching episode was identified as an extended exchange in which the topic continued essentially unchanged between the teacher and child or between children and which manifested three of the five principles of dialogic teaching described by Alexander (2006): purposefulness (teachers plan and steer classroom talk with specific educational goals in mind), collectiveness (teachers and children address learning tasks together as a small group or as a the whole classroom) and reciprocity (teachers and children listen to each other, share ideas and consider alternative viewpoints).

The other two principles, supportiveness and cumulateness (Alexander, 2006), were not considered critical nor feasible for the purposes of the present study which focused on scaffolding of dialogue among relatively young children (6–8-year-olds). The analyses indicated that direct evidence of the extent to which children felt supported and safe would be difficult to extract reliably from the transcripts at the episode level; however, the fact that children offered ideas and shared their opinions was an indirect sign of students' experiences of safety and supportiveness in the classroom. In a similar vein, the cumulateness of talk would not always be directly observable within each single episode because the discussions could be relatively short and not necessarily planned ahead, and teacher support could be quite minor. Because the focus of the study was on dialogic teaching episodes, classroom activities that did not contain elements of formal or informal learning tasks or exchanges between teacher and children (e.g., routines, individual tasks) were excluded from the analysis.

2.4.2. Division into two types of dialogic teaching patterns

The features of the interaction patterns identified in preschool classrooms in a previous study conducted by Rasku-Puttonen et al. (2012) were used as a starting point for the categorisation of the dialogic teaching episodes in the present analyses. In that study, three types of patterns were identified: in pattern 1, teachers provided children with opportunities to demonstrate knowledge and competence through question-answer sequences (presenting the IRF pattern without extended follow-up); in pattern 2, teachers supported children's participation and diverse contributions; and in pattern 3, teachers allowed space for child-initiated sharing of ideas. In the present study, pattern 1 (the IRF pattern) was not included in the analysis because the focus was on patterns that manifested dialogic teaching characteristics. In line with the former study,

dialogic teaching episodes were divided into two main patterns according to whether they represented teacher support or whether the children had space for their initiatives: *teacher-initiated dialogue* (pattern 2) and *child-initiated dialogue* (pattern 3). In teacher-initiated dialogues, the teacher actively supported children's participation and diverse contributions throughout the dialogue, whereas a child-initiated dialogue evolved as the teacher allowed space for children to share their ideas, but encouraged children's exchanges and maintained the cohesion of the discourse, if needed.

2.4.3. Analysing functions of talk to identify dialogic scaffolding strategies

In the next step of the analysis, the dialogic episodes that had been divided into teacher- and child-initiated dialogues were further analysed according to functions of talk. The purpose of this phase of the analysis was to extract strategies that teachers used to scaffold children's active participation and shared understanding through talk. Although special attention was paid to teachers' lines, children's lines were also included in the analysis. A unit of analysis was a single word, a sentence or sentences where the function of talk was clearly identifiable. As presented in the following examples, the functions consisted of various initiatives, responses, elaborations, feedback, expansions, generalisations, argumentative comments and summaries. An example is as follows:

Teacher: 'What do you see here on the table?' [inquiry]

Child: 'A telescope'. [factual answer]

Teacher: 'Yes, it's my grandfather's old telescope'. [prop and expansion]

Child: 'We have the same kind of a telescope at home'. [sharing experience]

Teacher: 'Oh really? And for what reason do you use your telescope?' [expansion and a follow-up question]

Child: 'Hmm, at least when it's dark outside and my dad wants to see stars'. [elaboration and sharing more information of an experience]

Special attention was also paid to different types of inquiries and questions posed by teachers. They were coded regarding whether they were open or closed, clarifying or expanding, practical and based on experience or abstract, examples of which include the following: 'What breed is your dog?' (closed and practical) and 'Do you know any other dog breeds?' (open, expanding and practical). 'Oh, you have a terrier. What type of a terrier is it?' (closed, clarifying and practical) and 'Does anyone have any idea what kind of food terriers or other small dogs might eat?' (open, expanding and abstract). Special attention was paid to inquiries and questions, because posing questions is one of the most common forms of exchanges in teacher–child interaction during teaching.

In all main phases of the analysis, we applied researcher triangulation within the research team to discuss the interpretations, and we re-examined the findings if consensus was not reached (Cohen, Manion, & Morrison, 2007). Ambiguities were acknowledged, identified and discussed among the research group.

3. Results

3.1. Patterns of dialogic teaching

The first aim of the study was to identify what kind of dialogic teaching patterns can be found in preschool and Grade 1 and 2 lessons. Overall, interaction in the classrooms in the present data

could be described as the transmission of information from teachers to children. The most typical forms of teacher–child interaction were the aforementioned initiation–response–feedback (IRF) exchanges that occurred in almost every documented lesson. Dialogic teaching episodes occurred significantly less often. In total, we identified 28 dialogic teaching episodes, of which 18 represented teacher-initiated patterns (pattern 2) and 10 represented child-initiated patterns (pattern 3). Seven of the dialogic teaching episodes were from preschool data (three representing pattern 2 and four representing pattern 3), nine from Grade 1 data (eight representing pattern 2 and one representing pattern 3) and twelve from Grade 2 data (seven representing pattern 2 and five representing pattern 3). The identified episodes included literacy, science and mathematics lessons.

In the next step, based on the analysis at the level of functions, we identified sets of functions in both teacher's and children's talk. Analysis of functions identified in teacher's talk (e.g., types of questions and prompts, extensions, summarising comments, confirmations) led further to identification of scaffolding strategies that teachers used to support children's active participation and shared understanding. The teacher's scaffolding strategies and the ways in which children's participated in the interaction implicated a further division into two sub-patterns for both patterns 2 and 3. As described in more detail below, the sub-patterns within each pattern were distinguished from each other by differences with respect to moderate or high quality of teacher scaffolding. The category that was seen as representing a higher quality of scaffolding (sub-patterns 2b and 3b) included versatile and rich participatory strategies that were likely to support children's conceptual thinking, joint understanding and synthesis of ideas and insights that had been shared (e.g., the teacher tended to ask open-ended rather than closed questions, to extend children's ideas or prompt for varied ideas, to relate own comments to children's experiences and to summarise the accumulated knowledge). The category of moderate-quality scaffolding contained more unitary forms of questioning and less support for active participation (e.g., in sub-pattern 2a asking closed or too abstract questions), and lower support for shared content understanding (e.g., in sub-pattern 3a asking few clarifying follow-up questions and few or none summaries of the main content of interest). Dialogic teaching episodes representing a teacher-initiated pattern were divided into sub-pattern groups 2a and 2b, and dialogic teaching episodes representing a child-initiated pattern were divided into sub-pattern groups 3a and 3b.

3.1.1. Teacher-initiated patterns

3.1.1.1. Pattern 2a: teacher-initiated teaching dialogue of moderate quality. Of the nine episodes that represented teacher-initiated pattern 2a, four were from literacy lessons, one from science lessons and four from mathematics lessons. These episodes were characterised by a high extent of prior planning on the part of the teacher (e.g., preparation of materials or goal-directed inquiry), and initiatives and involvement during the conversation to encourage children to share their knowledge, ideas and experiences. In this sub-pattern, the teachers typically asked a large number of short and closed questions to encourage as many children as possible to participate and to keep the dialogue moving along. Every episode included at least a few questions targeting a conceptual level; in some episodes, the majority of the teacher's questions were at this level. Questions formed chains of cumulative, coherent lines of shared experiences and opinions, but the dialogue lacked open, deep exchanges of thoughts.

In addition to asking questions, teachers made expansions and clarifications related to the children's comments; near the end of each episode, the teacher could draw together the main ideas and

Example 1

Teacher-initiated teaching dialogue of moderate quality (pattern 2a): Planting seeds.

Context: In the beginning of the lesson, the teacher reviewed what had been learned in prior lessons on the growth of plants by using an IRF pattern: Where do flowers and plants get water? Where do the roots get water? What else does the plant get from the soil besides water?

Teacher: The next topic that we are going to study is how to grow a plant from a seed. There are different sizes of seeds, and this time I selected this mysterious-looking bag of mixed seeds. So there will be different colours of flowers. This one is called a 'sweet pea'. You can grow it in a pot. Does anyone know what to do with it when summer comes? Where can you move or put it? (...) Sally?

Child: In the sun.

Teacher: And ...

Child: Outside.

Teacher: Yes, outside (.) because it can grow even more and because it is (.) a sweet pea it has this nice perfume scent. Since there are mixed seeds in the bag, the colour each of you will get to grow will be a surprise.

Child: Does everyone get his/her own or do we do it as a group?

Teacher: Everyone gets their own seed to grow.

Child: Yeah (*children whispers*).

Teacher (*Points at a watering can*): Why do you think you need to do this? Molly?

Child: So that they will grow.

Teacher: Yes, and what are these? Anna?

Child: Flower seeds. They become flowers.

Teacher: Yes and these seeds are a bit special because they have this hard coat. The directions said that you need to soak them in water overnight. So in order for us to be able to plant them today, I let them soak overnight. What do you think happened to the seed last night when it was in the water?

Child: I know, I know, I know.

Teacher: Arthur?

Child: It gets softer.

Teacher: Yes (.) Well, what do you think, what gets easier when the coat of the seed is softer?

Teacher: Well, the beginning of the growing process gets easier. And you know what? Another way would have been to use a piece of sandpaper and to make the coat a little bit thinner. That way the growing is easier. But because I didn't have sandpaper I thought it would be better for us to soak the seeds. When you get those two or three seeds, will you put them just anywhere in the jar? How will you plant them? Sue?

Child: I would plant the whole thing.

Teacher: But in which part of the jar would you plant it? Alice?

Child: Well, I would plant them a bit farther away from each other so that they wouldn't grow, like, together.

Teacher: Yes, that's right. Please take out your science notebooks so we can check the planting directions.

summarise what had been learned and what kind of new understanding was achieved in the joint talk. In this type of dialogue, the children's participation depended on the help and encouragement of the teacher; the children did not usually share their thoughts unless they were prompted to do so.

Example 1 demonstrates a typical episode presenting pattern 2a, where the teacher's questions are partly practical and partly aimed at the level of concepts. The children participated in the dialogue but did not contribute their own initiatives, besides one practical question from a child who wanted to know if they all got their own seeds to plant. This seems to imply that certain portions of the teacher's talk contained concepts that presumably were unfamiliar to the children. The level of the teacher's talk did not fully match the level of most of the children's experiences or conceptual understanding, which may have been the reason for so few instances of children sharing their own ideas. For example, when the teacher asked the children to recount what becomes easier when seeds are soft, none of the children volunteered any responses to the question, which required some prior knowledge and was clearly targeting a particular correct answer. In order to draw more active participation from the children, one possible choice of action could have been to adapt the question more to the children's level by giving hints or by tying the question about the seed into the children's prior experiences with seeds and plants.

3.1.1.2. Pattern 2b: teacher-initiated teaching dialogue of high quality. Of the nine episodes that represented teacher-initiated pattern 2b, four were from literacy lessons, four from science lessons and one from mathematics lessons. The teacher support and scaffolding of the children's participation and shared understanding included fewer teacher questions than in pattern 2a, but the questions were more open in nature. They were also characterised by a closer match with the children's everyday experiences; this contributed to more freely flowing conversation and initiative among the children. The teachers scaffolded the children's understanding process by expanding, clarifying and summarising both their own and the children's ideas.

In *Example 2*, the teacher asked only a few questions, but the questions were on a par with the children's prior knowledge and experiences of the topic; these questions created a safe space and an optimal level for the children to willingly share their thoughts. The teacher encouraged all of the children to contribute and share different views, and thus the talk between the teacher and the children was balanced. Following a broad exchange of different views, the main content of the dialogue was wrapped up jointly by the teacher and the children to clarify the moral point of why one is not likely to make friends by fooling them.

3.1.2. Child-initiated patterns

3.1.2.1. Pattern 3a: child-initiated teaching dialogue of moderate quality. Of the five episodes that represented child-initiated pattern 3a, two were from literacy lessons, two from science

Example 2

Teacher-initiated teaching dialogue of high quality (pattern 2b):
What is fooling?

Context: The teacher and the children have read a story.

Teacher: Who is the story about?

Child: About Aana.

Teacher: Mmm. What do you think this word 'fooling' means? They talked a lot about fooling.

Child: It's like cheating.

Teacher: Good.

Child: That it's not true.

Teacher: Yes, you are right.

Many more children start sharing their own ideas about what 'fooling' means.

Teacher: Would anyone else like to talk about fooling?

Child: He wanted to be his friend so he, like, tried to make him excited.

Teacher: Yes. So Kim already told the reason why he was fooling. But yes, you have given many really nice definitions of fooling. So fooling is like lying and playing tricks and so on.

Child: I think fooling sounds a bit like a fool, a person who does funny things.

Teacher: That's right. A fool that can fool others. Haha. Well, Alice, could you please tell everybody one more time why he was fooling?

Child: Because he wanted to be his friend.

Teacher: Is it right to get friends this way?

Many children answer 'no' and shake their heads.

Teacher: Mmm, you are right. It's not good to get friends by fooling.

lessons and one from mathematics lessons. The child-initiated dialogues typically had a relatively equal balance between the children and the teacher talking. Although pattern 3a was defined by a child's initiative to share his or her knowledge or thoughts, the teacher played a significant role as a facilitator of the dialogue. The teacher allowed space for the children to contribute freely, but at the same time guided the flow of the dialogue. In the episodes identified as being pattern 3a, the teacher listened actively and paid attention to the children's comments by asking clarifying questions or expanding on some of the children's comments, but the teacher did not steer the dialogue into clear goals related to understanding of the content.

As seen in [Example 3](#), the teacher was open to the children's comments and made some expansions based on these comments; however, the teacher did not introduce any higher-level concepts in the conversation or summarise either the meaning of the content being discussed or the shared understanding at the end of the dialogue. The dialogue did not contain questions posed by the teachers that provoked thinking, nor were there requests for the

Example 3

Child-initiated teaching dialogue of moderate quality (pattern 3a): Unusual dreams.

Context: The teacher and children have finished reading a story and the teacher opens a space for child-initiated talk by saying, 'Now, is there anything more you would like to talk about?'

Child: Well, every time I dream I bump into a house and then I fall from my bed to the floor.

Teacher: Well, sometimes when you dream you feel like you really (...)

Child: ... can, like, fly.

Teacher: It can feel like you really are falling. Or you can dream that you are somewhere outside naked, and when you wake up you don't have a blanket.

Child: One time I went sleepwalking, and I walked out to the stairs with my blanket.

Children continue sharing their unusual dreaming experiences.

Teacher: You really had some wild stories. But now we're no longer dreaming, so we'll start writing and I'll tell you what to write.

children to explain their dreams. The episode included active social sharing, and many children participated eagerly, but the episode did not seem to evolve into the integration of sharing and content goals.

3.1.2.2. Pattern 3b: child-initiated teaching dialogue of high quality.

Of the five episodes that represented child-initiated pattern 3b, three were from literacy lessons and two were from science lessons; none were from mathematics lessons. The initial setting of the dialogue was similar to that found in pattern 3a, but the teacher's facilitating role was more effectual in strategically scaffolding the children in order to generate high-quality dialogic sharing. The teacher allowed space for the children to talk; however, by actively listening to them and posing well-timed questions, the teacher also actively supported them to expand on their comments and deepen their thinking. The teacher expanded on the children's comments, but also challenged their thinking processes and encouraged them to elaborate on the ideas they had presented instead of simply telling them straight answers. The episodes coded as 3b typically integrated social and content goals, and were linked to practical topics that the children found interesting.

[Example 4](#) contains a clear structure, through which the teacher constructed the dialogue with the children. The teacher not only reviewed and summarised the main points at the end of the dialogue, but also made recaps during the talk. The teacher provided effective support for the children through expansions and questions and by encouraging their participation.

3.2. Strategies of scaffolding participation and shared understanding through dialogue

3.2.1. Strategies of scaffolding teacher-initiated teaching dialogues

The second aim of the study was to examine the kinds of

Example 4

Child-initiated teaching dialogue of high quality (pattern 3b): Age limits in movies.

Context: The teacher and children have just finished a teacher-initiated dialogue concerning how dangerous piranhas are.

Child: I watched a late-night TV show in which they went diving in a lake. But then they forgot one man, and the others left with their boat and then a shark came and bit the man's legs off. And then a piranha came and bit the woman's legs and she died too.

Teacher: Was it some kind of movie?

Child: Yes.

Child: What movie?

Child: It was some ... Well, I can't remember the name but it was on a few weeks ago.

Teacher: That's why those kinds of movies are on late at night, because they include violent scenes that are not meant for children to see. You should always obey those age limits. Have any of you noticed that the age limits are sometimes marked with letters and sometimes with the age? For example, if the movie is marked with a 'U', children of your age are allowed to watch it. Raise your hand if you have seen these age-limit markings somewhere.

Children continue eagerly sharing the kinds of markings and movies they have seen.

Child: I've watched Harry Potter.

Many children agree with this comment.

Teacher: The Harry Potter movies have these limits because children your age are not used to seeing those kinds of scary scenes. But, for example, with your parents you can watch movies that are meant for children around your age. But 18 movies are only for adults.

Child: I have watched them. I watch them all the time.

Teacher: Well, have you ever thought why they put these limits on movies? Why is there a limit of 18 years?

Child: No, I haven't ...

Teacher: Have they just wanted to annoy you so that you can't watch them?

Child: You can have bad dreams.

Teacher: Yes. The limits are there to protect you so that you won't have nightmares. Imagine if you had never seen some horrible and nasty thing happen and then you saw an adult movie, and you saw it there for the first time. After that, you might have bad feelings and wish you hadn't seen it. You have to take care of your mind.

Child: I have.

Teacher: You'll have plenty of time to watch those movies when you are adults.

strategies teachers use when scaffolding children's participation and shared understanding through dialogic teaching. The teacher-initiated teaching dialogues we observed typically contained many concrete behavioural incidences of teacher scaffolding. The scaffolding strategies used were often very concrete and direct with respect to encouraging children's participation. The teacher's role was that of a leader, who first attracts children's interest, pulls them into a mode in which they are eager and willing to share their thoughts and then creates a safe environment for the children to participate without fear of embarrassment.

Table 2 lists examples of both teacher's and children's behavioural acts or strategies for maintaining dialogue. This list of strategies implies a more active and versatile role for the teachers than for the children in keeping the dialogue alive. Several teacher questions were typically seen in the beginning of the dialogue to open space for the sharing of information; they were followed by the teacher's offering of hints and prompts to support content understanding. The teacher often used low modality inquiry terms and open questions in order to get as many children as possible to participate and to convey that there was not only one correct answer. By propping the children's answers, the teachers indicated that they were listening and interested. The episodes seemed to lead to the most active participation when the topic and questions were linked to the children's concrete experiences.

In comparison to the teacher's high investment of effort and goal-setting, the children had significantly lighter roles in setting the stage and sustaining the dialogue. The children answered the teacher's questions, but their participation depended on the teacher setting a level for the dialogue that was concrete and comfortable enough to allow many children to participate by sharing their knowledge and experience. When this optimal level was reached, the children began willingly sharing their thoughts and their talking reached a balance with the teacher's talking (pattern 2b).

3.2.2. Strategies of scaffolding child-initiated teaching dialogues

The child-initiated teaching dialogues that we observed indicated a more balanced structure between the teacher's and the children's talk, and in these two patterns (3a and 3b) the teacher's role was closer to a facilitator than a leader. In the teacher-initiated dialogues, the teacher's scaffolding focussed mostly on supporting the children's participation as such, whereas in the child-initiated dialogues, the stress was more on providing support for the children's content understanding; for example, the understanding of concepts and learning to engage in content-related problem-solving and argumentation. In these two patterns, the teacher did not need to attract the children's interest because the children themselves had introduced the topic and initiated the dialogue. Because the teacher had not planned or prepared the content or direction of the dialogue beforehand, it was necessary for the teacher to actively listen in order to be able to scaffold the spontaneously progressing dialogue.

Table 3 lists examples of the most typical ways both the teacher and the children effectively contributed to maintaining child-initiated dialogues in patterns 3a and 3b. Providing space for the children themselves to share their thoughts did not mean that the dialogue would be devoid of goals or that the teacher would not actively participate. The teacher's role as a facilitator was based on active listening and, when needed, asking expanding or clarifying questions to encourage the children to explain their thinking and understanding in more depth. If possible, the teacher linked the topic being discussed to subject concepts or content and to moral rules or societal knowledge by elaborating on the children's comments. The teacher typically accepted the children's answers without evaluation, which was critical for creating a safe and free

Table 2
Strategies of scaffolding and children's reactions in teacher-initiated teaching dialogues.

Teacher scaffolding strategies	Children's reactions
<ul style="list-style-type: none"> • Uses interesting and inquiry-stimulating vocabulary • Shows that he/she is listening, and prompts children's comments by using short conforming phrases (yes, that's right, mm) or comments, or by repeating the child's comment • Can adopt a low modality, using words such as 'perhaps' and 'might' as an invitation to a range of possible actions • Indicates that there might not be just one correct answer, and that children are allowed to express their opinions and to explain them • Uses authentic open-ended questions that allow children to tell about their personal experiences • Provides hints, makes prompts and reformulates questions if they turn out to be too challenging • Repeats what has been learned earlier, for instance, by using a short initiation-response-feedback (IRF) sequence in the beginning of (or just before) the episode • Repeats good questions or remarks made by a child in the group for the whole class to reflect on 	<ul style="list-style-type: none"> • Answer the teacher's questions • Listen actively • Participate by offering their own opinions or comments, especially when the topic is close to their own life experiences and interests

Table 3
Strategies of scaffolding and children's reactions in child-initiated teaching dialogues.

Teacher scaffolding strategies	Children's reactions
<ul style="list-style-type: none"> • Allows room for dialogic space to evolve and actively listens • Asks only a few questions, consisting mainly of follow-up questions to clarify children's comments • Links children's ideas and experiences to moral rules and societal knowledge • Expands on children's comments and summarises the knowledge that has been accumulated • Accepts responses without evaluating them 	<ul style="list-style-type: none"> • Begin the dialogue • Share their thoughts and ideas in balance with the teacher • Listen to each other • The more experience children have related to the topic, the more comfortable they will feel in participating

zone of participation. At the end of the dialogue, the teacher summarised the main content of the dialogue by linking the expressed experiences, ideas and viewpoints together into a broader context.

