



Dialogues across time and space in a video-based collaborative learning environment

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Abstract

In this study, we investigate how pre-service teachers' group dialogues emerged and intersected across time and space as students collaboratively constructed a video-based mind map to prepare for oral exams in a pedagogy course. The study was conducted as part of a design-based research project investigating the ways that video-based mind maps can support learning as both a collaborative activity and a classroom resource. We applied interaction analysis methods to recordings taken during the production of the mind map as well as the videos made by students within the mind map itself to analyze synchronous and asynchronous dialogues among group members as they viewed, recorded, and uploaded videos. The findings offer an in-depth understanding of how collaboration occurs in different space-time configurations within and across groups as mediated by video resources. We discuss how these findings contribute to computer-supported collaborative learning (CSCL) research on the ways collaboration can emerge across different levels of activity as well as the pedagogical implications for introducing video-based dialogues into the classroom.

Keywords Video-based computer-supported collaborative learning · Design-based research · Group and whole-class levels of learning · Mind maps · Higher education · Interaction analysis

Introduction

Video-based collaborative learning is a practice in which video is an integrated part of collaborative group work. Video recordings can give both learners and researchers the opportunity to capture specific moments in time, revisit these moments, and do so in collaboration and dialogue with others to enhance professional practice (Gaudin and Chaliès (2015); Derry

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et al. (2010)). Consequently, using video to further learning processes is not a new phenomenon. Several studies have found video to have great potential for learning, collaboration, and sharing of new ideas through dialogue (Noetel et al. (2021); Ramos et al. (2021)). In teacher education contexts, video-based collaborative learning studies have focused on both learners in group work (e.g., Cattaneo, et al. (2022)) as well as whole-class situations (e.g., Arya et al. (2014)) with video recordings of practice used for professional development. Others have investigated video feedback (Mahoney et al. (2019)) as well as student-generated video creation for assessment (Hawley and Allen (2018)). Sometimes, researcher and teacher activity also converge around video when analysis and reflection become resources for mutual learning (Davidsen and Vanderline (2014)). Video is, thus, a dynamic and flexible tool.

In this paper, video serves both as a kind of group knowledge representation and as a way to connect dialogues over time. We build on research showing how digital tools can support sharing knowledge and making ideas transparent for others (Major et al. (2018); Frøyttlog and Rasmussen (2020)). These studies often have a strong interest in dialogic pedagogy, founded upon the core principles recognizing multivocalism and the need to work toward democratic and constructive collaborative interaction (Howe and Mercer (2017)). A common challenge among educators striving to facilitate dialogues that improve student understanding is managing shifts between small group work and whole-class interaction; there is a need to find productive ways to support dialogues between groups that do not require direct teacher mediation (White (2018)). Toward these ends, video recorded small group dialogues can be made transparent for a whole class of students if uploaded to a digital platform. When groups work together with such a platform, dialogues can be transported across rooms and made accessible for all the participants simultaneously (Beal & Hontvedt (2023)). Consequently, video can be a primary means for large scale collaborative learning connecting small group and whole-class work.

Within the field of computer-supported collaborative learning (CSCL), video is most often used as an analytical lens for research purposes (Zahn et al. (2021)) rather than strictly as a learning tool. An important and persistent challenge in CSCL has been to shift between units of analysis that include small group collaboration (often in dyads or triads) on the one hand and whole-class units on the other (White (2018); Stahl and Öner (2013)). Accordingly, we often encounter studies that focus on the individual and group level or community level of analysis. These approaches bring valuable insights, yet we know that learning does not occur in isolation and that these levels are inevitably intertwined (Stahl and Öner (2013)). Even so, few attempts have been made to analytically capture the complexity of interrelationships across levels. In this fine-grained analysis, we will pay close attention to how groups collaborate through video dialogues and how meaning develops in the movement between small group and whole-class levels of participation. Engaging in this practice happens over time, as do all CSCL practices, making it imperative to take temporality into account in the analysis (Mercer (2008)).

The temporal and spatial dimensions of activity capture important aspects of CSCL processes. For example, Ligerio and Ritella (2010) analyzed the tempo of collaboration and the role of the technology as teachers prepared a pedagogical scenario to use in school. They found the tempo of activities to vary depending on factors such as the aims of the activity, features of tools, and skills teachers employed in their work. Kumpulainen and Rajala (2017) investigated how time-space contexts were created and managed by groups of fifth-grade students writing a script for a school musical production. They showed how timescales were made relevant, creating different opportunities for learning in which students positioned themselves as actors and authors, in contrast to agents of predefined tasks and activities. Similarly, Ludvigsen et al. (2011) investigated intersecting trajectories of

participation in how patients reinterpreted biomedical knowledge and demonstrated that developing shared objects can connect historical aspects and present “in situ” interaction with learners’ future orientations. In the current paper, different kinds of group dialogues are seen as overlapping through video. Episodes that are separated in time and space may be none the less closely related in a trajectory in which time can be best described as folded rather than unidirectional and linear (Lemke (2000)).

