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Inquiry - without posing questions?

Helle Alrø¹ & Marit Johnsen-Høines²

Abstract: This article discusses what inquiry conversations could mean when learning mathematics.³ Referring to Gadamar's distinction of true and apparent questions it is discussed what it takes to be inquiring and if this attitude necessarily includes posing questions. Which qualities are expressed in inquiring questions, and what other ways of communicating may have an inquiring function in learning conversations? The intention is to develop and frame the concept of 'inquiry' in learning conversations, and this is the focus of analysis of an authentic classroom situation, where teacher and pupils are exploring the concept of 'volume'. Further, this analysis informs a discussion of listening as an important element of an inquiring learning conversation.

Keywords: teacher education, classroom communication, inquiry, listening, dialogue

Introduction

[...] the path of all knowledge leads through the question. To ask a question means to bring into the open. The openness of what is in question consists in the fact that the answer is not settled. It must still be undetermined, awaiting a decisive answer. The significance of questioning consists in revealing the questionability of what is questioned. [...] Every true question requires this openness. Without it, it is basically no more than an apparent question. We are familiar with this from the example of the pedagogical question, whose paradoxical difficulty consists in the fact that it is a question without a questioner.

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*Or from the rhetorical question, which not only has no questioner but no object.
(Gadamer, 2004, p.357)*

Teaching and learning conversations are characterised by questioning and answering. The teacher asks, and the pupils answer the teacher questions. Questions are considered to be crucial for the pupils' learning, and as such they can be seen as a *descriptive* quality of teaching as a phenomenon. There are also *normative* qualities of questions that can be considered good or bad, interesting or boring etc. In earlier studies we have been concerned with both such qualities of classroom communication and how qualities of communication may influence qualities of learning (see e.g. Alrø & Skovsmose, 2002; Johnsen-Høines, 2002).

Short sequences of communication is a descriptive quality of classroom communication. The teacher asks a question, the pupil answers the question, and the teacher evaluates the answer. Sinclair and Coulthard (1976) have described this communication pattern in terms of Initiative-Response-Feedback (IRF). This pattern is strongly positioned in the classroom, and it is easily recognized by the participants who can experience it as disciplining and authoritarian, but also as nice and comfortable as it is well-known in the context of schooling. Sometimes the IRF-pattern is broken by a more inquiring conversation style through which the participants collaborate in finding answers to questions they did not have beforehand. In such cases the communication structure becomes less predictable, as the participants in a cautious listening and dwelling manner explore ideas together. The IC-Model⁴ describes such inquiring conversations in terms of dialogue (Alrø & Skovsmose, 2002, p. 100; 2006, p. 112).

In this article we want to examine how such unpredictable conversations are initiated and unfold in the mathematics classroom. What characterizes inquiring and curious questions, who poses them, and how do they influence the direction of the learning conversation? However, inquiry may not only be about questioning. Inquiry and interrogative is not necessarily the same thing (Lindfors, 1999, p. 62).

⁴ Alrø og Skovsmose (2002) describe a dialogue as a conversation with such qualities. Through analysis of classroom communication they identify an *IC-Model* (Inquiry Cooperation Model) that includes dialogic speech acts like *getting in contact, locating, identifying, advocating, thinking aloud, challenging, and evaluating*.

What is inquiry?

Inquiry is a conversation with specific qualities. A dialogue includes equality, inquiry, unpredictability and risk taking (Alrø & Skovsmose, 2002). This means to have an open, curious, and wondering attitude towards the subject, the partner of conversation, oneself, the interaction and the relationship. "In order to be able to ask, one must want to know, and that means knowing that one does not know." (Gadamer, 2004, p.357)

According to Bakhtin utterances are addressive, which means that they include continuations and expect responses. Thus, to Bakhtin every utterance is a response to both earlier and future utterances – it is part of a communication chain. Accordingly, an utterance cannot be understood in isolation from its past and its future. Answers, however, that do not include new questions, are not dialogic. They close the conversation (Bakhtin, 1998; Johnsen-Høines, 2002). Gadamer describes such questions as "apparent questions" (2004, s. 357). Questions may be open and inquiring to possible answers, but they need not be. Other utterances including the answer might be inquiring as well in a dialogue, if they include inquiring continuations.

