Full length article

The role of querying: Investigating subject-oriented meaning-making

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A B S T R A C T

This study investigates how students in a 10th-grade class used querying in subject-oriented meaning-making. We combine thematic analysis of a video-recorded learning trajectory comprising eight lessons in social science, with interaction analyses of selected episodes. We investigate how querying may prove productive and we aim to identify teaching strategies that are conducive to such querying. The findings suggest that querying can lead to cognitively demanding coordination and enhance an evaluative epistemic stance. We found the use of a microblogging tool to be productive in facilitating querying by displaying contrasting ideas and mediating uptake in whole-class conversations. Strategies to obtain productive querying are related to the teacher's assignments and uptake of students' contributions, as well as the teacher allowing students space to explore.

1. Introduction

Previous research has shown the importance of particular moves and patterns in dialogic teaching (e.g. Alexander, 2008; Barron, 2000; Mercer & Littleton, 2007; Nystrand et al., 1997). A recent large-scale study (Howe et al., 2019) that qualitatively investigated how twelve indicators of dialogic teaching related to student learning outcomes demonstrated the positive correlation between students' learning and two such moves: querying and elaboration. Howe et al. (2019) operationalised querying as 'doubting, full/partial disagreement, challenging, or rejecting a statement'. Thus, the concept covered several phenomena previously studied by researchers investigating classroom talk. When explaining why elaboration and querying proved productive, Howe et al. pointed to an example where a teacher facilitated a whole-class dialogue by repeatedly inviting students to build on previous students' utterances through questions such as, 'Who would like to add or build on what [previous-student] just said?' (Howe et al., 2019, p. 490). The authors argued that such moves created connections between utterances. When student participation was high, these connections often led to elaborations and made querying likely because the chain of utterances often brought forward differences of opinions and knowledge. This finding suggests that verbal moves, such as querying and elaboration, are not productive in themselves. Each needs to be connected to other moves, together forming productive patterns. To understand how verbal moves like querying can be productive, we will study how this particular move is embedded in naturalistic classroom interactions.

Taking a sociocultural perspective, studying meaning-making through interactions (Bakhtin, 1986; Linell, 1998), this article investigates how querying is associated with students' subject-oriented meaning-making and how productive querying can be facilitated.

The investigation is based on Howe et al.'s findings, as well as previous research studying related phenomena (Mercer et al., 1999; Reznitskaya et al., 2009; Strømme & Furberg, 2015). By focusing on the interactions, we add to this research by investigating how, why and in which instances querying can prove productive for students' subject-oriented meaning-making, as well as how teachers can facilitate such moves in ways that can lead to productive meaning-making.

Our empirical material consists of a learning trajectory of eight lessons in a tenth-grade social science class (students aged 14–15). As Howe et al. (2019) found querying to be relatively rare in their empirical material, we were curious to study this move closer when we discovered that it occurred quite frequently in one of the lessons in this material. When further analysing the material, we identified all episodes where querying occurred and categorised them according to productivity. We discovered clustering of querying episodes in three lessons (see Appendix A), the only ones where a digital microblogging tool was used. Therefore, we wanted to investigate how the teacher and students used this tool in relation to querying. Previous research has shown that microblogs and digital whiteboards can initiate conversations and support collaborative learning and reflection (Major et al., 2018; Mercier et al., 2015), and studies have also shown that microblogs can open new opportunities for organising discussions, questions and elaborations of students' contributions (Rasmussen & Hagen, 2015).

Aiming to expand on Howe et al.'s (2019) finding that querying correlated with students' learning, we investigated our empirical material further with the following research questions:

1. How can teachers facilitate querying that is productive for students' subject-oriented meaning-making?
2. How can querying influence students' subject-oriented meaning-making?

1.1. Challenging and argumentation in classroom talk

Research has described different kinds of classroom talk found to be particularly productive. Such talk often focuses on building interactions on students' ideas, argumentation for these ideas, and challenges to them. These ways of talking are closely related to querying. One such approach, the Thinking Together programme,[1] use the term exploratory talk to describe classroom interactions that are found to be particularly productive for students learning. In such talk, students engage critically but constructively with each other's statements. They are encouraged to challenge each other's ideas as a means of analysing and evaluating them. These challenges should be justified and alternative hypotheses offered. Opinions should be sought and considered before decisions are jointly made, and the aim is to achieve consensus (Mercer & Littleton, 2007). In such activities students are interthinking, or using language to think together as they make sense of experiences and solve problems, thus achieving more by working together than alone. Inquiry-oriented dialogue has similarities with exploratory talk, and the main goal is to collectively formulate reasonable judgments, adding to a group's existing body of knowledge and mutual understanding (Dobber et al., 2017; Macagno, 2000). This form of dialogue is a collaborative attempt to reach a sound conclusion, and the students' argumentation skills become central (Reznitskaya & Gregory, 2013). These skills comprise examination and coordination of different perspectives (Schwarz, 2009) and may include challenging. Interaction presupposes some degree of coordination of thoughts for establishing common ground (Linell, 1998). Barron (2000) studied peer group interaction, comparing groups that succeeded in completing collaborative work and problem solving and groups that did not. She found that the most successful groups were highly coordinated. In activities where the students worked coordinated, they constantly monitored each other, played complementary roles in completing problems, and referred and responded to each other's ideas (Barron, 2000). Omland (2021) explained this connection by distinguishing coordination as a condition for interthinking.

Through the above-mentioned approaches and others (e.g. accountable talk [Resnick et al., 2018], collaborative reasoning [Reznitskaya et al., 2009] and quality talk [Murphy et al., 2018]), students learn that their own views and opposing views of their peers can be defended, defeated or reconstructed using general principles of argumentation. In this way, they are exposed to a multiplicity of ideas. Because they are encouraged to explore the validity of each idea, participants are stimulated to acquire new information about the topic under consideration (Schwarz, 2009). As such, they must consider objections to their personal theories and assumptions, attempt to understand alternative positions, and formulate objections and/or counter-objections (Stein & Miller, 1993). Through this interactional work, where students engage in collaborative inquiry, formulating, supporting and challenging multiple interpretations, they acquire deeper, more complex disciplinary knowledge (Engle & Conant, 2002; Krange & Ludvigsen, 2008; Reznitskaya & Gregory, 2013).

To expand a topic from other perspectives, counter-arguments are central tools. Research has found strong evidence for the power of contrasting and problematising ideas during peer talk (see e.g. Howe, 2014; Howe et al., 1992; Howe & Mercer, 2007; Strømme & Furberg, 2015). When comparing individual pre- and post-tests of students working in groups where the participants were known to have similar ideas with students in groups with contrasting ideas, repeated studies (e.g. Howe et al., 1992; Williams & Tolmie, 2000) have found that the latter had consistently greater progress. Howe and Mercer (2007) concluded that expressions of contrasting opinions during group work were the single most important predictor of learning gain. Although achieving consensus is a goal in exploratory talk, Howe et al. (1992) found that it was not correlated with learning. In fact, they found that the groups of peers who reached the lowest number of agreements learned the most (p. 126).

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[1] https://thinkingtogether.educ.cam.ac.uk/

1.2. Dialogic interaction as an epistemic stance

Because we seek to understand the role of querying in interactions, we find it fruitful to investigate some premises of the relevant qualities of dialogue to understand the conditions under which querying may prove productive. We follow Linell's (1998) definition of dialogue as 'interaction through symbolic means by mutually co-present individuals' (p. 10). We use the term *dialogic* as an adjective to describe interactions with an inherent aim towards mutual exploration of topics and co-construction of new understandings.

