Teacher professional development as a means of transforming student classroom talk

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HIGHLIGHTS

- We examined the effects of a teacher development programme focused on the implementation of dialogic teaching.
- A change in classroom discourse parameters was identified. The amount of talk with reasoning increased.
- Student talk with reasoning is related to the occurrence of other indicators of dialogic teaching.

ARTICLE INFO

ABSTRACT

This study deals with the impact of a teacher development programme focused on the implementation of dialogic teaching practice. Four indicators of dialogic teaching were measured: student talk with reasoning, teachers' open questions of high cognitive demand, teacher uptake, and open discussion. An analysis of video recordings made before and after the programme showed a change in classroom discourse and an increase in the amount of student talk with reasoning, attributed to changes in teacher communication behaviour. The participants were eight Czech teachers in lower secondary schools who took part in a one-year action research teacher development programme.

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1. Introduction

Classroom discourse — forms of talk in the classroom and their educational functions — is a key topic in the educational sciences. Researchers increasingly agree that learning is most effective when students are actively involved in a dialogic co-construction of meaning (Wells & Arauz, 2006). One approach to the dialogic co-construction of meaning, termed 'dialogic teaching' (Alexander, 2006; Lyle, 2008; Reznistkaya & Gregory, 2013), aims to use communication to promote higher cognitive functions in students. "Dialogic teaching harnesses the power of talk to engage children, stimulate and extend their thinking, and advance their learning and understanding" (Alexander, 2006, p. 37). Other important features of dialogic teaching are engaged students, student autonomy and the fact that students are allowed to influence the course of action in the classroom, at least to a certain extent. Power relations between teacher and students are flexible; there is room for negotiation as to what constitutes an adequate answer (Resnistkaya & Gregory, 2013).

Despite evidence (e.g., Billings & Fitzgerald, 2002; Gutierrez, 1994; Kutnick & Colwell, 2010; Mercer & Littleton, 2007; Scott, Ametller, Mortimer, & Emberton, 2010) that dialogic teaching is possible and beneficial, research based on larger samples has consistently shown the prevalence of a transmissive mode of instruction in which teachers present to students certain facts and then check whether students have learned them (Wells & Arauz, 2006). Teachers ask students a large number of questions that are mostly closed-ended, i.e., certain answers are seen as correct and it is the students' task to produce these answers. These questions are typically characterised by a low level of cognitive demand, requiring students merely to show that they remember subject

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matter presented to them earlier. Student answers are short and simple and are usually lists of learned facts, corresponding to the requirements of the teacher's questions. The teacher's feedback is usually a brief response to the correctness or otherwise of the student's answer; the development of a student's answer or suggestions for further consideration are generally absent. Although there are studies evidencing the ability of students to autonomously influence, to a certain degree, the patterns of classroom discourse (see e.g., Rampton, 2006), it is important to bear in mind that classroom interaction is shaped by cultural norms "limiting the times at which students can talk, the topics they can legitimately address, and the ways in which they can express themselves" (Segal & Lefstein, 2015).

These features of communication in lessons, discussed in a number of international research studies (Alexander, 2001; Burns & Myhill, 2004; Kumpulainen & Lipponen, 2010; Nystrand, Gamoran, Kachur, & Prendergast, 1997; Parker & Hurry, 2007; Sedova, Salamounova, & Svaricek, 2014) demonstrate that dialogic methods are rarely part of teachers' inventories of teaching methods. One possible explanation is that teachers do not get the kind of educational support that would allow them to implement dialogic teaching in their work. According to Corden (2009), teachers probably did not encounter this type of teaching when they were students themselves, nor were they systematically trained in this method in the course of their pre-service education. To address this gap, we designed and implemented a professional development programme — focused on the implementation of a dialogic approach into teaching practice — for lower secondary school teachers in the Czech Republic. The questions we posed were whether the project led to a change of classroom discourse parameters, and if so, what were the main variables contributing to this shift.

2. Theoretical background

The term *dialogic teaching* is most directly associated with Alexander (2006), who states that spoken language should play a central role in teaching, since it provides an opportunity to influence students' thought processes through their involvement in classroom discourse. Questions in dialogic teaching are structured in such a manner so as to provoke thoughtful answers and these answers are supposed to provoke further new questions. This serves to create a coherent line of enquiry (Alexander, 2006, p. 41). Among his inspirational sources, Alexander (2005, 2006) emphasizes in particular Vygotsky and Bakhtin.

Vygotsky (1978, 1981) believed that there is a strong connection between thinking and speaking; he pointed to the central role of language in the development of higher mental functions. At the same time, he claimed that each psychological function appears twice in the development of a child, first on the social level (i.e., in the interaction between the child and other people), and second on the individual level (the level of internalised psychological processes). It follows from this reasoning that a child can adopt and appropriate other people's voices, ideas and thought processes as a tool for its own thinking and learning. Classroom talk is in this conception considered the most essential cultural tool mediating learning (Lehesvuori, 2013). More recently Sfard (2007, 2008) uses the term *commognition* — coined as a blend of *communication* and *cognition* — in order to emphasise the indivisibility of these two phenomena. She recommends viewing learning not as acquisition of knowledge, but as participation in a certain discourse. Simply put, if a student if a student is engaging in a discourse and performing cognitive operations at a high level, then learning has taken place (Sfard, 2008).

Bakhtin (1981) concerned himself with micro processes of discourse and language. He used the term dialogism in the sense of switching between various mental perspectives and the interanimation of different voices. This means that each participant brings to communication something unique and original. The consequent mixing of various elements creates a dialogue in which individual voices react to one another, each utterance responding to the previous one and stimulating the following one. In the situation of a school class where classroom discourse is not controlled by the teacher but, rather, the teacher's and various students' perspectives and positions are presented, creating a polyphony of voices, then students' thinking, creativity and learning abilities develop because problems are better understood thanks to the realization of differences (see Mortimer & Scott, 2003).

Nystrand et al. (1997) distinguish dialogically versus monologically organised instruction, depending on whether the construction of meaning involves several voices (students and teacher), or one voice (the teacher as the only one to decide what is valid knowledge).

A more elaborated view is offered by Mortimer and Scott (2003), who, inspired by Bakhtin (1981), distinguish between authoritative and dialogic discourse. Authoritative discourse aims to deliver and achieve the reproduction of specific content that is considered to be true and accurate whereas the aim of dialogic discourse is to offer content for thought. Such content is open to questioning and alternative perspectives. An approach common in schools is when the teacher asks questions of the students to check their memorised knowledge and the students answer. This form of discourse cannot be considered dialogic (see also Scott, 2008; Scott et al. 2010).

In schools, the presence of both types of discourse is desirable, since authoritative discourse guarantees continuity and the reliable transmission of culturally valued content, while dialogic discourse encourages creativity and allows for innovation. Indeed, Nurkka, Viiri, Littleton, and Lehesvuori (2014) suggest that the teacher should alternate between authoritative and dialogic discourse, and thus create a rhythm in classroom discourse. However, the research cited above shows that while authoritative talk between teacher and students is abundant in schools, genuine dialogue is rare.

2.1. Indicators of dialogic teaching

Through engaging students in a rich and stimulating discourse, with different voices being heard, dialogic teaching develops mental activity, deepens thinking and enriches understanding. But how is such teaching to be recognised? Scholars involved in empirical exploration of the issue have drawn on different indicators to determine the presence of dialogic teaching. Nystrand et al. (1997) (see also Nystrand, Wu, Gamoran, Zeiser, & Long, 2001; Applebee, Langer, Nystrand, & Gamoran, 2003) employs the following criteria: (1) *authentic questions* — open-ended questions which aim to reveal a student's ideas and opinions and for which there is no set answer; (2) *uptake* — a situation in which the speaker builds on what has been said by the previous speaker, increasing the coherence of the dialogue; (3) *higher order teacher feedback* — comments on the correctness or incorrectness of a student's response, as well as more elaborate feedback on the content of the student's response; (4) *open discussion* — a sequence that includes at least three participants who respond to each other for more than 30 s.

