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Full Length Article

Investigating educational dialogue: Variations of dialogue amount and quality among different subjects between early primary and secondary school classrooms

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ABSTRACT

To support student learning throughout their school journey, it is important to investigate the authentic state of educational dialogue both in early primary and secondary school to map the potential variations concerning dialogue. The present study examined educational dialogue in early primary school and secondary school in literacy, mathematics and science lessons. Video-recorded classroom lessons ($n = 115$ in both grades) of Grade 2 primary school teachers ($n = 50$) and Grade 9 subject teachers ($n = 36$) were analysed in terms of the amount, duration, and quality of episodes of educational dialogue. Educational dialogues were found to be typically longer in Grade 9 than in Grade 2. In terms of the quality of educational dialogue, teacher-initiated dialogue of moderate quality occurred more in Grade 9 classrooms, whereas teacher-initiated dialogue of high quality was observed more in Grade 2 classrooms. In Grade 2, both the amount and quality of dialogue varied across subjects, whereas in Grade 9, variation concerning specific subjects was scant. The findings contribute to prior research by suggesting differences in several aspects of educational dialogue between early primary and secondary school. These variations should be considered when supporting students' learning and participation through educational dialogue in different developmental phases and in different subjects.

1. Introduction

Educational dialogue refers to effective teacher–student interaction in which the teacher and students explore and build knowledge together through purposeful, reciprocal, and cumulative educational classroom talk (Alexander, 2006). Despite the acknowledged importance of educational dialogue for students' development and learning, the occurrence of classroom dialogue and student participation in dialogic discussion observed at diverse school levels is scant and unevenly distributed between classrooms (Howe & Abedin, 2013; Howe et al., 2019; Sedova & Navratilova, 2020). Overall, primary school classrooms have been suggested to represent a

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more favourable context for educational dialogue than those of secondary school (Higham et al., 2014). However, this proposition may be influenced by the preponderance of the focus of prior studies, especially those involving interventions seeking to promote educational dialogue in primary school settings (e.g. Alexander, 2018; Mercer et al., 1999; Mercer & Littleton, 2007; O'Connor et al., 2015). On the other hand, empirical evidence on the link between the quality of educational dialogue and student learning outcomes is strongest in studies conducted among secondary school students (e.g. Kiemer et al., 2015; Sedova et al., 2019; Sedova & Sedlacek, 2023) and older primary school students (e.g. Alexander, 2018; Howe et al., 2019; Mercer & Littleton, 2007; Muhonen et al., 2018). The literature indicates a distinct lack of information concerning the differences between the classroom dialogue in primary and secondary school. Moreover, mapping of specific characteristics of educational dialogue in lessons across school levels and different subjects is limited. Thus, the present study addresses these issues by analysing dialogue in both early primary and secondary school classrooms taking into account both amount and quality of dialogue.

Potential differences in educational dialogue in primary and secondary school classrooms can be considered from both organisational and student-related perspectives. From an organisational perspective, primary classrooms are portrayed as having a more holistic approach to learning and a greater flexibility for teacher's instructional approaches, whereas secondary schools are suggested to be more restricted by organisational, psychological and assessment demands (Higham et al., 2014). In Finland (where the present study was carried out), primary teachers teach the majority of the subjects for their students, and they typically teach the same student group for several years, whereas in the secondary school, each subject is taught by a different subject teacher in separate courses (Finnish National Agency for Education, 2018). The latter approach with its higher focus on subject- and course-specific learning, typically mandated by the curriculum, has been suggested to restrict the opportunities for high-quality classroom interaction between teacher and students (Higham et al., 2014). Despite the organisational structure of the school, in the Nordic countries (to which Finland belongs to), the overall classroom culture has been considered flexible and supporting students' autonomy and interactions (Klette et al., 2018). Still, prior research has also indicated variations of interaction quality and quantity in the Nordic context of both primary (e.g. Kovalainen & Kumpulainen, 2007; Muhonen et al., 2016) and secondary school (e.g. Gamlem & Munthe, 2014; Hähkiöniemi et al., 2022; Vattøy & Gamlem, 2019).

From a student-related perspective, student characteristics such as the age and developmental level of the students are also likely to be reflected in the types and prevalence of educational dialogue in the classroom. Young students are still in the phase of developing their communicative competence and learning to use language effectively and appropriately in social situations (van der Wilt et al., 2022). They are still practicing the routines and ways of interaction that are desirable in the classroom setting, and therefore, active use of interactional learning strategies, such as taking turns to ask questions or listening to each other's comments and elaborating them further, may require active support from the teacher (Littleton et al., 2005; Mercer & Littleton, 2007). Nevertheless, young students are typically eager to ask questions and share their knowledge (Muhonen et al., 2016; Rasku-Puttonen et al., 2012; van der Veen et al., 2017). In secondary school, students are supposed to have gained more experience on how to participate in effective classroom interaction and have also developed greater content knowledge of different subjects (Higham et al., 2014; Sedova et al., 2019). On the other hand, because adolescence is a challenging period with significant changes in students' overall development, identity, cognition and self-reflection (Steinberg & Morris, 2001), for some adolescents, school may seem disconnected from their life in general, and they may experience disaffection and withdrawal from school (Zyngier, 2008).

In conclusion, prior literature has not provided comprehensive information regarding differences among school levels with respect to conditions which form a favourable context for emergence of educational dialogue. There is a lack of prior research investigating the variation in occurrence and quality of educational dialogue between classrooms of younger and older students and variation between subjects. In order to support students' learning through educational dialogue in different developmental phases throughout their school journey, rigorous examination of features of dialogue at different school levels is needed. The present study addresses this research gap by investigating educational dialogue in authentic classroom settings (without a design involving interventions) in Finnish early primary school (Grade 2) and secondary school (Grade 9) classrooms. The study examines possible differences in educational dialogue amount and quality between the two school levels in literacy, mathematics, and science lessons.

1.1. Educational dialogue

The theoretical framework of the present study draws from the socioculturally oriented tradition (see Vygotsky, 1978). Effective utilisation of language and communication between teacher and students is considered a vital element of high-quality teaching which supports shared knowledge building and learning (e.g. Hennessy et al., 2016; Howe & Abedin, 2013; Lefstein, 2010). In the present study, the construct of *educational dialogue* is used to describe effective whole-class discussions in which both teacher and students participate in the learning process by sharing their knowledge and thoughts, by questioning, elaborating diverse views and further building shared knowledge on one another's thoughts (Alexander, 2006; Mercer & Littleton, 2007). During educational dialogue, the educational discussion between teacher and students can be characterised by Alexander's (2018, p. 6) five principles of dialogic teaching which involve the following: “*collective* (the classroom is a site of joint learning and enquiry); *reciprocal* (participants listen to each other, share ideas, and consider alternative viewpoints); *supportive* (participants feel able to express ideas freely, without risk of embarrassment over ‘wrong’ answers, and they help each other to reach common understandings); *cumulative* (participants build on their own and each other's contributions and chain them into coherent lines of thinking and understanding); and *purposeful* (classroom talk, though open and dialogic, is structured with specific learning goals in view)”. Dialogic teaching has also been characterised as being critical (participants identify and examine diverse points and questions) and meaningful (participants relate to the topic and bring their own views to the discussion) (Lefstein, 2010). It is also important to acknowledge that other closely related concepts have been used in prior literature to describe educational classroom dialogue/talk between teacher and students or between peers (e.g.

exploratory talk in Barnes & Todd, 1977; Mercer & Dawes, 2008; dialogic instruction in Nystrand, 1997; dialogic inquiry in Wells, 1999; and accountable talk in Michaels et al., 2008). However, since the focus of this study is on whole class dialogue, in which both teacher and students actively participate in the educational discussion, we considered Alexander's (2006) outlining of dialogic teaching as best describing the approach and nature of educational dialogue in our study and providing a clear depiction of the key features for our analysis of educational dialogue.