Describing how every utterance in a dialogue must be interpreted with regard to previous utterances and the anticipation of further utterances (and thereby the anticipation of how one's own utterances will be interpreted), Bakhtin (1986) explained how we construct meaning through dialogues. In dialogues, meaning emerges between voices and must be constructed and reconstructed in particular situations (Bakhtin, 1986). Building on Bakhtin, Linell (1998) described this double process of dialogue as response-initiative. Each utterance in a dialogic exchange reflects that the speaker is simultaneously responding to previous utterances and initiating further responses by the other. These descriptions show how both the speaker and the listener are involved in meaning-making and how dialogic interaction constitutes a *joint construction* (Linell, 1998) in which meanings are situationally negotiated. Such negotiated meanings build upon *meaning potentials* (Linell, 1998) inherent in the concepts, utterances and tools in question. Meaning potentials are historically and culturally constructed, but they also depend upon the interlocutors' previous experiences (Linell, 1998; Säljö, 2010). Meaning potentials can be situationally negotiated and defined, such as in a school context, where concepts often have specific meanings that are distinguished from their everyday use (Omland, 2021; Rødnes et al., 2021).

Through dialogic interactional work, interlocutors create a dialogic space (e.g. Cook et al., 2019; Wegerif, 2010) where differences between voices can be explored. This space is widened when new arguments or topics are introduced and deepened when students increase their reflections by elaborating the meaning of arguments to better understand the topic (Baker et al., 2003).

Our interpretation of dialogic interactions implies an epistemic position that suggests plurality and equality in opposition to authoritarian voices trying to dominate others (Lefstein, 2010). This epistemic stance has implications for dialogic interactions in classrooms. To some degree, this stance is incompatible with the normative assumption underlying much classroom talk, where the 'truth' is owned by the teacher or textbook (Reznitskaya & Gregory, 2013). Thus, to increase a dialogical orientation in the classroom, researchers have found it fruitful to apprehend science, for instance, as not being about absolute and certain knowledge (Mortimer & Scott, 2003). In dialogic orientations, the epistemic stance of the interlocutors can be seen as equally important (Wilkinson et al., 2017).

Kuhn (1991) discerned three categories of epistemic beliefs based on individuals' cognitive stances. Individuals who regarded expert knowledge as certain and absolute, and their own theories as unsusceptible to challenge, were categorised as taking an *absolutist* epistemic stance. Those who denied the possibility of expert certainty and claimed their own certainty as equal to or greater than the experts regarded knowledge as not consisting of facts at all. As they accepted the coexistence of multiple viewpoints, they were categorised as *multiplist*. Subjects who held *evaluative* theories also denied the possibility of certain knowledge and reflected the understanding that viewpoints could be compared and evaluated. At the core of the evaluative process lay their view of argument as a fundamental path to knowing.

In Kuhn's study, subjects changed their epistemic stance when faced with different topics, showing epistemic stances were not necessarily a static belief system. When comparing epistemic stances with argumentation skills, Kuhn found that subjects with an entirely or predominantly evaluative approach had significantly higher scores than those with an entirely absolutist approach.

Both multiplist and absolutist epistemic stances are incompatible with dialogic meaning-making (Reznitskaya & Gregory, 2013). Individuals holding a multiplist stance fail to appreciate dialogic interactions because they see knowledge as relative and personal. Individuals holding an absolutist stance see knowledge as certain. Thus, neither of these stances opens for exploring new meanings through dialogues. This finding has important implications for how teachers facilitate classroom dialogues (Wilkinson et al., 2017). With an evaluative epistemic stance, arguments become central in dialogic meaning-making. Howe and Mercer (2007) pointed to the normative environment for talk in British classrooms as incompatible with children's active engagement in using language to co-construct knowledge. Developing a classroom culture for dialogic interactions requires a non-normative stance (Wells, 2009).

1.3. Mediating technologies

As accounted for above, the use of the digital tool coincided with occurrences of querying in our material. While digital environments or tools do not lead to productive interactions and talk in themselves, they mediate the activated processes. Digital tools should be conceptualised as part of practices that create meaning potential for participants. When used in specific ways, digital tools have been shown to be productive in mediating dialogic interactions (Amundrud et al., 2021; Major et al., 2018; Mercer et al., 2019) and can function as tools for teachers and students. Rasmussen et al. (2019) showed how a microblogging tool was productive in facilitating metatalk about ground rules, and Stornaiuolo, 2016 showed that digital tools can mediate challenging conversations by enabling participants to pick up on others' perspectives. Similarly, interactive whiteboards may facilitate joint attention to shared texts in classrooms (Mercer et al., 2010), functioning as a base for further discussions of views and perspectives, thereby grounding and sustaining engagement (Gillen et al., 2007; Omland, 2021; Rasmussen & Hagen, 2015; Rødnes et al., 2021). In these ways, digital tools can draw learners into a dialogic space that promotes engagement in the generation and evaluation of ideas (Pifarré, 2019). Kuhn and Crowell (2011) concluded that such argumentative reasoning skills could be developed in dialogic activities using specific types of software that create conditions for different forms of contribution uptake from students and teachers.

2. Methods

2.1. Project

The teacher in the analysed trajectory participated in the research project Digitalised Dialogues across the Curriculum (DiDiAC), which was a collaboration between the University of Oslo, the University of Cambridge, and 22 teachers in Norway and England. The aim was to develop teaching practices that combined dialogic teaching (https://thinkingtogether.educ.cam.ac.uk/) with a micro-blogging tool, Talkwall, to support classroom talk. In Talkwall, a task or a question is posed, and participants can post short contributions. All contributions become visible to the participants in a feed, and the students or teacher can choose to add the contributions to a wall. The wall allows for different ways of sorting the contributions. On a class screen, such as an electronic whiteboard, the teacher's or individual students' walls can be shared with the class. Fig. 1 shows a reconstruction of the wall used in the discussion analysed in Section 3.1.

2.2. Materials and selection

During the main data collection, which was conducted in spring 2017, we studied single lessons where Talkwall was integrated as a central tool in the teaching design. After finishing this collection, we were curious to investigate how the tool could be integrated into a longer trajectory. In autumn 2018, we continued our collaboration with one teacher and followed her 10th grade social science class over eight lessons focusing on the post-World War II (WWII) period. Every lesson was video recorded and constitutes the empirical material analysed in this article. We selected the teacher because previous studies (Omland, 2021; Omland & Rødnes, 2020; Rødnes et al., 2021) showed that she practised a range of dialogic strategies and used technology in productive ways.

We investigated this material by conducting two main iterations of thematic analysis (Braun & Clarke, 2006, 2012), watching each episode while focusing on the interactions. During the first iteration, we discerned specific interactional patterns, the teacher's moves, her orchestration, how the classroom culture was built and maintained, and the use of technology. During the work with these analyses, we became curious to investigate how the students sometimes pursued the challenging of a topic further. We viewed selected episodes repeatedly and discussed them with co-researchers. This work confirmed the perception of active student querying and led attention towards the conditions that made these interactions possible.

To understand the function of querying, we needed a more detailed analysis of how querying was used. To this end, we conducted a second iteration of thematic analyses and identified 21 episodes where querying occurred. These episodes were analysed according to productivity, defined by uptake (Nystrand et al., 1997). This process resulted in four categories:

1. We found four of the 21 episodes to be non-productive in that querying did not lead to further elaborations.
2. In seven episodes, querying led to elaborations of previous arguments.
3. In six episodes, querying led to the introduction of new arguments or information.
4. In three episodes, querying led to discussions that included more than four students, leading to more querying, elaborations, and new arguments and information. We term these episodes 'rich discussions'.

We also identified in which form querying was posed (questions, comments or rejections), who did the querying, and if it took place in a group or with the whole class. The first author performed these analyses. To validate this work, all authors watched and discussed problematic occurrences. An overview of the categorisation is given in Appendix B.