Compared to the teacher-initiated patterns, the children not only played a more active role in commencing the dialogue, but they willingly took more responsibility for the flow of the conversation even though they were supported and encouraged by the teacher. The children's own knowledge and experiences of the topic resulted in a richer and more equal range of participation, and many more opportunities and perspectives for content understanding emerged as a result.

4. Discussion

The present study set out to examine what kinds of dialogic teaching patterns can be identified in early school classrooms, and what kinds of strategies teachers use when scaffolding children's participation and shared understanding through dialogic teaching. Two main patterns of dialogic teaching were identified in the study, which were each further divided into two sub-patterns: teacher-initiated moderate- and high-quality patterns and child-initiated moderate- and high-quality patterns. The teacher-initiated teaching patterns were characterised by concrete strategies that were generated by the teacher, who played the role of a leader and actively supported and maintained the dialogue. In the child-initiated patterns, the talk and responsibility of the dialogue were more balanced between the children and the teacher; the role of the teacher was primarily to facilitate the children's active, partly self-regulated sharing of thoughts. The results are of particular importance as they contribute to the scant previous knowledge by emphasising the different scaffolding strategies of teachers, and describing the concrete means of maintaining productive dialogue in the classroom.

Our first research question focussed on the types of dialogic teaching patterns that can be identified in early school literacy, mathematics and science lessons. The results showed that, first, both teacher- and child-initiated patterns were identified from the

data and, second, that the sub-patterns within each pattern were distinguished from each other by differences with respect to the moderate or high quality of teacher scaffolding. The analyses indicated that in preschool settings, the child-initiated patterns were as common as the teacher-initiated patterns based on an equal amount of identified episodes, whereas especially in Grade 1, the majority of dialogic episodes represented the teacher-initiated pattern. Although the sample size did not allow us to draw any strong conclusions concerning the effects of context, the findings did imply that preschool classrooms may be more conducive to child-initiated dialogues than primary school classrooms. This might be due to the primary school teachers having a more binding responsibility for advancing the age-level learning goals in basic academic skills that are set in the national curriculum in Finland, which may limit the time used for discussion, open-ended questions and the exploratory approach to classroom dialogue (Smith, Hardman, Wall, & Mroz, 2004). In preschool, such academic aims for children's learning do not exist in the Finnish curriculum. Prior studies have indicated that during the training phase, the main concerns among student science teachers are lesson content, discipline and time management (Lehesvuori, Viiri, & Rasku-Puttonen, 2011). If the time required for children to share their ideas and opinions is seen to be taking away from the more immediately pressing academic targets of learning, it is understandable that teachers are not willing to invest time for discussion at school, despite its acknowledged beneficial aspects.

Although the effects of the subjects of the lesson (i.e. literacy, science or mathematics) were not our research aim as such, based on the results it is interesting to note that all four patterns could be identified in the literacy lessons (13 episodes in total). This may be due to the heavy emphasis on literacy lessons each day in early school years, and to the numerous content fields of literacy, which allow for a rich range of different teaching methods during the program. On the other hand, dialogic episodes were least often identified during the math lessons (6 episodes in total). In the present dataset, only one of the mathematics lessons contained an episode that represented a child-initiated dialogic pattern. Moreover, the findings indicated several episodes of both child-initiated

dialogues (4 episodes) and high-quality teacher-initiated dialogues (4 episodes) in the science lessons, although science lessons in secondary school are typically found to be authoritative with scant dialogue (Mercer, Dawes, & Staarman, 2009). Scott and Ametller (2007) argue that meaningful student learning in science lessons would require space for dialogic discussions before introducing and concluding the discussion with an authoritative voice. The subject of science (especially in the early school years' curriculum, which emphasises topics related to children's own experiences) is likely to offer a more flexible and varied lesson structure than, for example, a mathematics lessons, where learning often involves recitation and independent tasks rather than classroom discussions.

Our second research question focussed on the teachers' strategies of scaffolding the children's participation and shared understanding. Various studies have acknowledged that the teacher's role as a facilitator is vital for students' engagement in dialogic exchanges, providing them with opportunities to learn to ask questions, examine and evaluate given ideas, negotiate solutions and reason and explain propositions (Alexander, 2008; Mercer & Littleton, 2007). Our findings suggest that teacher scaffolding strategies may be different depending on whether the dialogue is teacher-initiated or child-initiated. The quality of the teacher's strategies may be especially important for facilitating shared understanding and conceptual learning through dialogue, while the activeness and timing of teacher strategies may be especially relevant for ensuring equally distributed participation among the children. However, even high levels of teacher activeness (e.g., frequent questions or prompts) did not necessarily lead to high rates of children's participation (for example, in pattern 2a). This suggests that activeness of the teacher and quality of teachers' scaffolding strategies are mutually interdependent (e.g., asking open-ended questions may allow more children to share thoughts and provide more opportunities for reflection), and both aspects of scaffolding, supporting children's active participation and promoting shared understanding, are necessary for productive classroom dialogue. According to Game and Metcalfe (2009), scaffolding in dialogic teaching allows students to have thoughts they most likely would not have on their own, while still being able to recognise them as their own. Scaffolding is thus not about manipulating children's ideas towards teacher-intended targets, but rather involves supporting them to venture deeper in their thinking and to consider different points of views regarding their own experiences.

Setting the stage for open classroom dialogue typically requires that the teacher has clearly identified learning goals for the lesson (Gillies, 2015). Based on the results of the present study, during teacher-initiated dialogues, the teacher is likely to have a clear agenda for the learning and use a wide variety of strategies to reach goals and provide intentional scaffolding for children to participate in the dialogue. By listening to the children's proposals, posing questions and being interested in their ideas and views, the teacher conveys respect for the children as full members of the community, thereby fostering their willingness to participate (Hännikäinen et al., 2010). The quality of the teacher's questions plays a critical role in supporting children's participation and in encouraging them to ask thought-provoking questions and share their own knowledge and experiences (King, 2002). Our results suggest that authentic questions that resonate with children's experiences and allow them to draw from their knowledge stimulate classroom dialogues. In addition, concrete examples and personal experiences about the topic are often necessary for children to link their previous experiences into a new set of knowledge.

In the child-initiated dialogues in our study, teacher scaffolding was characterised by active, sensitive listening and inquiry. Child-initiated dialogue can be quite demanding for teachers because

they cannot predict where the dialogue might lead, and they might not necessarily have a prior plan for the discussion. However, in these situations, teachers also need to have the learning goal clear in their mind to be able to be sensitive and flexible during learning sessions. The findings of the study indicate that active listening is needed for the teacher to be able to follow the flow of the dialogue and to summarise it in a way that will be meaningful for the children. The teacher's role is critical in teaching children to ask and to answer questions, and in helping them to learn how to explain their own thinking (Gillies, 2013). According to Chinn et al. (2000), students participate and engage in high-quality classroom dialogue only if they are specifically asked to give reasons and justifications for their conclusions. The teacher's support is needed both to facilitate the children's deeper thinking and to ensure more active participation than simply answering questions.

Based on the relatively low amount of identified dialogic teaching episodes, the findings of this study indicate that both teacher- and child-initiated dialogues are scant in early-year classrooms. Increasing child-initiated dialogues in the early primary grades is especially needed to facilitate children's willingness and ability to actively share their thoughts and ideas. This requires evidence-based information to be available for teachers regarding how to scaffold children towards goal-directed interaction and shared understanding. Mercer et al. (2009) suggest that the findings to date concerning dialogic teaching have not had an effective impact on education in schools, as most teachers have only a vague idea about how to use discussion as a teaching tool and lack specific strategies to conduct dialogic teaching.

Development towards a more dialogic teaching culture needs to begin during the teacher education process by providing, observing and practising concrete and specific strategies to support both teacher- and child-initiated dialogues. Gillies (2004) pointed out that teachers use more mediated-learning interactions when they have received training in communication skills that are designed to promote students' thinking and to scaffold their learning. In turn, the students of trained teachers in her study modelled many of their teachers' verbal behaviours, provided more detailed explanations and asked more questions than students in the control classes. Access to a range of scaffolding strategies and self-efficacy beliefs may be a critical prerequisite for teachers to allow space for child-initiated talk in lessons without fear of losing valuable time or control of the classroom. Linking the topic to the children's personal experiences and to previous knowledge may effectively raise the level of teacher-initiated dialogue and increase the children's participation. Both teacher- and child-initiated dialogues have their own place in classrooms; neither of them can be considered to be more effective for learning than the other. Supporting children's natural curiosity and eagerness to share their experiences in the early school years creates a basis for the use of discussion as a productive way of learning.

The current study does have certain limitations. First, the criteria for identifying the dialogic teaching episodes are somewhat problematic as all the identified pattern types in the present study manifested only three of the five principles of dialogic teaching described by Alexander (2006) (i.e. purposefulness, collectiveness and reciprocity); the two other principles (i.e. supportiveness and cumulateness) could not be proved in all patterns. Future studies are needed to obtain more empirical evidence regarding how all of these five dialogical principles can be identified in classroom interactions. Second, although we recognised the importance of nonverbal interaction, we were unable to analyse body language and gestures from the audio-recorded lessons. In turn, this allowed us to concentrate on verbal communication, which plays a greater role in actual dialogue. Third, a larger sample size would be needed in further studies to study the variations in patterns more deeply. In

addition, the benefit for children's learning outcomes was not controlled as part of the study. Further research is needed to examine to what extent the quality of classroom dialogue is associated with young children's academic and motivational outcomes. Finally, the study's educational context needs to be taken into account, as Finnish children enter primary school quite late (at age seven) compared to many other countries. Furthermore, the pre-school curriculum in Finland does not have strict academic learning aims.

To conclude, teacher-initiated dialogue involves the intentional scaffolding of children's participation through questioning with a clear learning goal in mind, while in child-initiated dialogues, teacher scaffolding consists of active listening and inquiry towards learning and understanding. This study indicates that the quality of scaffolding may be highly linked with shared understanding of content and scaffolding activeness when the children actively participate. The value of dialogic teaching should be acknowledged more strongly in everyday classroom situations in order to create a setting for children's active participation and shared understanding. The present study produces important practical information for educational professionals in terms of how to scaffold children's participation and shared understanding through both teacher- and child-initiated teaching dialogues.

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References

- Alexander, R. (2000). *Culture and pedagogy: International comparisons in primary education*. Oxford: Blackwell Publishers.
- Alexander, R. (2006). *Towards dialogic teaching* (3rd ed.). New York: Dialogos.
- Alexander, R. (2008). *Towards dialogic teaching: Rethinking classroom talk* (4th ed.). York: Dialogos.
- Applebee, A. N., & Langer, J. A. (1983). Instructional scaffolding: reading and writing as natural language activities. *Language Arts*, 60, 168–175.
- Chinn, C. A., O'Donnell, A. M., & Jinks, T. S. (2000). The structure of discourse in collaborative learning. *Journal of Experimental Education*, 69, 77–97. <http://dx.doi.org/10.1080/00220970009600650>.
- Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). London: Routledge/Falmer.
- Cole, M., & Engeström, Y. (1993). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed cognitions, psychological and educational considerations* (pp. 1–46). New York: Cambridge University Press.
- Edwards, D., & Mercer, N. (1987). *Common knowledge*. London: Methuen/Routledge.
- Elbers, E. (1996). Cooperation and social context in adult-child interaction. *Learning and Instruction*, 6, 281–286. [http://dx.doi.org/10.1016/S0959-4752\(96\)00016-3](http://dx.doi.org/10.1016/S0959-4752(96)00016-3).
- Fernández, M., Wegerif, R., Mercer, N., & Rojas-Drummond, S. M. (2001). Reconceptualizing 'scaffolding' and the zone proximal development in the context of symmetrical collaborative learning. *Journal of Classroom Interaction*, 36–37, 40–54.
- Fisher, R. (2003). *Teaching thinking: Philosophical enquiry in the classroom* (2nd ed.). London: Continuum.
- Fisher, R. (2005). *Teaching children to think* (2nd ed.). Cheltenham: Nelson Thornes.
- Game, A., & Metcalfe, A. (2009). Dialogue and team teaching. *Higher Education Research & Development*, 28, 45–57. <http://dx.doi.org/10.1080/07294360802444354>.
- Gillies, R. (2004). The effects of communication training on teachers' and students' verbal behaviours during cooperative learning. *International Journal of Educational Research*, 42, 257–279. <http://dx.doi.org/10.1016/j.ijer.2005.07.004>.
- Gillies, R. (2015). Dialogic interactions in the cooperative classroom. *International Journal of Educational Research*. <http://dx.doi.org/10.1016/j.ijer.2015.02.009>.
- Gillies, R. (2013). Productive academic talk during inquiry-based science. *Pedagogy*, 8, 126–142. <http://dx.doi.org/10.1080/1554480X.2013.767770>.
- Gillies, R., Nichols, K., Burgh, G., & Haynes, M. (2012). The effects of two strategic and meta-cognitive questioning approaches on children's explanatory behaviour, problem-solving, and learning during cooperative, inquiry-based science. *International Journal of Educational Research*, 53, 93–106. <http://dx.doi.org/10.1016/j.ijer.2012.02.003>.
- Habermas, J. (1991). *The theory of communicative action* (Vol. 1). Cambridge: Polity Press.
- Haworth, A. (2010). Bakhtin in the classroom: what constitutes a dialogic text? Some lessons from small group interaction. *Language and Education*, 13(2), 99–117. <http://dx.doi.org/10.1080/09500789908666762>.
- Howe, C. (2010). Peer dialogue and cognitive development: a two-way relationship? In K. Littleton, & C. Howe (Eds.), *Educational dialogues: Understanding and promoting productive interaction* (pp. 32–47). London: Routledge.
- Howe, C., & Abedin, M. (2013). Classroom dialogue: a systematic review across four decades of research. *Cambridge Journal of Education*, 43, 325–356. <http://dx.doi.org/10.1080/0305764X.2013.786024>.
- Hännikäinen, M., & Rasku-Puttonen, H. (2010). Promoting children's participation: the role of teachers in preschool and primary school learning sessions. *Early Years*, 30, 147–160. <http://dx.doi.org/10.1080/09575146.2010.485555>.
- Joiner, R., Littleton, K., Faulkner, D., & Miell, D. (2000). *Rethinking collaborative learning*. London: Free Association Books.
- King, A. (2002). Structuring peer interaction to promote high-level cognitive processing. *Theory Into Practice*, 41, 34–39. http://dx.doi.org/10.1207/s15430421tip4101_6.
- LaParo, K. M., Pianta, R. C., & Stuhlman, M. (2004). The classroom assessment scoring system: findings from the pre-kindergarten year. *The Elementary School Journal*, 104, 409–426. <http://dx.doi.org/10.1086/499760>.
- Lefstein, A. (2006). *Dialogue in schools: Towards a pragmatic approach*. London: King's College London. Working Papers in Urban Language & Literacies, #33.
- Lefstein, A. (2010). More helpful as problem than solution: some implications of situating dialogue in classroom. In K. Littleton, & C. Howe (Eds.), *Educational dialogues, understanding and promoting productive interaction* (pp. 170–191). London: Routledge.
- Lehesvuori, S., Viiri, J., Rasku-Puttonen, H., Moate, J., & Helaakoski, J. (2013). Visualizing communication structures in science classrooms: Tracing cumulativity in teacher-led whole class discussions. *Journal of Research in Science Teaching*, 5, 912–939. <http://dx.doi.org/10.1002/tea.21100>.
- Lehesvuori, S., Viiri, J., & Rasku-Puttonen, H. (2011). Introducing dialogic teaching to science student teachers. *Journal of Science Teacher Education*, 22, 705–727. <http://dx.doi.org/10.1007/s10972-011-9253-0>.
- Lerikkanen, M.-K., Niemi, P., Poikkeus, A.-M., Poskiparta, M., Siekkinen, M., & Nurm, J.-E. (2006). *The First Steps Study (Aikuporta)*. Finland: University of Jyväskylä. Unpublished data.
- Littleton, K., & Howe, C. (2010). *Educational Dialogues: Understanding and promoting productive interaction*. Abingdon: Routledge.
- Littleton, K., & Mercer, N. (2010). The significance of educational dialogues between primary school children. In K. Littleton, & C. Howe (Eds.), *Educational dialogues: Understanding and promoting productive interaction* (pp. 302–321). London and New York: Routledge.
- Lyle, S. (2008). Dialogic teaching: discussing theoretical contexts and reviewing evidence from classroom practice. *Language and Education*, 22, 222–240. <http://dx.doi.org/10.2167/le778.0>.
- Mercer, N., & Dawes, L. (2008). The value of exploratory talk. In N. Mercer, & S. Hodgkinson (Eds.), *Exploring talk in school* (pp. 55–71). London: Sage.
- Mercer, N., Dawes, L., & Staarman, J. K. (2009). Dialogic teaching in the primary science classroom. *Language and Education*, 23, 353–369. <http://dx.doi.org/10.1080/09500780902954273>.
- Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. London: Routledge.
- Mesa, V., & Chang, P. (2010). The language of engagement in two highly interactive undergraduate mathematics classrooms. *Linguistics and Education*, 21, 83–100. <http://dx.doi.org/10.1016/j.linged.2010.01.002>.
- Murphy, P. (2008). Defining pedagogy. In K. Hall, P. Murphy, & J. Soler (Eds.), *Pedagogy and practice: Culture and identities* (pp. 28–39). London/Milton Keynes: Sage and The Open University.
- Myhill, D., & Warren, P. (2005). Scaffolds or straitjackets? Critical moments in classroom discourse. *Educational Review*, 57, 55–69. <http://dx.doi.org/10.1080/0013191042000274187>.
- Nystrand, M., Wu, L., Gamoran, A., Zeiser, S., & Long, D. (2003). Questions in time: investigating the structure and dynamics of unfolding classroom discourse. *Discourse Processes*, 35, 135–196. http://dx.doi.org/10.1207/S15326950DP3502_3.
- Pakarinen, E., Lerikkanen, M.-K., Poikkeus, A.-M., Kiuru, N., Siekkinen, M., Rasku-Puttonen, H., et al. (2010). A validation of the classroom assessment scoring system in Finnish kindergartens. *Early Education & Development*, 21, 95–124. <http://dx.doi.org/10.1080/10409280902858764>.
- Palinscar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, 2, 117–175. http://dx.doi.org/10.1207/s1532690xci0102_1.
- Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008a). *The Classroom Assessment Scoring System (CLASS). Manual Pre-K*. Baltimore: Brookes.
- Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008b). *The Classroom Assessment Scoring System (CLASS). Manual, K-3*. Baltimore: Brookes.
- Rasku-Puttonen, H., Eteläpelto, A., Häkkinen, P., & Arvaja, M. (2002). Teacher's instructional scaffolding in an innovative information and communication technology-based history learning environment. *Teacher Development*, 6, 269–287. <http://dx.doi.org/10.1080/13664530200200168>.
- Rasku-Puttonen, H., Lerikkanen, M.-K., Poikkeus, A.-M., & Siekkinen, M. (2012). Dialogical Patterns of Interaction in Preschool Classrooms. *International Journal of Educational Research*, 53, 138–149. <http://dx.doi.org/10.1016/j.ijer.2012.03.004>.
- Reznitskaya, A., Kuob, L.-J., Clark, A.-M., & Miller, B. (2009). Collaborative reasoning: a dialogic approach to group discussions. *Cambridge Journal of*

- Education*, 39, 29–48. <http://dx.doi.org/10.1080/03057640802701952>.
- Rogoff, B. (2008). Observing sociocultural activity on three planes: participatory appropriation, guided participation and apprenticeship. In P. Murphy, K. Hall, & J. Soler (Eds.), *Pedagogy and practice: Culture and identities* (pp. 58–74). Los Angeles: Sage.
- Rojas-Drummond, S., Hernández, G., Vélez, M., & Villagrán, G. (1998). Cooperative learning and the appropriation of procedural knowledge by primary school children. *Learning and Instruction*, 30, 37–61. [http://dx.doi.org/10.1016/S0959-4752\(97\)00001-7](http://dx.doi.org/10.1016/S0959-4752(97)00001-7).
- Rojas-Drummond, S., & Mercer, N. (2003). Scaffolding the development of effective collaboration and learning. *International Journal of Educational Research*, 39, 99–111. [http://dx.doi.org/10.1016/S0883-0355\(03\)00075-2](http://dx.doi.org/10.1016/S0883-0355(03)00075-2).
- Scott, P., & Ametller, J. (2007). Teaching science in a meaningful way: striking a balance between 'opening up' and 'closing down' classroom talk. *School Science Review*, 88, 77–83.
- Sedova, K., Salamounova, Z., & Svaricek, R. (2014). Troubles with dialogic teaching. *Learning, Culture and Social Interaction*, 3, 274–285. <http://dx.doi.org/10.1016/j.lcsi.2014.04.001>.
- Sinclair, J., & Coulthard, R. (1975). *Towards an analysis of discourse: The English used by teachers and pupils*. London: Oxford University Press.
- Skidmore, D. (2006). Pedagogy and dialogue. *Cambridge Journal of Education*, 36, 503–514. <http://dx.doi.org/10.1080/03057640601048407>.
- Smith, F., Hardman, F., Wall, K., & Mroz, M. (2004). Interactive whole-class teaching in the national literacy and numeracy strategies. *British Educational Research Journal*, 30, 395–411. <http://dx.doi.org/10.1080/01411920410001689706>.
- Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher-student interaction: a decade of research. *Educational Psychology Review*, 22, 271–297. <http://dx.doi.org/10.1007/s10648-010-9127-6>.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.
- Wells, G. (1999). *Dialogic inquiry: Towards a sociocultural approach to mediated action*. Hemel Hempstead: Harvester-Wheatsheaf.
- Wells, G. (2007). Who we become depends on the company we keep and on what we do and say together. *International Journal of Educational Research*, 46, 100–103. <http://dx.doi.org/10.1016/j.ijer.2007.07.010>.
- Wells, G., & Arauz, R. (2006). Dialogue in the classroom. *Journal of the Learning Sciences*, 15, 379–428. http://dx.doi.org/10.1207/s15327809jls1503_3.
- Wolfe, N., & Alexander, R. J. (2008). *Argumentation and dialogic teaching: Alternative pedagogies for a changing world*. London: Futurelab.
- Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, 17, 89–100. <http://dx.doi.org/10.1111/j.1469-7610.1976.tb00381.x>.
- Yates, G. C., & Yates, S. M. (1990). Teacher effectiveness research: towards describing user-friendly classroom instruction. *Educational Psychology*, 10, 225–238. <http://dx.doi.org/10.1080/0144341900100304>.