Within the framework of sociocultural learning theory, Vygotsky (1978) presented the concept of "zone of proximal development" (ZPD), operationalised as a distance between the actual and potential levels in a skill or conceptual understanding which may be bridged by adult support, or collaboration with more capable peers, which guidance may contribute to more advanced knowledge or problem solving than the child may achieved independently. In the current educational literature, the ZPD is often linked with the construct of scaffolding (Wood et al., 1976) described as a process through which an individual may achieve a goal which would most likely not have been possible to reach without assistance. In educational dialogue, teachers have the opportunity to support students in engaging collaborative and productive communication (Kumpulainen & Lipponen, 2010) and guide their understanding and thinking in ways that contribute to deeper learning (e.g. Howe & Abedin, 2013; Mercer & Littleton, 2007; van der Veen et al., 2015). The teachers' active use of diverse scaffolding strategies and their adjustment to individual and contextual classroom factors are of great importance in supporting the emergence of dialogue and students' learning through it (e.g. Cazden, 2001; Rojas-Drummond et al., 2013; Webb et al., 2019). Through both teacher-centred active strategies (e.g. asking questions, providing feedback, encouraging students to explain, justify and clarify their thinking) and student-centred scaffolding strategies (e.g. introducing authentic questions and discussion topics that are close to students' personal experiences and allowing dialogic space for students' initiatives, ideas and questions) teachers can support students' conceptual development and dialogue skills (e.g. Nystrand, 1997; Rasku-Puttonen et al., 2012; Rojas-Drummond et al., 2013; Webb et al., 2019). In effect, it is the quality of teachers' scaffolding strategies and the subsequent level of students' participation that have been suggested to serve as indicators when determining the quality of educational dialogue. For instance, four patterns of educational dialogue (utilised in the analysis of the present study) outlined by Muhonen et al. (2016, 2018, 2020, 2021), indicate dialogue quality (moderate or high) based on the teachers' scaffolding activeness and strategies, on the involvement of the students, and on the initiator of the dialogue (either teacher or student).

Prior literature on teacher scaffolding in dialogic interactions has predominantly focused on primary school students. It may, however, be expected that the nature of educational dialogue and teacher scaffolding may undergo changes in nature as students move from primary to secondary school. Since prior research has typically focused on investigating educational dialogue within certain grade levels, more research is needed on differences in educational dialogue between early primary and secondary school.

1.2. Educational dialogue and classroom talk in early primary school

Prior studies focusing on early primary school years' educational dialogue have highlighted the critical role of teacher scaffolding. It has been argued that young students require teachers' active guidance for learning how to use talk productively as a tool for sharing information, listening and taking turns in shared knowledge building, enabling them to reach collaborative educational dialogue and rich learning opportunities (Littleton et al., 2005). According to Patterson (2018), teachers of young students should support the students' emerging dialogue through both verbal scaffolding (especially questioning) and non-verbal scaffolding that can also allow non-verbal participation, which may be a more natural form of participation for some younger children. High levels of variation in student participation and teacher scaffolding can occur in the early school years classrooms as students are still learning the rules and customs of how to participate in constructive educational dialogue (Littleton et al., 2005). For instance, in their study of student participation and teacher scaffolding/reactions in Finnish Grade 3, Kovalainen and Kumpulainen (2007) showed four different types of student participation to which the teachers responded differently. Vocal students with a high level of participation were treated as partners by the teacher and given opportunities to manage turn-taking during the discussion. Responsive students with a medium level of participation received teachers' analytic scaffolding to take their utterances further and to enrich them with elaborations and clarifications. Bilateral students with a medium level of participation were socially scaffolded by the teacher with a focus on orchestrating the students' turn-taking. Finally, silent students were actively encouraged by the teacher to engage in whole-class discussions by asking them direct questions. However, the teacher rarely aimed to extend the discussion with silent students.

The majority of studies in the primary school setting have been conducted to enhance educational dialogue through interventions and professional development programs (e.g. Alexander, 2018; Mercer & Littleton, 2007; O'Connor et al., 2015). However, a smaller set of studies focusing on authentic classroom interaction have shown interesting features of educational dialogue taking place in primary classrooms among different subjects. Though the data sets of the prior studies have included a variety of different subjects (predominantly literacy, mathematics and science), the studies have not considered the variations of educational dialogue among the different subjects but have mostly focused on the overall interactions. For instance, the authentic Finnish classroom data of Muhonen et al. (2016) included video-recorded lessons of literacy, mathematics, and science. The study did not examine subject-specific differences, but it did show that although the overall amount of educational dialogue in Finnish early school years appears to be relatively scant, it is predominantly characterised by high-quality dialogue that is initiated by the teacher. In this type of educational dialogue, the teacher typically makes the initiation, but students participate in the discussion by sharing their knowledge and commenting on each other's thoughts. In a study conducted on English primary school lessons of mathematics, English and science, Vrikki et al. (2019) showed that the authentic overall classroom talk reflected a high number of dialogic features, such as elaboration and reasoning, but there was considerable variation across classrooms. Furthermore, in a comparative study of primary school classrooms of five countries (US, France, England, India, Russia), Alexander (2000) showed that the quality and balance of authentic educational classroom talk varied significantly among classrooms, mainly due to the varying nature of the teachers' questioning. In some primary classrooms,

teachers' specific or factual questions would elicit only short student answers, whereas in other classrooms, teachers' more open-ended questions generated extended and elaborative classroom dialogue. Though the data included a variety of language and mathematics lessons, the study did not consider subject-specific variations in their comparison. Therefore, despite these interesting and valuable findings in the early primary school context, there is a further need for research that considers the possible subject-specific variations of educational dialogue within authentic classroom data.

1.3. Educational dialogue and classroom talk in secondary school

Prior research on educational dialogue and types of classroom talk in secondary school has predominantly been focused on science teaching (i.e. biology, physics, chemistry, mathematics and geography lessons; see e.g. [Howe et al., 2015](#); [Jones & Tanner, 2002](#); [Lehesvuori et al., 2011](#); [Ruthven et al., 2016](#)). These studies have, in general, found dialogic interactions in the science classroom to be rare. Instead, secondary school classroom talk is dominated by sequences of initiation-response-feedback exchanges (IRF; [Sinclair & Coulthard, 1975](#)), in which the teacher asks a question, the student provides an answer to the question and the teacher gives feedback regarding the answer ([Mercer, 2002](#); [Nystrand, 1997](#)). Also, at least in the context of Norwegian secondary school, teachers' feedback during classroom interactions has been found to be more encouraging than learning oriented ([Gamlem & Munthe, 2014](#)). Although students' verbal participation in secondary classrooms has been shown to be scant, [Hähkiöniemi et al. \(2022\)](#) identified three levels of students' dialogic interactions in Finnish mathematics and physics lessons in the following decreasing order: 1) presenting separately multiple ideas, 2) commenting on surface features of each other's ideas and 3) analysing others' ideas by asking questions and elaborating or challenging them further. Despite the fact that presenting separate multiple ideas was found to be the most common type of participation, the findings indicated that Finnish secondary students' classroom talk also included more developed dialogic interactions.