Based on the thematic analyses, we did interaction analyses (Derry et al., 2010; Enqvist-Jensen et al., 2017; Jordan & Henderson, 1995; Mercer, 2004) of all identified episodes in the above-mentioned categories, discerning what the querying looked like in each. It was crucial for us to study querying in the classroom context, first, because we consider the uptake of querying as important as the
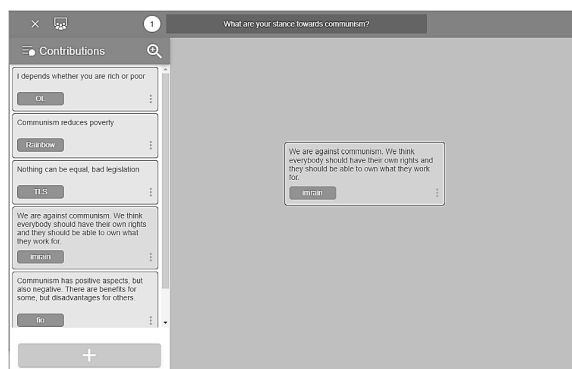

Fig. 1. Reconstruction of Talkwall.

actual querying for productivity and, second, because we wanted to analyse the moves that produced querying to investigate how it was facilitated.

We present the interaction analyses in different ways in the next subsection. As the focus of this article is on querying that is productive for students' meaning-making, the emphasis will be on what we have termed 'rich discussion'. First, we present the analysis of one of the rich discussions and investigate the interactions turn by turn. With this approach, we seek to investigate how details in the participants' querying contributed to interactional meaning-making. Second, we summarise the findings of the analysis of the three first categories, presenting the different structures in the interactions as we try to discern why these differences occurred and what implications they had for the students' meaning-making. We include some findings from the thematic analyses in the discussion to give a broader basis to answer our research questions. We have used the following operationalisations of the core concepts as the main tools for investigating the interactions:

1. Querying: doubting, full/partial disagreement, challenging or rejecting a statement (Howe et al., 2019).
2. Coordination: describes how interlocutors, to some degree, have to establish a mutually shared perspective or vantage point to understand each other (Linell, 1998). Coordination comprises activities where students constantly monitor each other, play complementary roles in completing problems, and refer and respond to each other's ideas (Barron, 2000).
3. Dialogic space: the situationally negotiated space for shared meanings (Cook et al., 2019). This space can be widened or deepened (see Section 1.2).

3. Analysis

The students in this study attended a 10th grade class in a lower secondary school located in one of the largest cities in [country]. The class consisted of 27 students (15 boys and 12 girls). The first iteration of thematic analysis revealed how the class built and maintained a culture for dialogic interaction. During the first [Project name] intervention in spring 2017, the students and teacher in collaboration discussed and agreed upon a set of ground rules. In the first lesson of the trajectory recorded autumn 2018, they reminded each other of these rules and discussed why they were important tools for talk. They concluded that they needed to respect each other's opinions, allow for criticism and gather knowledge to build arguments. Based on observation and thematic analysis, we identified how the class practised these rules regularly during talk. They respected each other by listening while others were speaking, but they also challenged others when they disagreed. Across the trajectory, we observed all students contributing to classroom talk. Only three or four did not speak on their own initiative. We conclude that the class over time had cultivated a culture for talk, which is important to understand the orchestration of the following discussion.

The following conversations were part of a longer trajectory that also included more instructional sequences, for instance the teacher synthesising and the students using textbooks or other resources. However, as querying was not identified in such sequences, they are not included in the following analysis.

3.1. Querying that leads to rich discussion

In two of the three episodes we discerned as rich discussions, the students initiated the querying, while the teacher did in the last. In all three, the querying involved challenging and contrasting ideas. To further discern the details in the role of querying in students' meaning-making, we present our analysis of one episode, where a student's querying led to a whole-class discussion. The episode was initiated by an assignment in Talkwall. The teacher asked the students, who were working in groups of three, to take a stance towards communism and post a microblog about it on Talkwall. The groups then read the other groups' posts, chose one, and prepared questions for the group that posted it. We analysed the conversation that followed the first group's interview. The chosen Talkwall post was:

We are against communism. We think that everybody should have their own rights and they should be able to own what they work for.

The interviewing group (group 1) asked if the students who posted this contribution (group 2) could see some positive aspects of communism as well. After getting the response that everybody having employment was positive, Aisha represented the interviewing group as she introduced the conversation that follows. We have divided the transcript and accompanying analysis into three sections. Because we investigate querying, we have cut some turns of lower relevance for this focus.

Transcript 1
How do you get rid of poverty?

Turn	Group	Speaker	Action
1	1	Aisha:	Yes, ok. Ehh, but how would you, if you could come up with suggestions, how would you get rid of poverty then, within capitalism, if that's what you think is better?
2	2	Inaya:	Capitalism? That's, you stand for what you do, really. Many people don't have the chance to learn and go to school and work and things ((breathes out)). And, I don't really have an answer to that.
3		Teacher:	Mhm. Yes, how do you get rid of poverty? I think that is a very good question, Aisha. Ilyas.
4	3	Ilyas:	Often in capitalistic countries, there is democracy, and in democracies everybody has a right to schooling, a:::[nd
5		Teacher:	[Is that so everywhere? In capitalistic countries?
6	3	Ilyas:	No, but here in Europe and in the USA, so:::[
7	3	Simen:	[Larger communities.

Aisha initiated the conversation by challenging Group 2 to produce suggestions to eliminate poverty within capitalism, showing that she viewed communism as a better approach to achieve this (T1). Inaya answered this query by seemingly thinking aloud (T2) as she stated that, in capitalism, many people 'don't have the chance to learn and go to school and work
and things'. This reasoning was aligned with Aisha's and showed Inaya's attempt at coordinating to Aisha's thinking that if all individuals do not have a chance to learn and go to school, it is harder to get rid of poverty. The teacher then established Aisha's question as a topic worth exploring further by repeating it and acknowledging it as a good one (T3). She let Ilyas answer, and he built on the part of Inaya's statement about people not having the chance to go to school, querying it by stating that capitalistic societies are often democracies where people have a right to schooling (T4). The teacher interrupted him, querying his statement by asking if that is so everywhere (T5). This question made Ilyas adjust his previous comment to include only Europe and the USA (T6). By querying his statement, the teacher invited him to continue his reasoning, thus deepening the dialogic space. Both Ilyas and Simen (T7) used this opportunity to nuance Ilyas' previous comment. By repeating his contribution (T8), Ilyas acknowledged Simen's utterance as a valid adjustment of his own previous comment, confirming the coordination of their thoughts.

The students' coordination work becomes apparent in how they tried to answer each other's querying. They used each other's contributions in their reasoning and building of new arguments. The collective meaning-making was dependent on their attempts to coordinate their thoughts (T2, T4, T7, T8). Their way of relating to each other's utterances and seeking coordination shows their respect for each other and for the idea of exploring a topic together, in a shared line of reasoning.

This transcript demonstrates how querying can contribute to the students' meaning-making by widening and deepening the dialogic space. First, Aisha's querying introduced the topic of *poverty*, which led Inaya to mention schools, and the connection between *schooling* and poverty was followed for a while. Ilyas queried the notion that schooling was not available to all in capitalistic societies, arguing that they were *democracies*. The querying in these first turns introduced three new topics, adding to the discussion's richness, making it more complex and widening the dialogic space. New arguments were introduced both by the querier and the queried.

The teacher's comments in this extract served to keep the dialogic space open. By first lifting Aisha's question as a topic for whole-class discussion and then by querying Ilyas, the teacher made sure that the dialogic exploration of the students' ideas continued. Her last querying also deepened the dialogic space by making Ilyas and Simen reflect on and nuance Ilyas' previous comment (T6–T8).