Alongside these widely accepted indicators, other researchers also suggest: total student talk time during interactive sequences (Molinari & Mameli, 2013), triadic interaction — discursive sequences that involve at least three actors (Molinari & Mameli, 2013; 2015), the occurrence of student questions (Nystrand et al., 2001), the expression by students of thoughts with reasoning (Pimentel & McNeill, 2013), the presence of elaborated explanation in student talk (Sotter et al., 2008), the open-endedness and cognitive

demandingness of questions (Gayle, Preiss, & Allen, 2006), the use of mistakes as opportunities (Myhill & Warren, 2005), and probing questions or tossing back students' ideas by the teacher (Pimentel & McNeill, 2013). Each of these indicators can be to a certain extent considered as an indicator of dialogic teaching.

However, some researchers have also articulated the view that the presence of indicators is no guarantee of dialogic teaching. Boyd and Markarian (2011, 2015), for instance, reject indicators as such since they reflect only surface features. They regard, for instance, the indicator of openness of teacher questions as ambiguous. In their opinion, closed-ended questions are also capable of encouraging students to participate actively in an open discussion, which is evidenced by their case study of a teacher who uses closed-ended questions to spark discussion. An inverse example is provided by Lefstein, Snell, and Israeli (2015) who argue that a teacher can ask open-ended questions without stimulating elaborate and thoughtful responses on the part of students. They also conclude that an individual discourse move cannot be used as an indicator of the dialogic character of instruction.

Alexander (2006) accepts that indicators serve as a hint, but the decisive factor is the basic epistemology of classroom interaction, i.e., the degree to which students are required to think and formulate ideas themselves, rather than simply repeat somebody else's ideas. From this point of view, some indicators may be considered more reliable than others. If the aim of dialogic teaching is to have students who are engaged and stimulated to think (Alexander, 2006), it may be better to concentrate on the characteristics of student speech, rather than on those of teacher speech. Expressing a complete thought with reasoning (Pimentel & McNeill, 2013) or the presence of elaborated explanation in student talk (Sotter et al., 2008) can be considered as indicators that reflect dialogic discourse better than, for example, teacher questions and feedback.

2.2. Teacher professional development as a path to dialogic teaching

Dialogic teaching defines the role of the teacher in a specific manner. To some extent, the teacher has to make room for students to speak more and must attribute greater epistemic weight to student talk than in the classic transmissive mode of instruction. This does not mean, however, that the teacher steps back into the role of a facilitator; dialogic teaching requires both student engagement and teacher intervention (Alexander, 2006). This view is based on Vygotsky's concept of the teacher as a competent adult who introduces the child to the symbolic system of the given culture. According to Corden (2009), teachers should not try to suppress their expert role, but as much as possible should use their expertise to develop the child's expertise.

Although the ultimate goal of dialogic teaching is the productive participation of students in classroom discourse, it is the teachers who create the conditions for this participation. Therefore, it is important to provide teachers with educational opportunities that will enable them to establish dialogic teaching in their classes. A number of projects of this type have been implemented; here we will limit our discussion to those that were at the same time conceived as research. This means that teachers received educational support and scientific methods were applied to monitor whether any shift towards dialogic teaching occurred in their teaching practice.

As far as methodology is concerned, these research and development projects typically use video recordings of the lessons to document the method of teaching. As indicated by Borko, Jacobs, Eiteljorg, and Pittman (2008), video is presently a prominent tool of teacher training because of its unique ability to capture the richness and complexity of classrooms for later analysis. For this reason, video is an outstanding tool in any educational research.

2.2.1. Previous research

Chinn, Anderson, and Waggoner (2001) trained teachers in how to use a collaborative reasoning technique, an approach to literature discussion intended to stimulate critical reading and thinking as well as personal engagement. Four teachers and their Grade 4 classes participated in the project. In a first step, a classroom video recording was made of each participating teacher. Subsequently, the teachers took part in a workshop focused on the use of collaborative reasoning. Teachers then prepared lessons using collaborative reasoning. Each teacher worked in tandem with one researcher who followed the progress of the teaching and discussed it with the teacher. At the end of the project, two video recordings of each teacher's lessons were made and compared with their first video recording, made before teachers attended the workshop. This comparison revealed an increase in dialogic indicators − students had begun to talk more in class and teachers, in contrast, talked less. The proportion of students' responses to other students rose dramatically while the proportion of students' elaborated utterances providing evidence for a claim or offering alternative perspectives also rose. The total number of teacher questions fell, but the proportion of authentic questions rose.

Wells and Arauz (2006) conducted a professional development programme, which lasted for seven years and had a fairly open structure. The participants were teachers interested in adopting an inquiry orientation to classroom discourse. The length of their involvement in the project varied. The group met over the years at workshops and discussion sessions. The nine teachers involved made regular video recordings of their own teaching. Researchers then divided the recorded episodes, according to whether they were taken in the initial or final phase of the project. These files were then compared to determine whether there had been a change in classroom discourse as a result of participation in the project. Researchers were interested primarily in instances of open discussion. They noted that there had been an increase in the number of discussion-type sequences, but the proportion of these sequences remained low.

Lefstein and Snell (2014) and Snell and Lefstein (2011) also carried out a development programme for teachers and monitored whether communication in the classroom became more dialogic. The programme was conducted at a single primary school and involved bi-weekly professional development workshops, in which the researchers facilitated collaborative lesson planning and reflection on video-recorded excerpts of the classroom practice of seven teachers. Snell and Lefstein (2011) subsequently compared selected indicators (especially type of teacher questions and types of teacher feedback) across the sample in order to determine whether there had been a shift towards dialogic teaching. An increase in the openness of the teacher questions was the only common pattern found.

Osborne, Simon, Christodoulou, Howell-Richardson, and Richardson (2013) collaborated with eight teachers from four lower secondary schools. Over the course of two years, the teachers attended five workshop days with the researchers and subsequently were supposed to disseminate the knowledge gained at their school through reflective meetings with other teachers. The workshops were mainly devoted to the question of how to engage students in discussion and how to get them to argue and to model this argumentation. Between the workshops, researchers visited the schools and collected data, including making video recordings, but did not provide teachers with systematic feedback on their teaching. They relied on the expectation that the process of professional growth would stem from the teachers themselves. However, their subsequent evaluation of student performance failed to

show any changes.

Pimentel and McNeill (2013) surveyed the approach to discussion of five teachers in a professional development programme focused on the implementation of urban ecology lessons into middle school curriculum. The programme included the question of how to promote active participation of students in classroom discussion. All teachers in the programme were asked to give two lessons that were video recorded. A subsequent analysis showed that none of the teachers taught dialogically, the approach to teaching was authoritative, student-initiated interactions appeared only rarely and most student utterances amounted to a single word or a simple phrase. There were few cases of students expressing more elaborate thoughts containing reasoning.

Pehmer, Gröschner, and Seidel (2015) involved six secondary school teachers in the Dialogic Video Cycle programme which aimed at improving classroom dialogue through the use of video as a reflective tool. The core of the programme lay in workshops which included group discussion of video recordings of the teaching of the participating teachers. Change was evaluated by comparing teaching in the video recordings made before the project and after its completion. In the analysis, the researchers focused on the types of teacher questions and feedback, and the nature of student talk. They noted that the teacher questions and student talk remained unchanged, but the feedback changed; at the end of the project feedback was less focused on tasks and more focused on student learning processes and self-regulation.