Similar to studies in the primary school context, several intervention studies and professional development programs have been conducted to increase the amount and quality of educational dialogue and co-operative learning (also in peer groups) in secondary classrooms (e.g. [Davies et al., 2017](#); [Howe et al., 2015](#); [Ruthven et al., 2016](#); [Sedova et al., 2016](#); [van de Pol et al., 2017](#)). [Nystrand et al. \(2003\)](#) have suggested that secondary school teachers, who typically specialise in one subject, lack a broader understanding of how effective educational dialogue unfolds and how it should be initiated and scaffolded. Intervention studies have, thus, involved utilisation of effective questioning, especially authentic uptake and high-level thinking questions, in order to facilitate student participation and learning through dialogue ([Davies & Meissel, 2016](#); [Nystrand et al., 2003](#)). In particular, teachers' providing space for the adolescents' own perspectives has been highlighted as an important means to support students' learning ([Bru et al., 2010](#)). Studies conducted in authentic secondary school classrooms, however, have documented that teachers pay relatively little attention to their students' perspectives during dialogue ([Vattøy & Gamlem, 2019](#)).

Although it has been suggested that there is a great potential for sophisticated educational dialogue in secondary classrooms due to both students' greater cognitive ability and conceptual understanding ([Higham et al., 2014](#)), evidence regarding authentic classroom dialogue among different subjects has remained limited. Thus, there is a need to investigate the nature of authentic secondary school dialogue especially across different subjects.

1.4. Aims of the study

The major body of empirical evidence on educational dialogue draws from studies conducted at the primary school level (e.g. [Alexander, 2000](#); [Kovalainen & Kumpulainen, 2007](#); [Muhonen et al., 2016](#); [Vrieki et al., 2019](#)). Educational dialogue in secondary school classrooms is studied to a lesser extent, and the research has mainly focused on dialogic interventions of science education (e.g. [Howe et al., 2015](#); [Jones & Tanner, 2002](#); [Lehesvuori et al., 2011](#); [Ruthven et al., 2016](#)). There is a gap in research addressing the specific nature of educational dialogue at both primary and secondary school levels within the same study that utilises authentic observational data drawn from lessons of different subjects. Therefore, in order to support student learning at the different stages of their school journey, research is needed to investigate the authentic state of educational dialogue both in early primary and secondary school in order to map the potential variations concerning dialogue. The aim of the present study was to examine the amount and quality of educational dialogue in early primary school (Grade 2) and secondary school (Grade 9) as well as their variation in lessons of different subjects. Thus, the research questions of the present study were the following:

RQ1: To what extent does the amount of educational dialogue vary between Grade 2 and Grade 9 classrooms?

RQ 2: To what extent does the quality of educational dialogue vary between Grade 2 and Grade 9 classrooms?

RQ 3: To what extent do the quality and amount of educational dialogue vary in Grade 2 and Grade 9 classrooms among the lessons of literacy, mathematics, and science?

2. Method

2.1. Participants and procedure

The sample of the present study comprised data from two Finnish longitudinal studies that have investigated classroom interactions using data from video-recorded classroom lessons. The sample of Grade 2 was part of the Teacher and Student Stress and Interaction in Classroom study (TESSI; [Lerkanen & Pakarinen, 2016-2022](#)). The data were collected in 2019 in eight municipalities in central Finland. The sample of Grade 9 was part of the First Steps study ([Lerkanen et al., 2006-2016](#)). The data were collected in 2016 in four

Finnish municipalities: two in central, one in eastern and one in western Finland. Both studies were approved by the Ethics Committee of the University of Jyväskylä. In both studies, the participants gave their written consent for their participation (parents gave consent for their child's participation). The participants were provided with information regarding the study and its objectives. They were aware that the participation was voluntary, and they had the opportunity to drop out of the study at any point.

In Grade 2, the original sample comprised 50 Finnish primary teachers and their 710 students. The primary teachers worked as a class teachers who predominantly taught lessons of all subjects for their own class. The teachers' (3 male, 47 female) average age was 45.7 years, and they had, on average, 18.5 years of teaching experience. The students in the Grade 2 classrooms (50.7 % girls, 49.3 % boys) were predominantly eight years of age. On average, there were 18.8 students (minimum 5, maximum 26) in the participating classes. The parents' educational level varied from no vocational education to licentiate or doctoral degree (Mode = vocational school degree).

In Grade 9, the original sample of video-recorded lessons were drawn from classrooms of 86 subject teachers (12 male, 64 female) and 1481 students (47.5 % girls, 52.5 % boys). The subject teachers were specialised in one or multiple subjects which they taught for different classes of students. The teachers' average age was 44.1 years, and they typically had >15 years of teaching experience (experience ranged from a minimum of 1–5 years to >15 years). On average, the students were 15 years of age, and average number of students present in the participating classes was 18.5 (minimum 5, maximum 26). The parents' educational level varied from no vocational education to licentiate or doctoral degree (Mode = master's degree). In the samples of both Grades 2 and 9, all teachers had a master's degree, which is a requirement for both primary and subject teachers in Finland.

The data collection followed a similar type of procedure both in the Grades 2 and 9 classrooms. The lessons involving the participating teachers and their students were video-recorded in order to capture authentic classroom interactions. The participating teachers did not receive any guidance or instructions on how to conduct educational dialogue in their teaching. They were free to organise their teaching according to their own preferences. The video-recordings were conducted with two video cameras that were placed in the opposite corners (front and back corners) of the classroom. The lessons typically lasted for 45 min. In Grade 2, three lessons were recorded during one school day for each primary teacher (for one teacher four recorded lessons were available). A total of 151 lessons from 50 Grade 2 class teachers were available. In Grade 9, on average, 3.6 lessons for each subject teacher were recorded during one or several school days. A total of 307 lessons from 86 subject teachers were available.

The initial samples of both grades included a variety of subjects (e.g. mathematics, literacy, science, religion, sports, art, crafts, home economics and English as a foreign language). For the present analyses, only the lessons of literacy, mathematics, and science were included in the data. For Grade 2, data were available for 57 lessons for literacy, 43 lessons for mathematics and 15 lessons for science (a total of 115 lessons from 50 primary teachers). In Grade 9, the original data pool was larger, but a corresponding number of lessons per subject was selected consisting of 57 literacy lessons out of the 80 lessons available, 43 mathematics lessons out of the 58 lessons available and 15 science lessons out of the 16 lessons available (a total of 115 lessons). These lessons were drawn from lessons of 36 subject teachers. The sampling was conducted using random number tables. As a result, from both Grades 2 and 9, 115 video-recorded classroom lessons were considered for further analysis.

In addition, the teachers filled out a questionnaire on background information of themselves and the students in their classes.

2.2. Analysis strategy

The phases of analysis focused on the following: 1) amount of educational dialogue, 2) quality of educational dialogue and 3) comparison of the amount and quality of educational dialogue between Grade 2 and 9 classrooms.

The first author was responsible for all the analysis phases. Other members of the core research team were involved in research triangulation throughout the research process, in which potential ambiguities were acknowledged, identified, and discussed if needed. The first author consulted one or multiple members of the core research team for discussion and evaluation whenever the content of the episode was ambiguous concerning the quality of educational dialogue. In these cases, the correct pattern of educational dialogue was determined in collaboration. In the light of other various examples from the current and prior data, the authors discussed the pattern decisions and carefully analysed the content of the episode. In prior research, a similar type of analysis strategy (concerning phases 1 and 2) has been applied to other data sets (at different grades of primary school level) and has been reported in the previous work of the research team (e.g. Muhonen et al., 2016, 2018, 2020, 2021).