The next transcript continues where this exchange ended, and we see how Aisha continued querying Ilyas' answer.

Transcript 2
How should they earn money within capitalism?

Turn	Group	Speaker	Action
9	1	Aisha:	But if you think about refugees, and they are (…) too old to (…) get the schooling you can get for free, how would you then solve the problem?
10	3	Ilyas:	What did you say, what did you say?
11	1	Aisha:	Do you know (…) a little like ( ) that they can get, because they are finished with compulsory school and the likes, so they cannot go to school, how can they then get employment? In this society.
12	3	Ilyas	First, they have to learn the language and then they have to school and then …
13	1	Aisha:	Yes? [School, school also costs money.
14	3	Simen:	[Yes, they can choose for themselves.
15	3	Ilyas:	That is, that depends. Private school or public school.
16	1	Aisha:	College? University?
17			((laughter))
18	3	Ilyas:	Yes, that costs money for everybody.
19	1	Aisha:	Yes, but if you not only look at schools, how should they otherwise earn money within capitalism?
20	3	Ilyas:	Loans?

In the first turn of this transcript, Aisha seemingly accepted Ilyas' contribution about schools being available to all in democracies. Still, she continued her querying, pointing out that refugees may be too old for free schooling (T9), adding new information to the discussion. Ilyas asked her what she said twice (T10). This might be interpreted as not hearing Aisha, but it might also be that he did not understand her question and thus needed more from her to coordinate to her idea. The latter seems to be Aisha's interpretation because she elaborated on her thought, asking how refugees could get employment when they could not go to school (T11). Ilyas' next utterance shows some difficulties with coordination because after stating that first they have to learn the language, he repeated that they have to go to school (T12). Aisha continued her querying, repeating that schooling costs money (T13). Simen (T14) overlapped her speech, adding that refugees can choose for themselves. We interpret this attempt at elaboration as support for Ilyas' point of view, showing coordination, but as there was no uptake of this contribution, it was unproductive. Ilyas continued trying to coordinate with Aisha by querying her last comment that school costs money; specifically, he pointed out that it depends on whether the school is private or public (T15). Aisha then specified that she meant education beyond compulsory school, naming colleges and universities (T16). Ilyas acknowledged her point, stating, 'Yes, that costs money for everybody', indicating that they achieved both coordination and agreement on schools (T18). Aisha then built on this coordination of thoughts and continued querying, putting the question of schooling aside and asking how refugees could earn money within capitalism (T19).

This transcript demonstrates how querying and coordination can be intertwined in two opposite ways. On the one hand, the querying led to increasingly demanding cognitive coordination. Ilyas struggled to understand Aisha's querying (T10, T13), and it took several turns with questions and elaborations before they achieved coordination (T19). On the other hand, the querying also helped coordination by leading to clarification. By querying Aisha's statement that school costs money (T16), Ilyas led Aisha to elaborate (T17), resulting in coordination.

The extract demonstrates how the students' querying and their work to coordinate their thoughts served to keep the dialogic exploration going. Aisha's querying (T9, T12, T14, T17) led Ilyas to new reflections and elaborations (T16, T19). Through these joint

efforts, the dialogic space was deepened. After they had established common ground (T19), they widened this space, Aisha through rephrasing her querying (T20) and Ilyas by bringing in new ideas (T21). In this way, both expanded their thinking.

It is interesting to observe that the interactions moved between students without any intervention from the teacher, who allowed the students space to explore. She positioned Group 1 with responsibility for querying through the assignment. Aisha's role as querier is somewhat unusual, and it is reasonable to assume that it would not have happened without this orchestration.

After this transcript, the dialogue first moved towards student loans and the possibility of donating money. The following transcript starts with Aisha referring to a suggestion from Inaya about donating money as an answer to Aisha's question on how to get rid of poverty within capitalism (T1).

Transcript 3
I haven't gotten a specific answer.

Turn	Group	Speaker	Action
35	1	Aisha:	I haven't gotten a specific answer to how the solution could come, just donate money, but yes.
36	3	Ilyas:	[What, what was the question?
37		Teacher:	[Yes, but that's a suggestion. [Capitalism that's donation of money, often.
39	1	Aisha:	[How to get rid of poverty within capitalism ((looking towards Ilyas, not the teacher))
39		Teacher:	Aisha, [it's like
40	3	Ilyas:	[There will always be poor people. That's just how it is.
41		Teacher:	There should just [be poor people?
42	3	Ilyas:	[No, no.
43		Teacher:	That is just how it is, and that's ok?
44	3	Ilyas:	It's not like ok, [but
45		Teacher:	[So, is it ok that you are poor?
46	5	Jibril:	If you're poor, then you're poor. There's nothing you can do about it.
47	3	Ilyas:	[Yes, i::t's like, not everybody can save the whole world.
48	1	Aisha:	[But there's something you can do (…) That's what capitalism, communism is for, it's like, everybody should share equally and such.
49	3	Ilyas:	Yeh, yeh, but still, it's not fair, that's what I think
50		Teacher:	Ilyas, why is it not fair? That everybody [should …
51	3	Ilyas:	[I think that it's unfair that a person who went to school for many years, ehh a::nd like, worked very hard, to be where he is today, should earn the same as a person that was too lazy to nearly work at all, and that has been too lazy to get something done.

This dialogue opened by Aisha stating that she did not think that donating money was a sufficient answer to her question (T35). She got two simultaneous responses to this (T36, T37). Asking her to repeat the original question, Ilyas attempted to coordinate, making sure he answered adequately (T36). This statement also shows his willingness to keep the dialogic space open and continue the exploration. The teacher's utterance (T37) was not picked up; instead, Aisha answered Ilyas by repeating her initial question (T38). The teacher's next utterance (T39) was interrupted by Ilyas' response. He tried to answer Aisha's question by stating, 'There will always be poor people' (T40). The teacher queried this utterance by rephrasing it as a question, asking if there *should* be poor people (T41). This approach can be seen as an attempt to make Ilyas reflect on his previous comment, thus inviting deepening of the dialogic space. Ilyas interrupted the teacher halfway, denying her question (T42), but the teacher did not seem to acknowledge his denial. She elaborated on her querying (T43, T45) and interrupted Ilyas' further attempt at elaboration (T44). Jibril then entered the conversation. His contribution might be interpreted as saying that the teacher's question about whether it was ok for people to be poor was irrelevant because 'there's nothing you can do about it' (T46). These turns (T40–T45) seemed to make Ilyas reflect on his previous comment, thus opening a meaning potential towards deepening the dialogic space. This potential was not immediately utilized. The teacher interrupted what might have been Ilyas' attempt (T44, T45), and Jibril seemingly found the teacher's comment irrelevant (T46). However, Jibril's comment led Ilyas to deepen the dialogic space by elaborating (T47), while Aisha widened the space by bringing in new arguments (T48).

Aisha and Ilyas started to speak at the same time, displaying contrasting ideas as part of their querying. Ilyas seemingly viewed Jibril's comment as relevant, acknowledging it with a 'yes' and elaborating that 'not everybody can save the world' (T47). Aisha disagreed with Jibril, rejected his comment, and queried it by stating that there *was* something people could do, namely, share equally (T48). She connected this solution to communism, coordinating with the outset for the discussion, namely, the students' stances towards communism. Ilyas acknowledged her querying, perhaps a little reluctantly with his 'yeh, yeh', before stating, 'It's not fair' (T49). The teacher then queried Ilyas again, asking him why it was not fair (T50). This time the teacher's querying gave Ilyas the opportunity to elaborate, and he explained his view. By pointing out that he thought it unfair that people who did not work equally hard should earn the same, he brought a new aspect into the exploration, justifying his view (T51). He elaborated the comment initially queried by the teacher (T40), thus deepening the dialogic space. Because he brought in new explanations, he also widened the space.