II

KNOWLEDGE-BUILDING PATTERNS IN EDUCATIONAL DIALOGUE

by

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Knowledge-building patterns in educational dialogue



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ABSTRACT

This study aimed to examine knowledge-building patterns in Grade 6 educational dialogues. The data consisted of 20 video-recorded lessons from the classes taught by seven teachers, selected by using a latent profile analysis and examined with a qualitative functional analysis of classroom talk. Episodes of educational dialogue were found to represent three main types of knowledge, based on facts, views and experiences. These three types were further identified as forming six diverse knowledge-building patterns in educational dialogues. The findings indicated that factual orientation dominated the Grade 6 lesson dialogues. However, factual knowledge building often occurred with the other two main types of knowledge.

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1. Introduction

Classrooms constitute settings of knowledge building, where ideally, students and their teacher jointly develop their understanding (Mercer, 1995). Accounts of knowledge building emphasise the key role of social interaction (e.g., Brown & Duguid, 2000; Sawyer, 2007; Scardamalia, 2002), as well as educational dialogue as a facilitator of students' learning (e.g., Alexander, 2006; Fernandez, Wegerif, Mercer, & Rojas-Drummond, 2001; Lyle, 2008; Mercer, 2008). Wertsch (1979) elaborates on the Vygotskian view about the developmental relevance of dialogue to social interaction. Mercer (2008) points out the accumulated evidence that the functional structure of the dialogue between adults and children—not only its content—contributes to children's learning.

The literature on educational dialogue indicates that in science lessons, for instance, the dialogue features that are beneficial to students' intellectual growth consist of instructional practices that involve students proposing ideas and explaining their reasoning to peers (e.g., Howe et al., 2007). However, the functions that comprise productive educational dialogue in the early school years may be somewhat different, such as allowing space and time for children to share their experiences (Muhonen, Rasku-Puttonen, Pakarinen, Poikkeus, & Lerkkanen, 2016), from those in the later grades of primary school, with the subject lessons' stronger and academically oriented focus. A limitation in the relevant literature is the lack of studies on knowledge building in the educational dialogues that are identified in teacher–student interactions in the whole class. Consequently, the present study aims to analyse the types of knowledge-building patterns in dialogues involving Grade 6 students and their teachers.

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1.1. Sociocultural learning approach and classroom dialogue

The sociocultural approach to learning views knowledge as socially constructed through language. This view is largely based on [Vygotsky's \(1978\)](#) description of the dual functions of language as a psychological tool for individuals to make sense of their experiences and a cultural tool for sharing experiences and understanding them collectively. The sociocultural learning theory has since been widely applied in the research on classroom dialogue, collaborative learning and educational use of communication technology ([Mercer, 2008](#)). Similarly, the social semiotic approach ([Halliday, 1978](#)) perceives language as an important mediator through which social and cultural values are constructed, preserved and contested. When using language, individuals build meanings by representing their experiences of the world rather than just transmitting them. Meaning making implies creating relationships with other people that are relevant in the context in which they occur ([Eggs, 1994](#)). This approach to language aligns with the systemic theory that observes a systemic relationship between the form of the language and the context in which the language is used ([Eggs, 1994; Halliday & Matthiessen, 2014](#)).

According to [Alexander \(2006\)](#), the core intent of dialogue is to exchange ideas that prompt further questions. Dialogic teaching in the classroom setting can be predicated on five principles of interaction that harness the power of talk to stimulate and develop students' thinking, learning and understanding ([Alexander, 2000, 2006](#)). Through dialogic interaction in the classroom, students learn to ask questions, explain their viewpoints and comment on one another's ideas ([Alexander, 2006](#)). Classroom interaction can be considered dialogic when it fulfils the criteria of being: 1) collective (as a small group or the whole class, students and their teacher address learning tasks together), 2) reciprocal (students and their teacher listen to each other, share ideas and consider alternative viewpoints), 3) supportive (students may articulate their ideas without fear of embarrassment and help one another reach shared understanding), 4) cumulative (the participants build on their own and others' ideas and link them to form coherent lines of thinking and enquiry) and 5) purposeful (teachers plan and steer classroom talk with specific educational goals in mind). Furthermore, [Barnes and Todd \(1977\)](#) argue that classroom discussion should meet the basic requirements of everyday conversation – sharing relevant information, clearly explaining opinions and critically evaluating explanations.

The accumulated evidence on the developmental benefits of educational dialogue (or productive classroom talk, a term used in the literature with a similar meaning) indicates links between the quality of teacher–student dialogue and the growth of students' understanding about diverse school subjects, especially science (e.g., [Alexander, 2000; Lemke, 1990; Mortimer & Scott, 2003; Wells, 1999](#)). In their school-based research projects, [Mercer and Littleton \(2007\)](#) have aimed to help teachers provide their students with opportunities for engaging in focused, equitable and reasoned discussions to develop their thinking skills. They have pinpointed the essential qualities of a reasoned debate, which they call exploratory talk, in line with [Barnes' \(1976\)](#) study. With the open sharing of ideas and constructive conflict, the concept of exploratory talk constitutes a visible pursuit of shared understanding and knowledge building through dialogue. The use of exploratory talk for students' learning has been previously analysed with British and Mexican primary school children and has proven effective in promoting their collaboration, communication, reasoning and learning (e.g., [Mercer, Wegerif, & Dawes, 1999; Rojas-Drummond & Mercer, 2003; Rojas-Drummond, Mercer, & Dabrowski, 2001](#)). These studies have provided knowledge of how children talk when working on joint activities, as well as teachers' strategies when scaffolding the interactive process of knowledge construction.

1.2. Collaborative knowledge building in classroom dialogue

The meaningful role of the peer group in students' learning is widely acknowledged (e.g., [Salisbury, 2012](#)), while teachers are regarded as performing more of a coaching function in facilitating the students' knowledge-building processes (e.g., [Hämäläinen & Laine, 2015; Hämäläinen & Vähäsantanen, 2011](#)). [Barnes and Todd \(Barnes & Todd, 1977; Barnes, 1976\)](#) were among the first researchers to investigate students' talk when working together. As indicated, [Mercer's \(2008\)](#) findings have shown that focused, sustained and reasoned dialogue in a classroom helps students solve problems and promotes their conceptual understanding and learning. Introduced by [Harasim \(1989\)](#), the concept of collaborative knowledge building involves mutual exploration of issues and arguments, agreements and disagreements, questioning together, dynamic interaction and building on one another's ideas ([Harasim, 1989; Kaye, 1992; Sorensen, 1997](#)).

In his model of the knowledge-building process, [Stahl \(2000\)](#) views knowledge as a socially mediated product. Individuals first generate personal beliefs from their own perspectives on the basis of sociocultural knowledge, shared language and external representations. These beliefs are then transformed into knowledge through social interaction and discussion, provided that individuals' negotiations of different perspectives lead to their acceptance of a common result. For collaborative knowledge building to occur, it is not enough that students and their teacher share knowledge, but the knowledge needs further elaboration based on the presented ideas and thoughts ([Arvaja, Salovaara, Häkkinen, & Järvelä, 2007](#)). This requires reciprocal understanding among the participants ([Byman, Järvelä, & Häkkinen, 2005](#)).

[Mercer and Littleton \(2007\)](#) define learning through collaborative knowledge building as a process where not only the students work together, but the students and their teacher are also engaged in coordinated, continuing attempts to build common, shared knowledge or solve a problem. It has been argued that the successful pursuit of collaborative learning depends on students' sharing views relevant to the discussion and having a joint conception of its goal ([Barnes & Todd, 1977; Bennett & Dunne, 1992; Galton & Williamson, 1992](#)). Students' personal experiences, curiosity and ownership of their

learning have also been emphasised (Goos, Galbraith, & Renshaw, 1999). Practices that align with educational dialogue aim at providing learners with spaces and tools to participate in collaborative meaning making (Nathan & Knuth, 2003; Wells, 1999).

Collaborative knowledge building and the length of time used in negotiation and planning have been linked to successful learning outcomes and problem solving (e.g., Fall, Webb, & Chudowsky, 1997; Webb, 1993). Several studies have concluded that collaborative learning may facilitate students' academic performance, motivation and self-esteem (e.g., Mercer, 2008; Slavin, 1980). For example, Underwood and Underwood (1999) document that students who express more opinions and verbally analyse the learning perform best in computer-based problem-solving tasks. Howe et al. (2007) propose that productive classroom interaction includes students' active involvement by presenting ideas, contrasting opinions and explaining and reasoning about them. Interestingly, although achieving consensus in problem solving can protect and peaceful dialogue, it does not necessarily support the participants' conceptual understanding (Howe & Tolmie, 2003).

Promoting knowledge-building dialogues through collaborative learning can be challenging for educators (Sorensen & Takle, 2002). Building an open educational dialogue in the classroom requires careful planning and structuring clear goals for learning (Gillies, 2015; Gillies, Nichols, Burgh, & Haynes, 2014). A teacher plays an important role in creating a space for students' active participation through open questions and feedback and by supporting the students in explaining their ideas and opinions (Gillies, 2013; Gillies, Nichols, Burgh, & Haynes, 2012; La Paro, Pianta, & Stuhlman, 2004), as well as helping them recognise how their earlier experiences, actions and activities contribute to their understanding (Mercer, 1995). Scaffolding provided for both whole-class and small-group interactions can promote the development of individual reasoning and the advancement of learning and understanding (Rojas-Drummond & Mercer, 2003). However, previous research suggests that student do not typically experience high-quality instructional interactions (Justice, Mashburn, Hamre, & Pianta, 2008). Identifying key features of effective classroom interactions is important for teachers to be more instructionally supportive in their interactions with students (Jamil, Sabol, Hamre, & Pianta, 2015).

There are strong assumptions and accumulating evidence with respect to the benefits of productive and educational dialogue for learning opportunities. However, there is also an obvious need for a closer examination and description of the types of knowledge-building that transpire through and within dialogue. Consequently, the present study aims to analyse functions of classroom talk to describe what kinds of knowledge-building patterns can be identified in Grade 6 educational dialogues between the teacher and students.

2. Methodology

2.1. Participants and classroom observations

This study represents a subsample of a large, population-based follow-up (Lerikkanen et al., 2006) of 2000 children from four municipalities with their parents and teachers. The children have been followed up from preschool to Grade 9 to examine links between students' academic skill development (especially literacy and math), motivation, well-being (e.g., engagement, problem behavior), and the contribution of factors such as parent and teacher practices and beliefs, quality of classroom interaction, and teacher-student and peer relations to child outcomes. The teachers were asked for their written consent to participate in the study, and the parents gave their consent for their children's participation. All participating schools were Finnish speaking. A subsample of teachers participated on a voluntary basis in classroom video-recordings of at each grade. The video-recorded lessons of 46 Grade 6 teachers and their classrooms (12-year-old students), collected in spring 2013, comprise the sample for the present study. The teachers participating in the classroom video recordings were selected on a voluntary basis from the total of 98 participating teachers. In total, 158 lessons were video-recorded in Grade 6 classrooms (two to four lessons per teacher). On average, 19 students (3–30 students, depending on the class size, $SD=5.81$) were present in the classrooms during the video-recordings. The research situation was not manipulated in any way but represented a typical school day in Grade 6 classrooms. All teachers had at least a Master's degree.

2.2. Selection of data with latent profile analysis

Due to the study's purpose to identify knowledge-building patterns in educational classroom dialogue, the first phase of the study involved identifying the teachers and lessons with the likelihood for high occurrence of teacher-student exchanges meeting the criteria of educational dialogue. This selection stage was carried out with latent profile analysis (LPA) based on the codings of the classroom video-recordings, using the Classroom Assessment Scoring System-Secondary (CLASS-S), an observational instrument based on Teaching Through Interactions (TTI) framework (Pianta, Hamre, & Mintz, 2012).

The CLASS-S is a secondary school version of the CLASS observation instruments, which are validated and widely used to systemically code the quality of daily teacher-student interactions in classrooms. The CLASS-S measures three domains of teacher-student interaction along 12 dimensions: (1) emotional support (three dimensions: positive climate, teacher sensitivity and regard for student perspectives), (2) classroom organisation (three dimensions: behaviour management,

productivity and negative climate), (3) instructional support (five dimensions: instructional learning formats, content understanding, analysis and inquiry, quality of feedback and instructional dialogue), and student engagement as the 12th dimension. Following procedures outlined for coding of videotapes (Pianta et al., 2012), each lesson (45 min) was coded in approximately three 15-min segments from videotape by a trained observer on a 7-point scale: low (1–2), moderate (3–5) or high (6–7) quality. The CLASS-S manual (Pianta et al., 2012) provides detailed indicators of each dimension and examples of teacher behaviour and classroom interactions for these ratings. CLASS-S is validated in the Finnish school context, and the training procedure is explained in more detail by Virtanen et al. (2016). Inter-rater reliabilities, calculated as intraclass correlation coefficients (ICCs) based on 20% of the lessons rated by two observers, varied between 0.57 and 0.75. ICCs were computed in order to estimate the agreement between raters with a high ICC indicating a high inter-rater agreement (recommended by McGraw & Wong, 1996).

The data selection for qualitative analysis was based on the CLASS-S scores of five selected dimensions, using teachers as the unit of selection. The following five dimensions were chosen based on capturing the aspects of interactional quality that would be typically present in educational dialogues: 1) positive climate, 2) instructional learning formats, 3) content understanding, 4) quality of feedback and 5) instructional dialogue. Of the selected CLASS-S dimensions, positive climate represents an aspect of emotional support that indicates the enjoyment and emotional connection that students have with teacher, as well as is reported to contribute to student achievement, engagement, and motivation (Pianta et al., 2012). The other four dimensions representing instructional support are known to foster students' thinking skills and conceptual development (e.g., La Paro et al., 2004; Yates & Yates, 1990), especially when associated with deep and meaningful conversation about educational content (Wolfe & Alexander, 2008). Instructional learning format specifies how teachers engage students in activities by maximizing their learning opportunities. Content understanding indicates the approaches teachers use to help students' understand the key ideas in an academic discipline. Quality of feedback refers to the ways in which teachers extend and expand students' learning through their responses, and instructional dialogue reflect how teachers use structured, cumulative questioning and discussion to guide and prompt students' understanding of content. (Pianta et al., 2012.) The purpose of choosing these five dimensions was to optimise the occurrence of educational dialogues in the data that was selected through latent profile analysis in the next stage.

The latent profile analysis (LPA) enables the identification of mixtures of subpopulations (subgroups) from the observed data and provides statistical tests for evaluating the existence and number of the subgroups. In the present study, latent profile analysis was applied to identify subgroups of teachers with different profiles on the five selected dimensions of CLASS-S. The eventuality was to identify a subgroup with a profile representing the highest interactional quality ratings, out of the entire sample pool, on these dimensions (i.e., a subgroup with the highest likelihood of dialogic episodes to be identified in the video-recorded lessons). The LPA was conducted using the Mplus 7.3 program (for a similar approach to data selection using LPA to identify CLASS profile subgroups see Salminen et al., 2012). To determine the most appropriate number of latent subgroups, we used three criteria recommended by Muthén (2001, 2003). These three criteria comprise the following: 1) *the model fit*, using the indices of log-likelihood value, Akaike's information criterion, Bayesian information criterion and the adjusted Bayesian information criterion, as well as the Vuong–Lo–Mendell–Rubin test, the Lo–Mendell–Rubin adjusted likelihood ratio test and the parametric bootstrapped likelihood ratio test for statistical testing; 2) *the classification quality* by using posterior probabilities and entropy values; and 3) *the interpretability of the latent subgroups* – based on feasibility of the solution and number of teachers assigned to latent subgroups value in practice.

Based on all three information criteria (including the model-fit indices, values indicating classification quality, and interpretability), the three-subgroup solution was the best among the models to which different numbers (from two to five) of latent subgroups were fitted. For the subgroup of interest, comprising seven teachers with the highest mean scores (with respect to the other two subgroups) on all five CLASS-S dimensions, subgroup membership was stable in the three-, four- and five-subgroup solutions (see Table 1). Subsequently, the seven teachers (out of a total of 46 teachers participating in video-recordings) belonging to this subgroup, along with their 20 lessons (out of 158 lessons in total), were selected for the qualitative analysis. These selected teachers' lessons consisted of the following subjects: literacy (n=9), mathematics (n=6), religion (n=3), physics/chemistry (n=1) and history (n=1). Each lesson had an average duration of 45 min.

Table 1
CLASS scores in subgroups, mean (SD).

Dimension	Subgroup 1 (n = 17)	Subgroup 2 (n = 22)	Subgroup 3 (n = 7)	Total Sample Mean (n = 46)
Positive climate	4.59 (0.16)	4.95 (0.15)	5.71 (0.16)	4.93 (0.10)
Instructional learning formats	4.33 (0.10)	4.97 (0.10)	5.43 (0.17)	4.80 (0.08)
Content understanding	3.07 (0.11)	4.07 (0.09)	5.05 (0.14)	3.85 (0.12)
Quality of feedback	2.46 (0.12)	3.11 (0.09)	4.08 (0.24)	3.02 (0.10)
Instructional dialogue	2.13 (0.12)	2.75 (0.09)	4.14 (0.18)	2.73 (0.12)

Note. Scores vary from 1 to 7.

2.3. Identifying episodes of educational dialogue within the lessons

The transcribed lessons of the final sample (20 lessons by seven teachers) were read through several times to identify episodes containing educational dialogue and to set their boundaries. Educational dialogue was defined as continuous exchange between the students and their teacher in which the topic continued essentially unchanged and that fulfilled Alexander's (2006) five principles of dialogic teaching, i.e., the episode contained exchanges which were: 1) collective (teachers and students address learning tasks together); 2) reciprocal (teachers and students listen to each other, share ideas and consider alternative viewpoints); 3) supportive (students articulate their ideas freely, without fear of embarrassment, and they help each other to reach a shared understanding); 4) cumulative (teachers and students build on their own and each other's ideas and link them into coherent lines of thinking and enquiry); and 5) purposeful (teachers plan and steer classroom talk with specific educational goals in mind). Based on fulfilling these criteria (all principles needed to be present in every episode), 57 episodes of educational dialogue were identified within the 20 lessons. The classroom activities that did not involve any formal or informal learning tasks or exchanges between the students and their teacher (e.g., individual tasks, routines) were excluded from the analysis.

2.4. Functional analysis of episodes of educational dialogue

The identified 57 episodes of educational dialogue were analysed by applying the Functional Analysis of Children's Classroom Talk (FACCT) developed by Kumpulainen and Wray (2002), who evaluated the quality of children's oral language interaction in the classroom. Because the present study focused on teacher–student educational dialogue, teacher talk was also included in the analysis. Altogether, 19 functions (16 originating from Kumpulainen and Wray's framework, with some modifications) were applied to both the teacher's and the students' talk (see Table 2 for the adapted framework). Kumpulainen and Wray (2002) *informative* function was renamed *factual* function, with a specified definition to be more compatible to learning situations. A new function, *view*, was added to the framework to represent a function in which the expression of an opinion contained information. The *judgemental* function, an original code by Kumpulainen and Wray, was restricted to expressions that merely indicated agreement or disagreement. The *supportive* and *hinting* functions were included in the framework as actions used by teachers to encourage student participation and sharing of thoughts and knowledge.

The unit of analysis was a single word, a sentence, or sentences where at least one function was clearly identifiable. The coding using the functional framework thus encompassed all utterances expressed either by the teacher or the students. The units could be coded as having several overlapping functions (i.e., the functional codes were not mutually exclusive). For example, the question *Which planet is closest to the sun?* would be assigned to both the interrogative and factual functions. Table 3 presents an example of how the functional framework was applied to the classroom dialogue.

Although the first author identified the educational dialogue episodes and coded the functions, the research team applied researcher triangulation (Cohen, Manion, & Morrison, 2007) in all main phases of the analysis. The six identified patterns (presented in Section 3 – Results) were carefully discussed in the light of the various examples from the data. Ambiguities were acknowledged, identified and discussed by the research group; if consensus was not reached, the findings were re-examined.

Table 2
Adapted version of the Functional Analysis of Children's Classroom Talk (FACCT) framework applied to the context of classroom dialogue.

Function	Code	Description
1. Factual ^a	(F)	Providing facts, knowledge or general information, from previous ideas, pre-existing knowledge
2. Interrogative	(Q)	Asking questions to obtain information or social approval
3. Responsive	(R)	Answering questions
4. Organisational	(OR)	Organising and controlling behaviour
5. Judgemental	(J)	Expressing agreement or disagreement
6. Argumentational	(ARG)	Reasoning in language
7. Compositional	(C)	Creating written or spoken text not earlier mentioned, revising or dictating
8. Reproductional	(RP)	Reproducing previously encountered language either by reading or repeating
9. Experiential	(E)	Expressing personal experiences
10. Expository	(EXPO)	Using language with the demonstration of a phenomenon
11. Hypothetical	(HY)	Formulating a hypothesis
12. External thinking	(ET)	Thinking aloud during a task
13. Imaginative	(IM)	Introducing or expressing imaginative situations
14. Heuristic	(HE)	Expressing discovery
15. Affectional	(AF)	Expressing personal feelings
16. Intentional	(IN)	Signalling intention to participate in discourse
17. View ^b	(O)	Expressing personal opinions
18. Supportive ^b	(S)	Encouraging someone to share thoughts, opinions or information
19. Hinting ^b	(H)	Giving clues to obtain further information

^a Name of the function changed from *informative* to *factual*. The definition of the function is also more specified to correspond to educational talk.

^b Added function.

Table 3
Application of the adapted functional analysis framework to educational dialogue.

Context: Teacher and students are discussing about plugs		
Student:	In the UK, there are three pins.	(F), (E) ^a
Teacher:	Yes. All around the world they use different kinds of plugs. But how do you handle it when you go abroad?	(J), (F) (Q)
	When you, for example, go [on] a trip to the UK, take your phone [. . .] and notice there, "Hey, I can't plug in my charger here".	(H), (IM)
Student:	Well, in the UK or if you go somewhere, they sell these things with three pins and two on the other side.	(F), (E)

Though the teacher supports the students by asking questions, encouraging and giving hints, the students participate and share their knowledge in a balanced way. The students' knowledge and facts are based on their travelling experiences, giving their utterances a double meaning – factual and experiential.

^a Each row including one or more function codes represents one unit of analysis.