Thus, an inquiring approach implies an opened continuation full of curiosity and wish to understand more. However, inquiry presupposes an already existing insight into the field of inquiry – for instance as pre-understandings or underlying hypotheses. Further, for people to join an inquiry it requires an invitation and a common agenda in order to get into the potential field of interest. This agenda is about developing the subject, the community, and the interaction in progress (dialogicity).⁵

Inquiry is directed towards ongoing reflections and towards new inquiring questions. "The art of questioning is the art of questioning ever further - i.e. the art of thinking. It is called dialectic because it is the art of conducting a real dialogue" (Gadamer, 2004, p. 360). To be inquiring can mean to be experimenting, (re-)searching, wondering, trying out, anticipating. Gadamer underlines this point when he describes the hermeneutic characteristics of the question: "The essence of the question is to open up

⁵ Referring to Bakhtin's text theoretical perspective Johnsen-Høines (2002) describes, how childrens' understanding of mathematics arises from the meeting between, the conjectures between or the conflict between different understandings. Børtnes (1999, p. 24) writes: "A meaning manifests its depths when it meets and touches another and strange meaning: it seems like the beginning of a dialogue between those who conquer the one-sidedness and closedness of those meanings" [authors' translation]. Thus, to describe dialogicity means to describe movements (interaction) between meanings (utterances).

possibilities and keep them open” (p. 298). To be inquiring can be confronting established ways of thinking and ways of talking. It can be challenging.

To describe communication as inquiry is to describe how the participants aim at a common field of interest and to identify dialogical characteristics. In this article, the didactical context of organising dialogic teaching and learning activities is of special interest.

A question is directed (addressed) towards one or more answers. However, the person who asks does not necessarily have a curious aim. A question may be posed without an inquiring approach. The IRF-conversation serves as an example. If the teacher asks questions to which he has the authoritative answer himself, pupils are supposed to give minimal responses, i.e. they contribute as little as possible to the ongoing conversation (See Lemke 1990; Alrø, 1995).

Such questions can be necessary and useful into the context of learning. However, they might also unify or limit the pupils’ learning activities. That the teacher has the right answer to questions is one way of describing the quality of such interactions. That the answers are defined by the textbook would be another. That the questions might be used as training for a coming test would be a third one. The interaction might appear as a rhetorical trial practised by the pupils themselves, in which they focus on being good at drilling. Such an approach, however, can obstruct a subject-oriented curiosity. Thus, the IRF-pattern does not support empowerment and educating pupils as independent and critical reflective citizens.

To ask questions can appear to be fairly authoritarian. Questions legitimise authoritative ways of communicating, when it requires a continuation in line with the intention of the question (Johnsen-Høines, 2002, p. 87). Questions can be used as tool for oppressing or disciplining, e.g. when the person to answer does not understand or has no possibility to follow the ”rules of the game” (Streitlien, 2009). They may not know the answer, or they may not understand what is expected from them. To feel free from such oppression can mean to question the questions. It requires an inquiring stance and practice of communication in terms of a curious, investigative, challenging and critical attitude to critically reflect different kinds of questions.⁶

⁶ For a discussion of being critically reflective towards authoritarian texts, see Johnsen-Høines (2002, p. 201–207).

The situation we refer to in what follows takes place in a classroom where student teachers do practice teaching⁷ in a fifth grade mathematics classroom. The student teachers participate together with teacher trainers and didacticians in a school-industry partnership. The aim of this partnership is for the students to learn mathematics and mathematics in use when pendling between different contexts of school and industry (Johnsen-Høines, 2010). The group of student teachers referred to in the situation below collaborates with a grocery shop. They collect data for their theses focussing on language and learning. The conversation below is part of the student teachers' data. We analyse the conversation in order to get an insight into the collaborative interaction taking place between student teacher and pupils when dealing with the subject of 'volume'. The focus of analysis is the function of questioning in the interaction including intention, context, and potentials for learning mathematics. A special interest is paid to utterances of inquiry.

The analytical approach refers to pragmatics and the study of language in use (Austin, 1962; Searle, 1969; Wunderlich, 1975) that operates with a broad understanding of language as a combination of words, body and voice. The analysis considers the use of language in the conversational context and how the participants create meaning of the conversation. This qualitative approach starts from what is actually being said and done. As the use of language is the data of analysis, this is what is quoted and referred to as documentation when interpreting what is going on in the conversation in the classroom context. In this way data can be explicated and interpretations be challenged from other research perspectives.