Again, the transcript shows how the students worked to coordinate their contrasting ideas. Ilyas showed genuine interest in Aisha's question (T3), and she chose to answer him instead of the teacher (T38). Jibril's revoicing of Ilyas' utterance also shows coordination of thoughts. By accepting his revoicing (T47), Ilyas showed that Jibril had understood his intention.

The teacher took a more active role in this transcript than in the previous two. Her first querying (T41, T43, T45) had the potential to deepen the dialogic space in the sense that it seemed to make Ilyas rethink his answer. However, because she gave Ilyas no time to answer (T43) and interrupted him (T45), she also narrowed the dialogic space. In this situation, Jibril's comment (T46) opened the space again, leading to elaborations from both Ilyas and Aisha. Through these three utterances (T43, T47, T48), the dialogic space was both widened and deepened as the students introduced three new arguments.

In the teacher's next querying of Ilyas (T50), she asked an open question and gave him sufficient answering time. This led Ilyas to elaborate in a way that made his reasoning clearer and introduced a new argument that justified his view. Thus, he exploited the potential for both deepening and widening the dialogic space that the querying invited.

Together, the analysis of this rich discussion shows how the querying constituted a tool for argumentation that facilitated advanced coordination, contributed to expanding the dialogic space and led to increased reasoning. Through their queries of each other's stances, the students opened the potential for exploring new meanings, which they exploited by putting forward various ideas. Our thematic analysis revealed that Ilyas' final argument became the topic of the next rich discussion in the trajectory. This exchange was initiated by a student who did not take part in the discussion analysed in Section 3.1. It shows how students whose voices were not heard in the analysed interactions reflected on the arguments activated within them.

3.2. Querying that brought in new arguments

In the six episodes categorised as introducing new arguments, the dialogue expanded beyond the previous lines of reasoning. In five of them, the querier had to elaborate on the querying, which led to further elaborations from the person queried. In four of these episodes, the querying also led to uptake from new interactors. In all six episodes, the querying led to investigations of new arguments as well as the inclusion of more voices. The dialogic space widened in both these ways.

The teacher was involved in all episodes, even though she did the querying in only two of them. In the episodes initiated by students, the teacher did uptake of their querying, either by asking the student to elaborate, posing the querying as a subject for further discussion, asking more students to reflect on the question, rephrasing it or giving an elaborated answer herself. Once she invited the students to query her own contribution by saying, 'Or what? Am I wrong?' In the episode below, the teacher was talking to the students while they were discussing in groups. In the first turn, she was querying a group's suggestion of posing global warming as the most important active conflict today.

Turn	Speaker	Action
1	Teacher:	Mhm, because global warming is in a way (…) But why is that a conflict?
2	Imen:	Because it is [
3	Inaya:	[You could manage to stop it. You could manage [
4	Imen:	[Yes, but, people disagree so much about what could be done and everything.
5	Teacher:	What could be done?
6	Imen:	Yes, that people could, people don't agree on who, which countries should do what, and people don't achieve agreement. Even though it is like (…)

In this sequence, the teacher's querying introduced new arguments as well as elaborations on previous comments. This sequence also shows how she continued asking (T5) until the students produced reasons (T6), thus deepening the dialogic space.

The episodes in this category show how a teacher can engage in classroom interactions to make the querying more productive by asking for further elaborations or making a querying comment a subject of discussion for the whole class. The teacher's moves contributed to expanding the dialogic space because they brought new arguments to the discussion, sometimes introduced by the teacher, but most often by the students as a response to the teacher's elaboration of previous comments or questions (as seen in T6 above). By distributing the interactions among the students, she also ensured that multiple voices took part in the classroom interaction. Because she was not involved in any of the episodes with single elaborations (Section 3.3), it is reasonable to assume that the increased productivity was related to her contributions.

3.3. Querying that leads to elaboration of previous arguments

In the seven episodes included in this category, the querying led to elaboration of the previous utterance. These elaborations took the form of comments answering the querying, and the querying did not lead to further reflections. All of these episodes occurred during group interactions where the teacher was not present. The querying seemed to function as an invitation to elaboration and was less productive than in the two previous categories. In the episode below, the group was trying to come up with examples of active conflicts.

Turn	Speaker	Action
1	Hanna:	The conflict, the conflict that Russia hold an enormous war exercise-thing without telling other countries.
2	Imen:	Isn't that more like a conspiracy? Is it like, proven?
3	Hanna:	No, but it is, it is a conflict. They didn't tell anybody, and they have, just had, it was on the news.
4	Inaya:	Ok, Russia?

The above querying led Hanna to elaborate her utterance (T3). It is easy to imagine that this situation could have led to further explorations if the teacher, as in the examples in the two previous categories, had brought the question into a whole-class discussion or asked Imen what she meant by her querying. The querying in the episodes in this category did not expand the dialogic space to the same degree as it did in the previous. Instead, it led to single elaborations without further inquiries.

3.4. Non-productive querying

In the five episodes characterised as non-productive, the querying did not lead to any uptake. One episode occurred while the students tried to come up with examples of conflicts to post on Talkwall.

Turn	Speaker	Action
1	Imen:	What other conflicts?
2	Inaya:	The conflict about Pakistan.
3	Imen:	There is no conflict in Pakistan.
4	Inaya:	India and Pakistan.
5	Imen:	No, that's over by far, bro. The conflict about the election in Sweden ((reading from Talkwall)). Isn't that, isn't that more like a disagreement?

In this excerpt, the querying stopped the ongoing line of reasoning, and the interactions moved on to other topics. Three of the episodes in this category occurred during group interactions, and they were initiated by one student that rejected another student's comment. Two occurred in whole class; in one of them, the teacher rejected a student's comment, while in the other, a student rejected

the teacher's querying. In our material, all the non-productive episodes of querying involved rejections, indicating that querying in the form of rejections is less productive than other forms. We hypothesise that rejections do not offer potential for further explorations. Instead, they close the dialogic space, as demonstrated in the above transcript.

4. Discussion

4.1. How can teachers facilitate querying that is productive for students' subject-oriented meaning-making?

Our analyses investigated how querying led to different degrees of productivity. The strategies used have many similarities with classroom interactions that previous research has found to be particularly productive. As in exploratory talk (Mercer & Littleton, 2007), the students engaged critically and constructively with each other's contributions and challenged each other's ideas. Confirming previous research (Howe et al., 2019; Reznitskaya & Gregory, 2013; Schwarz, 2009), we saw how their argumentation skills became central for meaning-making through coordination and querying of each other's thoughts. Our analyses suggest certain strategies for facilitating productive querying. Even though the teacher's involvement often seemed peripheral, she was involved in all episodes where the querying proved most productive. Thus, her orchestration seemed crucial for the students to engage in productive querying. We summarise her strategies in three approaches that were a part of the classroom culture developed over a long period:

1. The assignments she gave the students, including her use of Talkwall,
2. Her uptake of her students' contributions, and
3. How she gave her students space to explore.

We will discuss these strategies in the following sections.

4.1.1. Assignment and use of Talkwall

The assignment that led to the analysed rich discussion (transcripts 1–3) has three central components that we argue facilitated the rich querying. First, the teacher asked the students to discuss in groups and take *a stance*. In this way, the teacher led them to make a judgment as the foundation for further reasoning. Collectively, the class produced a variation of ideas, adding to their existing body of knowledge (Dobber et al., 2017; Macagno, 2000; Schwarz, 2009). Not surprisingly, this exchange also led to contrasting ideas.