2.2.1. Analysis of the amount of educational dialogue

In the first phase of the analysis, episodes of educational dialogue were identified from video-recorded lessons of both Grade 2 and Grade 9 classrooms. During viewing of the videos, the first author made general notes about the nature of the interactions, learning contents, and classroom actions. The main aim of this analysis stage was to identify episodes of educational dialogue, also referred to as communicative events (see Hymes, 1972), and to determine the duration and timing of the episodes in the video-recordings. Episodes of educational dialogue were defined as continuous verbal whole-class educational discussions, which contained indicators of the five principles of dialogic teaching according to Alexander (2006): 1) collective, 2) reciprocal, 3) supportive, 4) cumulative, and 5) purposeful classroom talk between the teacher and students (see examples of the episodes of educational dialogue in Appendix 1). Since the focus was on reciprocal and cumulative discussions, separate question–answer sequences were only included if they occurred as part of more continuous discussions, but not as their own episodes. Episode boundaries were determined based on change of discussion topic or change of activity of the lesson. Each episode represented continuous discussion under the same topic or theme. When the topic or activity changed, the episode was considered as having come to an end. A new episode was considered as starting when a new discussion topic or theme was introduced either by the teacher or the students and the new discussion topic continued without

revisitation to previous topic. Possible topic revisitations were considered as part of the previous episode. Each potential episode was reviewed several times to ensure that the dialogue met Alexander's five principles of dialogic teaching and that the episode boundaries were designated accurately in order to determine the duration of the episode. The identified episodes were tabulated, and their start and end times, duration, and the subject of the lesson as well as the more specific discussion topics were recorded.

2.2.2. Analysis of the quality of educational dialogue

In the second phase of the analysis, the focus was on analysing the content of the identified dialogue episodes in order to determine the quality of the dialogue. The episode content was examined with respect to communicative acts (see Hymes, 1972), that is, separate statements of the teacher and students. All independent communicative acts were considered as separate units of analysis. Regarding the speaking turns of the teacher and students, the unit of analysis could represent a single turn, part of a turn or a combination of multiple turns. The length of the analysis unit varied from one word to a sentence, but sometimes even included multiple sentences depending on the content of the communicative act. A variety of different types of communicative acts were found within the analysed episodes of educational dialogue. In terms of the most common communicative acts of teachers, different types of questions (e.g. closed or open, practical or abstract, expanding or clarifying), feedback comments (e.g. confirming, refuting, constructive, expanding) and summarising comments were identified. In terms of the most common communicative acts of students, different types of responses (e.g. closed or open, practical/experiential or abstract/factual, expanding or clarifying), elaborations and justifications (e.g. factual, experiential or opinionative) were identified. A unit could comprise one communicative act, but multiple communicative acts per one unit were also possible, especially in terms of questions (e.g. 'Have you ever seen a bear's nest?', practical/experiential and closed) and responses (e.g. 'Yes, I have seen!', practical/experiential and closed; 'In our back yard, in this little forest, there is a bear's nest.', expanding and practical/experiential). In addition, for each independent episode of educational dialogue, it was determined if the initiator of the dialogue was the teacher or one of the students.

Based on this detailed analysis of the episode content and the initiator of the dialogue, the episodes of educational dialogue were categorised in terms of the four patterns of educational dialogue introduced by Muhonen et al. (2016, 2018, 2020, 2021); see Fig. 1). The patterns combine information on 1) the initiator of the dialogue (teacher or student) and 2) the quality of the dialogue (moderate or high). Moderate quality dialogues (initiated either by the teacher or a student) describe educational discussion that is predominantly built on short or closed questions and comments. In this type of dialogue, teacher scaffolding strategies are narrow in scope, and especially in teacher-initiated moderate quality dialogue, discussion relies highly on the teacher's active questioning. High quality dialogues (initiated either by the teacher or a student) represent more versatile and reciprocal educational discussion, in which the students actively participate in shared knowledge building by sharing their knowledge, commenting on others' initiatives and responses, and asking questions. In addition, the teacher utilises a rich variety of scaffolding strategies and allows space for students' initiatives and ideas, which allows them to build knowledge together. Each of the identified episodes of educational dialogue were categorised into one of the four pattern types (see sample extracts of the four pattern types in the Appendix 1).

2.2.3. Comparison of the amount and quality of educational dialogue between the Grade 2 and 9 classrooms

In the final phase of the analysis, statistical analyses with SPSS Statistics 26 (IBM, Armonk, NY, USA) were conducted to investigate the variation of the amount and quality of educational dialogue between the Grade 2 and 9 classrooms. Independent samples *t*-tests were conducted to determine whether the amount of educational dialogue (total number of episodes and total sum of dialogue duration per lesson) and quality (number of the episodes representing each of the four patterns of educational dialogue) varied between the Grades 2 and 9. In addition, one-way ANOVAs were conducted to examine the educational dialogue amount and quality in

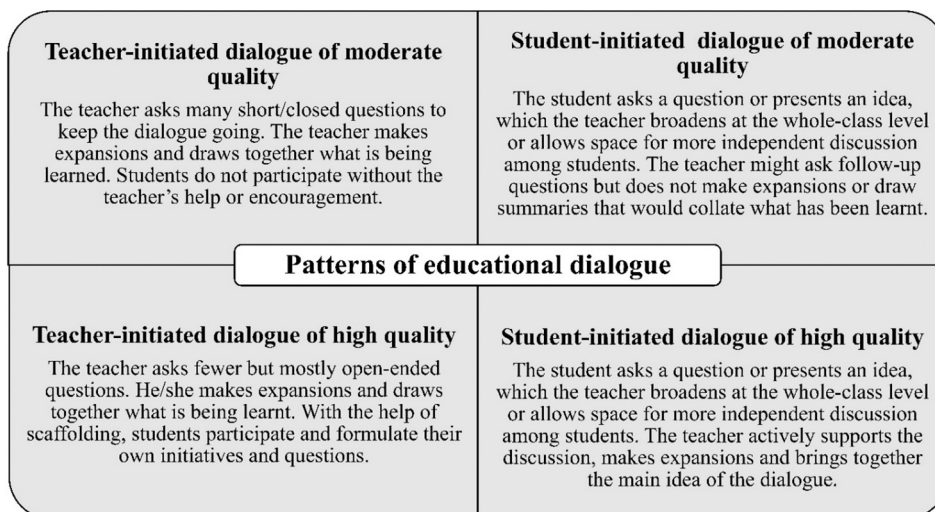


Fig. 1. Patterns of educational dialogue (Muhonen et al., 2016, 2018, 2020, 2021).

the Grade 2 and 9 classrooms in three school subjects: literacy, mathematics, and science. Finally, multiple comparison post hoc tests with Bonferroni correction were conducted to compare the frequencies of the episodes of educational dialogue pairwise, that is, between two subjects at a time (literacy vs. mathematics, literacy vs. science and mathematics vs. science).

3. Results

The first research question addressed the extent to which the amount of educational dialogue varied between Grade 2 and Grade 9 classrooms. Independent sample *t*-tests were conducted to investigate whether the amount (in terms of episode amount and dialogue duration) varied significantly between Grades 2 and 9 (see Table 1). Compared with Grade 2 classrooms, educational dialogue duration per lesson was found to be statistically significantly longer in Grade 9 classrooms. In terms of number of episodes, no statistically significant difference was found between Grades 2 and 9.

The second research question pertained to the extent to which the quality of educational dialogue varied between the Grade 2 and Grade 9 classrooms. The independent samples *t*-test showed statistically significant differences between Grades 2 and 9 in terms of the two teacher-initiated dialogue types (see Table 1). The extent of teacher-initiated dialogue of moderate quality was significantly higher in Grade 9 classrooms than in Grade 2 classrooms, whereas the extent of teacher-initiated dialogue of high quality was higher in Grade 2 classrooms compared with Grade 9 classrooms. In terms of student-initiated dialogues of moderate quality and high quality, no statistically significant differences were found between the two grades. In the Appendix 1, sample extracts of the four patterns of educational dialogue are presented to demonstrate the typical quality types of educational dialogue in the Grade 2 and 9 classrooms in concrete terms.