***"Underneath the desk" – an example from 'Real-life Education'*⁸**

Student teachers teach mathematics close to practice in a 5th grade mathematics class. They collaborate with a grocery shop situated in the neighbourhood of the school. The pupils are going to learn about trade and economic life in the community. They are going to apply mathematics to real-life situations and they are going to learn mathematics from real-life situations. The important thing is that learning mathematics is closely related to using mathematics. The student teachers plan their own practice teaching by also

⁷The notion *practice teaching* is in this chapter referring to the practicum that is included as part of the teacher training study.

⁸ In Norwegian *praksisnær undervisning*. The schools are situated in Fjell, one of the three municipalities participating in the initiative 'Real-life Education'.

reflecting what such a concept could involve. Together with teacher trainers and didacticians they want to study the communitive conditions for learning mathematics. They study how the mathematics conversations develop when the pupils act in the shop and when they act in the classroom. They have chosen *volume* as their mathematical subject. They prepare themselves by discussing their own insight in the subject, and by discussing the coming presentation of the subject in the classroom. What would they want the pupils to learn and how would they arrange the learning environment. For instance they do not find it sufficient for the pupils to know that volume is "length times width times height". The teacher trainer stresses that it might be difficult to teach 'volume' in that class. It has not been taught before and the pupils have been working only a little with the concept of 'area'. But the student teachers feel positively challenged by the situation. They discuss how the pupils would get insight into the subject of 'area' by formulating this as "how much space would it take...?" Further, so they argue, they have previously been working with space by referring to the measure of capacity. They have had pupils find out how much water could be contained in different kinds of bowls, and the pupils have been measuring and making their guesses. For instance they have used litre as the unit of measure, not cubic decimetre. They would also use milk cartons. "How much water could be contained?" would be another formulation of the problem than "How many milk cartons could be contained?" In such ways the students want to stimulate the pupils' movements between different ways of thinking.

"How much space would it take?" is a didactical grip to develop a concept of length, area and volume, and to develop an insight into the process of measuring. The pupils are Norwegian children from the western part of the country. They have a good basis for understanding the concept of area through their experience with ferry traffic. They know how many cars could be placed at the deck, and they are able to estimate whether there is space enough for them to go or not.

The student teachers enter a discussion with the teacher trainer and the didacticians about approaching the subject of volume in this respect. Further, they want the pupils to get a meta level insight as regards what it would mean to measure. "It is necessary but insufficient that they become able to measure length times width times

height”, the student teachers emphasize both before and after the teaching course. ”How much space would it take?” indicates an inquiring approach.

In what follows we present a classroom situation where the pupils work on presented exercises. The student teacher⁹ catches sight of Karl (a pupil) who is sitting under his desk. Jonas (another pupil) is standing next to the desk. The student teacher arrives at the desk and addresses Karl¹⁰:

ST: How are you doing? Did you lose anything?

Karl: Not at all. We finished the exercises.

ST: OK, can I see them?

Karl: Please, show them, will you? [addressing Jonas] I am a little busy.

ST: What keeps you busy, then?

Karl: I am figuring out how many pizza boxes could be placed underneath the desk.¹¹

Jonas: Yes, we pretend the desk to be the shop, and then we just need the pizzas inside. Are we aloud to try this? We finished the other things [exercises].

ST: How exciting. Please, go on.

The student teacher initiates the conversation from a pedagogical and organisational perspective. The pupils are going to do the exercises they are supposed to do, and the student teacher is the classroom manager. If we interpret her question from this perspective it is not inquiring if Karl has lost anything. It would rather be a way of indicating that Karls is not supposed to sit underneath the desk. Thus, her question can be seen as an attempt to make the pupils work and behave. She is supposed to make sure that the pupils work in a fruitful way. However, a good reason to sit *underneath* instead of *at* the desk, would be to have lost something that has to be found. Karl’s answer indicates that he has understood the implicit managing meaning of the teacher question. He explains that they have finished the exercises they were supposed to do – and therefore he

9 There is only one student teacher participating in the quoted excerpt.

10 The transcript is translated from Norwegian.

11 Karl talks about a small scale pizza box of those they have seen in the shop. Making small scale boxes is one of their previous activities in the project.

would have a valid reason to sit underneath the table. He is "a little busy" and that is why he asks Jonas to present their work. This may be understood as a little unpolite way of neglecting the student teacher's request of showing her the exercises, as if he is doing something much more important. The student teacher's question is backwards directed towards activities the pupils have already been doing, but Karl's answer is forwards directed. He may be much more occupied with the new idea they are just about to figure out. However, Karl shows his good intentions by asking Jonas to show the exercise as he is not sitting underneath the desk.