Second, the teacher secured the visualisation of these different voices by asking the students to post them on Talkwall (see Fig. 1), which constituted a starting point for the evaluation process of the arguments' validity. In this way, she used contrasting ideas as a central tool in orchestrating classroom talk. This has been found to be a particularly productive approach (Howe, 2014; Strømme & Furberg, 2015). Furthermore, when she used Talkwall, she asked the students to explain and elaborate on their contributions. The thematic analysis showed how the students prepared themselves for defending their Talkwall contributions. By reading other groups' opinions in advance, they prepared both for arguments that might be held against their own contribution and for arguments in agreement with or opposition to other groups' contributions. In this way, the students were prepared to query other groups' posts as well as to defend their own arguments when others queried them. Due to this orchestration, the class practised argumentation skills and were shown that these skills can be important for making new meanings (Reznitskaya & Gregory, 2013).

Our thematic analysis showed that querying to a large degree coincided with the use of Talkwall (Appendix A). We argue that the way Talkwall visualises different opinions facilitates querying. A digital tool like Talkwall creates a triadic structure for talk in the classroom involving the teacher, the students and the digital tool. By means of the students' microblogs, talk can be treated as representations that are visible to all participants, and these representations can be activated when participants find them relevant in a particular sequence of talk.

The third approach that facilitated querying during the rich discussion was the way the teacher's assignment positioned students with a querying role. This positioning represents a breach of classroom norms. Normally, students are positioned as equals, with limited power to evaluate each other's contributions, whereas the teacher is positioned with both the right and duty to choose which utterances and questions to make subjects for classroom interaction (Alexander, 2008). We argue that such norms can hinder students pursuing querying of an argument, as a breach demands a seldom-seen degree of engagement and agency. These norms might explain why the students' querying led to fewer elaborations and shallower discussion when the teacher was not present to facilitate their interactions (see Sections 3.3 and 3.4). In the analysed rich discussion, the teacher assigned a student the position of querier as part of the pedagogical structure. As we have seen, the other students accepted this role. We argue that this assignment was an important element for the unfolding of the rich discussion. This finding resonates with previous studies, demonstrating that when students were assigned specific roles, the talk became enriched since the positions that the students took often allowed for wider differences in views and knowledge (Engle & Conant, 2002; Resnick et al., 2018).

During the interactions categorised as querying that led to elaborations (Section 3.3), the students often accepted each other's arguments without pursuing them. They occasionally asked challenging questions, but the roles they were assigned as equally knowledgeable peers restricted them to accept the answer given. In the analysed rich discussion, the students, to some degree, managed to break free from these normative roles. We hypothesise that this was due to the teacher's assignments of roles and to the fact that the class accepted and recognised that Aisha practised this role.

4.1.2. Uptake of students' contributions, complex and open questions

The teacher's uptake of the students' querying seems crucial for it to be productive. In all the student-initiated episodes where the

querying proved most productive, the teacher performed uptake. Her positioning the querying as important seemed crucial for the students to pursue the lines of thought. In the analysed rich discussion, the teacher's uptake of Aisha's question secured it as a topic for discussion. Aisha's question had some qualities that made it especially interesting to pursue. It was both complex and open (Nystrand et al., 1997), and Aisha herself seemed genuinely interested in understanding and seemingly had no predefined answer. To answer her question, the students built on their previous knowledge, and the question's complexity caused them to examine several relevant angles (e.g. schooling, loans and money donations). Open and complex questions like this one can invite students to evaluate a topic, pose their own arguments and evaluate others. In this way, such questions can promote an evaluative stance because students learn that argumentation can lead to further understandings. We hypothesise that this is why the combination of complexity and openness of Aisha's querying gave it the potential to be particularly productive.

4.1.3. Creating space to explore

Our analyses have shown the importance of the teacher's orchestration for the students' querying. This orchestration comprised asking the students to take a stance before displaying their opinions on Talkwall, thus visualising contrasting ideas. The students were positioned through the assignment to query each other. In the following discussion, the teacher did uptake of one query she found interesting, then allowed the students space to explore it. In these explorations, she positioned herself as a partner in the dialogue (Omland & Rødnes, 2020), not as an authority with the correct answers. This approach is in line with the need for developing a non-normative stance (Wells, 2009) and for promoting an evaluative epistemic stance (Kuhn, 1991; see Section 4.2.4).

Even though the teacher's role was crucial for productive querying to occur, her role was relatively withdrawn. By letting the students explore the topic freely, she gave them authority to pursue the topic and positioned their continued exploration as important for their emerging understanding. In this way, she facilitated a dialogic space (Wegerif, 2010), where they deepened and widened their understandings. The dialogue analysed in Section 3.1 moved in varied directions, also in directions that could be argued to be moving away from the subject topic. The teacher could have guided the discussion more closely either by stopping the explorations or by introducing a wider range of subject-related topics to widen the dialogic space in directions she wished for. We argue that by not doing so, she gave the students authority to explore based on their own reasoning. If she had controlled the conversation to a larger degree, we hypothesise that this important aspect might have been lost. At the same time, by insisting on the positioning towards either communism or capitalism, the teacher maintained a focus on core concepts of the social science curriculum and the learning goals of this trajectory. In addition, more curriculum-oriented aspects were more in focus in other parts of the trajectory.

4.2. How can querying influence students' subject-oriented meaning-making?

Previous research has explained the benefits of dialogues and argumentations by pointing out that students acquire deeper and more complex disciplinary knowledge by engaging in such interactions (Engle & Conant, 2002; Krange & Ludvigsen, 2008; Reznit-skaya & Gregory, 2013). The analysis of interactions presented in this article may add to these explanations by investigating how querying may contribute to students' meaning-making. In the following sections we point to four possible explanations.

4.2.1. Expanding the dialogic space

Querying represents contrasting voices and is a result of one voice challenging the soundness of another. As a result, querying can make disagreements, differences in positions and misinterpretations visible through interactions. This interactional tension creates a potential for exploring new meanings. Since querying often represents a new voice that introduces new topics and leads to new explanations, querying can widen the dialogic space (transcripts 1, 2 & 3). Querying can also deepen the dialogic space by leading to further reflections on an idea. In the analysed rich discussion, it was often the teacher's queries that deepened the dialogic space (transcripts 1 & 3). Such expansions contribute to students' meaning-making in different ways. By widening the space, the topic becomes related to larger contexts, which may lead to a better understanding of the knowledge involved. By deepening the space, meaning-making becomes focused, increased reasoning may be supported, and misinterpretations may be sorted.

4.2.2. Motivating continued reflections

Groups of peers ending their discussions by disagreeing have been found to have better learning outcomes than groups reaching an agreement (Howe et al., 1992; Williams & Tolmie, 2000). This finding is intriguing, since many authors have argued that developing consensus or having a common goal leads to a more advanced understanding of a theme or knowledge domain (e.g. Mercer & Littleton, 2007). Our empirical analysis shows that disagreement can lead to further reflections and adds to the findings that disagreeing can be part of a productive trajectory. The discussion depicted in Section 3.1 did not end in this lesson, as the students brought up the line of argumentation in the next lesson. This fact indicates that, by not reaching a conclusion or agreement, they continued to reflect on the topic. We argue that consensus in many school subjects is not a goal in itself; more important is to develop the capacity to participate in querying and understand that more positions than one can be valid. We hypothesise that the kind of continued reflection seen in our material can lead to increased learning outcomes.

4.2.3. Prompting coordination

The analyses showed how querying and coordination were intertwined (Section 3.1). Querying often requires cognitively challenging coordination, but it can also help coordination because it sometimes reveals misinterpretations or confusion and serves as an invitation to repair. We hypothesise that one of the reasons why querying can prove productive is that it demands this high level of coordination. When students are asked to elaborate, it is their own thoughts they comment on. When they are queried, they have to

coordinate their thoughts with another person's idea, expanding their thinking beyond their previous reasoning.