The third research question addressed possible variations in the amount and quality of educational dialogue in the Grade 2 and 9 classrooms in literacy, mathematics, and science lessons. The one-way ANOVA revealed that, in Grade 2, there were statistically significant differences in both the number of dialogue episodes and in the duration of educational dialogue between the lessons of the three subjects (see Table 2). Multiple comparison post hoc tests with Bonferroni correction showed that, in terms of the number of dialogue episodes, the mean value was significantly different between literacy and science ($p = .006$, 95 % CI [-2.60, -0.33]) and between mathematics and science ($p = .026$, 95 % CI [-2.46, -0.12]). Also, regarding the duration of educational dialogue, the mean value differed significantly between literacy and science lessons ($p = .001$, 95 % CI [-494.13, -102.97]) and between mathematics and science lessons ($p = .018$, 95 % CI [-434.42, -30.22]). The comparisons indicated that more educational dialogues were found in science lessons compared with literacy and mathematics lessons in Grade 2. In Grade 9, no statistically significant differences were found regarding the number of dialogue episodes and the duration of educational dialogue among the three subjects.

In terms of dialogue quality, in Grade 2, the one-way ANOVA revealed differences for teacher-initiated dialogues but not for student-initiated dialogues (see Table 2). Both, teacher-initiated moderate and high-quality dialogues differed statistically significantly among the lessons of the three subjects. Multiple comparison post hoc tests with Bonferroni correction showed that the mean value of teacher-initiated moderate quality dialogues was statistically significantly higher in mathematics than in literacy ($p = .005$, 95 % CI [0.10, 0.73]). Mean value of teacher-initiated high-quality dialogue differed significantly between literacy and science lessons ($p = .035$, 95 % CI [-1.76, -0.05]) and between mathematics and science lessons ($p = .006$, 95 % CI [-2.03, -0.26]). That is, more teacher-initiated dialogue of high quality was found in science lessons compared with literacy and mathematics lessons in Grade 2. In Grade 9, a marginally significant difference was found concerning student-initiated moderate quality dialogue. The multiple comparison post hoc tests showed that the mean value differed marginally significantly between literacy and science ($p = .084$, 95 % CI [-0.35, 0.02]) and between mathematics and science ($p = .069$, 95 % CI [-0.36, 0.01]) lessons, suggesting that more student-initiated

Table 1
Grade 2 and 9 descriptive information and comparisons of the study variables.

	Grade 2			Grade 9			<i>t</i>	<i>df</i>	<i>p</i>
	Sum	M (SD) ^c	Min/ Max ^c	Sum	M (SD) ^c	Min/ Max ^c			
<i>Dialogue amount</i>									
Episode amount	183	1.59 (1.66)	0/12 ^d	179	1.56 (1.51)	0/9 ^e	0.166	228	.868
Dialogue duration ^a	28,952	251.76 (291.26)	0/1,993	46,022	400.19 (443.52)	0/1,809	-3.000	228	.003**
<i>Dialogue quality^b</i>									
Teacher-initiated moderate-quality dialogue	54	0.47 (0.67)	0/3	97	0.84 (0.98)	0/4	-3.386	228	.001***
Teacher-initiated high-quality dialogue	106	0.92 (1.26)	0/8	59	0.51 (0.97)	0/4	2.762	228	.006**
Student-initiated moderate-quality dialogue	5	0.04 (0.25)	0/2	6	0.05 (0.26)	0/2	-0.262	228	.794
Student-initiated high-quality dialogue ^b	21	0.18 (0.66)	0/6	16	0.14 (0.40)	0/2	0.608	228	.543

Note. $p^{**} < 0.01$, $p^{***} < 0.001$.

^a Dialogue duration in seconds.

^b Numbers stand for the episode quantity representing the quality.

^c Descriptive information per lesson.

^d 29 lessons with 0 episodes of educational dialogue.

^e 37 lessons with 0 episodes of educational dialogue.

Table 2

Descriptive information and comparisons of the study variables among the lessons of literacy ($n = 57$), mathematics ($n = 43$) and science ($n = 15$) in Grades 2 and 9.

	1 Literacy		2 Mathematics		3 Science		<i>F</i>	<i>p</i>	Post hoc test
	Sum	M (SD) ^c	Sum	M (SD) ^c	Sum	M (SD) ^c			
Grade 2									
<i>Dialogue amount</i>									
Episode amount	76	1.33 (1.23)	65	1.51 (2.04)	42	2.80 (1.47)	5.020	.008**	1,2 < 3
Dialogue duration ^a	10,719	188.05 (189.12)	10,934	254.28 (340.90)	7,299	486.60 (351.37)	6.885	.002**	1,2 < 3
<i>Dialogue quality^b</i>									
Teacher-initiated moderate-quality dialogue	16	0.28 (0.49)	30	0.70 (0.80)	8	0.53 (0.64)	5.238	.007**	1 < 2
Teacher-initiated high-quality dialogue	51	0.89 (1.08)	28	0.65 (1.36)	27	1.80 (1.27)	4.993	.008**	1,2 < 3
Student-initiated moderate-quality dialogue	0	0.00 (0.00)	4	0.09 (0.37)	1	0.07 (0.26)	1.889	.156	ns.
Student-initiated high-quality dialogue	6	0.21 (0.84)	3	0.07 (0.26)	8	0.40 (0.63)	1.522	.223	ns.
Grade 9									
<i>Dialogue amount</i>									
Episode amount	88	1.54 (1.42)	61	1.42 (1.24)	30	2.00 (2.36)	0.831	.438	ns.
Dialogue duration ^a	20,858	365.93 (416.80)	18,879	439.05 (481.53)	6,285	419.00 (448.84)	0.345	.345	ns.
<i>Dialogue quality^b</i>									
Teacher-initiated moderate-quality dialogue	47	0.82 (0.95)	41	0.95 (1.09)	9	0.60 (0.74)	0.734	.478	ns.
Teacher-initiated high-quality dialogue	31	0.54 (0.93)	15	0.35 (0.75)	13	0.87 (1.51)	1.669	.193	ns.
Student-initiated moderate-quality dialogue	2	0.04 (0.19)	1	0.02 (0.15)	3	0.20 (0.56)	2.915	.058 [†]	ns.
Student-initiated high-quality dialogue	9	0.16 (0.41)	4	0.09 (0.37)	3	0.20 (0.41)	0.531	.589	ns.

Note. $p^{\dagger} < 0.10$, $** < 0.01$.

^a Dialogue duration in seconds.

^b Numbers stand for the episode quantity representing the quality.

^c Descriptive information per lesson.

dialogue of moderate quality was found in science lessons than in literacy and mathematics lessons. No other differences concerning educational dialogue quality were found among the lessons of literacy, mathematics, and science in Grade 9.

4. Discussion

The present study examined the amount and quality of educational dialogue at two school levels: in early primary school (Grade 2) and in secondary school (Grade 9) lessons. Variations in the amount of educational dialogue (number and duration of episodes) and quality were analysed across different subjects (literacy, mathematics, and science). In terms of dialogue amount, educational dialogue duration per lesson was found to be longer in Grade 9 than in Grade 2 classrooms. With respect to quality of educational dialogue, teacher-initiated dialogue of moderate quality was observed significantly more often in Grade 9 classrooms, whereas teacher-initiated dialogue of high quality was more frequently observed in Grade 2 classrooms. In Grade 2, the amount and quality of dialogue also varied across subjects. In Grade 9, little or no significant variation emerged with respect to amount and quality of dialogue across the three subjects.