Karl initiates a new direction of the conversation by telling that he is busy. The student teacher follows up: "What keeps you busy, then?" She does not seem to notice Karl's kind of unpolite rejection of a teacher enquiry, and she does not insist in controlling the exercises. On the contrary, she seems to be genuinely interested in Karl's upcoming activity. We cannot hear it from her tone of voice, but from the continuation of the conversation it seems obvious to interpret her question as inquiring, i.e. she asks in order to get to know, not in order to control. The student teacher praises ("how exciting") the pupils and encourages ("please, go on") them to continue their inquiry.

Karl's continuation may not be caused by the comment of the student teacher at all. His argumentation and the follow up from Jonas indicate that the two of them continue almost without further reflection of the question. Jonas asks the student teacher if they are "allowed" to go on with their activity, and the student teacher accepts. Again, the question has a managing function in the classroom context. The boys seem to be well aware that they participate in, and at the same time break with, this classroom management. "Are we allowed to try this? We finished the other things [exercises]". They use the opportunity to tell the student teacher about the alternative activity they cope with, and simultaneously they accept the authority and role of the student teacher. The argument for being "allowed to" is that they have already finished the things they were supposed to do.

The pupils have initiated a conversation about their inquiry cooperation. They have entered a landscape of inquiry (Alrø & Skovsmose, 2002; Skovsmose, 2001) in which they themselves have defined their route into the classroom subject of 'volume'. One might say that through the pizza box exercise, Karl and Jonas have taken ownership

of their learning process. They are so preoccupied with the idea that they want to carry on. It looks like willing hands make light work. They almost play a game in which they "pretend the desk to be the shop". They keep inquiring "how many pizza boxes could be placed underneath the desk", a question they would not be able to answer beforehand. They may not need further argumentation for the reason to find out how many pizza boxes "can be placed underneath the desk". They have just decided for themselves to find out. Maybe they are well aware that they consider the concept of volume in different ways, and that they have taken charge of "How much space would it take?" by using different units of measuring. Their activity might generate a continuing didactical question at a more superior level: How would the activity of those boys come to function as a reference for continuing inquiry?

The boys decide to find out how much space it would take to stack the pizza boxes underneath the desk. However, this is not the game of playing shopkeepers. They construct different units to express the size of space and how many boxes it takes to fill out the space. This indicates that the pupils have adopted the goal of the teaching course. They seriously try to get insight in: "How much space would it take?"

The student teacher has left the inquiry to the students, and Karl is still sitting underneath the table. He does the measuring and Jonas does the registration:

Karl: It is 83 cm down here.

Jonas: What do you mean 'down'? Here in the front?

Karl: No, the other way around. On this side it is 83.

Jonas: [nods and writes down]

Jonas wants to know what is being measured. He questions Karl's result of 83 cm by asking: "What do you mean 'down'? Here in the front?" This makes Karl specify what he has been measuring so that Jonas can put it down. They measure breadth, length and height in order to estimate how many units (pizza boxes) can be contained underneath the desk.

The student teacher approaches the desk when the pupils are about to calculate further. Karl is clearly impressed by the size of the number he gets:

Karl: Oh! It might contain... eh... six five three six two, that is a lot. How much is it?

ST: Yes, take a look. Sixtyfivethousandthreehundredandsixtytwo, this... this is certainly a big number. What have you been calculating right now, then?

Karl: How many pizza boxes could be placed if we had a shop underneath the desk.

ST: Yes, there would be space for a whole lot of pizza, wouldn't it?

Karl: Maybe we could calculate some more things?

ST: Just go for it.