It is difficult to draw any general conclusions from the research results cited above due to variations in the selected indicators and, to some extent, the method of monitoring. The effects achieved are diverse both in content and scope of change; some programmes can be considered very successful (e.g., Chinn et al., 2001), while others seem to be somewhat ineffective. Although all the programmes implemented were carefully designed, theoretically well-founded and conducted by experienced researchers, the researchers' expectations were not fulfilled in their entirety, instead, rather minor changes were identified in most cases. An overview of this kind does not provide a sufficient basis to infer the decisive factors in the (in)effectiveness of the intervention; however, the nature of the educational support provided to the teachers appears to be one of the key elements. Programmes in which teachers received feedback concentrated directly on the process of their teaching in class (Chinn et al., 2001; Snell & Lefstein, 2011; Pehmer, Gröschner, & Seidel, 2015) led to a considerable, or at least partial, change. In contrast, programmes in which the analysis of video recordings did not serve as a basis for feedback to teachers on their teaching method (Osborne et al., 2013; Pimentel & McNeill, 2013) did not result in any change. In any case, it is apparent that to implement a successful programme of this type is not an easy task and is an issue that deserves further research.

3. Aim and questions addressed

The aim of this paper is to present the results of an action research study of a teacher development programme which sought to introduce dialogic teaching into the practice of teachers at Czech lower secondary schools. Like the authors of the above-cited studies, we monitored the presence of selected indicators of dialogic teaching and compared video recordings of the lessons of participating teachers both before they entered the programme and after they completed it.

However, we reflect on the validity of the different indicators (see Section 2.1) and also assume that different indicators may be interrelated. We focus on one main indicator, the nature of student talk, which is for us, the decisive parameter of classroom discourse. We are interested in finding out whether the amount of student

talk – characterised by formulation of a complete thought accompanied by reasoning and argumentation – increased following the development programme. We consider this indicator reliable, taking a commognition perspective (see Sfard, 2008) which understands involvement in the discourse as a sign of learning. Commognition for us refers to students' verbal activity which leads to their deepened thinking and enriched understanding (Alexander, 2006).

Nonetheless, student talk was not something that we could influence directly. As already stated above, we see the teacher as the actor who creates the conditions for participation of students in classroom discourse. In accordance with this conception, within the teacher development programme, we sought to change the communication behaviour of teachers. Namely, we endeavoured to ensure that teachers increasingly posed *open questions of high cognitive demand* to students, provided them with *uptake* and allowed a communication structure of *open discussion*. We assumed that these changes on the part of teachers would induce changes on the part of students, who would participate more frequently in communication and whose utterances would become more complex and richer in argument.

In order to investigate these assumptions, we posed the following research questions:

1) Did the teacher development programme lead to a change in the nature of student talk in the monitored lessons of the teachers?
2) Which teacher indicators influenced the character of student talk?

4. Methods

4.1. Research design

Action research is built on the participation of everyone involved, i.e., both researched individuals and researchers. It takes place in an actual environment and has the goal of satisfactorily dealing with selected issues according to considerations of the practitioners and researchers' expert theoretical analysis. Action research has a cyclical character: first, a problem is identified, and only then is a change designed and implemented. After the evaluation of the effects caused by the change, another change is proposed and its implementation is monitored. In this way, cycles follow one after the other in a spiral process of progressively formulating and testing solutions to practical problems (Wall & Higgins, 2006).

In our case, the initial problem was teacher-student communication in lower secondary schools and the desired change was to shift the parameters of this communication towards the principles of dialogic teaching. When defining the problem, we began with the results of a previous research project focused on describing classroom discourse at a lower secondary school. In that research project, we concluded that Czech teaching practice is far removed from dialogic teaching, even though teachers are in favour of it and consider it a highly productive teaching method.

4.2. Teacher development programme

We designed a teacher development programme and implemented it with eight teachers who participated in it over the course of either the 2013/14 school year (four teachers) or the 2014/15 school year (four teachers). During the programme, the teachers were trained in ways to transform their practice, while the transformation process was monitored within the framework of our research. We made video recordings of all participating teachers

before starting the programme and again after completing it. Comparative analysis of video recordings before and after the programme allowed us to establish whether there had been a change in classroom discourse.

The teacher development programme consisted of several components: 1) workshops for teachers which included group discussion; 2) documentation of lessons by means of video recordings; and 3) reflective interviews conducted between a researcher and a teacher in which video recordings of individual lessons were discussed. The progress of the project is represented by the diagram in Appendix 1. In Workshop 1 teachers were acquainted with the concept, principles and key indicators of dialogic teaching as well as methods to achieve it. Workshop 2 was devoted to teacher questions and uptake issues. Workshop 3 was dedicated to increasing student participation and to the implementation of open discussion. Workshop 4 was the final one and provided space for sharing experiences of the project. All workshops included collaborative discussion on how to achieve the indicators of dialogic teaching in classrooms. Specific methods of instruction realisable in the classroom were planned. Suggestions were put forward by both researchers and teachers, who reflected on how to apply already-known methods to dialogic teaching.

Between workshops, the teachers tried to incorporate elements of dialogic teaching into their teaching. Their task after Workshop 2 was to implement *open questions of high cognitive demand* and *uptake*, and, after Workshop 3, *open discussion*. Researchers, who each worked in tandem with one teacher, attended the schools and took 45-min video recordings of the lessons. The researcher then selected sequences from the video recording which they watched with the teacher and together they discussed the lesson — what had occurred, which new features had been implemented and what impact these changes had had. These reflective interviews usually lasted for 45−60 min and focused on whether the individual indicators had been understood and implemented correctly by the teacher. The interviews also served as an impetus for a more general reflection on whether the teacher's procedures were in accordance with the epistemology of dialogic teaching and whether the principles of dialogic teaching had been adhered to (Alexander, 2006). These discussions were also used for planning the next lesson.

The concept of reflective practice (Schön, 1983) became the leading principle of the whole programme. We were inspired primarily by Korthagen's ALACT model (Korthagen & Kessels, 1999; Korthagen, Kessels, Kosters, Lagerwerf, & Wubbels, 2001) which includes the following components: 1) action; 2); looking back on the action; 3) awareness of essential aspects; 4) creating alternative methods of action; 5) trial. Component 1 in our case corresponds to a lesson being video recorded. Components 2−3 correspond to the teacher and the researcher watching the recording together. Component 4 corresponds to making a plan for the next lesson and Component 5 corresponds to actually carrying out that next lesson. The advantage of the ALACT model lies in the fact that it is in principle analogical to a general model of action research. The same order of steps serves, on the one hand, teacher development, and, on the other, data collection.

4.3. Participants

Eight teachers from five lower secondary schools (ISCED 2A)[1] participated in the programme. They were all experienced and highly motivated teachers who showed a strong interest in self-education and professional improvement. These teachers registered for the programme voluntarily, based on an offer sent out to schools by researchers. The offer was limited to certified teachers of Czech or civics in lower secondary school. We used this limitation to prevent an overly heterogeneous group of participants and teaching situations; it was also our aim to create a group whose members were relatively similar so that they could effectively share their experiences.

The fact that teachers had voluntarily signed up for the programme possibly impacted the progress of the project and the resulting data. It is reasonable to assume that the project attracted teachers with an above-average level of self-confidence and success, given that it required teachers who were willing to undergo long-term monitoring of their work in class and was highly demanding in terms of time and effort. All participants showed high motivation and determination to learn and transform their practice. If the same project were implemented with a group of less motivated teachers, it is possible that any resultant change would be less convincing.[2]

All five schools in the study are situated in the South Moravian region, located in the south-eastern part of the country and one of fourteen administrative units in the Czech Republic. All schools were state-run and attended by middle and working class students.

4.4. Data

We collected the following data during the project.

1) Video recordings of lessons, totalling nine lessons per teacher: (a) Two lessons were recorded prior to the start of the programme; these lessons represent the situation before the intervention; (b) Two lessons were recorded at the end of the programme; these lessons represent the situation after the intervention; (c) Five lessons were recorded during the course of the programme. We assumed that these lessons would show a gradual implementation of changes and that the recordings would allow us to monitor any progress.
2) Audio recordings of interviews with individual teachers: (a) Entry and exit interviews, discussing each teacher's approach to teaching, their self-image and their concept of students; (b) Reflective interviews stimulated by the video recordings after lessons 3−7. We thus conducted at least seven interviews with each teacher in the sample during the project.
3) Audio recordings of group discussions at workshops.
4) Questionnaires and tests for students handed out at the beginning and at the end of the programme.