3. Results

3.1. Three types of knowledge in educational dialogue

As the functional framework was applied, diverse functions of classroom talk were identified. Interrogative and responsive functions were especially present in all the analysed episodes, which is not surprising, considering that questions and answers are typical features of classroom dialogue. However, the research team was mainly interested in the functions associated with collaborative knowledge building and deepening the understanding of the content. *Factual*, *view* and *experiential* were the three main functions that occurred the most and were associated with collaborative knowledge building by bringing new knowledge and content to the discussion in the identified educational dialogue episodes. This finding indicated that the knowledge contained in the dialogues was mostly built through the corresponding three types of knowledge – *fact*, *view* and *experience*. The factual function occurred frequently and was predominant in the majority of the identified episodes. However, factual knowledge was often shared simultaneously with the other two main types of knowledge – view and experience. Sharing of these three types of knowledge and their combinations (e.g., stating of views based on factual knowledge) formed a total of six different knowledge-building patterns in educational dialogue (see Fig. 1).

3.2. Knowledge-building patterns in educational dialogue, manifesting three types of knowledge

3.2.1. Pattern A: sharing of facts (26 episodes)

Pure factual dialogues (Pattern A) consisted of functions coded with factual intention and execution. The dialogue typically began with a factual question presented either by the teacher (18) or a student (8) and continued with question-answer sequences. The questions could be open or closed, seeking factual knowledge or requesting simple argumentation (which could be answered by closed alternatives, e.g., agree or disagree). The teachers and the students participated equally in knowledge building through inquiry and information sharing. Although facts were presented throughout the dialogues, the teachers and the students were often held accountable for justifying the shared factual knowledge (see Example 1). Collaborative knowledge building was usually based on a text that had been read together or on shared previous knowledge. A clear factual goal had to be attained as a result of each dialogue. Factual dialogues occurred in all subjects included in the study, as follows: literacy (10), mathematics (3), religion (11), history (1) and physics/chemistry (2).

Example 1 Pattern A: Sharing of facts.

Context: The teacher and the students have studied the relationship between time units.		
Teacher:	I have a task for you. Please convert 145 min into hours. Can you also explain what you do when you convert it? Andy.	
Student:	Well, first, I will naturally think that there is the 145. Then, I will figure out what is the closest [complete] hour that fits. That's 120 min, which is two hours. And when I add to that 25 min, it is 145.	
Teacher:	Very well explained.	
Student:	Thank you.	
Teacher:	So, first, you should look for what it is closest to, and then, you will get the hang of it. Did anyone think in some other way?	

More students begin explaining their own conversion techniques.

3.2.2. Pattern A/B: sharing of views based on facts (seven episodes)

Pattern A/B comprised functions coded as factual intention and factual and views including execution. This type of dialogue typically started with the teacher's (6) or a student's (1) factual but reflection-seeking question. Shared knowledge was built through one or few open-ended questions, and the answers contained both factual knowledge and views, thus representing a balanced sharing of facts and ideas or opinions. Sharing of factual knowledge and someone's views on the issue were often linked together, since choosing to convey a specific fact to others could be interpreted as

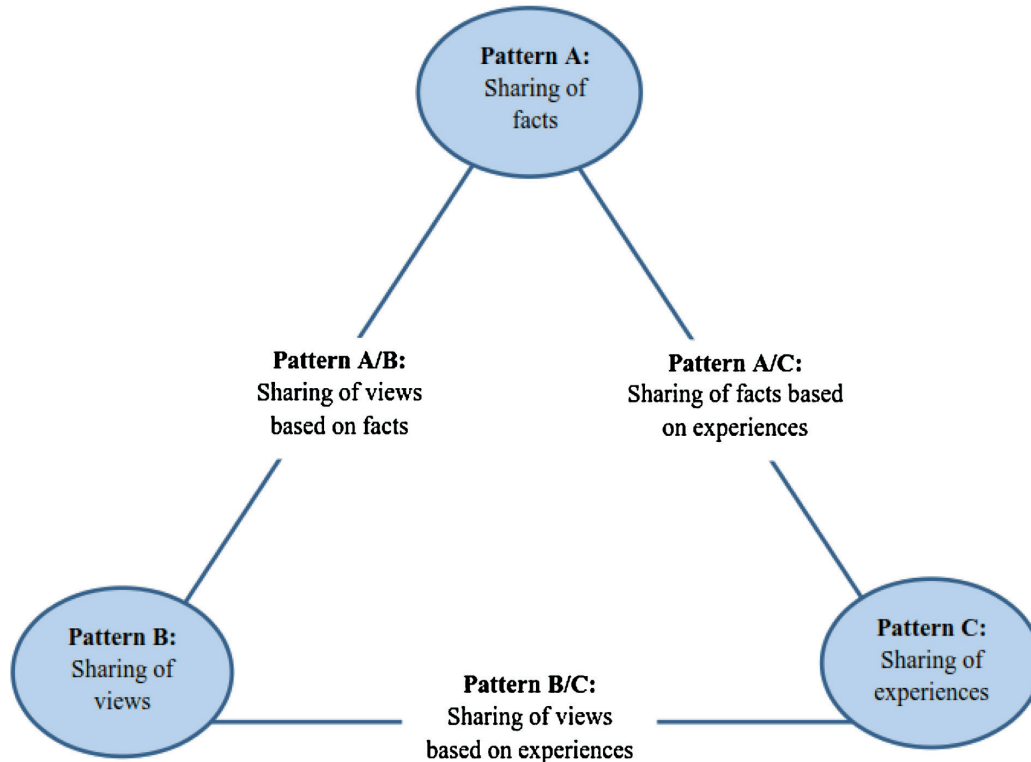


Fig. 1. Knowledge-building patterns in educational dialogue, manifesting the three types of knowledge.

stating an opinion. By definition, there was rarely only one correct answer to the open-ended question presented by the teacher (see Example 2). The discussion and collaborative knowledge building in the A/B pattern were usually based on previous knowledge and related opinions, sometimes also on a text or a study chapter that the class had read together. This pattern appeared to be driven by a goal linked with increasing factual knowledge and raising awareness about the diversity of opinions on the issue at hand. This type of dialogue occurred in literacy (2), religion (3) and mathematics (1) lessons.

Example 2 Pattern A/B: Sharing of views based on facts.

Context: The teacher tells the students that the topic of the religion lesson is discrimination.

Teacher:	Do we have discrimination in Finland? I mean, do some people get discriminated here? Alice.
Student:	Well, you can always find it here in school.
Teacher:	Yes, you can find it in school, many kinds of discrimination. Let's get back to it in just a moment. Sammy.
Student:	People with darker skin.
Teacher:	People with darker skin. Or as a whole, people who look different from the mainstream. I am pretty sure we have discrimination also here in our hometown in different areas. <i>(The teacher gives an example.)</i>
Student:	Sometimes, you can have it also at work. If someone has made it into a high position though first he was among the weakest.
Teacher:	Mm, yes, in the work life, lots of discrimination can be found. There is a lot of talk about the age racism. Any idea what it means?
Student:	It means that older people call younger ones with names.

The teacher and the students continue discussing the meaning of age racism and other forms of discrimination in and out of school.

3.2.3. Pattern B: sharing of views (11 episodes)

This pattern predominantly consisted of functions coded as view-seeking intention and execution. In the majority of the cases, the dialogue started with a teacher's question prompting the students to express their views, ideas or opinions (9) and less often with a student expressing his or her views (1). Shared knowledge was built through questions presented by both

the students and their teacher, as well as through balanced sharing of views and thoughts and arguments about views. Shared knowledge was usually based on previous knowledge, a text read together or sometimes, shared experiences. The dialogue's intended goal appeared to be directed towards reflecting different viewpoints rather than revising or understanding specific factual knowledge. As Example 3 indicates, although the pattern contained the expression of views, the discussion also had clear educational content. The episodes identified as Pattern B took place in literacy (6), religion (4) and math (1) lessons.

Example 3 Pattern B: Sharing of views.

Context: In the previous religion lesson, the students learned about heroes.

Teacher:	In your own opinion, what is a good everyday hero like? There are no answers in the book, so these are just your own opinions. You can say three things. Jamie.
Student:	Someone who is not afraid to stick out for someone and help.
Teacher:	Mm, yes, all were good answers. Lenny.
Student:	Someone who helps others, takes others into account, is brave and brings out courage in others, too.
Teacher:	That is very important, that one takes others into account. And that is a quality that might be . . . might be a bit difficult to even practise. I mean that for many people, encouraging others comes kind of naturally. Ralph.
Student:	Someone who helps.
Teacher:	The will to help is of course very important. Sammy.
Student:	Police officers and firefighters.
Teacher:	That's right; there are these professions where people help others as their work. But I don't think that people in those professions have hoped to become heroes or hope to save people. Rather, I believe they hope that they wouldn't have to save anyone, that things would be that good.

The discussion about everyday heroes continues.

3.2.4. Pattern B/C: sharing of views based on experiences (two episodes)

Pattern B/C consisted of episodes containing codes of view-seeking intention and experiential execution. The dialogue started typically with a teacher's open question asking students to express their views on an issue. This pattern comprised only one or a few questions, and shared knowledge was built mostly on balanced sharing of experiences and exchanging of personal views by both the students and their teacher (see Example 4). The pattern's educational goal seemed to focus on exchanging and reflecting on different viewpoints and experiences rather than reviewing any factual knowledge. This type of dialogue occurred only in two religion lessons.

Example 4 Pattern B/C: Sharing of views based on experiences.

Context: The teacher and the students have watched a few short animated video clips about domestic violence.

Teacher:	What kinds of thoughts do you have about these different forms of violence? Sally.
Student:	So basically, someone can do so that, for example, if a man beats his woman, and the woman wants to get a divorce, the man can say, for example, "I will kill myself if you go". And then, the woman can't do anything.
Student:	Yes, like in that story where they had to live with a stepfather. And when they wanted to leave him, he said, "if you go, you won't get any money for living, or I will not pay child support".
Student:	I also know a case in our [neighbourhood]. There is a couple, and from their place, you can hear fighting once in a while. <i>Details about the case are discussed.</i>
Teacher:	Why don't these people simply just leave the relationship? Terry.
Student:	Well, like I said, it could be that even if [. . .] one wants to go, the other one earns more money.
Teacher:	Money issues, yes. Jessica, did you have some opinions?
Student:	Well, I thought, maybe they just don't want to leave. Like they might think that the other person is still nice.

The discussion continues.

3.2.5. Pattern C: sharing of experiences (five episodes)

Pattern C consisted of episodes containing functions coded as experience-seeking intention and experiential execution. The dialogue was started either by a student willing to share his or her experience (three episodes) or by the teacher requesting the students to share their experiences about a certain topic (two episodes). The way in which the dialogue was initiated had an impact on which of the two directions the dialogue headed toward. Example 5 presents a pattern of sharing experiences where the teacher's interrogative intention leads to a discussion that relies on questions and answers about experiences with different fuses. The other type of pattern, which started from a student's initiative to share an experience, typically led to a dialogue containing only a few questions. In Pattern C, shared knowledge was mostly built through balanced sharing of experiences by the students and their teacher. Patterns comprising pure sharing of experiences were identified in religion (2) and physics/chemistry (3) lessons.

Example 5 Pattern C: Sharing of experiences.

Context: The teacher and the students are talking about fuses.

Teacher:	How many of you have a fuse box at home? (<i>The students raise their hands.</i>) How many have it in the hallway? (<i>Most of the students raise their hands again.</i>)
Student:	At the back of the hallway.
Teacher:	Yes. Usually, it is always in the hallway or near it. How many of you have been at home when a fuse has blown? (<i>Many of the students raise their hands.</i>)
Student:	To me, it has happened two times.
Teacher:	What happened, Sarah, when a fuse did blow?
Student:	Well, the room went dark, and the TV shut down.
Teacher:	And what did you do then?
Student:	We [put in] a new fuse.

The teacher and the students continue studying about fuses by reading their textbooks.

3.2.6. Pattern A/C: sharing of facts based on experiences (six episodes)

Pattern A/C consisted of episodes with functions coded as factual intention and experiential execution. The dialogue started by either the teacher's (4) or a student's (2) factual questions or information sharing. The dialogue sometimes included a few factual questions, but mostly, it was constructed with balanced and interlinked sharing of facts and experiences (see Example 6). The shared facts were by definition based on and typically also justified with experiences, such as personal accounts and stories. This pattern occurred in physics/chemistry (5) and literacy (1) lessons.

Example 6 Pattern A/C: Sharing of facts based on experiences.

Context: The teacher and the students are discussing different types of electric plugs and adaptors.

Student:	In the UK, there are three pins.
Teacher:	Yes. And all around the world, they use different kinds of plugs. But how do you handle it when you go abroad? When you, for example, go on a trip to the UK, you take your phone with you and notice there that "hey, I can't plug in my charger here".
Student:	Well, in the UK or if you go somewhere, they sell these things with three pins and two on the other side.
Teacher:	What do you call them? Does anyone know?
Student:	Is it an adapter?
Teacher:	Yes. There are different kinds of adapters. The Finnish word for it would be maybe <i>sovitin</i> or <i>muunnin</i> , maybe. You really put this converter on, and then it works just normally there in the UK or wherever you go. Yes, Tommy.
Student:	It is such a huge thing with all the plugs and everything.
Teacher:	Yes, there are two types of adapters. I have seen one that you just turn around and can find different kinds of pins. Or then, there are these smaller ones that you can separate from each other but still carry as one piece.
Student:	Well, in the guest boats, they have adapters, too.

The teacher and the students continue sharing facts based on their experiences.

4. Discussion

This descriptive study set out to examine how knowledge can be built through classroom interaction and, specifically, what kinds of knowledge-building patterns can be identified in educational dialogues in Grade 6 lessons. First, three types of knowledge were identified, as follows: fact, view and experience. Second, sharing of these three types of knowledge was identified to form six knowledge-building patterns in educational classroom dialogue. Three of the patterns represented the pure sharing of each type of knowledge (Pattern A: Sharing of facts, Pattern B: Sharing of views and Pattern C: Sharing of experiences). The other three patterns signified the blended forms of sharing knowledge (Pattern A/B: Sharing of views based on facts, Pattern B/C: Sharing of views based on experiences and Pattern A/C: Sharing of facts based on experiences). The factual function of knowledge was actively involved in the majority of the identified dialogic episodes. The starting point of the dialogue often concentrated on factual knowledge. The students and their teacher used the other two types of knowledge (i.e., experience and view), often to express their factual knowledge and in this way, contributed to collaborative knowledge building. In most of the patterns, sharing of knowledge took place in a way which represented relatively balanced turn taking and equal opportunities for both teacher and students to participate in the exchange by asking questions, providing answers and comments listening attentively or justifying and elaborating their thoughts. The teacher could invite students to discussion by asking both open and closed questions or asking for broader elaboration, but also students were found to make initiatives by asking questions or sharing their knowledge or stories.

The findings further indicated that classroom dialogues in Grade 6 strongly focused on factual knowledge. The factual function had an important contribution to half of the identified pattern types (sharing of facts, sharing of views based on facts and sharing of facts based on experiences), and most of the identified episodes were dominated by the factual function. This finding seems to indicate that educational discussions in the classroom in the final year of primary school mostly rely on earlier factual knowledge and inquiries of students and their teacher. This is an interesting result since our previous studies have shown that in the early school years' authentic educational classroom talk, students are most devoted to and actively

participate in the dialogue when the discussion focuses on sharing their own experiences (Muhonen et al., 2016; Rasku-Puttonen, Lerkkanen, Poikkeus, & Siekkinen, 2012). The results of these studies with younger children imply that the nature of the classroom dialogue and shared knowledge building may change from the experience-dominated to the fact-dominated type by student age.

The function of sharing views also played an important role by being represented in three types of knowledge-building patterns (sharing of views, sharing of views based on facts, and sharing of views based on experiences). In these patterns, educational talk was built through sharing opinions and justifying individual viewpoints. The successful pursuit of collaborative learning has been shown to depend on students' sharing views relevant to the discussion and having a joint conception of the discussion's goal (Barnes & Todd, 1977; Bennett & Dunne, 1992; Galton & Williamson, 1992). This finding was also evident in the identified episodes. Opinions and justifications were always related to the topic being discussed and studied, and the conceptions shared by the students and their teacher were positively accepted in most of the cases. According to Howe et al. (2007), expressing contrasting opinions in a group is an important predictor of learning. Stahl (2000) proposes that the acceptance of a common result in the negotiation of different perspectives can be considered knowledge. In this study, contradictory opinions were mostly presented between the students and their teacher, but the sharing of views and opinions among the students was mostly harmonious and contributed to joint understanding. In their study about peer-group interaction in collaborative meaning making, Kumpulainen and Kaartinen (2000) point out that successful collaboration requires active negotiation and adjustment of varying viewpoints. The difference between the teacher's and the students' views prompted the participants to explain and to argue about their positions, which seemed to lead to a more versatile and richer dialogic exchange. It was not always clear whether a final agreement was reached; particularly concerning facts based on experiences or views, it might be unlikely and would not even be necessary to arrive at a consensus.

The function of sharing views was perceived as also connected to the third main function, experience – previously acknowledged as important for students' learning (Goos et al., 1999). In all three pattern types involving experiences (sharing of experiences, views based on experiences, and facts based on experiences), sharing of students' and their teacher's personal experiences took place in a balanced fashion. Stahl (2000) views language – a medium of knowledge – as based on individual experiences that are accepted in acts of understanding or agreement. Individual experiences originally have their meaning and value only for the student or the teacher in question, but when this personal experience is brought to a joint discussion, often linked to facts and views, and is acknowledged and possibly validated by others, the individual experience can be defined as shared knowledge. In school, examinations and activities typically focus on testing students' factual knowledge, and opinions and experiences may be given relatively little space. However, factual knowledge may provide the necessary background for students to feel comfortable in participating in dialogue by sharing their experiences and opinions as well.

Out of the framework that used 19 functions of classroom talk, only three functions were identified as being focally involved in producing shared knowledge building in the educational dialogue. Other kinds of functions in the classroom are present but may not be as critical for contributing important new content to the discussion. Constructing open and dialogic classroom talk is typically regarded as requiring teacher planning and structure provision (Gillies, 2015). In the light of the present study's results, we suggest that the teacher's most pivotal role is to actively foster and utilise student participation and talk to build knowledge together through shared discussion in the classroom. It is essential for the teacher to create a supportive classroom climate for the students to freely express their thoughts (e.g., Alexander, 2006). Although sharing of factual knowledge seemed to dominate in Grade 6 lessons, for some students, it might be easier or more natural to share their thoughts based on their views or experiences. It is vital to acknowledge the need to support diversity in classroom talk and to allow different types of knowledge to enter the discussion, which will likely help all students in dialogue participation.

In comparison to previous studies' results, the Grade 6 students seem to play a more active role in their lessons, including dialogue and especially in collaborative knowledge building, than the students in the early school years. For example, Muhonen et al. (2016) show that most of the identified classroom dialogues are actively supported by teachers in the early school years, especially in teacher-initiated dialogues. On the other hand, children perform a significantly more active role in child-initiated dialogues where they eagerly share their personal experiences and stories. However, this present study among Grade 6 students shows their ability to actively participate in classroom discussion and collaborative knowledge building in any kind of educational dialogue. The students do not entirely depend on their teacher's support; instead (as described in the pattern descriptions), they ask questions, spontaneously share information and initiate discussions. The students express mature thoughts and respect one another by listening and commenting politely. This behaviour might indicate that students' collaborative and interactive skills can be developed during their primary years, both in expressing knowledge and becoming more independent and competent in dialogue participation.

This study's results also have some practical implications. Because the nature of classroom dialogue may vary between early and late primary grade students, teachers should take this into account in lesson planning, but teacher education should already pay attention to this matter. Previous research has indicated that teachers play a key role in creating cooperative learning opportunities for students (Gillies, 2016), and they can engage students in higher-level thinking through scaffolding in classroom interaction and educational dialogue (Gillies et al., 2012; Muhonen et al., 2016). Since the Finnish National Board of Education (2014) stresses interaction and discussion in classroom practices, it is imperative that teachers utilise dialogue as an active knowledge-building method. Teachers should also explore the possibilities of different knowledge-building patterns to acknowledge the concrete ways to scaffold educational dialogues.

This study's outcomes may serve as useful tools for teacher education for the purpose of enhancing the quality and variety of teacher training and teaching practices. Diverse knowledge-building structures of classroom dialogues can already be discussed, demonstrated and practised during pre-service teacher training. Lehesvuori, Viiri, and Rasku-Puttonen's (2011) intervention study shows that student teachers are able to challenge traditional teaching methods and increase their dialogic approach. However, they experience certain challenges when implementing dialogic teaching, such as timing, discipline and the possible lack of content knowledge. It is important that student teachers learn to utilise dialogue as an effective and meaningful method of daily teaching practice at an early stage in order to increase dialogic teaching and learning in classrooms. Teachers should pay attention to careful lesson planning and structuring, with clear goals for learning in order to build an educational dialogue (Gillies et al., 2014; Gillies, 2015). However, the nature of scaffolding and the strategies to support shared understanding in knowledge building can vary, depending on whether the educational dialogue is initiated by the teacher or the students (Muhonen et al., 2016; Rasku-Puttonen et al., 2012).

This study also has some limitations. First, due to the lack of studies on the functional structure of classroom talk between the teacher and the students in primary school, the function framework was a modified version of the FACCT framework (Kumpulainen & Wray, 2002). The original framework concentrated only on the talk among the students, excluding the teacher's talk. After the data-driven modifications, the framework became applicable to the whole class talk. However, many of the functions included in the original framework did not occur in this study's data, probably due to the teachers' involvement in the dialogue analysis. Though qualitative content analysis could be conducted through the data-driven approach, a more condensed and specific function framework would have been useful as a guide for the analysis. Hennessy et al. (2016) have recently developed and piloted a coding scheme for analysing educational dialogue for whole-class, group and paired work. They are also in the process of developing subschemes for more specific educational contexts, such as learning of specific knowledge domains, peer interaction and use of digital technology. There is a need to develop more frameworks that can be applied in diverse ways to both whole-class and small-group settings. Second, the original number of teachers ($n=46$) was relatively small, which might have decreased the power of testing in the LPA. For this reason, we focused only on the subgroup of seven teachers with the highest CLASS-S scores since this subgroup was clearly separated from the others in all solutions. Third, the observed teachers voluntarily participated in this study. The subjects and the number of recorded lessons also varied among the teachers. Fourth, the analysis and inquiry dimension was not included in the LPA since it seemed to favour the teachers who were conducting mathematics lessons, at the expense of the other subjects. By excluding this dimension, the entire domain of instructional support was not covered in the selection phase. Finally, we acknowledge that knowledge building in the classroom can take place in diverse ways, for example through more teacher-centered teaching methods such as lecturing. The study focuses on describing the ways of knowledge building manifested in educational dialogues in the present data, identified by selecting teachers with lessons of relatively high interactional quality.