With respect to the first research question, the findings showed that educational dialogues in this sample of Finnish Grade 9 classrooms were longer than in Grade 2 classrooms. This difference between primary and secondary school educational dialogue may be related to the developmental stages of the students. Secondary school students can be expected to have gained more experience on how to participate in classroom discussions with both different teachers and their classmates, and therefore, they may be more capable in engaging in extended educational dialogues. The finding of higher ability of students of this age for engaging in extended dialogue is in line with prior research which had documented positive effects of educational dialogue on student learning among secondary school students (e.g. Kiemer et al., 2015; Sedova et al., 2019; Sedova & Sedlacek, 2023) or older primary school student (e.g. Alexander, 2018; Howe et al., 2019; Mercer & Littleton, 2007; Muhonen et al., 2018). The longer duration of dialogue at Grade 9 may, however, also be associated with a more intentional role and higher effort that secondary teachers may take when scaffolding their students to participate in dialogue. It has been suggested that older students, especially in adolescence, rarely participate in classroom discussion without the teacher's encouragement (Myhill, 2006). Because of the specific developmental features of adolescence (Steinberg & Morris, 2001) secondary school students may be more concerned about criticism when sharing their knowledge with the whole class, and sensitive towards peer feedback. Therefore, enticing and encouraging adolescent students into dialogue is likely to require teachers to be active in questioning, especially making authentic high-level thinking questions which motivate students into voicing

their opinion and engaging in deliberation and argumentation which can, in turn, increase the length of educational dialogue (Davies & Meissel, 2016; Nystrand et al., 2003).

Grade 2 students, in contrast, are still acquiring and practicing the routines and ways of interaction (i.e., making initiatives, making stances, giving feedback) that are utilised in the classroom environment, and they may struggle with achieving a balance between engagement in accepted classroom behaviour (i.e., not interrupting, giving space, making a counterargument politely) and active interactional learning strategies (Littleton et al., 2005). During this learning phase of ground rules of educational dialogue in the early primary years, teachers are likely to be more active and face more challenges in orchestrating and guiding their young students' motivation to interact (Rasku-Puttonen et al., 2012) and managing the productivity of classroom behaviour at large. The need to focus also on classroom organisation and behavioural and cognitive regulation may take time and allow less time for scaffolding of the shared knowledge building, thus contributing to shorter dialogic episodes within the lessons. This challenge may be one of the reasons why prior studies, especially those involving interventions, have focused on promoting educational dialogue in primary school settings (e.g. Alexander, 2018; Mercer et al., 1999; Mercer & Littleton, 2007; O'Connor et al., 2015) and why scant research on the effectiveness of early primary students' dialogue is available.

With respect to the second research question, the findings indicated that teacher-initiated dialogue of moderate quality was observed more in Grade 9 classrooms, whereas teacher-initiated dialogue of high quality was found more in Grade 2 classrooms. In their work, Muhonen et al. (2016, 2018, 2020, 2021) described moderate quality dialogue as having a focus on teacher questioning that aims to steer and lead students to certain answers or learning goals. This type of highly goal-oriented discussion may be affected by the subject- and course-specific teaching and learning in the secondary school, which has been suggested to be often limited with respect to opportunities for creative, open dialogue and quality of classroom interaction between teachers and students (Higham et al., 2014). On the other hand, high-quality dialogue has been described as discussion in which both teachers and students make their own initiatives during the dialogue and participate equally by sharing their thoughts, asking questions and commenting on each other's thoughts (Muhonen et al., 2016, 2018, 2020, 2021). Reciprocal and supportive educational dialogue requires each party to trust each other and share thoughts without fear of embarrassment (Alexander, 2006). During the early primary school years, Finnish students are predominantly taught by one primary class teacher (typically for several years, even up to six years), which provides ample opportunities for the students to build a strong relationship with the teacher. Based on the sociocultural approach (Mercer & Littleton, 2007; Vygotsky, 1978), trust in the teacher-student relationship is likely to support the quality of the interaction and enhance learning utilising the ZPD when the teacher knows the students well and can adapt scaffolding based on each student's skills and needs. However, when moving to secondary school, the number of teachers with whom a student interacts daily with increases dramatically, since each subject is typically taught by a different subject teacher. Having multiple teachers may pose challenges to students for developing a trustful relationship with each of the teachers (Bru et al., 2010) which constitutes an important basis for supportive and reciprocal educational dialogue.

The third research question focused on the possible subject-specific variation of educational dialogue amount and quality across lessons of literacy, mathematics, and science. In Grade 2, differences were found regarding both the amount and quality of dialogue in the lessons of the three subjects. In pairwise comparisons, science lessons were observed to contain a higher amount of dialogue and more high-quality of dialogue than literacy and mathematics lessons. Prior research on educational dialogue has predominantly focused on science lessons and shown that discussions on science topics can facilitate aspects of exploration and argumentation both in primary and secondary school (see e.g. Howe et al., 2015; Lehesvuori et al., 2011; Mercer & Littleton, 2007; Ruthven et al., 2016). Bru et al. (2010) have noted that during the first school years students learn the basic skills of literacy, mathematics, and science, which they are likely to perceive as useful and interesting to learn. For effective educational dialogue to emerge, it is important that the students perceive the learning goals as being purposeful and important (Alexander, 2000). Especially in science, the students' interests and their own concrete experiences can evoke questions and the motivation to share the knowledge and experiences from their personal lives. A primary teacher, who is interested in young students' scientific experiences and sensitively utilises them by allowing space for educational dialogue in the classroom, can effectively support the development of students' scientific skills (Johnston, 2005). In addition, the analyses of the present study indicated that teacher-initiated moderate quality dialogue was more frequently observed in Grade 2 mathematics lessons than in literacy lessons. In Finnish early primary school, the focus of early mathematics is on automatization of basic arithmetic skills (Finnish National Agency for Education, 2014), which are needed to create the foundation for the mastery of more complex skills (such as mathematical thinking, explaining, and reasoning and strategies of solving more difficult math problems) (Clarke et al., 2012). Lessons focusing on consolidation of basic arithmetic skills may involve a lot of technical practice which is likely to contribute to goal-oriented short questioning by teachers rather than extended dialogue in the classroom.

In contrast, in Grade 9, the variations of educational dialogue amount and quality among the lessons of literacy, mathematics and science were limited. One explanation for this may be related to the nature and difficulty level of the subjects in secondary school. In secondary school, the topics and constructs studied become more complex, and the contents are likely to be more distant from students' daily lives and experiences. In addition, secondary school teachers have been shown to pay relatively limited attention to their students' perspectives during dialogue (Vattøy & Gamlem, 2019). Engaging in classroom dialogue based on complex and often abstract topics without including any personal experiences or opinions may not be appealing to many secondary school students. Building educational dialogue in secondary school may require teachers to invest more effort in their scaffolding of knowledge construction to support students through ZPD (see Vygotsky, 1978). Thus, although the students may have more skills and knowledge on how to participate in classroom dialogue than in the early grades, they may still require more teacher support in perceiving intrinsic value in discussing the topics and putting effort to advance their knowledge base. This is increasingly important in the adolescence years, when some students may experience school as being more disconnected from their lives, and their motivation and curiosity to ask questions shows signs of waning (Zyngier, 2008).