Prior to data collection, we had developed all the research protocols (e.g., informed consent forms, a schedule of videotaping and an interview guide). We then sought oral consent from the school principals and all the teachers to allow us to conduct the research in their schools. In the next step, we sought the written consent of all parents of students participating in the observed classes. Informed consent was also obtained from teachers to video record their interactions with students and from parents of children for their children to be video recorded. Participants were assured of confidentiality and of the ability to withdraw at any time. No-one withdrew. All identifying

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[1] To complete the required nine years of compulsory education, Czech students complete four grades of primary school (attended by students between 6 and 11/12 years of age). After this, students can either continue to study at the same school in the 'lower secondary' section or they leave to go to a high school, provided they pass the entrance exams. Most gifted students leave their schools for high schools, which is an aspect of the Czech educational system that is often criticised. The majority of schools are run by the state (97%). Only 2% are privately run or run by religious organisations (1%).

[2] All participants were guaranteed anonymity. Names are pseudonyms.

information was removed from the data before coding began. In order to ensure confidentiality, we confirmed that the videotaped lessons would be used only for this particular study, and for no other purposes. We paid special attention to avoid disturbing the students and the teacher during videotaping. By the time of the actual collection of data, the students and the teachers had become accustomed to the presence of the observer in the room. Nevertheless, it was unavoidable that the subjects felt the threat of being evaluated. We therefore continually emphasized our goal of making their teaching and learning practice more effective.

4.5. Tools and methods of analysis

In the report of the study given in this paper, we work exclusively with the video recorded data. The video recordings were transcribed verbatim and subjected to coding. Lessons were divided into episodes (see Lehesvuori, Viiri, Rasku-Puttonen, Moate, & Helaakoski, 2013; Lehesvuori & Viiri, 2015) since not all parts of the lessons provided appropriate material for analysis. An episode provides us with the basic analytical unit; it is a distinct entity within a lesson which consists of a specific activity, has its own theme and is characterised by one consistent goal. An episode comes to an end with a change of activity, theme or communication approach, which also means the beginning of another episode.

Having divided the lessons into episodes, we worked only with whole class teaching episodes that involved interaction between teacher and students; we excluded for example episodes consisting of reading a text, individual work or group work.[3] Individual lessons in the sample contained varying numbers of episodes; the average was 4.5 episodes per lesson. The analysis included a total of 220 whole class episodes from a total of 335 episodes. Of the 220 episodes, 51 took place in lessons before the start of the teacher development programme and 43 after its completion. The first research question is addressed by analysis of the pre- and post-episodes only. The analysis relating to the second research question included all 220 episodes.

4.5.1. Indicators

Student talk with reasoning was the key indicator in our analysis. We assessed whether a desirable change had occurred in this type of student talk after the teacher development programme. In addition, we followed three other indicators — teacher questions, teacher uptake and open discussion — and considered how these indicators related to student talk with reasoning.

4.5.1.1. Student talk with reasoning. We drew on the classification scheme proposed by Pimentel and McNeill (2013): (1) No response; (2) Word/Phrase; (3) Complete thought (resembles a sentence but no explanation of thinking is included); (4) Thought and reasoning (resembles a sentence and includes explanation). In our analysis, we coded student utterances according to only the fourth classification, Thought and reasoning. This is the kind of talk that we see when students productively participate in the joint construction of knowledge, think and publicly present their thoughts.

An example of student talk with reasoning:

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[3] Each episode has a certain goal, the unity of which is maintained throughout the episode. A change of the goal means a transition to a new episode. The most common objectives in whole class teaching episodes with interaction included in the analysis are: evoking a topic, presenting new subject matter, building understanding of concepts, practicing. In terms of these objectives, the episodes recorded before and after the intervention are comparable across the entire sample.

Teacher: So, can you tell me why you think that Aragorn is a hero?

Student: It seems to me that he was afraid at first, but he overcame this and led the army into a battle, a victorious battle, and he just decided to take on this burden and by that he helped everyone to succeed.

4.5.1.2. Teachers' open questions of high cognitive demand. We distinguished four types of teacher questions according to the criteria of openness (authenticity) and cognitive demand: (1) closed question of low cognitive demand (test question with a predetermined answer that students should know by heart); (2) closed question of high cognitive demand (test question with a given answer at which the students must arrive using their own thought processes); (3) open question of low cognitive demand (authentic question with many possible answers; does not require logical thought; students answer on the basis of their attitudes, feelings and experience); (4) open question of high cognitive demand (authentic question with many possible answers; it requires logical thought). In our analysis we included only the fourth type, i.e., open questions of high cognitive demand. Within dialogic teaching, this type of question is regarded as a productive means of inducing dialogue.

An example of a teacher's open question of high cognitive demand:

Teacher: So, can you tell me why you think that Aragorn is a hero?

4.5.1.3. Teacher uptake. In accordance with Nystrand et al. (1997, 2001), we used the term uptake to designate a situation in which the teacher builds on what has been said by the student. The teacher poses a new question to the student, based on his/her previous answer.

An example of teacher uptake:

Teacher: So, would you like to see the corrida?

Student: Yeah.

Teacher: Why yes?

Student: Um, because it's nice.

Teacher: And what is nice? Try, try to tell me what is nice about it?

4.5.1.4. Open discussion. In accordance with Nystrand et al. (1997, 2001) we coded as open discussion a sequence that includes at least three participants who react to each other for more than 30 s. The teacher may, but need not, take part in open discussion.

An example of open discussion:

Teacher: Why do you think that this behaviour of Don Quixote is nonsensical?

Student 1: That somebody has been building a mill for half a year to be able to mill flour and this knight comes there and starts, starts to destroy this mill. Does that make sense?

Student 2: No.

Student 3: He is paranoid.

Student 2: Yeah, exactly.

Student 4: I think that every activity or every human behaviour has some meaning.

Student 1: Just because somebody thinks that what they do is meaningful does not mean that it is really meaningful.

Student 4: But it is meaningful for this person.

In all cases, we counted the number of instances of the indicators in individual episodes, with the exception of open discussion where we recorded its duration in seconds. An indicator was counted only where the interaction was related to the topic of the lesson, so we omitted, for instance, organisational matters or other diversions from the curriculum. All transcripts were coded by two coders.[4] The coding was in each case based on the context of the given interaction sequence. In other words, both questions and responses were considered by the coders in their interrelatedness. Consideration of cognitive demandingness was in addition conditional on being familiar with the progress of the entire episode (the goal of the episode, type of task, etc.). Hence, the analysis contained for instance questions that would formally belong to questions of higher cognitive demand, but that were finally coded as questions of lower cognitive demand, since it was obvious from the context of the lesson that students merely looked the answers up in a text or repeated a response they had memorized. All differences in coding were resolved through discussion.

4.6. Data analysis

To determine differences in the number of utterances with reasoning between the episodes before and after the intervention, we used the non-parametric Wilcoxon signed-ranks T-test for related samples. The size of this effect is determined by estimated Cohen's d.

To estimate the impact of the other indicators on utterances with reasoning in an episode we applied the technique of multiple linear regression, which allowed us to maximise the prediction of the dependent variable.

5. Results

In the following section, we present the results of our analysis of both research questions. First, we observed whether and how significantly the amount of student talk with reasoning increased in the lessons of teachers after they had completed the teacher development programme. Subsequently, we examined which of the other indicators showed a correlation with the occurrence of talk with reasoning.