This study's findings indicate the need to increase classroom talk and dialogue in primary school. Though several educational dialogues were found from the data, the majority of the teachers who chose to volunteer had relatively low teacher-student interaction scores (measured by the CLASS-S) in utilising dialogue as a way of teaching. In this study, three subgroups of teachers, categorised by their interaction quality during the lessons, were identified through the LPA, but only the subgroup of teachers with the highest scores was qualitatively analysed. In the future, it would be interesting to study the other two subgroups of teachers in order to analyse the possible differences between higher- and lower-quality teaching practices, especially regarding classroom dialogues. Moreover, the nature and functions in lower-quality subgroups should be analysed to find ways to enhance dialogic teaching and to evaluate what kinds of tools are needed by the teachers.

5. Conclusions

Knowledge building through educational dialogue in Grade 6 lessons seems to emerge from three types of knowledge – fact, view and experience. These three types of knowledge, on their own or blended with each other, form six knowledge-building patterns in educational dialogue. Based on the identified episodes of classroom dialogue, factual knowledge seems to dominate in Grade 6. The students assume an active and versatile role in the dialogues, and they spontaneously participate and share their knowledge and thoughts. By acknowledging the three types of knowledge and their utilisation in educational dialogues, teachers can support a wider variety of educational discussions and students' active participation in knowledge building in the classroom. The results of the present study are of particular significance as they contribute to the literature by providing insights about the nature of educational dialogue and examples of the diverse ways in which knowledge can be built through dialogue in Grade 6 classrooms.

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References

Alexander, R. (2000). *Culture and pedagogy: International comparisons in primary education*. Oxford: Blackwell.

- Alexander, R. (2006). *Towards dialogic teaching*, 3rd ed. New York: Dialogos.
- Arvaja, M., Salovaara, H., Häkkinen, P., & Järvelä, S. (2007). Combining individual and group-level perspectives for studying collaborative knowledge construction in context. *Learning and Instruction*, 17(4), 448–459. <http://dx.doi.org/10.1016/j.learninstruc.2007.04.003>.
- Barnes, D., & Todd, F. (1977). *Communication and learning in small groups*. London: Routledge and Kegan Paul.
- Barnes, D. (1976). *From communication to curriculum*. Harmondsworth: Penguin Books.
- Bennett, N., & Dunne, E. (1992). *Managing classroom groups*. London: Simon and Schuster.
- Brown, J. S., & Duguid, P. (2000). *Social life of information*. Boston, MA: HBS Press.
- Byman, A., Järvelä, S., & Häkkinen, P. (2005). What is reciprocal understanding in virtual interaction? *Instructional Science*, 33(2), 121–136. <http://dx.doi.org/10.1007/s11251-004-7689-8>.
- Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education*, 6th ed. London: Routledge/Falmer.
- Eggins, S. (1994). *An introduction to systemic functional linguistics*. London: Pinter.
- Fall, R., Webb, N., & Chudowsky, N. (1997). *Group discussion and large-scale language arts assessment: Effects on students' comprehension*. CSE technical report, vol. 445, Los Angeles: CRESST.
- Fernandez, M., Wegerif, R., Mercer, N., & Rojas-Drummond, S. M. (2001). Re-conceptualising scaffolding and the zone of proximal development in the context of symmetrical collaborative learning. *Journal of Classroom Interaction*, 36(2), 40–54.
- Finnish National Board of Education (2014). *Perusopetuksen opetussummitelman perusteet 2014*. Helsinki: Finnish National Board of Education.
- Galton, M., & Williamson, J. (1992). *Group work in the primary classroom*. London: Routledge.
- Gillies, R., Nichols, K., Burgh, G., & Haynes, M. (2012). The effects of two meta-cognitive questioning approaches on children's explanatory behaviour, problem-solving, and learning during cooperative, inquiry-based science. *International Journal of Educational Research*, 53, 93–106. <http://dx.doi.org/10.1016/j.ijer.2012.02.003>.
- Gillies, R., Nichols, K., Burgh, G., & Haynes, M. (2014). Primary students' scientific reasoning during cooperative inquiry-based science activities. *International Journal of Educational Research*, 63, 127–140. <http://dx.doi.org/10.1016/j.ijer.2013.01.001>.
- Gillies, R. (2013). Productive academic talk during inquiry-based science. *Pedagogies*, 8, 126–142. <http://dx.doi.org/10.1080/1554480X.2013.767770>.
- Gillies, R. (2015). Dialogic interactions in the cooperative classroom. *International Journal of Educational Research*, 76, 178–189. <http://dx.doi.org/10.1016/j.ijer.2015.02.009>.
- Gillies, R. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, 41(3), 39–54. <http://dx.doi.org/10.14221/ajte.2016v41n3.3>.
- Goos, M., Galbraith, P., & Renshaw, P. D. (1999). Establishing a community of practice in a secondary mathematics classroom. In L. Burton (Ed.), *Learning mathematics: From hierarchies to networks* (pp. 36–61). London: The Falmer Press.
- Hämäläinen, R., & Laine, K. (2015). Classroom orchestration: Balancing between personal and collaborative learning processes. *International Journal of Virtual and Personal Learning Environments*, 5(3), 33–50. <http://dx.doi.org/10.4018/ijvple.2014070103>.
- Hämäläinen, R., & Vähäsantanen, K. (2011). Theoretical and pedagogical perspectives on orchestrating creativity and collaborative learning. *Educational Research Review*, 6(3), 169–184. <http://dx.doi.org/10.1016/j.edurev.2011.08.001>.
- Halliday, M. A. K., & Matthiessen, C. M. I. M. (2014). *Halliday's introduction to functional grammar*, 4th ed. London: Routledge.
- Halliday, M. A. K. (1978). *Language as social semiotic: The social interpretation of language and meaning*. London: Edward Arnold.
- Harasim, L. M. (1989). Online education. A new domain. In R. Mason, & A. R. Kaye (Eds.), *Mindweave. Communication, computers, and distance education* (pp. 50–62). Oxford: Pergamon Press.
- Hennessy, S., Rojas-Drummond, S., Higham, R., Márquez, A. M., Maine, F., Ríos, R. M., . . . Barrera, M. J. (2016). Developing a coding scheme for analysing classroom dialogue across educational contexts. *Learning, Culture and Social Interaction*. <http://dx.doi.org/10.1016/j.lcsi.2015.12.001> [in press].
- Howe, C. J., & Tolmie, A. (2003). Group work in primary school science: Discussion, consensus and guidance from experts. *International Journal of Educational Research*, 39, 51–72. [http://dx.doi.org/10.1016/S0883-0355\(03\)00073-9](http://dx.doi.org/10.1016/S0883-0355(03)00073-9).
- Howe, C. J., Tolmie, A., Thurston, A., Topping, K., Christie, D., Livingston, K., . . . Donaldson, C. (2007). Group work in elementary science: Towards organizational principles for supporting pupil learning. *Learning and Instruction*, 17, 549–563. <http://dx.doi.org/10.1016/j.learninstruc.2007.09.004>.
- Jamil, F. M., Sabol, T. J., Hamre, B. K., & Pianta, R. C. (2015). Assessing teachers' skills in detecting and identifying effective interactions in the classroom. *The Elementary School Journal*, 115(3), 407–432. <http://dx.doi.org/10.1086/680353>.
- Justice, L. M., Mashburn, A. J., Hamre, B. K., & Pianta, R. C. (2008). Quality of language and literacy instruction in preschool classrooms serving at-risk pupils. *Early Childhood Research Quarterly*, 23(1), 51–68. <http://dx.doi.org/10.1016/j.ecresq.2007.09.004>.
- Kaye, A. R. (1992). Learning together apart. In A. R. Kaye (Ed.), *Springer-Verlag [NATO ASI Series]*.
- Kumpulainen, K., & Kaartinen, S. (2000). Situational mechanisms of peer group interaction in collaborative meaning-making: Processes and conditions for learning. *European Journal of Psychology of Education*, 15(4), 431–454. <http://dx.doi.org/10.1007/bf03172986>.
- Kumpulainen, K., & Wray, D. (2002). *Classroom interaction and social learning: From theory to practice*. London: Routledge-Falmer.
- La Paro, K. M., Pianta, R. C., & Stuhlman, M. (2004). The classroom assessment scoring system: Findings from the pre-kindergarten year. *The Elementary School Journal*, 104(5), 409–426. <http://dx.doi.org/10.1086/499760>.
- Lemke, J. (1990). *Talking science: Language, learning and values*. Norwood: Ablex.
- Lehesvuori, S., Viiri, J., & Rasku-Puttonen, H. (2011). Introducing dialogic teaching to science student teachers. *Journal of Science Teacher Education*, 22, 705–727. <http://dx.doi.org/10.1007/s10972-011-9253-0>.
- Lerkanen, M.-K., Niemi, P., Poikkeus, A.-M., Poskiparta, M., Siekkinen, M., & Nurmi, J.-E. (2006). *The first steps study (Alkupaikat)*. Finland: University of Jyväskylä (Unpublished data).
- Lyle, S. (2008). Dialogic teaching: Discussing theoretical contexts and reviewing evidence from classroom practice. *Language and Education*, 22, 222–240. <http://dx.doi.org/10.2167/le778.0>.
- McGraw, K. O., & Wong, S. P. (1996). Forming inferences about some intraclass correlation coefficients. *Psychological Methods*, 1(1), 30–46. <http://dx.doi.org/10.1037/1082-989X.1.1.30>.
- Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. London: Routledge.
- Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and development of reasoning in the classroom. *British Educational Research Journal*, 25(1), 95–111. <http://dx.doi.org/10.1080/0141192990250107>.
- Mercer, N. (1995). *The guided construction of knowledge: Talk among teachers and learners*. Clevedon: Multilingual Matters.
- Mercer, N. (2008). Talk and the development of reasoning and understanding. *Human Development*, 51(1), 90–100. <http://dx.doi.org/10.1159/000113158>.
- Mortimer, E. F., & Scott, P. H. (2003). *Meaning making in science classrooms*. Milton Keynes: Open University Press.
- Muhonen, H., Rasku-Puttonen, H., Pakarinen, E., Poikkeus, A.-M., & Lerkanen, M.-K. (2016). Scaffolding through dialogic teaching in early school classrooms. *Teaching and Teacher Education*, 55, 143–154. <http://dx.doi.org/10.1016/j.tate.2016.01.007>.
- Muthén, B. O. (2001). Latent variable mixture modeling. In G. A. Marcoulides, & R. E. Schumacker (Eds.), *Advanced structural equation modeling: New developments and techniques* (pp. 1–33). Mahwah, NJ: Erlbaum.
- Muthén, B. O. (2003). Statistical and substantive checking in growth mixture modeling: Comment to Bauer and Curran. *Psychological Methods*, 8(3), 367–377. <http://dx.doi.org/10.1037/1082-989X.8.3.369>.
- Nathan, M. J., & Knuth, E. J. (2003). A study of whole classroom mathematical discourse and teacher change. *Cognition and Instruction*, 21(2), 175–207. http://dx.doi.org/10.1207/s1532690xci2102_03.
- Rasku-Puttonen, H., Lerkanen, M.-K., Poikkeus, A.-M., & Siekkinen, M. (2012). Dialogical patterns of interaction in preschool classrooms. *International Journal of Educational Research*, 53, 138–149. <http://dx.doi.org/10.1016/j.ijer.2012.03.004>.
- Pianta, R. C., Hamre, B. K., & Mintz, S. (2012). *Classroom assessment scoring system-secondary (CLASS-S)*. Charlottesville, VA: University of Virginia.

- Rojas-Drummond, S., & Mercer, N. (2003). Scaffolding the development of effective collaboration and learning. *International Journal of Educational Research*, 39, 99–111. [http://dx.doi.org/10.1016/S0883-0355\(03\)00075-2](http://dx.doi.org/10.1016/S0883-0355(03)00075-2).
- Rojas-Drummond, S., Mercer, N., & Dabrowski, E. (2001). Collaboration, scaffolding and the promotion of problem solving strategies in Mexican pre-schoolers. *European Journal of Psychology of Education*, 16(2), 179–196. <http://dx.doi.org/10.1007/bf03173024>.
- Salisbury, J. (2012). Vocational education and training: Sites for qualitative study. In S. Delamont (Ed.), *Handbook of qualitative research in education* (pp. 143–156). Cheltenham, UK: Edward Elgar Publishing.
- Salminen, J., Lerkkanen, M.-K., Poikkeus, A.-M., Pakarinen, E., Siekkinen, M., Hännikäinen, M., . . . Rasku-Puttonen, H. (2012). Observed Classroom Quality Profiles of Kindergarten Classrooms in Finland. *Early Education and Development*, 23(5), 654–677. <http://dx.doi.org/10.1080/10409289.2011.574267>.
- Sawyer, R. K. (2007). *Group genius: The creative power of collaboration*. New York: Basic Books.
- Scardamalia, M. (2002). Collective cognitive responsibility for the advancement of knowledge. In B. Smith (Ed.), *Liberal education in a knowledge society* (pp. 67–98). Chicago, IL: Open Court.
- Slavin, R. E. (1980). Co-operative learning. *Review of Educational Research*, 50, 315–342. <http://dx.doi.org/10.3102/00346543050002315>.
- Sorensen, E. K., & Takle, E. (2002). Collaborative knowledge building in web-based learning: Assessing the quality of dialogue. *International Journal on E-Learning*, 1(1), 28–32.
- Sorensen, E. K. (1997). *Learning in virtual contexts. Navigation, interaction, and collaboration*. Denmark: Aalborg University [Unpublished doctoral dissertation].
- Stahl, G. (2000). A model of collaborative knowledge-building. In B. Fishman, & S. O'Connor-Divelbiss (Eds.), *Proceedings of the fourth international conference of the learning sciences* (pp. 70–77). Mahwah, NJ: Erlbaum.
- Underwood, J., & Underwood, G. (1999). Task effects in co-operative and collaborative learning with computers. In K. Littleton, & P. Light (Eds.), *Learning with computers: Analysing productive interaction* (pp. 10–23). London: Routledge.
- Virtanen, T., Pakarinen, E., Lerkkanen, M.-K., Poikkeus, A.-M., Siekkinen, M., & Nurmi, J.-E. (2016). A validation study of the Classroom Assessment Scoring System Secondary among Finnish Grade 6. Manuscript submitted for publication.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.
- Webb, N. M. (1993). Collaborative group versus individual assessment in mathematics: Processes and outcomes. *Educational Assessment*, 1(2), 131–152. http://dx.doi.org/10.1207/s15326977ea0102_3.
- Wells, G. (1999). *Dialogic inquiry: Toward a sociocultural practice and theory of education*. Cambridge: Cambridge University Press.
- Wertsch, J. V. (1979). From social interaction to higher psychological processes: A clarification and application of Vygotsky's theory. *Human Development*, 22, 1–22. <http://dx.doi.org/10.1159/000112532>.
- Wolfe, N., & Alexander, R. J. (2008). *Argumentation and dialogic teaching: Alternative pedagogies for a changing world*. London: Futurelab.
- Yates, G. C., & Yates, S. M. (1990). Teacher effectiveness research: Towards describing user-friendly classroom instruction. *Educational Psychology*, 10(3), 225–238. <http://dx.doi.org/10.1080/0144341900100304>.

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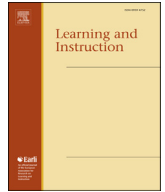
QUALITY OF EDUCATIONAL DIALOGUE AND ASSOCIATION WITH STUDENTS' ACADEMIC PERFORMANCE

by

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Quality of educational dialogue and association with students' academic performance



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ABSTRACT

The study used a mixed-methods approach to examine the associations between the quality of educational dialogue and students' academic performance and to analyse what kinds of dialogic teaching patterns of different levels of quality can be identified in classroom lessons. A total of 158 Grade 6 lessons were video-recorded, and the quality of the educational dialogue was assessed using the Classroom Assessment Scoring System-Secondary (CLASS-S) observational instrument. Multilevel modelling indicated that the quality of educational dialogue was positively associated with students' academic performance (grades) in language arts and physics/chemistry. Qualitative analysis was subsequently used to examine the quality of the patterns of dialogic teaching in language arts and physics/chemistry lessons ($n = 11$). The analysis revealed that teacher-initiated patterns were predominant in both subjects and that physics/chemistry lessons were more typically characterised by high-quality educational dialogue than language arts lessons.

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1. Introduction

As the nature and intent of teaching are seen less as a transmission of information and more as guidance and support for students' self-regulated learning and shared knowledge building (Wells & Arauz, 2006), it has been acknowledged that the quality of learning and its outcomes rely on learning activities and students' involvement in exploratory action (e.g. Bransford, Brown, & Cocking, 2000; Vermunt & Verloop, 1999). Through their organisation of activities and classroom time, teachers create and shape the dynamics of interactive opportunities, but the quality of the interaction between teachers and students as well as that of educational dialogue are most critical for the construction of knowledge and learning in classrooms (Alexander, 2006). The relevance of the quality of educational dialogue for the development of students' deep understanding has been documented in science, in particular, but it also applies to other curriculum subjects (e.g. Alexander, 2000; Howe, 2010; Mercer & Littleton, 2007;

Mortimer & Scott, 2003; Nystrand, 1997).

Although there is increasing documentation of the use and benefits of promoting exploratory talk among students in small-group discussions both in primary and secondary education (e.g. Dawes, Mercer, & Wegerif, 2000; Howe et al., 2007) as well as in higher education (e.g. Kaartinen & Kumpulainen, 2002), research evidence of learning gains relating to the quality of whole-class dialogue, as observed in authentic classroom situations, remains scarce. There is a need for more research on the benefits and learning outcomes of different types of educational dialogues (Howe, 2017; see Howe & Abedin, 2013 for a meta-analysis). Observations and video-recordings of authentic classroom discussions provide valuable data for examining students' learning and conceptual changes, but engaging in an analysis of this kind of data is also demanding and requires rigorous and systematic approaches (Mercer & Howe, 2012). Consequently, the aim of our study was to utilise a mixed-methods approach to examine the association between the quality of educational dialogue in whole-class lessons and students' academic performance (grades) in Grade 6 as well as the quality of teacher-initiated and student-initiated dialogic teaching patterns in different subjects.

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1.1. The sociocultural approach to learning and scaffolding

The conceptual basis of the present study draws from the sociocultural approach to learning and the Vygotskian view (1978) of the fundamental role of language in children's learning and development. According to the sociocultural theory, language can be defined both as a cultural tool for sharing and developing knowledge and as a psychological tool for analysing the content and processes of individual thoughts (Vygotsky, 1978); it is through language that individuals learn via interaction and build collective understanding. Although Vygotsky focused on adult-child interactions in general, sociocultural approaches to learning have been increasingly applied to teacher-student and peer interactions and to theoretical accounts of educational dialogue in the classroom.

Scaffolding is a term that is widely used to describe the process by which a teacher or more experienced peer supports a child's learning through interaction (Wood, Bruner, & Ross, 1976). Van de Pol, Volman, and Beishuizen (2010) suggest that scaffolding consists of three main features: 1) *contingency* (tailored, responsive and adjusted support); 2) *fading* (gradual withdrawal of the support over time) and 3) *transfer of responsibility* (the teacher eventually transfers the responsibility of performing the task to the student). Ideally (and what is meant by scaffolding in this study), the process of scaffolding is interwoven in educational dialogue whereby the teacher supports students' participation, meaning making and independent thinking, for example, through open questions, inquiry and feedback and encourages them to explain their thinking (Gillies, 2013; Rogoff, 2008; Rojas-Drummond, Torreblanca, Pedraza, Vélez, & Guzmán, 2013). Muhonen, Rasku-Puttonen, Pakarinen, Poikkeus, and Lerkkanen (2016) identified patterns of teacher- and student-initiated dialogic teaching with different qualities of teacher scaffolding and initiation of the dialogue. Two of the patterns presented moderate quality, with relatively unitary forms of scaffolding for students' participation, and shared understanding, e.g. mostly closed questions that did not invite students' active sharing and elaboration of their thoughts. In addition, the level of the questions and teachers' comments was mostly on an abstract level, not closely tied with the students' experiences and everyday lives. The two other patterns presented more versatile and rich scaffolding of students' participation and shared understanding, e.g. authentic open-ended questions, summaries of the main concepts, invitations for students to explain their opinions and justify them and the use of inquiry-stimulating vocabulary.

1.2. Educational dialogue and dialogic teaching

There is no clear consensus on the definition of educational dialogue, as it can be seen to occur between the teacher and students, or between students, and an emphasis can be placed on the exchanges and involvement of the participants in the dialogue or on the teacher's orchestration of the resources and scaffolds that contribute to dialogue. There is considerable variation in the terms used to refer to forms of educational dialogue, such as dialogical pedagogy (Skidmore, 2006), dialogic teaching (Alexander, 2006), dialogic inquiry (Wells, 1999), dialogic instruction (Nystrand, 1997), exploratory talk (Mercer & Dawes, 2008), accountable talk (Wolf, Crosson, & Resnick, 2006) and collaborative reasoning (Rheznitskaya et al., 2001). Wegerif's work (2007) proposes the idea of a 'dialogic space' within which teachers and students can negotiate, explore and confront different ideas in an open and constructive environment. Because the present study focuses on whole-class dialogue between the teacher and students, we see teachers as playing a vital facilitating role in educational dialogue. Consequently, in this study, we construe educational dialogue as

reciprocal interaction in the classroom, in which both the teacher and students are present, exploring different ideas and views in an attempt to build shared understanding in accordance with Alexander's (2000, 2006) criteria for dialogic teaching.