Karl reads the result as "six five three six two" and then he asks: "How much is it?" He seems to be impressed by the size of the number, and he probably asks in order to know how big it is. The answer of the student teacher "Sixtyfivethousandthreehundredandsixtytwo" might give Karl a better idea of the size of the number. Maybe this is what he is getting at. Through the question: "How much is it?" he seeks information, and the answer can be stored together with other information about the size of numbers. This could have continuing questions incorporated that can be productive for further inquiry.

The student teacher acknowledges the big number, although it would not really make sense to imagine that many boxes underneath the desk. Instead, she wants to know *what* they have actually calculated. Her question: "What have you been calculating right now, then?" can be heard as a controlling classroom manager voice. However, in this context we may rather interpret the question as an inquiry into something she does not know, yet. This interpretation is supported by the following comment: "Yes, there would be space for a whole lot of pizza, wouldn't it?" The student teacher paraphrases their wording. She confirms and acknowledges the pupils work, which can be very important for their ongoing activity. The big number of pizza boxes might support new reflections on volume, which may be noticed in their use of language. They wonder if they are allowed to continue their examination of volume as they address the teacher manager

role: "Maybe we could calculate some more things?" The student teacher encourages them by saying: "Just go for it," and Karl returns to Jonas.

Karl: Shouldn't we take the boxes for toilet paper as well? This was fun!
[another pupil made containers for toilet paper the day before]

Jonas: Then we can find out how many boxes for toilet paper can be placed in the shop. Then we have to see how big is the box, right?

Karl: [flicks through his note book] I've got it here. I solved it last lesson.

Karl's question may be understood as an invitation: "Shouldn't we take the boxes for toilet paper as well?" He emphasizes how he enjoys what they are doing by adding: "This was fun!" Jonas gives a more explicit formulation to what they are about to do and that they first have to define "how big is the box". Jonas follows up on Karl's invitation and refers to the shop game they have invented when working with volume: "how many boxes for toilet paper can be placed". Further, they refer to previous activities where they have constructed other kinds of boxes for the shop game. Karl can even use his calculations from an earlier lesson.

The student teacher shows up and intervenes in the conversation:

ST: What do you expect to find out now, then?

Jonas: How many boxes for toilet paper we can place underneath the desk.

ST: Yes, that is true. But I wonder, if you would be able to place less or more boxes for toilet paper than for pizza underneath your desk. What do you think about that?

Karl: We can have less boxes for toilet paper.

ST: OK... how can you be so sure?

Karl: Because the boxes for toilet paper take much more space... don't they?
[Addressing Jonas]

Jonas: Sure they do.

ST: It is going to be very exciting to see if you are right.

The pupils go on by measuring new "things" in order to find out "how much space would it take". "What do you expect to find out now, then?", the student teacher asks, and adds "What do you think about that?" She poses *forwards oriented inquiring questions* in order to get to know what they are about to do. A backwards oriented question like 'what did you find out, then?' could easily be heard as a control of the pupils' behavior rather than as a curious and wondering interest.

The student teacher supports the pupils' initiative to compare boxes of different sizes. She wonders if they "would be able to place less or more boxes for toilet paper than for pizza" underneath their desk. This comparison is a challenge for further inquiry. But the task is initiated from the pupils themselves, so Karl answers without hesitating: "We can have less boxes for toilet paper." The student teacher does not evaluate the answer. She accepts and challenges it: "OK... how can you be so sure?" Again, Karl has a ready answer to the question and he includes Jonas by seeking his confirmation. The student teacher still does not evaluate the answer, but invites for them to examine "if they are right".

The conversation above illustrates pupils' curious and wondering inquiry in mathematics education. The students examine and compare how many pizza boxes respectively boxes for toilet paper could be placed underneath their desk. The idea of "how much space would it take" and a variation of units help them to work seriously on the concept of volume. They seem to take *ownership* to their activity, which is confirmed and supported by the student teacher. They have an inquiring attitude to the subject, to each other and to self, that seems to support their learning processes. Through collaborative participation in dialogue they express, examine and challenge their findings and so they seem to collectively learn.

The excerpt also shows that a conversation can be put together by several conversations with different intentions. An inquiry conversation and a classroom managing conversation can be identified simultaneously. They influence each other and are both of importance to the classroom context. The student teacher handles the management perspective, but she also contributes to the inquiry conversation of the pupils. The pupils on the other hand preserve the management conversation (Johnsen-

Høines, 2002), and still both of them take the initiative and responsibility for the inquiry as they listen, observe and act together.