5.1. Talk with reasoning in lessons before and after the teacher development programme

The analysis is based on a comparison of teaching episodes before the intervention (N = 51) and after the intervention (N = 43) for all teachers in the sample. The results are summarised in Table 1. For each teacher the average incidence of thought and reasoning in episodes before the intervention and the mean in the episodes after completing the programme was calculated. A comparison of means shows that there was an increase in the number of these utterances in episodes after the intervention for almost all teachers. The only exception was teacher Hana, who had the same average incidence of utterances in episodes before and after the intervention. In the other cases, there are considerable differences. The last line of the table shows that there were on average six more utterances with reasoning in the teaching episodes across the sample after

completion of the programme in comparison with the episodes originating from lessons before the programme. The standard deviations also show a high degree of variability in the episodes. Episodes with a high number of utterances with reasoning alternate with episodes with little or even no occurrence of reasoning. This is due to the fact that we included in the analysis all interactive whole-class teaching episodes that occurred in the lessons concerned, i.e., episodes in which teachers pursued other goals than developing dialogue with students, such as, checking the knowledge acquired. In this regard, however, both sets of episodes are similar and the analysis is relevant.

In order to verify our research question, we used, with regard to the size of the sample and in particular the variability of the distribution mentioned above, the Wilcoxon signed ranks T test, which is used to determine whether the total ranks in two related groups are significantly different. Thus, we test the null hypothesis that the median of differences between pre and post equals 0. The results are summarised in Table 2. For comparison we also include the results of the paired samples test of the means; the results are only indicative, because the means are distorted by the high variability referred to above. Based on the tests carried out, we reject the null hypothesis and we can say that the episodes after the intervention contained a statistically significant higher number of utterances with reasoning than the episodes before the intervention. The difference in the incidence of utterances in the episodes in pre- and post-lessons cannot be deemed accidental. The statistical significance is supported by the effect size in the form of estimated Cohen's d, allowing us to say that intervention in the form of the development programme had a medium influence on the variability of the incidence of argumentative talk (d > .6) (see Table 3).

5.2. Factors explaining the occurrence of talk with reasoning

We tested the assumption that differences in the amount of talk with reasoning are influenced by the three other focus indicators of dialogic teaching examined, that is, the number of teacher questions of high cognitive demand, the amount of teacher uptake and the total time of open discussion. Given that we included in the project teachers of two different subjects, we also examined whether the episodes differed in this respect between Czech language lessons and civics lessons. The objective was to find a model that would best explain the variability of student talk with reasoning in the episodes.

The method applied was multiple linear regression. It was aimed at finding a model that would best predict the results of a dependent variable represented by the number of student utterances with thought and reasoning appearing in the teaching episodes. The other three indicators of dialogic teaching mentioned above were tested as independent variables. The first step was to verify the main prerequisites for linear regression. We verified the linearity of relations and normal distribution by using point distribution and residual analysis. To check apparent as well as hidden multicollinearity, we used the diagnostics of collinearity coefficients (VIF and tolerance). Values that are below the generally accepted critical values are given in Table 5. In the next step, we examined the use of a hierarchical linear model. In other words, we investigated whether the variability of student talk in the episodes was not significantly influenced by individual teachers (aggregated data). The ICC coefficient (intra-class correlation coefficient) for our data has a value of .08. It can therefore be concluded that only 8% of the differences in the amount of student talk with reasoning in the episodes is attributable to differences between teachers. The remaining variance can be attributed to the varying nature of communication in the episode. For this reason, analysis is applied only at the episode level.

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[4] Trained coders from among doctoral students of our department took part in the coding.

Table 1
Participants.

Teacher	Gender	Length of teaching experience	Teaching subject	Grade	Number of students in class	School
Jonas	Male	6 years	Czech	7	21	School A: a city
Radek	Male	8 years	Civics	9	22	School A: a city
Hana	Female	20 years	Czech	7	18	School B: a town
Vaclav	Male	3 years	Civics	9	20	School C: a village
Marcela	Female	22 years	Civics	8	26	School C: a village
Daniela	Female	11 years	Czech	7	20	School D: a city
Marek	Male	12 years	Czech	7	19	School E: a city
Martina	Female	5 years	Civics	7	19	School E: a city

Table 2
Distribution of student talk with reasoning in episodes.

	Pre					Post					
	Mean	N	SD	Min	Max	Mean	N	SD	Min	Max	Difference
Jonas	2.00	5	2.82	0	7	27.00	2	1.41	26	28	25.00
Radek	1.75	8	1.75	0	5	4.00	3	3.61	0	7	1.86
Hana	3.33	6	5.20	0	11	3.33	6	3.61	0	9	.00
Vaclav	3.57	7	3.31	0	10	13.83	6	14.99	3	40	10.26
Marcela	3.00	5	3.16	0	8	6.14	7	6.81	0	21	3.81
Daniela	1.36	11	1.56	0	5	8.63	8	10.04	0	23	8.68
Marek	.00	2	0	0	0	8.66	6	6.62	0	17	8.66
Martina	3.43	7	3.95	0	10	10.20	5	10.37	0	26	6.94
All	**2.41**	**51**	**3.04**	**0**	**11**	**8.93**	**43**	**9.72**	**0**	**40**	**6.52**

Table 3
Test of changes in the incidence in pre- and post-episodes.

	Wilcoxon signed ranks T test		Paired samples test			Effect size
	Z	p	T	df	p	
Pre_Post	2.37	.01	−2.55	7	.03	.59

As has been mentioned above, the goal was to find a model that would best explain the impact of individual indicators of dialogic teaching on the number of student utterances with reasoning in teaching episodes. In the first step, it was found that the subject being taught (Czech or civics) was insignificant for explanation of the utterances. Hence, we did not include this factor in further models. All indicators of dialogic teaching proved to be significant and a higher proportion of student utterances with reasoning can be explained when these indicators are included. The results are summarised in Table 4.

Model 1 is built solely on the indicator of open discussion. The model accounts for about 46% of the variance of student utterances. By including the indicator, amount of uptake (Model 2), the proportion of explained variance increased by 8%. By including the indicator, questions of high cognitive demand (Model 3), the proportion of explained variance increased only slightly. Yet this increase was significant. In aggregate, all the monitored indicators of educational communication account for 55% of the variance in student utterances. An analysis of variance (F-test) confirms that on the significance level $\alpha = 0.05$ the following may be used for

prediction of utterances with reasoning in episodes: open discussion time, the amount of uptake and the number of questions of high cognitive demand.

Model 3 provides the greatest possibility of prediction of the dependent variable (the amount of student talk with reasoning) and therefore deserves closer inspection. In our opinion, the proportion of variability explained can be considered a very good result of the regression analysis. Nevertheless, it should be noted that even so 45% of utterance variance remains factually unexplained. Table 4 summarises the data on the regression coefficients of the model.

The final regression equation takes the form: Y (the number of student utterances with an argument) = .47 + .01*X1 (open discussion) + .22*X2 (amount of uptake) + .14*X3 (number of questions of high cognitive demand). These coefficients may serve as a basis to estimate the number of utterances with reasoning in an episode. For example, the data indicate that a hypothetical increase by 100 s in the time of open discussion in an episode means an increase of one student utterance with reasoning. For this same increase of one student utterance with reasoning, an increase of approximately five uptake instances or seven questions of high cognitive demand is required.

6. Discussion

Our analysis shows that there was a significant change in the nature of student talk in the lessons of the teachers surveyed, since the number of cases when students formulated complete and elaborated utterances involving reasoning clearly rose. This change

Table 4
Results of multiple regression.

Model	R	R2	Adjusted R square	Std. error of the estimate	R Square change	F change	Sig. F change
1	.68[a]	.47	.46	5.28	.46	190.19	.000
2	.74[b]	.55	.54	4.86	.08	39.93	.000
3	.74[c]	.56	.55	4.82	.0	5.19	.002

Dependent variable: the amount of student talk with an argument in the episodes.
[a] Predictors: (Constant), discussion.
[b] Predictors: (Constant), discussion, uptake.
[c] Predictors: (Constant), discussion, uptake, open questions of high cognitive demand.