The concept of dialogic teaching, according to Alexander (2000, 2006), describes five principles of interaction that harness the power of talk to stimulate and develop students' thinking, learning and understanding and also extends interaction between students. Classroom interaction can be considered dialogic when it meets the criteria of being: 1) collective (participants, here teacher and students, address learning tasks together); 2) reciprocal (participants listen to each other, share ideas and consider alternative viewpoints); 3) supportive (students articulate their ideas freely without fear of embarrassment, and they help each other to achieve shared understanding); 4) cumulative (participants build on their own and each other's ideas and link them to coherent lines of thinking and enquiry) and 5) purposeful (the teacher plans and steers discussion with specific learning goals in mind). Two additional features have been suggested by Lefstein (2006) to complement the existing criteria for dialogic teaching. According to Lefstein, dialogue should also be: 6) meaningful (the teacher and students bring their own views to the discussion of a topic of mutual interest) and 7) critical (the teacher and students identify different points and explore questions related to them). Alexander (2013) suggests that by acknowledging and utilising the educational functions of talk (for thinking, learning, communicating, democratic engagement, teaching and assessing) in dialogic interactions, teachers can facilitate the development of students' cognitive and communication skills. Despite the important role of teachers as facilitators of educational dialogue, it is important to acknowledge the educational student-to-student dialogue that can be observed in dialogic classroom (Alexander 2008).

A number of studies have linked the quality of dialogue to how students learn. Nystrand (1997) proposes the following aspects as reflecting the quality of a teacher's dialogic instruction: 1) the use of authentic questions, 2) the incorporation of students' responses into subsequent questions and 3) allowing students' responses to modify the topic of discourse. Although it is the teacher who predominantly initiates and manages classroom dialogue (Wells, 2009), also students can provide turns that initiate sequences that the teacher or other students contribute to with their responses (Lemke, 1990; Nassaji & Wells, 2000). For younger students it can be difficult to engage in sustained discussion of a certain topic and they easily go off on side-tracks (Wells, 2009). Even these side-tracks can, however, turn into meaningful educational dialogues if the teacher sensitively responds to students' initiatives and ideas and scaffolds the shared knowledge-building process. Cazden (2001) suggests that it is only by allowing more time for students' answers and elaborations that the teacher can create a more dialogic atmosphere and classroom dynamic where students respond to and build on each other's comments. Muhonen et al. (2016) defined the quality of dialogue through differences in a teacher's scaffolding strategies and initiation of the dialogue. In student-initiated dialogues the student asks a question or presents an idea, which the teacher extends to whole class discussion or allows space for students' independent discussion, and the focus of the discussion is on the ideas that rise from students' interests. In teacher-initiated dialogues, teacher's involvement and questioning is typically planned a priori, and the teacher uses a wide variety of scaffolding strategies. Patterns showing different qualities of dialogue and turn-taking have also been documented by, e.g. Chin (2006), and Rasku-Puttonen, Lerkkanen, Poikkeus, and Siekkinen (2012).

1.3. Associations between educational dialogue and learning outcomes

The literature on educational dialogue has provided some evidence to support its contributions to students' reasoning and learning (Littleton & Howe, 2010; Mercer & Littleton, 2007; Nystrand, 1997). In science lessons, for instance, instructional practices involving students proposing ideas and explaining their reasoning to peers have been documented as dialogical characteristics that are beneficial to their intellectual growth (e.g. Howe et al., 2007). In addition to these findings, however, the empirical literature on concrete learning gains in relation to educational dialogue, especially between teachers and their students, is surprisingly scant (Howe, 2017; see Howe & Abedin, 2013 for a meta-analysis). The majority of studies in the field concentrate on collaborative peer group interaction and its effects on student development (e.g. Barnes & Todd, 1977; Howe, 2010; Underwood & Underwood, 1999).

Previous studies have suggested that collaborative classroom discussion can support students' academic performance and contribute to the positive development of motivation and self-esteem (e.g. Mercer, 2008; Slavin, 1980). For example, Azmitia and Montgomery (1993) show that dialogue was an important predictor of children's success in problem solving. Expressing contrasting opinions in group work has been shown to predict learning gains (Howe et al., 2007). In their dialogue-based intervention approach, Mercer and colleagues (Dawes et al., 2000; Mercer & Littleton, 2007) utilise exploratory talk in teacher-led sessions and group activities to portray dialogue as a tool for teaching, learning and the development of students' understanding. Students participating in their programme made gains in math and science tests and improved their individual reasoning and collective thinking skills (e.g. Mercer, 2008). In their examination of students' problem-solving skills in computer-based settings, Underwood and Underwood (1999) found that pairs of students which analysed the situation verbally and expressed their views, opinions, agreement and disagreement achieved the best outcomes. Research on cooperative learning methods has also demonstrated that cooperative efforts result in higher individual achievement compared to competitive or individualistic efforts (Johnson, Johnson, & Stanne, 2000).

Scaffolding provided by the teacher in both whole-class and small-group interactions is considered critical in supporting effective educational dialogue in the classroom and can promote the development of individual reasoning and the advancement of learning and understanding (Rojas-Drummond & Mercer, 2003). Wolf et al. (2006) show that dialogic classroom interaction, in particular, the fostering of accountable talk, is positively related to reading comprehension. They found that when teachers encouraged students to express their thoughts and ideas in their own words, the students' reading comprehension skills developed, whereas when teachers used closed questions to check students' comprehension, no development in high-level reading skills was identified. Likewise, in their review, Kyriacou and Issitt (2008) conclude that students' good mathematics outcomes were associated with the teacher seeking to elicit reasons and explanations instead of only correct answers.

1.4. Aims of the study

Although the body of research on educational dialogue has increased, evidence of its contribution to learning outcomes remains scant. There is an obvious need for empirical evidence on the associations between educational dialogue in the classroom and students' academic performance. In order to capture both the

effects of educational dialogue on achievement and the indicators of different patterns of quality across school subjects, a mixed-methods approach is needed. With respect to the quantitative analysis, it is also imperative to control for previous academic performance, gender, parental education, group size, and teachers' professional experience. The present study consisted of the following research questions:

- 1) To what extent is the quality of educational dialogue (as assessed by the CLASS-S) associated with students' grades in academic subjects in Grade 6?
- 2) What kinds of dialogic teaching patterns of different levels of quality can be identified in language arts and physics/chemistry lessons?

2. Method

2.1. Participants

The present study represents a subsample of a large-scale longitudinal follow-up study of approximately 2000 children, their parents and teachers from preschool to upper secondary education in four Finnish municipalities (Lerkkanen et al., 2006–2016). The sample of the present study consists of 46 teachers (24 female and 22 male) and their students in Grade 6 (608 12-year-old students: 330 boys and 278 girls) who participated in classroom video-recordings. The participating teachers were selected on a voluntary basis from a total of 98 teachers participating in the larger Grade 6 follow-up study. The teachers were asked for their written consent to participate in the study, and the parents gave consent for themselves and their children. A total of 158 lessons were video-recorded (from two to four lessons per teacher). The lessons represented typical school days and Grade 6 lessons. All classrooms were Finnish speaking, and all the teachers had at least a master's degree. The teachers' work experience ranged from a minimum of 1–5 years to more than 15 years (*Mode* = more than 15 years). The class size ranged from 7 to 30 students (*M* = 20.64, *SD* = 5.93; information was missing for 4 classes). Parents' (*n* = 493) vocational and higher education represented the average level of education in Finland, ranging from no vocational education to a licentiate or doctorate (*Mode* = master's degree).

2.2. Teacher measures: observed classroom interaction and quality of educational dialogue

The quality of teacher-student interactions in the 158 video-recorded lessons was assessed using the Classroom Assessment Scoring System-Secondary (CLASS-S), an observational instrument based on the Teaching through Interactions (TTI) framework (Pianta, Hamre, & Mintz, 2012). The CLASS-S is designed to measure the quality of the following three domains of teacher-student interaction along 12 dimensions: 1) Emotional Support (three dimensions: Positive Climate, Teacher Sensitivity and Regard for Student Perspectives); 2) Classroom Organisation (three dimensions: Behaviour Management, Productivity and Negative Climate); 3) Instructional Support (five dimensions: Instructional Learning Formats, Content Understanding, Analysis and Inquiry, Quality of Feedback and Instructional Dialogue), with the twelfth dimension being Student Engagement. Each 45-min lesson was divided into three segments lasting approximately 15 min. These were coded from the videotapes by a trained observer on a 7-point scale of low (1–2), moderate (3–5) or high (6–7) quality. The coding process was guided strictly on the basis of the CLASS-S manual (Pianta et al., 2012), which provides detailed descriptions of behavioural indicators for each dimension and examples of the

classroom interaction for the ratings. In order to estimate the level of agreement between raters, inter-rater reliabilities were calculated as intraclass correlation coefficients (ICCs) for 20% of the lessons that were rated by the two observers. The ICCs ranged between 0.57 and 0.75 (for more detail, see Virtanen et al., 2017).

As the present study focused on examining the association between educational dialogue (between teacher and students) and students' academic performance, the analysis utilised the following two CLASS-S dimensions to measure the quality of educational dialogue in the classroom: *Instructional Dialogue and Quality of Feedback*. The definition for the dimension of *Instructional Dialogue* and its indicators in the CLASS-S are based on Alexander's (2006) concept of dialogic teaching: engagement in deep and meaningful conversations with clear learning content leads to better student learning. According to Wolf & Alexander (2008), purposeful questioning and chaining of ideas into 'coherent lines of thinking and inquiry' are characteristics of productive educational classroom talk which the CLASS-S assesses with concrete indicators and their behavioural markers. The *Instructional Dialogue* dimension captures the quality of purposeful content-focused discussion between the teacher and students, i.e. their engagement in structured, cumulative questioning and discussion in the classroom, which is aimed at supporting students' content understanding. When rating the dimension on a 7-point scale, the coder pays attention to and makes a judgement of quality based on evidence of the following three indicators: 1) cumulative content-driven exchanges (e.g. exchanges that build on one another); 2) distributed talk (e.g. student-initiated dialogues, balance of teacher and student talk and peer dialogue) and 3) facilitation strategies (e.g. open-ended questions and statements, active listening).

The *Quality of Feedback* dimension is based on the notion that high quality of feedback enhances student learning by lessening the gap between student's own level and the targeted goal and by encouraging deeper processing of information and independence in thinking (Rogoff, 1990; Wood et al., 1976). The dimension captures the teacher's extending and expanding of students' learning. When rating the dimension, the judgement of quality is based on evidence of: 1) feedback loops (e.g. back and forth exchanges and follow-up questions); 2) scaffolding (e.g. hints, prompting of thought processes); 3) building on student responses (e.g. expansion, clarifications) and 4) encouragement and affirmation (e.g. recognition of effort). The CLASS-S dimensions and their behavioural markers are described in more detail in the CLASS-S manual (Pianta et al., 2012).

2.3. Student measures

2.3.1. Grades in academic subjects

The study utilised students' grades (on a scale from 4 to 10), computed by their class teacher at the end of the school year in Grade 6, for the following academic subjects: 1) language arts, 2) physics/chemistry, 3) religion, 4) history and 5) biology/geography. Physics/chemistry and biology/geography are taught as integrated subjects in Grades 5 and 6 by the class teachers (see the Finnish National Core Curriculum for Basic Education, 2004).

2.3.2. Previous academic performance

The students' previous academic performance in reading comprehension and arithmetic fluency in Grade 4 was controlled in the analysis. Reading comprehension was assessed using the nationally normed reading comprehension test (ALLU; Lindeman, 1998), which involves children silently reading a factual story and answering 12 multiple choice questions at their own pace, but within the maximum allotted time of 45 min. For each correct answer, 1 point is given, producing a maximum score of 12 (Kuder-

Richardson reliability = 0.76).

Arithmetic fluency was assessed using the Basic Arithmetic Test (Aunola & Räsänen, 2007). The test consists of 28 items containing 12 addition, 13 subtraction, 1 multiplication (e.g. $12 \times 28 = ?$) and 2 division problems (e.g. $240/80 = ?$) that can be attempted within a 3-min time limit. The test indexes a combination of speed and accuracy in math performance (e.g. Zhang et al., 2014). For each correct answer, 1 point is given, producing a maximum score of 28 (Kuder-Richardson reliability = 0.85).

2.4. Analysis strategy

2.4.1. Multilevel modelling

As the first step in the analysis, intraclass correlation coefficients were calculated to determine what proportion of the variance in students' grades was due to the classroom level (i.e. classroom differences and between-classroom variation) and what was due to the individual level (i.e. differences between individual students and within-classroom variation) (Heck & Thomas, 2009; Raudenbush & Bryk, 2002). Second, classroom-level correlations between the quality of educational dialogue and students' grades were calculated.

Third, separate multilevel path models for the students' grades were conducted to investigate the association between the quality of educational dialogue and students' grades, while accounting for a number of structural control variables (i.e. previous academic performance in Grade 4, gender, class size, teacher's work experience and the level of parental education). These structural variables were controlled for in line with findings showing their associations with student learning (e.g. Blatchford, Bassett, Goldstein, & Martin, 2003; Connor, Son, Hindman, & Morison, 2005; McClelland & Morrison, 2003) and following the choice of control measures in some previous classroom studies (see review of Wayne & Young, 2003). The multilevel modelling technique (Heck & Thomas, 2009; Muthén & Muthén, 1998–2012) enables one to enter various predictors both at the class level (*between-level*) and at the level of individual students (*within-level*). Since the focus of the present study is at the classroom level, we used the quality of educational dialogue to predict between-level variation in students' grades. The analyses were performed using the Mplus statistical package (Version 7.3).

2.4.2. Identifying episodes of educational dialogue and dividing them into dialogic teaching patterns

Based on the findings from the multilevel modelling, the subjects and lessons showing associations between grades and quality of educational classroom dialogue were selected for a qualitative analysis of the dialogic teaching patterns. The mid-range score of 4 in the CLASS-S ratings of both *Instructional Dialogue and Quality of Feedback* was used as the cut-off for selecting lessons for the analysis (i.e. only lessons in which CLASS-S ratings for those two dimensions exceeded the value of 4 were included in the qualitative analysis). The reasons for using this cut-off included our interest in classroom interactions with a high likelihood of dialogic exchange and the need to restrict the sample to a manageable size (from a total of 158 lessons).

The selected lessons were read several times to identify episodes of educational dialogue (the selected school subjects and number of lessons and episodes are presented in the results, section 3.2.). An episode of educational dialogue was defined as continuous exchange between the students and teacher in which the topic under discussion remained essentially unchanged. If the topic of focus changed either based on teacher's or a student's initiation, a new episode would ensue. A change in classroom activity could also mark the end of an episode (for example, the discussion ends and

Table 1

Patterns of dialogic teaching (Muhonen et al., 2016).

<p>Pattern 2a: Teacher-initiated teaching dialogue of moderate quality The teacher asks many short/closed questions to keep the dialogue going. He/she makes expansions and draws together what is being learned. Students do not participate without the teacher's help or encouragement.</p>	<p>Pattern 3a: Student-initiated teaching dialogue of moderate quality The student asks a question or presents an idea, which the teacher broadens at the whole-class level or allows space for more independent discussion among students. The teacher might ask follow-up questions but does not make expansions or draw summaries that would collate what has been learnt.</p>
<p>Pattern 2b: Teacher-initiated teaching dialogue of high quality The teacher asks fewer but mostly open-ended questions. He/she makes expansions and draws together what is being learnt. With the help of scaffolding, students participate and formulate their own initiatives and questions.</p>	<p>Pattern 3b: Student-initiated teaching dialogue of high quality The student asks a question or presents an idea, which the teacher broadens at the whole-class level or allows space for more independent discussion among students. The teacher actively supports the discussion, makes expansions and brings together the main idea of the dialogue.</p>

students move on to independent work). Although the overall topic of the lesson is almost always determined by the teacher, subtopics starting new episodes can be introduced either by teacher's or students' initiatives (e.g. turns consisting of questions, opinions, sharing experiences or factual information). To be identified as dialogic, each independent episode had to fulfil the five principles of dialogic teaching, as defined by Alexander (2006), i.e. interaction in the episode had to be: 1) collective; 2) reciprocal; 3) supportive; 4) cumulative and 5) purposeful. For instance, exchanges consisting of question-answer sequences without any follow-up (an IRF-pattern) were not included in the dialogic episodes. Since the focus of the study was on the interaction between teachers and students, classroom activities that did not involve exchanges between the students and their teacher (e.g. routine or individual work), or learning-related tasks, were excluded from the analysis.

Finally, episodes identified as representing educational dialogue were analysed and categorised into four types of dialogic teaching patterns. The coding was based on criteria described by Muhonen et al. (2016) showing a qualitative difference between two types of teacher-initiated patterns (patterns 2a and 2b) and two types of student-initiated patterns (patterns 3a and 3b) (see Table 1). In the coding by Muhonen et al., patterns 2b and 3b represent higher-quality educational dialogues and versatile and rich scaffolding strategies that are likely to support students' conceptual thinking, joint understanding and synthesis of ideas and information. Patterns 2a and 3a represent moderate-quality educational dialogues with relatively unitary forms of questioning, less support for active participation and lower support for shared content understanding.

3. Results

3.1. The association between the quality of educational dialogue and academic grades

To examine the potential differences between classrooms with regard to students' grades, ICCs and variance estimates were calculated at the between- and within-levels. The results (see Table 2) showed statistically significant differences between classrooms. In language arts 12% ($p < 0.05$), in physics/chemistry 16% ($p < 0.001$), in religion 17% ($p < 0.001$), in history 24% ($p < 0.01$), and in biology/geography 11% ($p < 0.01$) of the total variance was due to classroom differences. The rest of the variance in students' grades was due to individual differences between students within classrooms. The between- and within-level correlations between the study variables and descriptive statistics are also presented in Table 2. The quality of educational dialogue was found to correlate positively with students' grades in language arts and physics/chemistry: the higher the ratings of the quality of the educational dialogue (i.e. the latent variable consisting of CLASS-S ratings of Instructional Dialogue and Quality of Feedback), the higher the students' end of school year grades in language arts and physics/chemistry.

In the subsequent step, we ran multilevel models to determine whether the quality of educational dialogue was associated with students' subject grades, while controlling for previous academic performance, gender, class size, the teacher's professional experience and the level of parental education. First, we investigated a model that included the grades of all five academic subjects as a latent variable. This model fit the data adequately: [χ^2_{25} ($N_{\text{within}} = 608$, $N_{\text{between}} = 45$) = 164.86, $p < 0.001$; CFI = 0.95; TLI = 0.92; RMSEA = 0.06; SRMR_{between} = 0.10, SRMR_{within} = 0.04]. The results (Fig. 1) showed that the quality of educational dialogue was significantly related to the latent variable consisting of the students' academic grades.

Lastly, we conducted separate models for each of the five academic subjects. The model for language arts fit the data well [χ^2_6 ($N_{\text{within}} = 608$, $N_{\text{between}} = 45$) = 5.51, $p = 0.48$; CFI = 1.00; TLI = 1.01; RMSEA = 0.00; SRMR_{between} = 0.08, SRMR_{within} = 0.00], showing that the quality of educational dialogue was positively related to students' grades in language arts (see Fig. 2). The model for physics/chemistry also fit the data well [χ^2_5 ($N_{\text{within}} = 608$, $N_{\text{between}} = 45$) = 5.79, $p = 0.33$; CFI = 0.99; TLI = 0.96; RMSEA = 0.02; SRMR_{between} = 0.08, SRMR_{within} = 0.01], showing that the quality of educational dialogue was positively associated with students' grades in physics/chemistry (see Fig. 3). The models for other academic subjects also fit the data, but the quality of educational dialogue was not significantly associated with students' grades in religion, history or biology/geography in the separate models.

3.2. Episodes of educational dialogue in language arts and physics/chemistry lessons

Based on the findings of the multilevel modelling showing statistically significant associations between the quality of dialogue and students' grades in language arts and physics/chemistry in their separate multilevel models, these two subjects were selected for qualitative analyses. This decision was based on our focus on subjects with strong links between the quality of educational dialogue and student achievement as well as on the need to limit the sample of lessons to which the detailed qualitative analysis could be applied. Next, episodes of educational dialogue in Grade 6 language arts and physics/chemistry lessons were examined with respect to differences in the quality of the patterns of teacher-initiated and student-initiated dialogic teaching.

Using criteria based on the five principles of dialogic teaching (Alexander, 2006), 54 episodes (34 episodes in language arts lessons; 20 episodes in physics/chemistry lessons) of educational dialogue were identified within 11 lessons taught by 11 different teachers (9 lessons in language arts and 2 lessons in physics/chemistry). The next phase involved an analysis of these episodes with respect to the different types of dialogic teaching patterns (see Muhonen et al., 2016): two types of teacher-initiated and two types of student-initiated patterns. In the present data, five episodes

Table 2
Correlations between the study variables (within-level below the diagonal, between-level above the diagonal), means, variances and ICCs ($N_{between} = 46$; $N_{within} = 608$).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	Var _{between}	M	ICC
1 Quality of Educational Dialogue(G6) ³ Students' Grades in Grade 6	1.00	0.31 ^c	0.21	0.17	0.28 ^c	0.11	–	0.04	-0.26	0.03	0.01	-0.05	0.47	2.89	–
2 Grade in Language Arts ¹	–	1.00	0.68 ^a	0.56 ^b	0.65 ^a	0.52 ^b	–	0.34	0.03	0.46 ^d	0.71 ^a	0.03	0.10 ^d	8.26	0.12 ^c
3 Grade in Biology/Geography ¹	–	0.67 ^a	1.00	0.56 ^b	0.66 ^a	0.59 ^a	–	0.54 ^c	0.26	0.52 ^c	0.67 ^a	0.02	0.12 ^b	8.27	0.11 ^b
4 Grade in History ¹	–	0.66 ^a	0.74 ^a	1.00	0.56 ^a	0.52 ^b	–	0.38 ^d	0.41	0.50 ^b	0.32	0.03	0.27 ^b	8.20	0.24 ^b
5 Grade in Physics/Chemistry ¹	–	0.59 ^a	0.71 ^a	0.64 ^a	1.00	0.69 ^a	–	0.34	-0.23	0.01	0.55 ^b	0.23	0.12 ^b	8.45	0.16 ^c
6 Grade in Religion ¹	–	0.64 ^a	0.71 ^a	0.72 ^a	0.63 ^a	1.00	–	0.29	0.07	0.24	0.34 ^d	0.19	0.22 ^a	8.22	0.20 ^a
<i>Control Variables</i>															
7 Student's Gender ²	–	-0.34 ^a	-0.18 ^a	-0.12 ^b	-0.02	-0.19 ^a	1.00	–	–	–	–	–	0.00	1.54	0.003
8 Parental Education ¹	–	0.26 ^a	0.31 ^a	0.34 ^a	0.34 ^a	0.27 ^a	0.10 ^c	1.00	0.93	0.39	0.59 ^b	-0.13	0.14	4.79	0.07 ^c
9 Reading Comprehension (G4) ¹	–	0.45 ^a	0.43 ^a	0.44 ^a	0.47 ^a	0.46 ^a	-0.12 ^c	0.21 ^a	1.00	0.84 ^a	0.55 ^b	0.25	0.19	8.21	0.03
10 Arithmetic (G4) ¹	–	0.29 ^a	0.24 ^a	0.27 ^a	0.25 ^a	0.22 ^a	0.12 ^c	0.15 ^a	0.24 ^a	1.00	0.57 ^b	0.09	1.60 ^c	17.37	0.11 ^c
11 Class Size ³	–	–	–	–	–	–	–	0.45 ^a	–	–	1.00	0.06	35.09 ^a	20.62	–
12 Teacher Experience ³	–	–	–	–	–	–	–	-0.02	–	–	–	1.00	1.45	3.93	–
<i>Var_{within}</i>															
M	–	0.73 ^a	0.91 ^a	0.88 ^a	0.63 ^a	0.87 ^a	0.25 ^a	1.90 ^a	5.71 ^a	12.82 ^a	–	–	–	–	–
Min	–	6	5	5	5	5	1	1	1	4	–	–	–	–	–
Max	–	10	10	10	10	10	2	7	12	26	–	–	–	–	–

Note. ^a $p < 0.001$, ^b $p < 0.01$, ^c $p < 0.05$, ^d $p < 0.08$. ¹ variable both at between-level and within-level, ² within-level variable, ³ between-level variable, – not estimated, ⁴ gender 1 = girl, 2 = boy.