The analysis indicates how inquiry in conversation is closely related to listening. In what follows we want to elaborate on this assumption in a broader theoretical perspective.

Authentic and non-authentic inquiry

Most didactical approaches are concerned with childrens' ability to ask questions. For instance children can be encouraged to pose wh-questions when participating in different activities. The teacher is supposed to evaluate the quality of such questions. However, it might be difficult for pupils to generate questions of real interest when simultaneously trying to satisfy a teacher request for good and right questions. The pupils would probably focus on the questioning technique instead of the subject content. Inquiring questions come from within, Lindfors claims (1999, s. 56). They presuppose a motivation and intention in learning. Thus, inquiring questions are part of what Rogers would call significant learning (Rogers, 1969). Or as Gadamer puts it: "To reach an understanding in a dialogue is not merely a matter of putting oneself forward and successfully asserting one's own point of view, but being transformed into a communion in which we do not remain what we were" (2004, p. 371).

Inquiry can emerge when pupils take ownership of the learning process like in the excerpt above, or when they consider themselves to be intentionally participating in the learning process. A teacher trainer and participant in the project 'Real-life Education' expresses it this way: "Only when the pupil defines himself as intentionally participating in the learning process he will experience the need for learning"¹²

Conversations may involve a lot of questions but this does not guarantee inquiry in terms of an examining and wondering attitude, or that the participants intend to know more. Lindfors (1999, p. 64) prefers to talk about two kinds of inquiry. One is *information seeking* about questions to which you have no answer, yet, but that can be answered in terms of concrete facts. The other is *wondering* that opens up for co-wondering and new inquiry, but not in order to come up with a solution to the question.

¹² The quotation is taken from an unpublished text by Olav Vårdal: *Praksisnær undervisning, eit komplementært læringsfelleskap*, 2008.

Both kinds of inquiry aim at learning, but as information seeking aims at getting clarification and harmony, wondering aims at keeping the examination in the open (Lindfors 1999, p. 134–135). The latter includes conflict, risk taking and examination, and this may be a challenging experience. Both information seeking and wondering are inquiry activities but they include different qualities of learning. Maybe the combination of the two can work as a mixture of support and challenge. Thus, in the didactical context we have analysed in this article, we find both of these inquiring attitudes.

Inquiring questions cannot be followed by evaluating comments like in the IRF-structure or in the construction of wh-questions. It has no meaning to evaluate for instance the wondering question of Jonas: "What do you mean 'down'? Here in the front?" Neither when Karl questions the big number: "How much is it?" Such questions cannot reasonably be followed by answers like: 'Yes, very well' or 'No, please try again'.

Lindfors (1999, p. 51–52) introduces the concepts of authentic and non-authentic questioning activities in the classroom. *Authentic* questioning activities means collaborative wondering and information seeking. The participants keep an open attitude when they collaborate in order to learn together. Staged examinations, as for instance when pupils have to formulate specific wh-questions, are *non-authentic* inquiry activities. They include no wondering, and the activities remain instrumental (Mellin-Olsen, 1984; 1987). Pupils' inquiry, however are not always expressed in terms of wh-questions. That is the reason why they cannot easily be identified in the classroom (Lindfors, 1999, p. 53).

Inquiring utterances are tentative, dwelling and trying out. This is the case for some hypothetical utterances like: "Could it be the case that ...? What if ...? How about ...? Could we try to ...? How come that ...?" or tentative utterances like when Karl presents his idea: "Shouldn't we take the boxes for toilet paper as well?"

Thus, inquiring utterances might be formed as questions, but they could also be formulated differently: "I imagine that ... Let us try to ... If it is so, then ... One might see it this way ... How strange that ...". In other words "inquiry" or "interrogative" are not identical concepts (Lindfors, 1999, p. 62). Inquiry includes an invitation, like when the student teacher says: "I wonder, if you would be able to place less or more boxes for toilet paper than for pizza". In the same way the final comment of the student teacher, "It

is going to be very exciting to see if you are right”, can be interpreted as an invitation and a support to the pupils’ inquiry.