Table 5
Regression coefficients.

Model		Unstandardised coefficients		Standardised coefficients			Tolerance	VIF
		B	Std. error	Beta	t	Sig.		
1	Constant	2.37	.39.		5.99	.00		
	Open discussion	.02	.00	.68	13.91	.00	1.00	1.00
2	Constant	.97	.46		2.11	.03		
	Open discussion	.02	.01	.69	14.86	.00	.99	1.00
	Uptake	.31	.06	.24	5.21	.00	.99	1.00
3	Constant	.47	.46		1.04	.14		
	Open discussion	.01	.00	.60	12.28	.00	.85	1.91
	Uptake	.22	.07	.18	2.91	.00	.49	2.03
	Questions of high cognitive demand	.14	.06	.15	2.28	.02	.43	2.27

Dependent variable: the amount of student talk with reasoning in the episodes.

can be attributed to the teacher development programme, because the nature of student talk is determined by the communication behaviour of teachers, which changed as a result of programme input. The significance of this study resides in the fact that we have demonstrated that by acting upon the teacher it is possible to influence indicators of classroom discourse on the part of students.

In Section 2.2.1 we cited the results of a number of similar projects, some of which managed to induce change, while others succeeded only partially or not at all in this task. In the research conducted by Pimentel and McNeill (2013), no increase in the proportion of complete student thought with reasoning was achieved; student utterances remained very brief, on the level of a word or phrase. Likewise, student talk remained unchanged in the research of Pehmer et al. (2015). On the other hand, in a project undertaken by Chinn et al. (2001) the proportion of student talk increased and the character of student talk changed – students began to formulate longer and more elaborate contributions, including giving evidence for their claims or offering alternative perspectives. Given these differences in results, we need to think about the factors that decide the success or failure of in-service teacher education. We believe that our project exhibits some similarities with that of Chinn et al. (2001), particularly, the emphasis on a longer duration of interaction between a researcher and a teacher and on joint reflection on the video recordings of teachers' own teaching. We attempt to analyse what may be the advantages of a professional development programme designed in this way.

One of the starting points for our project was the fact that dialogic teaching is a rare phenomenon in Czech classes (Sedova et al., 2014). Resnitskaya and Gregory (2013) state that dialogic teaching, which is generally advocated by theorists and researchers, is difficult for teachers to implement. According to these authors, this is due to the fact that teachers are not able to transform abstract theoretical principles into specific classroom practices that reflect these principles. We believe that this statement gives an accurate account of the situation because teachers appear to be in principle inclined towards dialogic teaching and declare a desire to teach in this way, but fail to do so (Sedova et al., 2014). According to Resnitskaya and Gregory (2013), teacher education and development should focus on helping practitioners develop coherent instructional frameworks that integrate both theoretical and practical knowledge (p. 128).

We believe that we managed to maintain this link between conceptual and practical tools (Grossman, Smagorinski, & Valencia, 1999) in our project. The project included workshops attended by the teachers in which ideas and principles concerning dialogic teaching were presented. At the same time, these workshops were also used as a platform for planning specific classroom practices. Subsequently, these classroom practices were used in actual instruction in teachers' classes and were further modified to best fit

the initial theoretical concept.

This bridge between theory and practice would not be possible without three specific measures – contextualisation, phasing of the change and reflection. By contextualisation we mean the transfer of aspects of the programme directly to the teachers' workplaces, i.e., to a real setting. According to Van den Bergh et al. (2015), a good professional development programme needs to be contextually situated. Similarly Adey (2006) states: "If you want to change what happens in schools, you must get into schools" (p. 51).

Phasing of a change means to segment the process into individual steps. It is a well-known fact that the introduction of a meaningful change in teaching requires time (Adey, 2006; Butler, Novak Lauscher, Jarvis-Selinger, & Beckingham, 2004). However, in our opinion it is not only the duration of the development programme that matters, but also the way individual phases of the project follow each other and allow the accumulation of progress. In our programme, phasing was present through the gradual introduction of individual elements of dialogic teaching. For instance, teachers were expected to change the way they asked questions after Workshop 2 and to use open discussion in their classes after Workshop 3. A good debate is not possible without a good question, and therefore the ability to use open questions of high cognitive demand was required at an earlier stage. Phasing was also manifest in the way that each lesson implemented by a teacher was followed by reflection on it, progress was recognised and a plan to further deepen the change was created for the next lesson. Our data confirm that the changes were in fact introduced gradually and partially. In our analysis in this paper, we compared the initial and final state; in a future publication, our goal is to describe the partial changes that occurred gradually in the practice of individual teachers during the programme. Although our data demonstrate a convincing increase in the monitored indicators between lessons before and after the development programme, this growth does not have a linear course, i.e., there was not a higher number of indicators of a certain type in each subsequent lesson. On the contrary, during the project we witnessed phases in the development of individual teachers when progress came to a halt or phases that were even marked by regress and a drop in indicators. These individual trajectories of individual teachers are particularly interesting and we will deal with them in our further analyses. We believe that a detailed analysis of these trajectories can provide an answer to the question of how teachers learn to change their teaching practice and, on the other hand, what hinders learning.

The fact that the increase in indicators was not linear requires attention. We managed to reverse the regress stages by including reflection of video recordings carried out by a researcher working in tandem with a teacher in the project. These joint reflections became the main platform that provided space to recognize an unproductive course of development and to search for and test possibilities for

overcoming it. In our opinion, the resulting change would have been hard to achieve to such a marked degree without a strong presence of the element of reflection in the development programme.

The importance of reflection in teacher education is universally acknowledged (see e.g., Davis, 2006; Korthagen et al. 2001; Lane, McMaster, Adnum, & Cavanagh, 2014; Postholm, 2008). Korthagen's model (Korthagen & Kessels, 1999; Korthagen et al. 2001), which we used in designing the development programme, posits that there will initially be an action (in our case, implementing the lesson) which is followed by looking back on the action and developing awareness of its essential aspects (in our case a reflective teacher interview carried out with a researcher). After that, alternative methods of action are created and the modified action is repeated. Korthagen's model is cyclical, thus allowing phasing as described above. It is based on getting the teachers to become aware of aspects of their activities that they would otherwise not be consciously aware of. This feature is particularly useful since communication behaviour is usually characterised as being to a considerable degree beyond the conscious control of an actor. Reflection on our own communication processes enables the development of practical wisdom (Luneberg & Korthagen, 2009) which involves sensitivity and awareness of the essentials of a given situation, and which allows teachers to find, and apply, suitable methods. Practical wisdom is precisely the element that allows the bridge between theory and experience (Luneberg & Korthagen, 2009), and thus between the abstract theoretical principles and corresponding classroom practices (Resnitskaya & Gregory, 2013).

In addition to providing evidence that classroom discourse can be transformed through in-service teacher education, the results of our study also enrich understandings of the phenomenon of dialogic teaching as such. Above all, they bring a new voice to the debate on the meaningfulness of dialogic indicators (see Section 2.1). Boyd and Markarian (2011) understand indicators as somewhat formal and as not guaranteeing the dialogic character of the discourse. It is evident that the act of asking an open-ended question need not necessarily stimulate the student to give an elaborate answer, just as one can imagine that in an open discussion students can make comments that are brief and void of content.

Our analysis is based on the fact that we have identified a central indicator that in our opinion represents the dialogic nature of the discourse. This indicator is student talk with reasoning. If this kind of talk is present, it means that the students are actively involved in the dialogic co-construction of meaning (Wells & Arauz, 2006), as they autonomously formulate their own ideas and substantiate them. Through multiple regression analysis, we demonstrated that the other three indicators monitored — open questions of high cognitive demand, uptake and open discussion — function as predictors in relation to the character of student talk.

This finding may serve as empirical support for the theoretically constructed concept of dialogic teaching. It points to the fact that the discursive moves of teachers and students are interrelated and that a certain type of communication behaviour on the part of teachers actually induces a certain type of communication behaviour on the part of students. The concept of dialogic teaching appears in the light of our findings to be coherent and meaningful.