4.2.4. Supporting an evaluative epistemic stance

Querying constitutes an important tool in arguments. In addition to bringing in more perspectives and leading students to deepen their interactions, our analyses showed that querying can constitute a means to evaluate, compare and defend ideas. By partaking in interactional trajectories where querying occurs, students can experience reasoning and evaluations that lead to better understanding and explicit argumentation promoting the soundness of a hypothesis. In the analysed trajectory, the teacher positioned her students as authors of arguments that were used to make new meanings. In this way, she also built their agency as evaluative epistemological thinkers (Kuhn, 1991). As an evaluative epistemic stance has been found crucial in dialogic meaning-making (Reznitskaya & Gregory, 2013), the building of such a stance becomes important for productive classroom dialogues.

5. Conclusion

In this article, we identified teacher moves that may facilitate productive interactions where students actively query each other and coordinate their ideas. We aimed to show how and why querying can support students' subject-oriented meaning-making. In the analysed trajectory, querying most often represented a genuine will to understand and participate in ongoing dialogue, leading to new ways for the students to relate to a theme or a domain while learning both the content and how to participate in classroom interactions. Through these practices, students can develop an evaluative epistemological stance by learning to compare and evaluate ideas and opinions. This is demanding, since it requires interlocutors to build on assumptions where more than one position and line of argumentation can be valid. Such a norm is often connected to the development of citizenship and understanding of how some aspects of democracy work (Mathé & Elstad, 2018). In classrooms such understandings can be developed through participation in dialogues that recognise both ideas of how consensus can be built and differences in positions (Strømme & Furberg, 2015).

In the analysed trajectory, the teacher's role was crucial for the productivity of students' querying. Through her orchestration, Talkwall helped visualise different opinions and claims that became resources in the ongoing dialogues. Our analysis shows that the triadic structure of the talk can facilitate productive interaction between the teacher, the students and the digital tool. Through developing the pedagogical structure, task design and interactional moves, as well as assigning different roles and positions, the teacher created conditions that facilitated subject-oriented meaning-making.

Our analysis has demonstrated how students were allowed space to explore their ideas and how they exploited this opportunity by expanding this space. Querying led to demanding coordination and continued reasoning, which helped them understand each other's positions while seemingly agreeing to disagree. We argue that processes like these support the building of an evaluative epistemic stance, of argumentative competence, and ultimately of citizenship: being able to understand that other people see the world differently and respecting their views even when disagreeing on a justified basis.

This case study gives new insight into how a classroom culture can facilitate specific forms of talk and productive interaction. When not taking the form of rejections, querying creates the potential for dialogic explorations by introducing new topics and tensions and by promoting students' reasoning. In this way, querying has the potential to both deepen and widen a dialogic space. Interactions that comprise querying require cognitively demanding coordination, thus developing students' reasoning skills.

Declaration of competing interest

None.

Appendix A. The lessons in the recorded trajectory

Date & minutes	Discussed subject	Talkwall use	Episodes with querying
180,911 45 min	They discuss ground rules and why they are needed.	No	1
180,914 90 min	They discuss conflicts, exploring the concept and coming up with different examples of conflicts.	Yes	10 (1 rich discussion)
180,918 45 min	They repeat what a conflict is and start learning about the Cold War.	No	2
180,921 90 min	They discuss consequences of WWII and the differences between communism and capitalism and start talking about how Europe changed after the war.	No	1
181,009 45 min	They repeat the topics from the previous lesson as the students help each other remember in different groups.	No	0
181,016 45 min	They discuss their attitudes towards communism.	Yes	3 (1 rich discussion)
181,019 90 min	They continue the discussion from the previous lesson and extend it to include capitalism and freedom of speech.	Yes	4 (1 rich discussion)
181,026 90 min	They discuss different topics from the Cold War, such as how Europe was divided, the arms race, NATO and the Warsaw Pact, espionage and the EU, among others.	No	0

Appendix B. Episodes with querying

Date, Episode	Non-productive	Productive Elaboration	New explanation	Rich discussion	Teacher/student speaker	Whole class/group	Form of querying
180911,1	x				T	WC	Challenging question
180914,1	x				S	G	Question that implies a rejection
180914,2		x			S	G	Challenging question
180914,3	x				T	WC	Repeats comment, seemingly interpreted by student as a rejection
180914,4		x	x		S	WC	Rejection, leads to elaborations by two students and teacher
180914,5	x				S	G	Rejection
180914,6		x			S	G	Challenging question
180914,7		x			S	G	Rejection
180914,8		x			S	G	Challenging question
180914,9		x	x		T	G	Challenging question
180914,10		x	x	x	S	WC	Challenging question
180918,1		x	x		S	WC	Challenging question
180918,2		x	x		S	WC	Disagreeing comment
180921,1		x			S	G	Challenging question
181,016,1		x			S	G	Comment, exemplifying why post is no good
181016,2		x	x	x	Both	WC	Long episode, initiated by assignment
181016,3		x	x		S	WC	Answer to teacher's invitation to querying
181019,1	x				S	G	Rejection
181019,2		x	x	x	Both	WC	Challenging question
181019,3		x			S	G	Challenging question
181019,4		x	x		T	WC	Challenging question
Sum: 21	5	16	9	3			
Sum excluding other categories		7	6				

Appendix C. Transcription conventions

Sign	Explanation
(…)	This sign indicates a short time interval between speech
[	A square bracket indicates the onset of an interruption or overlapping speech
:::	Colons indicate the lengthening of a word or sound
( )	Empty parentheses indicate that it was difficult to hear what was said
((looks up))	A sentence that appears within double parentheses describes an action

References

Alexander, R. (2008). Towards dialogic teaching: Rethinking classroom talk. *Dialogos*.

Amundrud, A., Smørdal, O., & Rasmussen, I. (2021). # Fact or # opinion: The educational design of a microblogging activity intended to engage students in productive interactions. *Technol. Pedagog. Educ.*, 1–17.

Baker, M. J., Quignard, M., Lund, K., & Séjourné, A. (2003). Computer-supported collaborative learning in the space of debate. In B. Wasson, S. Ludvigsen, & U. Hoppe (Eds.), *Designing for change in networked learning environments* (pp. 11–20). Springer.

Bakhtin, M. M. (1986). The problem of speech genres. In C. Emerson, & M. Holquist (Eds.), *Speech genres and other late essays* (pp. 60–102). University of Texas Press.

Barron, B. (2000). Achieving coordination in collaborative problem-solving groups. *Journal of the Learning Sciences, 9*(4), 403–436.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101.

Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *search designs: Quantitative, qualitative, neuropsychological, and biological: Vol. 2. APA handbook of research methods in psycho* (pp. 57–71). American Psychological Association.

Cook, V., Warwick, P., Vrikki, M., Major, L., & Wegerif, R. (2019). Developing material-dialogic space in geography learning and teaching: Combining a dialogic pedagogy with the use of a microblogging tool. *Thinking Skills and Creativity, 31*, 217–231.

Derry, S. J., Pea, R. D., Barron, B., Engle, R. A., Erickson, F., Goldman, R., & Sherin, B. L. (2010). Conducting video research in the learning sciences: Guidance on selection, analysis, technology, and ethics. *Journal of the Learning Sciences, 19*(1), 3–53.

Dobber, M., Zwart, R., Tanis, M., & van Oers, B. (2017). Literature review: The role of the teacher in inquiry-based education. *Educational Research Review, 22*, 194–214.