Dialogic listening

An inquiring attitude can include ”dialogic listening”. This concept was introduced by Stewart & Logan (1999, p. 226–227) as an alternative to active listening. Active listening is directed towards one party of the conversation in order to address what this person understands, whereas dialogic listening is directed towards both parties and their mutual understanding. Dialogic listening means to be open and inquiring to both parties in order for them to co-create meanings (Stewart & Logan, 1999, p. 227). In the excerpt above we identify such a common process of meaning production. The boys try to figure out together how to operate with volume. All through this process they support each other and they get support from the teacher as well.

Davis (1996) does not use the concept of ’dialogic listening’ in his research on teacher roles in mathematics education. But he reflects similar ideas when distinguishing between evaluative, interpretive and hermeneutic listening.

In sum, then, evaluative listening is an uncritical taking in of information that is out there, interpretive listening involves an awareness that one is projecting onto one’s understandings particular biases that are in here, and hermeneutic listening is a participation in the unfolding of possibilities through collective action.
(Davis, 1996, p. 118)

Like dialogic listening hermeneutic listening does not focus on one party of the conversation. The hermeneutic listener is rather interested in the relationship and what is happening between the parties: ”[T]he tone of these conversations was not what-I-think; what-you-think, but more toward what-we-think” (Davis, 1996, p. 118).

Stewart and Logan (1999) describe dialogic listening as a playful process with certain qualities in the party attitude: modesty, humility, confidence and acknowledgement towards the perspectives of others and of self. Dialogic listening is a collaborative process through which the parties aim at getting to know. This takes a lot of concentration and ability of being present.

Dialogue presupposes a focus on a subject and an intention of getting to know. Thus, dialogic listening is directed towards this intention. It gives an important basis for further inquiry among the parties. Utterances can be characterised as listening acts if they reflect what has been said or what is going to be examined further. They would relate to future conversations. Thus, both information seeking and wondering utterances can be listening acts.

Dialogic listening takes an open and curious attitude and a number of communicative competences. First of all, the parties have to encourage each other to tell more, to elaborate, and to explain points of view. The use of metaphors can be of special interest because they contribute to reveal understandings and give new meaning to others. Stewart & Logan (1999, p. 229) claim that dialogic listening is like going by tandem; you are not supposed to take the lead all the time. By examining this metaphor you might reach a better understanding of dialogic listening. Stewart and Logan also use a turning lathe as a metaphor for dialogic listening; you sit in front of each other, you slap the clay on the lathe and form the object from both sides. In this way you make a common product. During the process you can remove or add more clay. Sometimes the product will be ugly and insignificant. Sometimes it will be beautiful and unique. It is not possible to foresee the result. In the classroom conversation above there is no use of metaphors, but we have identified a playful approach in terms of a virtual shop with virtual pizza boxes and toilet paper. This could have a similar function as it develops during the interaction between the boys.

Another aspect of dialogic listening is reflecting back what has been communicated verbally and non-verbally in the conversation. By paraphrasing it is possible to encourage the other to continue his or her reflections. Stewart & Logan (1999, p. 230) introduce the concept of "paraphrase plus", which means for the parties to add something to the paraphrase, e.g. a question or a questioning tone through which they challenge or shed light on other dimensions of the utterance in order to encourage further reflections. This can be seen in the excerpt above where the student teacher paraphrases the big number that Karl has found by a confirming comment: "Sixtyfivethousandthreehundredandsixtytwo, this is certainly a big number." In what follows she questions the big number: "What have you been calculating right now?" The

concept of dialogic listening may be specified through communicative competences like being curiously examining, information seeking and wondering (see Alrø & Skovsmose, 2002; Johnsen-Høines, 2002).

Closing remarks

In this article we have pursued the concept of 'inquiry' in the mathematics classroom. We have discussed inquiry as a quality of developing a dialogic learning community. This community is basically established through verbal and non-verbal information seeking and wondering interaction. Such interaction pays less attention to what students have already thought and done. It is more an inquiry into what they could be about to think or do and of which they are not so certain. Thus, inquiry takes place in the Zone of Proximal Development – in the relationship between what is already known and what is not known, yet, but can be achieved by support from others (Vygotsky, 1978; Lindfors, 1999). The excerpt illustrates this and further it gives the opportunity to reflect the role of listening as an important dimension of inquiry.

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