It should also be said that the influence of individual predictors is not equal. Open discussion — a sequence that includes at least three participants who react to each other for more than 30 s — was identified as the most important variable affecting student talk. The longer the duration of open discussion in an educational episode, the higher the proportion of student talk with reasoning. The development of student responses through teacher's uptake and open questions of high cognitive demand turned out to be less effective, but nevertheless significant. While questions and uptake are fully in the hands of the teacher, establishing an open discussion requires the interplay of a greater number of communication actors. For this reason, the establishment of an open discussion can be difficult for teachers (see e.g., Lefstein & Snell, 2014).

This raises the question of why open discussion has greater impact than questions and uptake. Our data does not allow us to answer this question, but we can say that open discussion decreases the proportion of teacher talk and consequently increases the time of student talk. From our perspective, it is the nature of student utterances, i.e., whether students engage in student talk with reasoning, that plays a crucial role. In this respect, it should be noted that the structure in which students react to each other involves an exceptionally strong use of student voices. It is possible that the very presence of multiple mental perspectives and switching between them (Bakhtin, 1981; Scott et al., 2010) has a greater potential to stimulate students' thinking and expression of ideas than communication that takes place in a dyad between the teacher and one student.

On the whole, our findings suggest that it makes sense to teach teachers the specific skills of dialogic teaching as represented by the indicators discussed here. The findings also suggest that the study of specific indicators is a form of educational research that can contribute meaningfully to dialogic teaching. Although we agree that dialogic teaching is a complex epistemologic stance (Boyd & Markarian, 2011), we assume that within the framework of teacher education it is reasonable to divide it into partial indicators, allowing the actual achievement of the skills to which the indicators point to be easily monitored. Our study demonstrates this thesis.

7. Conclusion

In this study, we presented the results of an action research project aimed at transforming instruction in Czech lower secondary schools and moving it towards dialogic teaching, i.e., a type of participation in classroom discourse in which students are engaged, autonomous and cognitively stimulated. A compelling change in classroom discourse was witnessed in the classes observed. The character of student talk changed and became richer in argumentation. This means that students got an opportunity during class to create complex statements resulting from highly demanding thought processes. From a commognition perspective (Sfard, 2008), this is a significant shift that has a key influence on students' learning.

The change described above was mainly brought about by the fact that teachers introduced open discussion in their lessons. However, changes in teacher questions and uptake were also significant factors. Our study demonstrates that a change attributable to the effect of the teacher development programme occurred; however, further analysis is necessary to explore the progress of the transformation in more detail. Additional analysis, both quantitative and qualitative, needs to be carried out, with the aim of revealing the mechanism of the change, as well as giving an account of how the entire transformation was perceived and experienced by the actors themselves.

Appendix 1

An outline of the project and the individual components of the teacher development programme.
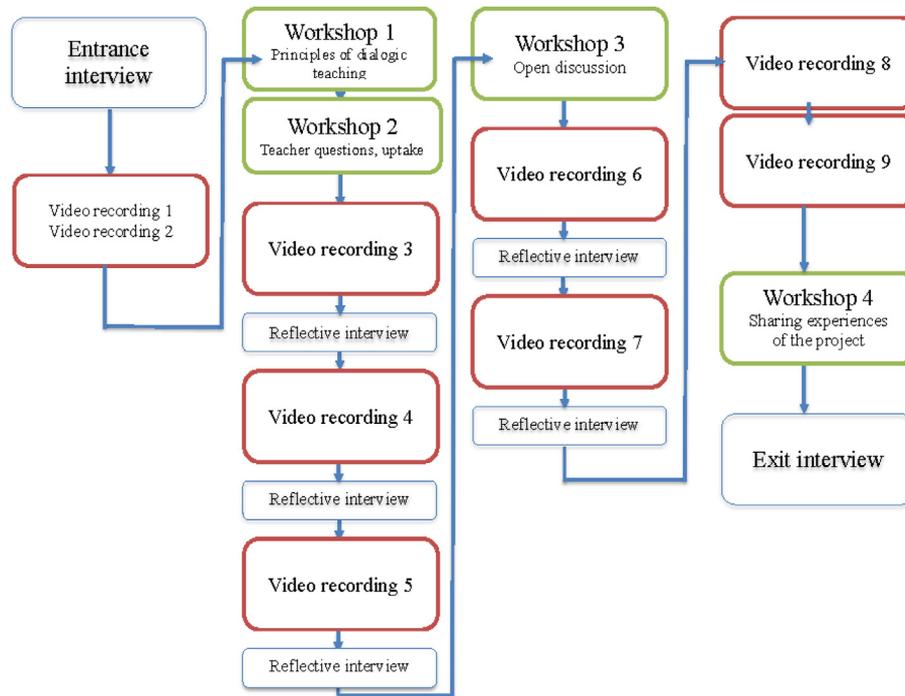
References

Adey, P. (2006). A model for professional development of teachers thinking. *Thinking Skills and Creativity, 1*(1), 49−56.

Alexander, R. (2001). *Culture and pedagogy. International comparisons in primary education*. London: Blackwell.

Alexander, R. (2005). *Culture, dialogue and learning: Notes on an emerging pedagogy*. Retrieved December 15, 2015 http://mmiweb.org.uk/hull/site/pt/downloads/alexander_dialogicteaching.pdf.

Alexander, R. (2006). *Towards dialogic teaching: Rethinking classroom talk*. Cambridge: Dialogos.

Applebee, A. N., Langer, J., Nystrand, M., & Gamoran, A. (2003). Discussion-based approaches to developing understanding: Classroom instruction and student performance in middle and high school English. *American Educational Research Journal, 40*(3), 685−730.

Bakhtin, M. M. (1981). In M. M. Bakhtin (Ed.), *The dialogic imagination: Four essays*. Austin: University of Texas Press.

Billings, L., & Fitzgerald, J. (2002). Dialogic discussion and the Paideia seminar. *American Educational Research Journal, 4*, 907−941.

Borko, H., Jacobs, J., Eiteljorg, E., & Pittman, M. E. (2008). Video as a tool for fostering productive discussions in mathematics professional development. *Teaching and Teacher Education, 24*(2), 417−436.

Boyd, M. P., & Markarian, W. C. (2011). Dialogic teaching: Talk in service of a dialogic stance. *Language and Education, 25*(6), 515−534.

Boyd, M. P., & Markarian, W. C. (2015). Dialogic teaching and dialogic stance: Moving beyond interactional form. *Research in Teaching of English, 49*(3), 272−296.

Burns, Ch, & Myhill, D. (2004). Interactive or inactive? A consideration of the nature of interaction in whole class teaching. *Cambridge Journal of Education, 34*(1), 35−50.

Butler, D. L., Novak Lauscher, H., Jarvis-Selinger, S., & Beckingham, B. (2004). Collaboration and self-regulation in teachers' professional development. *Teaching and Teacher Education, 20*(1), 35−455.

Chinn, C. A., Anderson, R. C., & Waggoner, M. A. (2001). Patterns of discourse in two kinds of literature discussion. *Reading Research Quarterly, 36*(4), 378−411.

Corden, R. (2009). *Literacy and learning through talk*. Open University Press.

Davis, E. A. (2006). Characterizing productive reflection among preservice elementary teachers: Seeing what matters. *Teaching and Teacher Education, 22*(3), 281−301.

Gayle, B. M., Preiss, R. W., & Allen, M. (2006). How effective are teacher-initiated classroom questions in enhancing student learning? In B. M. Gayle, R. W. Preiss, N. Burrell, & M. Allen (Eds.), *Classroom communication and instructional processes* (pp. 279−293). Mahwah, NJ: Lawrence Erlbaum Associates.

Grossman, P. L., Smagorinski, P., & Valencia, S. (1999). Appropriating tools for teaching English: A theoretical framework for research on learning to teach. *American Journal of Education, 108*(1), 1−29.