4.1. Implications, future directions and limitations

Theoretical and methodological implications of the present study draw from the novel design of examining video recordings collected from classrooms of both the early primary and secondary school and using a comparative approach to document variation in the amount and quality of educational dialogue across different subjects. Our findings indicated that although the quality of educational dialogue was higher in primary school Grade 2 classrooms, durations of educational dialogues were longer in the secondary school Grade 9 classrooms. These findings add to the prior literature suggesting differences between primary and secondary school educational dialogues considering both organisational and student-related perspectives (Higham et al., 2014). The more holistic organisational structure of primary school may contribute to the higher quality dialogue among younger students, whereas the developmental level of the older students may link with more extended classroom discussions. Our approach involved a rigorous qualitative analysis based on video-recorded lessons to determine the amount and quality of educational dialogues in the authentic classroom settings and statistical comparisons of the frequencies drawn from the qualitative analysis contrasting two school levels and the three different subjects (literacy, mathematics, and science). Prior literature has documented that analysis of variations and associations of educational dialogue is highly demanding, which underlines the need for a similar type of rigorous mixed-method research with observational data in the future (Mercer & Howe, 2012).

In terms of the practical implications of the study, we suggest that it is important for the teachers and teacher educators to become aware of the variations of educational dialogue amount and quality between early primary and secondary school in order to further develop their teaching. Teachers who teach at different school levels may benefit from training in different types of concrete scaffolding strategies and how to assess their students' learning through dialogue. Primary teachers would particularly benefit from training on how to allow and scaffold more extended time and space for their young students' initiatives and sharing of ideas and experiences, while effectively managing the classroom. Specific attention could be paid to increasing dialogue in early years' literacy and mathematics lessons, which often focus on the more technical learning contents of reading, writing and arithmetic (see Finnish National Agency for Education, 2014). In secondary school settings, where more moderate quality was found in the present study, teachers would likely benefit from training on how to utilise a variety of scaffolding strategies to reach high-quality dialogue. At its best, high-quality educational dialogue can engage the adolescent students in an active learning process which values their perspectives and reinforces their experiences of learning the subject as meaningful. In secondary school classrooms, high-quality dialogue may be more easily practised and reached through small group discussion which allows more space and creates a more supportive, trustful environment for adolescents in which they can share their thoughts. Training of both primary and subject teachers in dialogic teaching skills should be included in teacher training as part of pedagogical studies and continued in in-service training. In-service training could also be organised as joint training for both primary and secondary school teachers, which would encourage peer support, learning from others and insights about successful strategies.

The present study has certain limitations that should be considered. First, the number of the video-recorded lessons (151 lessons were selected for analysis from both Grade 2 and Grade 9 lessons) and the participating teachers (50 primary teachers and 36 subject teachers) was relatively small for statistical analyses. Therefore, it is important to replicate the findings with a larger sample size in the future. Second, the study was cross-sectional, and the samples consisted of teachers and students from two different studies. This means that the same students and their classroom interaction were not followed from Grade 2 to Grade 9. In future research, longitudinal study design is needed to investigate the development of educational dialogue across different grade levels among same students. Third, in Grade 2, all the video-recorded lessons of literacy, mathematics, and science were considered for the analysis phase, but in Grade 9, since the original data pool was larger, a corresponding similar number of lessons per each subject was selected. This selection should be taken into account when evaluating how well the selected lessons represent the lessons of literacy, mathematics, and science of the original data pool of Grade 9 lessons. Fourth, the present study was conducted in one country and culture: Finland, a Nordic country that has an educational system with a strong focus on high-quality classroom interactions. Therefore, caution is warranted when generalising the findings to different educational contexts.

5. Conclusions

Altogether, the findings of the present study provide important knowledge on how the amount and quality of educational dialogue may vary between early primary and secondary school classrooms in respect to different subjects. The observational data video-recorded in Finnish classrooms revealed that early primary classrooms were characterised by a higher quality but shorter duration of educational dialogue when compared with secondary classrooms. In secondary school, the dialogue amount and quality seemed to remain stable across the subjects, whereas in early primary school, science lessons provided the most favourable context for prevalence of high quality educational dialogue. The two school levels are, thus, likely to have their own challenges for the teachers and students in reaching the 'ideal' of extended, cumulative and purposeful educational dialogue in everyday school work. Considering both the organisational and student-related characteristics and needs of both school levels, pre- and in-service trainings of teachers should be tailored to include a focus on how to support the educational dialogue and students' active participation in the specific age group and setting as well as different subjects.

Declaration of competing interest

No potential conflict of interest was reported by the authors.

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Appendix 1

Sample extract 1:

Teacher-initiated moderate quality dialogue in Grade 9 mathematics lesson.

Context: The topic of the lesson is proportions.

-
- Teacher: Can you remember what a proportion means?
 Student 1: Yes! That you, like, cross multiply.
 Teacher: Indeed! You multiple across. For directly proportional variables, you can make a proportion, and the unknown can be solved from the proportion. You make the proportion so that you put the division sign between the numbers and the equal sign in the middle. So, in the map, the relation of distances is the same as in nature. And Terry, you said that we should cross multiply. So, what does it mean here?
 Student 1: So...twelve times x and nine time three.
 Teacher: Very good! 12 x equals nine times three. And then we only should solve the proportion.
 Student 2: This is tricky.
 Teacher: We can solve it. How much is nine times three?
 Student 3: Twenty-seven!
 Teacher: And what should we do then?
 Student 1: Well, then you put the equal sign and you divide.
 Teacher: Yes. So what do we have then?
 Student 2: I don't know this...
 Student 4: Twenty-seven and something, that 12...
 Teacher: Yes, 27 divided by 12. But as you can see, it can't be divided evenly. So...?
- Context: The teacher and students continue solving the proportion.*
-

Sample extract 1 represents teacher-initiated moderate quality dialogue in which the teacher actively guides the students towards understanding and solving proportions. The teacher initiates the dialogue by asking students a semi-closed factual question “Can you remember what a proportion means?” to which the students can share their factual knowledge (“Yes! That you, like, cross multiply.”; “So...twelve times x and nine time three.”). In the discussion, the teacher encourages students’ brief factual participation but not for further elaboration. The teacher scaffolding comprises of strategies such as asking questions to which there is one or limited number of answers (“How much is nine times three?”), asking follow-up questions (“And Terry, you said that we should cross multiply. So, what does it mean here?”; “And what should we do then?”), confirming students’ responses (“Very good! 12 x equals nine times three.”; “Yes, 27 divided by 12.”), and expanding on them (“For directly proportional variables, you can make a proportion, and the unknown can be solved from the proportion.”; “But as you can see, it can't be divided evenly.”).

Sample extract 2:

Teacher-initiated high quality dialogue in Grade 2 science lesson.

Context: The topic of the lesson is nature in the spring. The teacher and the students have been discussing what can be found in nature when the snow melts.

-
- Teacher: Who happens to know what plastic is made of? What are those plastic buckets made of?
 Student 1: It's made of oil.
 Teacher: Yes, the oil is drilled. I think the closest oil platforms are in Norway. They drill the oil deep from the ground, and through many complex processes the oil turns into plastic. Have you heard what people talk about plastic and nature? Who knows what people have been trying to tell us about plastic? (Many children raise their hand.) Quite a few of you seem to know, and after this everybody knows, good! Alice.
 Student 2: Plastic destroys our nature.
 Teacher: Yes, because the oil actually never decomposes. It may become a bit brittle but it remains, remains and remains. And then it often ends up in our seas. Poppy.
 Student 3: I have noticed that plastic never really decomposes. Because near where my grandparents live there is this hole in the ground, and I have been digging that hole quite a lot. We have been playing there with my little brother. And we have found all kinds of junk there. Rubber boots for example, and couple of days ago I found a half a shoe sole made of plastic. And one day I found some kind of piece of plastic there. I don't know what it was, it looked like a cone. So, I have found so many things there, and my mom told me not to dig there anymore.
 Teacher: Mmmm, yes, I understand. Well, Charlotte.
 Student 4: I watched a video with my mom about how much plastic there is in the seas and in water and how it destroys [nature]. They even showed how a sea turtle had a plastic straw in its nose.
 Teacher: Yes, you are very right, that is not funny at all. Those get stuck around birds' necks, too, for example.
 Student 5: And plastic bottles, too!
 Student 4: Yes, and one bird even died there because it ate plastic!