Engle, R. A., & Conant, F. R. (2002). Guiding principles for fostering productive disciplinary engagement: Explaining an emergent argument in a community of learners classroom. *Cognition and Instruction, 20*(4), 399–483.

Enqvist-Jensen, C., Nerland, M., & Rasmussen, I. (2017). Maintaining doubt to keep problems open for exploration: An analysis of law students' collaborative work with case assignments. *Learning, Culture and Social Interaction, 13*, 38–49.

Gillen, J., Staarman, J. K., Littleton, K., Mercer, N., & Twiner 2, A.c. (2007). A "learning revolution"? Investigating pedagogic practice around interactive whiteboards in British primary classrooms. *Learning, Media and Technology, 32*(3), 243–256.

Howe, C. (2014). Optimizing small group discourse in classrooms: Effective practices and theoretical constraints. *International Journal of Educational Research, 63*, 107–115.

Howe, C., & Mercer, N. (2007). Children's social development, interaction, and classroom learning. In *The primary review (research survey 2/1b)*. University of Cambridge.

Howe, C., Tolmie, A., & Rodgers, C. (1992). The acquisition of conceptual knowledge in science by primary school children: Group interaction and the understanding of motion down an incline. *British Journal of Developmental Psychology, 10*(2), 113–130.

Howe, C., Hennessy, S., Mercer, N., Vrikki, M., & Wheatley, L. (2019). Teacher–student dialogue during classroom teaching: Does it really impact on student outcomes? *Journal of the Learning Sciences, 28*(4–5), 462–512.

Jordan, B., & Henderson, A. (1995). Interaction analysis: Foundations and practice. *The Journal of the Learning Sciences, 4*(1), 39–103.

Krange, I., & Ludvigsen, S. (2008). What does it mean? Students' procedural and conceptual problem solving in a CSCL environment designed within the field of science education. *International Journal of Computer-Supported Collaborative Learning, 3*(1), 25–51.

Kuhn, D. (1991). *The skills of argument*. Cambridge University Press.

Kuhn, D., & Crowell, A. (2011). Dialogic argumentation as a vehicle for developing young adolescents' thinking. *Psychological Science, 22*(4), 545–552.

Lefstein, A. (2010). More helpful as problem than solution: Some implications of situating dialogue in classrooms. In K. Littleton, & C. Howe (Eds.), *Educational dialogues: Understanding and promoting productive interaction* (pp. 170–191). Routledge.

Linell, P. (1998). *Approaching dialogue: Talk, interaction and contexts in dialogical perspectives* (Vol. 3). John Benjamins Publishing.

Macagno, F. (2000). Types of dialogue, dialectical relevance, and textual congruity. *Anthropology & Philosophy, 8*(1–2), 101–121.

Major, L., Warwick, P., Rasmussen, I., Ludvigsen, S., & Cook, V. (2018). Classroom dialogue and digital technologies: A scoping review. *Education and Information Technologies, 23*(5), 1995–2028.

Mathé, N. E. H., & Elstad, E. (2018). Students' perceptions of citizenship preparation in social studies: The role of instruction and students' interests. *Journal of Social Science Education, 17*(3), 75–87.

Mercer, N. (2004). Sociocultural discourse analysis: Analysing classroom talk as a social mode of thinking. *Journal of Applied Linguistics, 1*(2), 137–168.

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

Mercer, N., Wegerif, R., & Dawes, L. (1999). Children's talk and the development of reasoning in the classroom. *British Educational Research Journal, 25*(1), 95–111.

Mercer, N., Warwick, P., Kershner, R., & Staarman, J. K. (2010). Can the interactive whiteboard help to provide 'dialogic space' for children's collaborative activity? *Language and Education, 24*(5), 367–384.

Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research, 97*, 187–199.

Mercier, E., Rattray, J., & Lavery, J. (2015). Twitter in the collaborative classroom: Micro-blogging for in-class collaborative discussions. *International Journal of Social Media and Interactive Learning Environments, 3*(2), 83–99.

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

Murphy, P. K., Greene, J. A., Firetto, C. M., Hendrick, B. D., Li, M., Montalbano, C., & Wei, L. (2018). Quality talk: Developing students' discourse to promote high-level comprehension. *American Educational Research Journal, 55*(5), 1113–1160.

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

Omland, M. (2021). Technology-aided meaning-making across participation structures: Interruptions, interthinking and synthesising. *International Journal of Educational Research, 109*, 101842.

Omland, M., & Rødnes, K. A. (2020). Building agency through technology-aided dialogic teaching. *Learning, Culture and Social Interaction, 26*, 100406.

Pifarré, M. (2019). Using interactive technologies to promote a dialogic space for creating collaboratively: A study in secondary education. *Thinking Skills and Creativity, 32*, 1–16.

Rasmussen, I., & Hagen, Å. (2015). Facilitating students' individual and collective knowledge construction through microblogs. *International Journal of Educational Research, 72*, 149–161.

Rasmussen, I., Amundrud, A. S., & Ludvigsen, S. R. (2019). Establishing and maintaining joint attention in classroom dialogues: Digital technology, microblogging and ground rules. In N. Mercer, R. Wegerif, & L. Major (Eds.), *The Routledge international handbook of research on dialogic education* (pp. 410–423). Routledge.

Resnick, L. B., Asterhan, C. S., & Clarke, S. N. (2018). *Accountable talk: Instructional dialogue that builds the mind*. Geneva, Switzerland: The International Academy of Education (IAE) and the International Bureau of Education (IBE) of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

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

Reznitskaya, A., Kuo, L., Clark, A., Miller, B., Jadallah, M., Anderson, R. C., & Nguyen-Jahiel, K. (2009). Collaborative reasoning: A dialogic approach to group discussions. *Cambridge Journal of Education, 39*(1), 29–48.

Rødnes, K. A., Rasmussen, I., Omland, M., & Cook, V. (2021). Who has power? An investigation of how one teacher led her class towards understanding an academic concept through talking and microblogging. *Teaching and Teacher Education, 98*, 103229.

Säljö, R. (2010). Digital tools and challenges to institutional traditions of learning: Technologies, social memory and the performative nature of learning. *Journal of Computer Assisted Learning, 26*(1), 53–64.

Schwarz, B. B. (2009). Argumentation and learning. In Muller-Mirza, & A.-N. Perret-Clermont (Eds.), *Argumentation and education* (pp. 91–126). Springer.

Stein, N. L., & Miller, C. A. (1993). A theory of argumentative understanding: Relationships among position preference, judgments of goodness, memory and reasoning. *Argumentation, 7*(2), 183–204.

Stornaiuolo, A. (2016). Teaching in global collaborations: Navigating challenging conversations through cosmopolitan activity. *Teaching and Teacher Education, 59*, 503–513.

Strømme, T. A., & Furberg, A. (2015). Exploring teacher intervention in the intersection of digital resources, peer collaboration, and instructional design. *Science Education, 99*(5), 837–862.

Wegerif, R. (2010). Dialogue and teaching thinking with technology. In K. Littleton, & C. Howe (Eds.), *Educational dialogues: Understanding and promoting productive interaction* (pp. 304–322). Routledge.

Wells, G. (2009). *The meaning makers: Learning to talk and talking to learn*. Hodder and Stoughton.

Wilkinson, I. A. G., Reznitskaya, A., Bourdage, K., Oyler, J., Glina, M., Drewry, R.Nelson, K., … (2017). Toward a more dialogic pedagogy: Changing teachers' beliefs and practices through professional development in language arts classrooms. *Language and Education, 31*, 65–82. https://doi.org/10.1080/09500782.2016.1230129

Williams, J. M., & Tolmie, A. (2000). Conceptual change in biology: Group interaction and the understanding of inheritance. *British Journal of Developmental Psychology, 18*(4), 625–649.