Gutierrez, K. (1994). How talk, context, and script shape contexts for learning: A cross-case comparison of journal sharing. *Linguistics and Education, 5*(3−4), 335−365.

Korthagen, F., & Kessels, J. (1999). Linking theory and practice: Changing the pedagogy of teacher education. *Educational Researcher, 28*(4), 4−17.

Korthagen, F., Kessels, J., Kosters, B., Lagerwerf, B., & Wubbels, T. (2001). *Linking practice and theory: The pedagogy of realistic teacher education*. Mahwah, NJ: Lawrence Erlbaum.

Kumpulainen, K., & Lipponen, L. (2010). Productive interaction as agentic participation in dialogic enquiry. In K. Littleton, & C. Howe (Eds.), *Educational dialogues: Understanding and promoting productive interaction* (pp. 48−63). London, New York: Routledge.

Kutnick, P., & Colwell, J. (2010). Dialogue enhancement in classrooms. Towards a relations approach for group working. In K. Littleton, & C. Howe (Eds.), *Educational dialogues: Understanding and promoting productive interaction* (pp. 192−215). London, New York: Routledge.

Lane, R., McMaster, H., Adnum, J., & Cavanagh, M. (2014). Quality reflective practice in teacher education: A journey towards shared understanding. *Reflective Practice, 15*(4), 481−494.

Lefstein, A., & Snell, J. (2014). *Better than best practice: Developing teaching and learning through dialogue*. London: Routledge.

Lefstein, A., Snell, J., & Israeli, M. (2015). From moves to sequences: Expanding the unit of analysis in the study of classroom discourse. *British Educational Research Journal, 41*(5), 866−885.

Lehesvuori, S. (2013). *Towards dialogic teaching in science: Challenging classroom realities through teacher education*. Retrieved December 15, 2015 https://jyx.jyu.fi/dspace/handle/123456789/41268.

Lehesvuori, S., & Viiri, J. (2015). Od teorie k praxi: Od plánování dialogického vyučování k jeho reflexi [From theory to practice: From planning to reflection on dialogic teaching]. *Studia paedagogica, 20*(2), 9−31.

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,*

50(8), 912—939.

Luneberg, M., & Korthagen, F. (2009). Experience, theory and practical wisdom in teaching and teacher education. *Teachers and Teaching: Theory and Practice, 15*(2), 225—240.

Lyle, S. (2008). Dialogic teaching: Discussing theoretical context and reviewing evidence from classroom practice. *Language and Education, 22*(3), 222—240.

Mercer, N., & Littleton, K. (2007). *Dialogue and the development of children's thinking: A sociocultural approach*. London & New York: Routledge.

Molinari, L., & Mameli, C. (2013). Process quality of classroom discourse: Pupil participation and learning opportunities. *International Journal of Educational Research, 62*, 249—258.

Molinari, L., & Mameli, C. (2015). Triadické interakce ve výukové komunikaci [Triadic interactions in classroom discourse]. *Studia paedagogica, 20*(3), 9—28.

Mortimer, E. F., & Scott, P. (2003). *Meaning making in science classrooms*. Milton Keynes: Open University Press.

Myhill, D., & Warren, P. (2005). Scaffolds or straitjackets? Critical moments in classroom discourse. *Educational Review, 57*(1), 55—69.

Nurkka, N., Viiri, J., Littleton, K., & Lehesvuori, S. (2014). A methodological approach to exploring the rhythm of classroom discourse in a cumulative frame in science teaching. *Learning, Culture and Social Interaction, 3*(1), 54—63.

Nystrand, M., Gamoran, A., Kachur, R., & Prendergast, C. (1997). *Opening dialogue. Understanding the dynamics of language and learning in the English classroom*. New York, London: Teachers College Press.

Nystrand, M., Wu, L. L., Gamoran, A., Zeiser, S., & Long, D. (2001). *Questions in time: Investigating the structure and dynamics of unfolding classroom discourse*. Cela Research Report Number 14005. New York: The National Research Center on English Learning & Achievement.

Osborne, J., Simon, S., Christodoulou, A., Howell-Richardson, Ch, & Richardson, K. (2013). Learning to argue: A study of four schools and their attempt to develop the use of argumentation as a common instructional practice and its impact on students. *Journal of Research in Science Teaching, 50*(3), 315—347.

Parker, M., & Hurry, J. (2007). Teachers' use of questioning and modelling comprehension skills in primary classrooms. *Educational Review, 59*(3), 299—314.

Pehmer, A. K., Gröschner, A., & Seidel, T. (2015). Fostering and scaffolding student engagement in productive classroom discourse: Teachers' practice changes and reflections in light of teachers professional development. *Learning, Culture and Social Interaction, 7*, 12—27.

Pimentel, S. D., & McNeill, K. L. (2013). Conducting talk in secondary science classrooms: Investigating instructional moves and teachers' beliefs. *Science Education, 97*(3), 367—394.

Postholm, M. B. (2008). Teachers developing practice: Reflection as key activity. *Teaching and Teacher Education, 24*(7), 1717—1728.

Rampton, B. (2006). *Language in late modernity. Interaction in an urban school*. Cambridge: Cambridge University Press.

Resnitskaya, A., & Gregory, M. (2013). Student thought and classroom language: Examinimg the mechanisms of change in dialogic teaching. *Educational Psychologist, 48*(2), 114—133.

Schön, D. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.

Scott, P. (2008). Talking a way to understanding in science. In N. Mercer (Ed.), *Exploring talk in schools: Inspired by the work of Douglas Barnes* (pp. 17—37). London: Sage.

Scott, P., Ametller, J., Mortimer, E., & Emberton, J. (2010). Teaching and learning disciplinary knowledge. In K. Littleton, & Ch Howe (Eds.), *Educational dialogues. Understanding and promoting productive interaction* (pp. 289—303). London, New York: Routledge.

Sedova, K., Salamounova, Z., & Svaricek, R. (2014). Troubles with dialogic teaching. *Learning Culture and Social Interaction, 3*(4), 274—285.

Segal, A., & Lefstein, A. (2015). *Exuberant voiceless participation: Dialogic sensibilities in the Israel primary classroom*. Retrieved December 15, 2015 http://www.academia.edu/11519244/WP156_Segal_and_Lefstein_2015._Exuberant_voiceless_participation_Dialogic_sensibilities_in_the_primary_classroom.

Sfard, A. (2007). When the rules of discourse change, but nobody tells you: Making sense of mathematics learning from a commognitive standpoint. *Journal of Learning Sciences, 16*(4), 565—613.

Sfard, A. (2008). *Thinking as communicating*. New York: Cambridge University Press.

Snell, J., & Lefstein, A. (2011). *Computer-assisted systematic observation of classroom discourse & interaction: Technical report on the systematic discourse analysis component of the Towards Dialogue study*. Working papers in Urban Language & Literacies. London: King's College London.

Sotter, A. O., Wilkinson, I. A., Murphy, K. P., Rudge, L., Reninger, K., & Edwards, M. (2008). What the discourse tells us: Talk and indicators of high-level comprehension. *International Journal of Educational Research, 47*(6), 372—391.

Van den Bergh, L., Ros, A., & Beijaard, D. (2015). Teacher learning in the context of a continuing professional development programme: A case study. *Teaching and Teacher Education, 47*, 142—150.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Vygotsky, L. S. (1981). The genesis of higher mental functions. In J. W. Wertsch (Ed.), *The concept of activity in Soviet psychology* (pp. 144—188). Armonk, NY: Sharpe.

Wall, K., & Higgins, S. (2006). Facilitating meta cognitive talk: A research and learning tool. *International Journal of Research & Method in Education, 29*(1), 39—53.

Wells, G., & Arauz, M. R. (2006). Dialogue in the classroom. *The Journal of the Learning Sciences, 15*(3), 379—428.