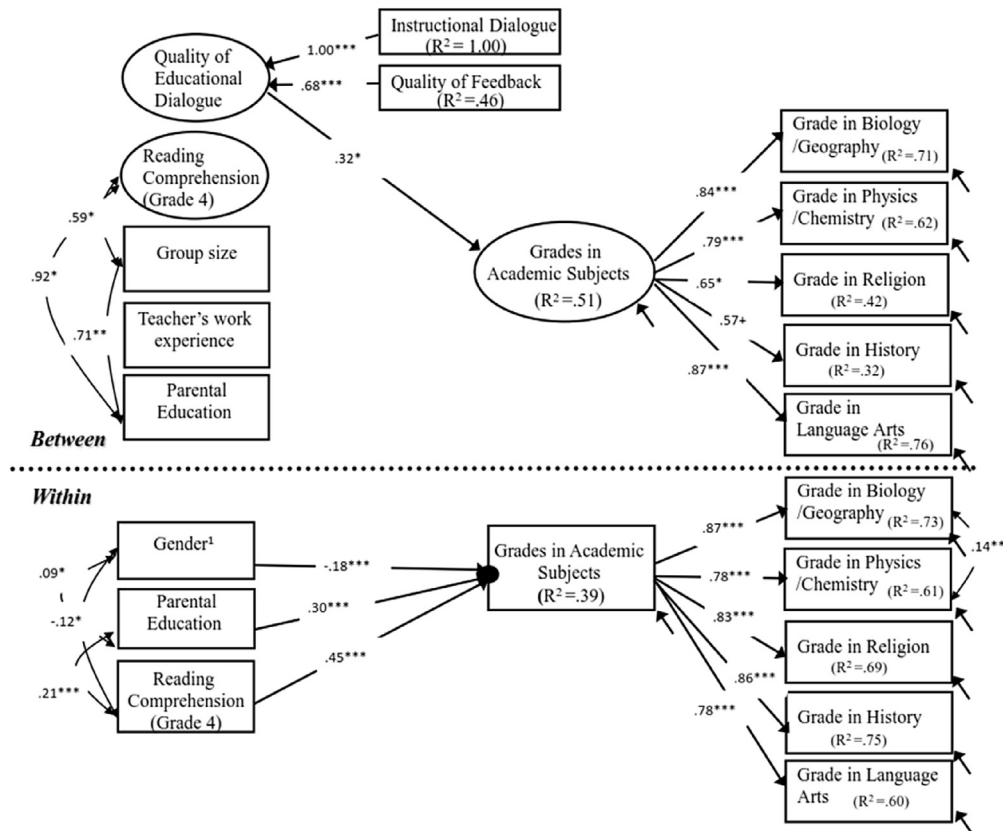


Fig. 1. Multilevel model for quality of educational dialogue and students' grades in academic subjects in Grade 6. Notes. Paths are presented as standardised estimates. ¹Gender 1 = girl, 2 = boy; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.07$.

were identified in the language arts lessons that did not match the criteria for any of the four patterns; in these episodes, educational dialogue was initiated and autonomously conducted by the students, and the teacher did not take part in the discussion unless the students needed guidance or help. These five episodes were seen to represent an additional pattern of dialogic teaching, that of pattern 4: peer-centred dialogue. We now describe in greater detail the five patterns of dialogic teaching identified in the present data.

3.2.1. Educational dialogue in language arts lessons

The educational dialogues in the language arts lessons were mostly led and supported by the teachers. The majority of the identified episodes represented teacher-initiated dialogues, especially pattern 2a, showing moderate quality (see Table 3). Both types of student-initiated patterns were more infrequent than the teacher-initiated patterns. Peer-centred dialogue (pattern 4) occurred in language arts lessons in five episodes. As a whole,

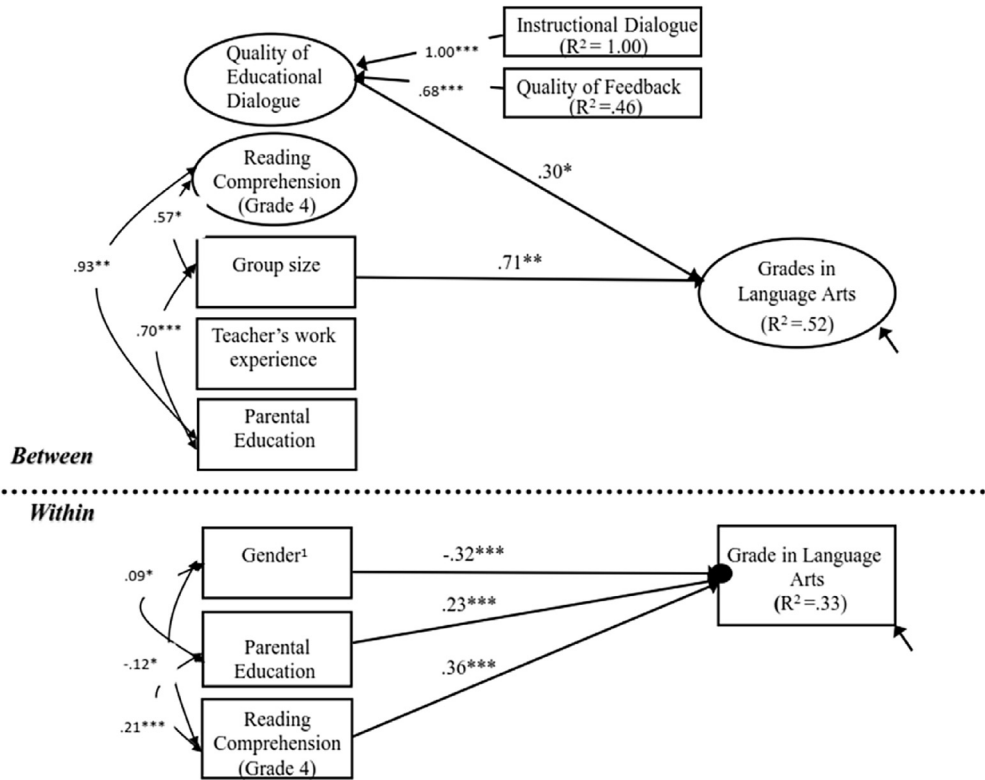


Fig. 2. Multilevel model for quality of educational dialogue and students' grades in language arts in Grade 6. Notes. Paths are presented as standardised estimates. ¹Gender 1 = girl, 2 = boy; ***p < 0.001, **p < 0.01, *p < 0.05.

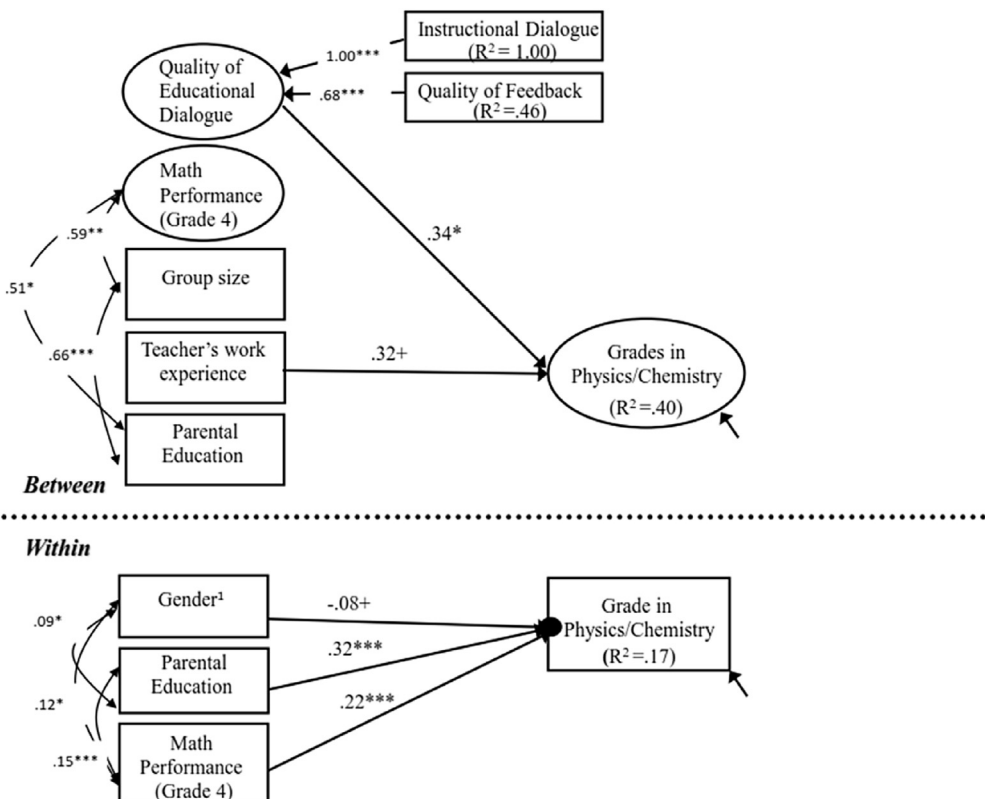


Fig. 3. Multilevel model for quality of educational dialogue and students' grades in physics/chemistry in Grade 6. Notes. Paths are presented as standardised estimates. ¹Gender 1 = girl, 2 = boy; ***p < 0.001, **p < 0.01, *p < 0.05, + p < 0.09.

Table 3
Identified episodes of educational dialogue in language arts and physics/chemistry lessons: patterns of dialogic teaching.

Patterns of dialogic teaching	Language arts Number of episodes *	Physics/chemistry Number of episodes **
Pattern 2a: Teacher-initiated teaching dialogue of moderate quality	16	7
Pattern 2b: Teacher-initiated teaching dialogue of high quality	7	10
Pattern 3a: Student-initiated teaching dialogue of moderate quality	2	0
Pattern 3b: Student-initiated teaching dialogue of high quality	4	3
Pattern 4: Peer-centred dialogue	5	0
Episodes in total	34	20

Note.*The length of an episode in language arts lessons varied from 143 words to 520 in Finnish.

**The length of an episode in physics/chemistry lessons varied from 282 to 596 words in Finnish.

dialogues indicating a moderate quality were more common in language arts than those indicating a high quality, but in student-initiated dialogues, there were more episodes indicating a high-quality than a moderate-quality of educational dialogue.

Example 1 demonstrates the most common type of pattern identified in language arts lessons: pattern 2a, the teacher-initiated pattern of moderate quality, where the flow of the dialogue relied on the teacher asking questions and prompting student participation. The topic under discussion was based on a novel that the whole class had read. Thus, all students had the necessary information to enable participation in the dialogue. Although the teacher's questions were primarily open-ended, the questions did not inspire the students to participate in a voluntary discussion beyond answering the questions posed.

Example 2 presents the additional pattern identified in the data – peer-centred dialogue (pattern 4). As illustrated through the example, it is the students whose thoughts and opinions are at the centre of the dialogue, and the interaction is mainly occurring between the students (exponents and opponents). The discussion is based on students' contrasting opinions and justifications regarding whether language arts should be an optional subject, not one based on the teacher's questions. Although the teacher does not have an active role as a participant in the dialogue, she listens attentively, and when needed, she guides students' participation by giving turns and encouraging them to justify their opinions. At the end of the dialogue, the main arguments are discussed together between the teacher and students to summarise the outcome of the debate as a whole.

Example 1

Teacher-initiated teaching dialogue of moderate quality (pattern 2a).

Context: The teacher and students had all read a youth novel	
Teacher:	Please tell me what the scene of the events looked like. Picture what it looked like in your mind. What is so great about literature is that it does not present you with a complete picture. As we said earlier, a movie based on a book provides you with fully developed thoughts, but when you read a book, you can imagine for yourself what it looks like there and what the apple trees look like, and ... So, after reading that text, how do you imagine that the scene of events looks? Danny?
Student 1:	There were those apple trees and that house and ...
Teacher:	Yes. Apple trees around the house ruins and an overgrown garden there. Yes, Joe?
Student 2:	So the apple trees were there and then the house was there only with the foundation, so there was like no wood, only that ...
Teacher:	Yes, only the stone foundation, so only the base was there. Yes, yes. What else? What kinds of details were you given?
<i>More students share their views with the teacher's encouragement.</i>	
...	
Teacher:	Yes, exactly. What do you think? Why did they choose those apple trees there? Why didn't he say that it was some ramshackle house in our town with only a stone foundation remaining? Why were the apple trees there? Ally?
<i>More students share their views with the teacher's encouragement.</i>	
...	
Student 3:	They were blooming.
Teacher:	Yes. And apple trees have a romantic meaning. For example, when older people read books, they want to envision these nice coffee dates they might have under apple trees on a warm day. And there might be that kind of romantic and beautiful atmosphere. And in Japanese books, they often portray cherry trees.
<i>The discussion about the book continues ...</i>	

3.2.2. Educational dialogue in physics/chemistry lessons

In the physics/chemistry lessons, the episodes of educational dialogue were also mostly led and scaffolded by the teacher (see Table 3). A total of 17 episodes of teacher-initiated educational dialogue were identified, but in the physics/chemistry lessons, the majority of the episodes represented higher-quality educational dialogues, with students actively participating in the discussion and using their own initiative to share information and ask questions. Student-initiated episodes occurred less frequently than teacher-initiated ones, but all three student-initiated episodes indicated a higher quality of educational dialogue.

Example 3 represents a teacher-initiated pattern of high quality (pattern 2b). This type of dialogue starts from the teacher's question and encouragement, but the discussions are not entirely dependent on the teacher's scaffolding. In fact, there is only one broader question on which the entire discussion is based. Students actively share their knowledge and thoughts but also willingly justify their answers without separate encouragement from the teacher. The teacher actively renders feedback on students' views by ensuring and clarifying their ideas and is open to unexpected answers and justifications. At the end of the discussion, the teacher also summarises the 'expected' correct answers but clearly indicates that other acceptable justifications were presented.

The fourth and final example (see Example 4) represents a student-initiated pattern of high quality. In this type of dialogue, the teacher allowed space for students' initiatives but still supported the flow of discussion by actively listening and asking questions to extend or clarify students' comments. In the example

Example 2

Peer-centred dialogue (pattern 4).

 Context: The goal of the lesson is to practice debating.

Teacher: ... Those who are in favour that language arts should be an optional subject can start.

Student 1: Well, not everybody gets good grades in language arts, so it could be a kind of remedial instruction to enable you to learn more. And if someone wants to learn more about things that you would later study in secondary school, you could then study them there. And there could be more literacy, more reading of books and stories.

Teacher: And now the opponents.

Student 2: But if you don't have it, you will never learn to read or write.

Student 3: Yes, or if you don't study it and you want to get into a higher position, you might not get there if you didn't ...

Student 2: If you didn't study language arts.

Student 1: But if you think you won't need it that much in the future ...

Student 3: You do need your own mother tongue.

Student 1: If you become, for example, a cleaner, you might not need it.

Student 3: But you need to know how to talk to and communicate with people.

Discussion between the students continues ...

Teacher: And now your closing words. Please justify your opinions.

After the final words, the main points of the debate were discussed together with the whole class.

Example 3

Teacher-initiated teaching dialogue of high quality (pattern 2b).

 Context: The topic of the lesson: conductors and insulators.

Teacher: Which of the following objects conduct electricity? Here we have a wooden stick, a spoon, a marker pen, a pencil, a piece of rock, a chalk, a comb, a sharpener and a strand of hair. Which of these conduct electricity? Joe.

Student 1: The hair, spoon, pencil, sharpener.

Teacher: The hair, spoon, pencil, sharpener. Mmm, well hair does not actually conduct electricity. So if you have hair there, please remove it. Ally.

Student 2: That piece of rock could be either way because you don't know what kind of rock it is.

Student 3: Is it iron?

Teacher: That is a good point. It really depends on the rock. So it might be that if there is enough of some iron ore in it, it might conduct electricity. Holly.

Student 4: And then that comb can also conduct electricity if there is metal in it.

Teacher: That is true. It didn't say what kind of a comb it was. There are also metallic combs. They surely conduct electricity. Good point. Sammy.

Student 5: Did someone say the marker pen already? It may conduct electricity

Teacher: Mmmm ...

Student 5: If there is some kind of liquid inside of it, it may conduct.

*The discussion about other possible objects and their qualities continues ...*Teacher: That is correct too. There are many options. But if we think about an ordinary spoon, it conducts electricity. A pencil conducts electricity and a sharpener. But there are also plastic ones. Those three.

above, the teacher shared information and elaborated on the students' thoughts and, importantly, summarised the main point at the end of the episode to clarify the content and the lesson to be learned (e.g. how to handle light bulbs when changing them). Although the teacher followed the students' lead, the dialogue still contained a clear structure and active scaffolding. As is typical of episodes representing pattern 3b, the topic of the discussion was very practical and close to the students' own interests or experience, particularly because the initiative behind the dialogue came from the students.

4. Discussion

The present study applied a mixed-methods approach to examine the association between educational dialogue in Grade 6 classrooms and students' academic grades as well as the quality differences between teacher-initiated and student-initiated dialogic teaching patterns. The results of the multilevel modelling

showed that educational dialogue was positively associated with student grades in language arts and physics/chemistry. The qualitative analysis of the language arts and physics/chemistry lessons indicated that while teacher-initiated dialogic teaching patterns were predominantly identified in the studied classrooms, student-initiated patterns were also identified. In the language arts lessons, the majority of the episodes of educational dialogue were of moderate quality, whereas in the physics/chemistry lessons, the majority of the episodes represented high-quality patterns. Moreover, an additional pattern of peer-centred dialogue was identified in the language arts lessons.

4.1. The association between educational dialogue and grades in academic subjects

The multilevel modelling indicated that the quality of educational dialogue in Grade 6 classrooms was associated with the students' grades. This novel empirical finding suggests that higher-

Example 4

Student-initiated teaching dialogue of high quality (pattern 3b).

Context: The teacher and students have studied devices that generate warmth using the study book and engaged in factual question-answer sequences.

Student: So, my friend has ... I mean they have this fireplace on the wall. So, there is like no real fire, but it looks like there is fire.

1:

Teacher: Okay. What kind of a fireplace is it?

Student: I don't know, some kind of an animation or something. But real looking. But it doesn't heat up at all.

1:

Teacher: Okay. For sure, there are people who have the strangest devices at home. Tommy?

Student: Well, my desk lamp, so there is that kind of a metallic cover on it. And it always heats up a lot.

2:

Teacher: Yes, they heat up very much. And that's right, you need to be careful when you change that kind of lightbulb. When it blows and breaks and you have to change it, you need to remember to wait for a while for the bulb to cool down. Because it's sizzling hot, you will surely burn your fingers if you go and change it straightaway. Even if I need light right now, straightaway, and I need a new bulb quickly, I always wait for it to cool down first.

The discussion continues ...

quality dialogue in the classroom is linked to better student performance in language arts and physics/chemistry in terms of grades. Exchanging ideas and opinions is conducive to shared understanding (Alexander, 2006) and contributes to thinking and learning in ways that students may not have been able to attain on their own by reasoning or reading a book (Game & Metcalfe, 2009). For this reason, listening in classroom dialogue, and ideally through active participation by sharing one's own thoughts, offers students richer opportunities for shared knowledge-building and self-regulation (Lonka, 1997) compared to traditional teacher-led lecturing that typically provides the correct responses (Vermunt & Verloop, 1999).

Prior research reports that the amount of dialogue in classrooms is scant and that dialogue in science lessons, for example, is typically teacher-led (Mercer, Dawes, & Staarman, 2009). This study examined associations between the quality of educational dialogue and students' grades in lessons on five subjects: language arts, religion, history, biology/geography and physics/chemistry and found associations, particularly for language arts and physics/chemistry. These five subjects and their topics do not only deal with the sharing of factual knowledge, but also allow for the sharing of personal experiences or views (Muhonen, Rasku-Puttonen, Pakarinen, Poikkeus, & Lerkkanen, 2017). Students are likely to have frequent personal experiences with natural phenomena and objects in their everyday lives, which support their participation in educational dialogue in their lessons. However, in every subject, there is a wide variation of learning goals and topics, and some topics are likely to be better suited for a dialogic approach than others. The topic or learning goal might have an impact on the kinds of questions (open or closed) that the teacher may ask or how students are able to participate in sharing their thoughts. A variety of techniques and approaches, in addition to dialogue, as defined here, may be beneficial for learning in diverse subjects (see Scott, Mortimer, & Aguiar, 2006). For example, religion lessons are typically characterised by sharing different views and can often be linked with moral dilemmas such as what is right or wrong. Language arts includes a wide variety of learning content that allows teachers to employ a range of teaching methods and means of promoting student participation. Language arts is also a subject that supports the study of other subjects, and opportunities for active dialogue among students and teachers and among peers are highly valuable for the development of communication and argumentation skills. Nevertheless, it was surprising that religion, history and biology/geography were not statistically significantly associated with the quality of educational dialogue in their separate multilevel models although a similar pattern of results was identified for the subjects (i.e., the higher the quality of educational dialogue was, the higher the students' grades were), and the link between the quality of educational dialogue and the latent factor

consisting of all the five subjects was statistically significant.