(continued on next page)

Sample extract 2: (continued)

Context: *The topic of the lesson is nature in the spring. The teacher and the students have been discussing what can be found in nature when the snow melts.*

Teacher: Yes! So, from now on, we all need to remember that if you have something plastic, never leave it in nature. And in the shop, always think through twice if you want buy something that is made of plastic. Think if you really need it, because it will remain, remain and remain. And now we have this new change that the shops do not give you plastic bags for free anymore. So, you need to buy it so that people would prefer to use fabric bags. How many of you have used those reusable fabric bags? (Many children raise their hand.)

Student 6: Sometimes, we take those with us to the shop.

Teacher: That is good. Did someone else want to say something about plastic?

Context: *The discussion continues, and children share their knowledge and experience about plastic in nature.*

Sample extract 2 represents teacher-initiated high-quality dialogue in which the teacher actively invites the students to elaborate and share different types of knowledge. The teacher opens the discussion by asking students' a semi-closed factual question "Who happens to know what plastic is made of?". However, quickly after some expanding the topic, the teacher opens more dialogic space with an open question allowing both factual, experimental, and opinionative knowledge ("Have you heard what people talk about plastic and nature? Who knows what people have been trying to tell us about plastic?"). The students actively participate to the discussion by sharing their knowledge ("Plastic destroys our nature."), experiences ("I have noticed that plastic never really decomposes..."; "I watched a video with my mom about how much plastic there is in the seas and in water and how it destroys [nature] ..."), and elaborating them further ("And plastic bottles, too!") cumulating the discussion. Though the students participate actively and willingly to the discussion, the teacher's scaffolding comprises a variety of strategies, such as guiding discussion and asking questions about authentic topics that allow children to tell their personal knowledge ("And now we have this new change that the shops do not give you plastic bags for free anymore. So, you need to buy it so that people would prefer to use fabric bags. How many of you have used those reusable fabric bags?"), showing interest with prompts, expanding comments and follow-up question ("Yes, you are very right, that is not funny at all. Those get stuck around birds' necks, too, for example."; That is good. Did someone else want to say something about plastic?") and accepting different kinds of views without judgement of their correctness ("Mmmm, yes, I understand.").

Sample extract 3:

Student-initiated moderate quality dialogue in Grade 9 literacy lesson.

Context: *The teacher and the students have been reading an old Finnish text that talks about women's role in the past centuries.*

Student 1: Is that 'sukanneule' [sock knitting] really spelled with three N-letters?

Teacher: Where is that?

Student 1: It is Annie who says so.

Student 2: Where?

Student 1: There, see!

Teacher: 'Sukanneule'... Well no, it should not be spelled with three N-letters.

Student 1: Right! Because I was really wondering.

Student 3: Of course there should be three of those!

Student 4: No! There should not be.

Student 3: Yes, there should.

Student 5: Su-kaN-Neu-le (divides the syllables). There should not be a third N.

Student 1: Perhaps it could be like a word of some dialect...? Like 'sukanneule' (stretches her pronunciation).

Student 4: But why should there be three N-letters? It's not right.

Teacher: Well, this text is, of course, taken from somewhere, so this copy we have here is not some original old edition. But, of course, in those old original documents, there could be a typing mistake for instance. Let's move on. So, women at that time were expected to knit socks. What else were they expected to do?

Context: *The teacher and students continue discussing women's role based on the text.*

Sample extract 3 demonstrates student-initiated moderate quality dialogue which is predominantly based on students' active participation and willingness to ask and share their knowledge. The first student initiates the discussion by asking a clarifying factual question ("Is that 'sukanneule' [sock knitting] really spelled with three N-letters?"). The teacher allows the dialogic space to open by allowing students to share their thoughts, responding to the student questions ("Sukanneule... Well no, it should not be spelled with three N-letters.") and suggesting explanations for the found mistake ("Well, this text is, of course, taken from somewhere, so this copy we have here is not some original old edition. But, of course, in those old original documents, there could be a typing mistake for instance."). The students actively share their knowledge and views ("Of course there should be three of those!"; "No! There should not be.") and ask questions ("But why should there be three N-letters? It's not right."), but the teacher does not encourage for further elaboration.

Sample extract 4:

Student-initiated high-quality dialogue in Grade 2 science lesson.

Context: *The topic of the lesson is hibernating animals. Students are doing a task in which they try to match the right nest with the right animal.*

- Student 1: Teacher! This big one cannot be bear's home because it is under the ground.
 Teacher: Well, actually, I think bears usually make their ground nests exactly in this type of knoll. Have you ever seen a bear's nest?
 Student 2: I have the bear nest here (shows her notebook).
 Teacher: Hmm, yes.
 Student 3: Yes, I have seen! In our back yard, in this little forest, there is a bear's nest. I have been there.
 Teacher: Yes, you have experience. I can also tell you something. This happened near our summer cottage. There was this lumberman who was about to go to thin out the forest. And there was this similar type of knoll in the forest, and he saw that at the top of the knoll there was steam coming out. The knoll was fully covered in snow but still there was steam coming out.
 Student 4: What?
 Student 5: There was a bear!
 Student 6: Yeah, there was a bear!
 Teacher: Indeed, the bear was sleeping there.
 Student 7: There was a bear who was sweating hard!
 Teacher: Yes, there was a bear sleeping. And then the lumberman thought it is best to hurry away from the forest.
 Student 7: I would have, too!
 Teacher: He thought that he would thin out the forest next year. Hopefully, there wouldn't be a bear then. What if he had turned on the chainsaw there?
 Student 8: It would have woken up!
 Teacher: Yes, the bear would have woken up annoyed. You need to let them sleep in peace.
 Context: *The teacher and the students continue the discussion and the task about hibernating animals.*

Sample extract 4 demonstrates student-initiated high-quality dialogue in which the students actively participate in the discussion of hibernating bears. The dialogue is initiated by the students (“Teacher! This big one cannot be bear's home because it is under the ground.”), after which the teacher opens the space for discussion by sharing clarifying factual knowledge (“Well, actually, I think bears usually make their ground nests exactly in this type of knoll.”) and inviting students' experiential knowledge with a follow-up question (“Have you ever seen a bear's nest?”). The students participate by sharing their own knowledge (“I have the bear nest here [shows her notebook].”; “Yes, I have seen! In our back yard, in this little forest, there is a bear's nest. I have been there.”) but also by commenting on the teacher's and other' statements (“There was a bear!”; “It would have woken up!”), therefore indicating that they were listening to each other's comments. The teacher asks only few questions since the dialogue is predominantly based on exchanging experiences about bears. Still, the teacher actively orchestrates the discussion by conforming students' comments (“Yes, you have experience.”; “Indeed, the bear was sleeping there.”), sharing her own both factual and experiential knowledge (“... And there was this similar type of knoll in the forest, and he saw that at the top of the knoll there was steam coming out...”), and importantly, summarising the main lesson for the whole class to learn (“Yes, the bear would have woken up annoyed. You need to let them sleep in peace.”).

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