In our study, students' grades in each subject were given at the end of the school year, capturing the accumulated academic performance at that point. In prior studies, outcome measures have been primarily associated with gains in learning assessed using immediate or follow-up tests (Mercer & Howe, 2012). For example, Howe, Tolmie, and Rodgers (1992) found that the positive effects of collaborative group work and interaction are often delayed and that post-tests conducted within hours of group work show no significant learning gains when compared to pre-test results. It has also been argued that educational dialogue primes students to make meanings of their later experiences (Howe, McWilliam, & Cross, 2005).

4.2. The quality of teacher-initiated and student-initiated educational dialogues in language arts and physics/chemistry lessons

The results of the qualitative analysis revealed somewhat different patterns of dialogic teaching in language arts and physics/chemistry lessons. In language arts lessons, teachers used relatively unitary forms of questioning and provided little support for active participation and shared content understanding compared to physics/chemistry lessons, which appeared to contain higher-quality educational dialogues and demonstrated more versatile and richer scaffolding strategies. The teacher's scaffolding strategies in high quality dialogues were in line with the previous research, especially with Nystrand's (1997) concept of dialogic instruction including the use of authentic questions, incorporating students' responses into subsequent questions, and allowing students' responses to modify the topic of discussion. It is possible that the topics studied in the physics/chemistry lessons afforded diverse opportunities for discussions to take place because the students had more prior knowledge of, concrete experiences with and views on these topics (e.g. electricity plugs). In language arts lessons, discussion may sometimes be thwarted by challenging and rather academically-oriented content about which students do not necessarily have prior knowledge or thoughts. For instance, in Example 1, it may have been that the teacher's talk did not fully match the students' level of conceptual understanding. Although the novel was directed at young readers, discussions on literary interpretation can be challenging. Moreover, the topic and romantic tone of the novel could have decreased the level of comfort or interest that the students had when it came to voluntarily sharing their thoughts.

Revealing the distinctive features of the quality of teacher-initiated and student-initiated educational dialogues in the two subjects required fine-grained qualitative analyses of a data set that could be narrowed down by utilising the results of the multilevel

analysis. The importance of and need for rigorous analysis of educational dialogue has been highlighted, especially in relation to studying students' learning and conceptual change (Mercer & Howe, 2012). It is important to acknowledge that several types of patterns of educational dialogue may contribute to effective classroom discussion. The results of the present study concur with Cazden's (2001) suggestion that dialogic space can be created by allowing time for students' answers, elaborations and initiations. Time, space and scaffolding that teachers afford for student-initiated talk may be as strong facilitators of beneficial learning experiences contributing to student outcomes as prior-planned teacher-initiated dialogues. Scaffolding of dialogue requires teachers to be sensitive for students' initiative turns, even sometimes those that seem side-tracks, in order to foster students' active participation and integrate their input into productive learning goals and contents. In student-initiated dialogue, teacher's role is nevertheless needed for in supporting of students' knowledge-building process. In the future, more mixed-methods studies in different school subjects are needed to capture both the quality and effect of educational classroom dialogue. There is also little research on students' initiative turns in whole class interaction (Sunderland, 2001). Although teachers are documented to predominantly initiate and manage classroom dialogue (Wells, 2009) more research is needed on students' initiative turns and how they contribute to the actual learning process.

4.3. Implications and limitations

The importance of dialogue in the classroom has been highlighted by scholars for quite some time, but there has been scant evidence of its empirical associations with student achievement outcomes. Based on the results of the present study, we argue that promoting diverse patterns of educational classroom dialogue is the key to productive classroom interaction and learning outcomes. An accumulation of evidence-based information about the concrete benefits of educational dialogue is critical for motivating teachers to use dialogue in their own classrooms. Recent research indicates that student teachers, especially in the sciences, worry about their competencies in content knowledge and the organisation and management of their lessons, and they see the orchestration of educational dialogue as both challenging and time-consuming (Lehesvuori, Viiri, & Rasku-Puttonen, 2011). Building the skills required to foster dialogic classroom interaction needs to start in teacher education and continue during in-service training. Teachers and student teachers need concrete tools to use and examples of how to support both teacher- and student-initiated dialogues in order to foster students' participation, engagement in argumentation and shared understanding (Muhonen et al., 2016). By acknowledging the different phases of scaffolding, such as contingency, fading and transfer of responsibility (Van de Pol et al., 2010) and the strategies for reaching these phases, the teacher can guide students towards becoming more independent participants, as reflected in the pattern of peer-centred dialogue. For instance, in the future, professional development programmes and interventions could be one way of enhancing the role of dialogue as a teaching method.

The current study has certain limitations that need to be considered before making any attempt to generalise the results. First, the number of Grade 6 teachers and their class sizes ($n = 46$) were relatively small, which may have decreased the power of the statistical testing. Therefore, it is important to replicate the findings in a larger sample in the future. Second, although we found an association between the quality of educational dialogue and students' academic performance, our study did not have a cross-lagged longitudinal design. Consequently, we cannot claim that

the quality of educational dialogue predicts students' improved learning, and caution is needed before making any direct causal inferences. Third, students' grades in the academic subjects were given by the class teachers, who were also responsible for classroom instruction. Thus, in future studies, more objective measures of achievement could also be used. Fourth, a clear limitation of the study is that only structural control variables were employed in the multilevel modelling. In his meta-meta-analysis, Hattie (2008) documented that structural factors, such as class size and teacher qualification, typically show only a minor effect on students' achievement, whereas factors such as teacher-student relationship, student engagement, motivation and classroom management tend to have a significantly stronger effect on students' achievement. In future research, these process quality variables, important for both learning and dialogue, should also be controlled for when examining educational dialogue.

Fifth, the number of language arts lessons available for the qualitative analysis was greater than that of physics/chemistry lessons available. Although the sample of lessons was restricted to language arts and physics/chemistry lessons with mid-range to high CLASS-S scores on dimensions of Instructional Dialogue and Quality of Feedback, it is important to acknowledge that similar patterns of educational dialogue are likely to be evidenced in the other three subjects. For example, prior studies (e.g., Muhonen et al., 2016) indicate that subjects such as religion and science can provide diverse opportunities for dialogic interaction. It would have been interesting and informative to conduct qualitative analyses on all five subjects. However, the decision was made to concentrate only on subjects with statistically significant associations with students' grades in the final model. Sixth, differences between individual teachers may, to some extent, explain the findings as it may be that some teachers are more inclined to use dialogue as a teaching method than others. Seventh, both the statistical and qualitative analyses focused on educational dialogue where the teacher's support was actively involved. However, other coding schemes (e.g. Michaels & O'Connor, 2011; Resnick, Michaels, & O'Connor, 2010; Wells, 1999) could have been utilised to capture a wider variety of educational discussion. For example, Hennessy and colleagues (2016) recently developed the Scheme for Educational Dialogue Analysis (SEDA) for analysing educational dialogue across various educational contexts as well as for applying to observations of whole class, group and paired work.

5. Conclusion

The present study showed that educational dialogue is indeed associated with students' academic performance in language arts and physics/chemistry. The qualitative analysis identified dialogic patterns representing both teacher- and student-initiated dialogic teaching, along with peer-centred dialogue. In the language arts lessons, educational dialogues were more likely to be characterised by their moderate quality, whereas in the physics/chemistry lessons, high-quality educational dialogues were more common. The results suggest that both the quality and amount of dialogue in the classroom need to be increased in order to support student learning. It is important that teachers have more access to evidence-based knowledge about the concrete benefits of educational dialogue and the models of how to utilise their diverse patterns in the classroom.

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References

- Alexander, R. (2000). *Culture and pedagogy: International comparisons in primary education*. Oxford: Blackwell.
- Alexander, R. (2006). *Towards dialogic teaching* (3rd ed.). New York: Dialogos.
- Alexander, R. (2008). Culture, dialogue and learning: Notes on an emerging pedagogy. In N. Mercer, & S. Hodgkinson (Eds.), *Exploring talk in school* (pp. 91–114). Los Angeles: Sage.
- Alexander, R. (2013). Improving oracy and classroom talk: Achievements and challenges. *Primary First*, 10, 22–29.
- Aunola, K., & Räsänen, P. (2007). *The basic arithmetic test*. Jyväskylä, Finland: University of Jyväskylä.
- Azmitia, M., & Montgomery, R. (1993). Friendship, transactive dialogues and the development of scientific reasoning. *Social Development*, 2(3), 202–221. <https://doi.org/10.1111/j.1467-9507.1993.tb00014.x>.
- Barnes, D., & Todd, F. (1977). *Communication and learning in small groups*. London: Routledge and Kegan Paul.
- Blatchford, P., Bassett, P., Goldstein, H., & Martin, C. (2003). Are class size differences related to pupils' educational progress and classroom processes? Findings from the Institute of Education Class Size Study of Children Aged 5–7 Years. *British Educational Research Journal*, 29, 709–730. <https://doi.org/10.1080/0141192032000133668>.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience and school*. Washington, DC: National Academy Press.
- Cazden, C. B. (2001). *Classroom discourse: The language of teaching and learning* (2nd ed.). Portsmouth, NH: Heinemann.
- Chin, C. (2006). Classroom interaction in Science. Teacher questioning and feedback to students' responses. *International Journal of Science Education*, 28, 1315–1346. <https://doi.org/10.1080/09500690600621100>.
- Connor, C. M., Son, S.-H., Hindman, A. H., & Morrison, F. J. (2005). Teacher qualifications, classroom practices, family characteristics, and preschool experience: Complex effects on first graders' vocabulary and early reading outcomes. *Journal of School Psychology*, 43, 343–375.
- Dawes, L., Mercer, N., & Wegerif, R. (2000). *Thinking together: A programme of activities for developing speaking, listening and thinking skills for children aged 8–11*. Birmingham: Imaginative Minds Ltd.
- Finnish National Board of Education. (2004). *Perusopetuksen opetusuunnitelman perusteet 2004 (Finnish national Core curriculum for basic education, 2004)*. Helsinki: Finnish National Board of Education.
- Game, A., & Metcalfe, A. (2009). Dialogue and team teaching. *Higher Education Research & Development*, 28(1), 45–57. <https://doi.org/10.1080/07294360802444354>.
- Gillies, R. (2013). Productive academic talk during inquiry-based science. *Pedagogies*, 8, 126–142. <https://doi.org/10.1080/1554480X.2013.767770>.
- Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.
- Heck, R. H., & Thomas, S. L. (2009). *An introduction to multilevel modeling techniques* (2nd ed.). New York: Routledge.
- Hennessey, S., Rojas-Drummond, S., Higham, R., Márquez, A. M., Maine, F., Ríos, R. M., et al. (2016). Developing a coding scheme for analysing classroom dialogue across educational contexts. *Learning, Culture and Social Interaction*, 9, 16–44. <https://doi.org/10.1016/j.lcsi.2015.12.001>.
- Howe, C. (2010). *Peer groups and children's development*. Oxford: Wiley-Blackwell.
- Howe, C. (2017). Advances in research on classroom dialogue: Commentary on the articles. *Learning and Instruction*, 48, 61–65. <https://doi.org/10.1016/j.learninstruc.2017.03.003>.
- Howe, C., & Abedin, M. (2013). Classroom dialogue: A systematic review across four decades of research. *Cambridge Journal of Education*, 43, 325–356. <https://doi.org/10.1080/0305764X.2013.786024>.
- Howe, C., McWilliam, D., & Cross, G. (2005). Chance favours only the prepared mind: Incubation and the delayed effects of peer collaboration. *British Journal of Psychology*, 96, 67–93. <https://doi.org/10.1348/000712604X15527>.
- Howe, C. J., Tolmie, A., & Rodgers, C. (1992). The acquisition of conceptual knowledge in science by primary school children: Group interaction and the understanding of motion down an incline. *The British Journal of Developmental Psychology*, 10(2), 113–130. <https://doi.org/10.1111/j.2044-835X.1992.tb00566.x>.
- Howe, C. J., Tolmie, A., Thurston, A., Topping, K., Christie, D., Livingston, K., et al. (2007). Group work in elementary science: Towards organizational principles for supporting pupil learning. *Learning and Instruction*, 17(5), 549–563. <https://doi.org/10.1016/j.learninstruc.2007.09.004>.
- Johnson, D. W., Johnson, R. T., & Stanne, M. B. (2000). *Cooperative learning methods: A meta-analysis*. Minneapolis: University of Minnesota, Cooperative Learning Center.
- Kaartinen, S., & Kumpulainen, K. (2002). Collaborative inquiry and the construction of explanations in the learning of science. *Learning and Instruction*, 12(2), 189–212. [https://doi.org/10.1016/S0959-4752\(01\)00004-4](https://doi.org/10.1016/S0959-4752(01)00004-4).
- Kyriacou, C., & Issitt, J. (2008). *What characterizes effective teacher-pupil dialogue to promote conceptual understanding in mathematics key stages 2 and 3? (EPLI-centre report no. 1604R)*. Institute of Education, University of London: Social Science Research Unit.
- Lefstein, A. (2006). *Dialogue in schools: Towards a pragmatic approach (working papers in urban language & literacies, #33)*. London: King's College London.
- Lehesvuori, S., Viiri, J., & Rasku-Puttonen, H. (2011). Introducing dialogic teaching to science student teachers. *Journal of Science Teacher Education*, 22(8), 705–727. <https://doi.org/10.1007/s10972-011-9253-0>.
- Lemke, J. L. (1990). *Talking science: Language, learning, and values*. Norwood, NJ: Ablex.
- Lerkkanen, M.-K., Niemi, P., Poikkeus, A.-M., Poskiparta, M., Siekkinen, M., & Nurmi, J.-E. (2006–2016). *The first steps study (Alkuportaat)* [Unpublished data]. Finland: University of Jyväskylä.
- Lindeman, J. (1998). *ALLU — ala-asteen lukutesti [ALLU — Reading Test for Primary School]*. Turku: University of Turku, the Center for Learning Research.
- Littleton, K., & Howe, C. (2010). *Educational dialogues: Understanding and promoting productive interaction*. London: Routledge.
- Lonka, K. (1997). *Explorations of constructive processes in student learning*. Doctoral thesis. Department of Psychology, University of Helsinki.
- McClelland, M., & Morrison, F. (2003). The emergence of learning-related social skills in preschool children. *Early Childhood Research Quarterly*, 18, 206–224. [https://doi.org/10.1016/S0885-2006\(03\)00026-7](https://doi.org/10.1016/S0885-2006(03)00026-7).
- Mercer, N. (2008). Talk and the development of reasoning and understanding. *Human Development*, 51(1), 90–100. <https://doi.org/10.1159/000113158>.
- Mercer, N., & Dawes, L. (2008). The value of exploratory talk. In N. Mercer, & S. Hodgkinson (Eds.), *Exploring talk in school* (pp. 55–71). London: Sage.
- Mercer, N., Dawes, L., & Staarman, J. K. (2009). Dialogic teaching in the primary science classroom. *Language and Education*, 23(4), 353–369. <https://doi.org/10.1080/09500780902954273>.
- Mercer, N., & Howe, C. (2012). Explaining the dialogic processes of teaching and learning: The value and potential of sociocultural theory. *Learning, Culture and Social Interaction*, 1(1), 12–21. <https://doi.org/10.1016/j.lcsi.2012.03.001>.
- Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. London: Routledge.
- Michaels, S., & O'Connor, M. C. (2011). *Coding guide for teacher talk moves. [Coding manual]*. Pittsburgh Science of Learning Center, PA: Unpublished Instrument.
- Mortimer, E. F., & Scott, P. H. (2003). *Meaning making in science classrooms*. Milton Keynes: Open University Press.
- Muhonen, H., Rasku-Puttonen, H., Pakarinen, E., Poikkeus, A.-M., & Lerkkanen, M.-K. (2016). Scaffolding through dialogic teaching in early school classrooms. *Teaching and Teacher Education*, 55(3), 143–154. <https://doi.org/10.1016/j.tate.2016.01.007>.
- Muhonen, H., Rasku-Puttonen, H., Pakarinen, E., Poikkeus, A.-M., & Lerkkanen, M.-K. (2017). Knowledge-building patterns in educational dialogue. *International Journal of Educational Research*, 81(1), 25–37. <https://doi.org/10.1016/j.ijer.2016.10.005>.
- Muthén, L. K., & Muthén, B. O. (1998–2012). *Mplus User's guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.
- Nassaji, H., & Wells, G. (2000). What's the use of 'Triadic Dialogue?': An investigation of teacher-student interaction. *Applied Linguistics*, 21(3), 376–406.
- Nystrand, M. (1997). *Opening Dialogue. Understanding the dynamics of language and learning in the English classroom*. New York: Teachers College Press.
- Pianta, R. C., Hamre, B. K., & Mintz, S. (2012). *Classroom assessment scoring system-secondary (CLASS-S)*. Charlottesville, VA: University of Virginia.
- Rasku-Puttonen, H., Lerkkanen, M.-K., Poikkeus, A.-M., & Siekkinen, M. (2012). Dialogical patterns of interaction in preschool classrooms. *International Journal of Educational Research*, 53(2), 138–149. <https://doi.org/10.1016/j.ijer.2012.03.004>.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Newbury Park, CA: Sage.
- Resnick, L. B., Michaels, S., & O'Connor, C. (2010). How (well structured) talk builds the mind. In D. Preiss, & R. Sternberg (Eds.), *Innovations in educational psychology* (pp. 163–194). New York, NY: Springer.
- Rheznitskaya, A., Anderson, R., McNurlen, B., Nguyen-Jahiel, K., Archodidou, A., & Kim, S. (2001). Influence of oral discussion on written argument. *Discourse Processes*, 32(2–3), 155–175. <https://doi.org/10.1080/0163853X.2001.9651596>.
- Rogoff, B. (1990). Apprenticeship in thinking. *Cognitive development in social context*. New York: Oxford University Press.
- Rogoff, B. (2008). Observing sociocultural activity on three planes: Participatory appropriation, guided participation and apprenticeship. In P. Murphy, K. Hall, & J. Soler (Eds.), *Pedagogy and practice: Culture and identities* (pp. 58–74). Los Angeles: Sage.
- Rojas-Drummond, S., & Mercer, N. (2003). Scaffolding the development of effective collaboration and learning. *International Journal of Educational Research*, 39(1–2), 99–111. [https://doi.org/10.1016/S0883-0355\(03\)00075-2](https://doi.org/10.1016/S0883-0355(03)00075-2).
- Rojas-Drummond, S., Torreblanca, O., Pedraza, H., Vélez, M., & Guzmán, K. (2013). Dialogic scaffolding: Enhancing learning and understanding in collaborative contexts. *Learning, Culture and Social Interaction*, 2(1), 11–21. <https://doi.org/10.1016/j.lcsi.2012.12.003>.
- Scott, P. H., Mortimer, E. F., & Aguiar, O. G. (2006). The tension between authoritative and dialogic discourse: A fundamental characteristic of meaning making in interactions in high school science lessons. *Science Education*, 90, 605–631. <https://doi.org/10.1002/sce.20131>.
- Skidmore, D. (2006). Pedagogy and dialogue. *Cambridge Journal of Education*, 36(4), 503–514. <https://doi.org/10.1080/03057640601048407>.
- Slavin, R. E. (1980). Co-operative learning. *Review of Educational Research*, 50(2), 315–342. <https://doi.org/10.3102/00346543050002315>.

- Sunderland, J. (2001). Student initiation, teacher response, student follow-up: Towards an appreciation of student-initiated IRFs in the language classroom. Retrieved from <http://docplayer.net/235154-Student-initiation-teacher-response-student-follow-up-towards-an-appreciation-of-student-initiated-irfs-in-the-language-classroom.html>.
- Underwood, J., & Underwood, G. (1999). Task effects in co-operative and collaborative learning with computers. In K. Littleton, & P. Light (Eds.), *Learning with computers: Analysing productive interaction* (pp. 10–23). London: Routledge.
- Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher-student interaction: A decade of research. *Educational Psychology Review*, 22, 271–297. <https://doi.org/10.1007/s10648-010-9127-6>.
- Vermunt, J., & Verloop, N. (1999). Congruence and friction between learning and teaching. *Learning and Instruction*, 9(3), 257–280. [https://doi.org/10.1016/S0959-4752\(98\)00028-0](https://doi.org/10.1016/S0959-4752(98)00028-0).
- Virtanen, T., Pakarinen, E., Lerkkanen, M.-K., Poikkeus, A.-M., Siekkinen, M., & Nurmi, J.-E. (2017). A validation study of classroom assessment scoring system-secondary in the Finnish school context. *Journal of Early Adolescence*. <https://doi.org/10.1177/0272431617699944>.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.
- Wayne, A. J., & Youngs, P. (2003). Teacher characteristics and student achievement gains: A review. *Review of Educational Research*, 73(1), 89–122. Retrieved from <http://www.jstor.org/stable/3516044>.
- Wegerif, R. (2007). *Dialogic education and technology: Expanding the space of learning*. New York: Springer. <https://doi.org/10.1007/978-0-387-71142-3>.
- Wells, G. (1999). *Dialogic inquiry: Towards a sociocultural approach to mediated action*. Hemel Hempstead: Harvester-Wheatsheaf.
- Wells, G. (2009). *Instructional conversation in the classroom: Can the paradox be resolved*. Retrieved from https://people.ucsc.edu/~gwells/Files/Papers_Folder/documents/ICAERA09.pdf.
- Wells, G., & Arauz, R. M. (2006). Dialogue in the classroom. *The Journal of the Learning Sciences*, 15(3), 379–428. https://doi.org/10.1207/s15327809jls1503_3.
- Wolf, M., Crosson, A., & Resnick, L. (2006). *Accountable talk in reading comprehension instruction (CSE technical report 670)*. University of Pittsburgh: Learning and Research Development Center.
- Wolfe, N., & Alexander, R. J. (2008). *Argumentation and dialogic teaching: Alternative pedagogies for a changing world*. London: Futurelab.
- Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *The Journal of Child Psychology and Psychiatry*, 17, 89–100. <https://doi.org/10.1111/j.1469-7610.1976.tb00381.x>.
- Zhang, X., Koponen, T., Räsänen, P., Aunola, K., Lerkkanen, M.-K., & Nurmi, J.-E. (2014). Linguistic and spatial skills predict early arithmetic development via counting sequence knowledge. *Child Development*, 85(3), 1091–1107. <https://doi.org/10.1111/cdev.12173>.