In this paper, we examine collaborative learning processes as they unfold across time and space in a video-based collaborative learning setting in which a class of pre-service teachers engaged in and about video dialogues. The students worked in groups to upload video dialogues, written text, and links and/or images about disciplinary topics to a Padlet (a web-based bulletin board tool). Combined, these resources make up what we define as a video-based mind map. During the activities, groups were seated in different rooms at the same time as they performed the task of recording video dialogues before watching and engaging with their peers’ video dialogues in the synchronized digital platform. Video-based collaborative learning pedagogies can be productive for student learning (Cattaneo et al. (2022)), yet there is a need to understand the temporal and special dimensions of such activities and what they mean for students’ meaning making in relation to the appropriation of different resources (Kumpulainen and Rajala (2017)). Prior research that investigated video-based mind maps found that the peers’ group videos created material and social structures for collaboration and in-depth negotiation (Beal & Hontvedt (2023)). We also know that dialogues can become a classroom resource in many different ways (Amundrud et al. (2022); Furberg and Silseth (2022)), yet we have a limited understanding of how video affords dialogues to intersect across time, how they can traverse conversational settings and potentially become objects of inquiry for peers and the implications this has for student learning. Therefore, the goal of this paper is to look at ways in which different layers of dialogue can be linked together through video; notions of temporality guide the analytic perspective into how video intersects with the students’ group and whole-class meaning making. We pose the following research questions:

What kinds of space–time constellations are supported by video-based mind maps?

How do these configurations mediate meaning making across levels in a network of dialogues?

Meaning making across levels of dialogue

Meaning making with video as mediational tool

We adopt a sociocultural perspective on human activity and learning to study the video-based collaborative learning practice in which pre-service teachers’ construction of meaning is regarded an interactional achievement (Wertsch (1998)). Learning is conceived of as a temporal, social, and situated process of meaning making in which language and gesture are fundamental, psychological, and cultural tools mediating meaning for the learners in the context (Vygotsky (1978)). This implies that any learning needs to be understood in terms of the larger system the participants take part in, as it is situated in a social, cultural, and historical context (Arnseth & Ludvigsen (2006)). Therefore, learning is not conceptualized as a transformation inside the individual (e.g., changes in mental structures) but as an interactive and dynamic process occurring among and in-between people as they engage in meaning making practices. Here, intersubjective meaning making captures “how people

in groups make sense of situations and of each other” (Suthers (2006) p. 321). Intersubjective meaning making can be pursued, maintained, or lost as people engage in collaborative learning activities over time (Mercer (2008)). Yet, meaning making processes are also dependent on and co-constituted by mediating tools that can enable practices to extend across time and space (Hakkarainen et al. (2015)).

We studied the meaning-making processes occurring in small groups and between these groups in a whole-class setting manifested in video dialogues. In interacting in and with video dialogues, face-to-face interaction is central, since language and embodied actions such as gestures and gaze are fundamental aspects of how people communicate and make meaning in conversation (Goodwin (2007)). Through interaction, people organize their bodies in relation to each other to establish a shared focus of attention (Goodwin (2007)). The concept of mediation offers a perspective on the role that artefacts such as video dialogues can take in pre-service teachers’ learning processes (Wertsch (1998)). A central premise of CSCL is that mediation explains how a computational artifact facilitates the interaction between two (or more) collaborating participants (Ludvigsen & Steier (2019)). As artifacts, video dialogues can become substantial means for knowledge co-construction influencing peer conversations (Beal & Hontvedt (2023)). Video can be considered a mediating tool that facilitates many different kinds of interactions and structures activity, in which it can also function as a knowledge artifact documenting evolving intersubjective understandings.

Notions of dialogue as resource for CSCL

One theme related to meaning making with video as a mediational tool in CSCL involves the significance of “dialogue” as a resource and the ways computers can mediate such dialogues. Dialogic pedagogies have been described in theory and studied in practice as acknowledging multiple voices and perspectives and building on the democratic classroom, co-construction practices, joint inquiries, and the exchange of ideas (Howe & Mercer (2017)). When we use the term dialogic, we are inspired by a Bakhtinian approach emphasizing meaning as something that emerges between different voices (Bakhtin (1981)). A video dialogue is the conversation itself, mediated by video, which develops between different learners. In Frøylog and Rasmussen’s (2020) mixed methods study, they explored the potential of a microblogging tool to promote distributed and productive whole-class dialogues in a lower secondary class. They found that the tool Talkwall supported such activities and that it strengthened participation as a collective endeavor. The learning activities were found to connect the whole-class dialogue to prior collaborative learning activities in which students, in turn, entered into activities with collaboratively constructed knowledge.

Mercer (2008) introduced dialogic trajectory as characterizing how speakers “move in unison” through a series of correlated interactions within the same practices. He pointed to the historical and dynamic nature of dialogues and smaller units of interaction—historical in how dialogues are located within institutional and cultural practices and dynamic in how those dialogues shape and are shaped through interaction as dialogues develop and emerge over time. This dual perspective helps describe how dialogues can be shared manifested experiences formed by and forming interactional accomplishments over time (Mercer (2008)).

Though CSCL environments can offer a multitude of mediational means and appropriate research designs to explore such practices, few studies have taken the leap to explore the temporal dimensions of group and classroom dialogues (Baker et al. (2021)). Dialogues are highly situated both in relation to the sociocultural setting and in relation to themselves.

Each utterance or contribution can only be understood in relation to what came before and what came after; each such move is also itself changing the situation and context for the subsequent move (Linell (2009)). Baker et al. (2021) argued for the “exchange” as the fundamental unit of analysis of dialogic learning. An exchange, in this view, consists of three parts including an initial presentation, a reaction, and an acceptance or ratification of the preceding two moves. For intersubjective meaning making to develop, all three of these elements must be in place as the dialogue is continuously and iteratively negotiated.

A dialogue can serve many functions. As noted, dialogue and dialogic meaning making play an analytic role in articulating a unit of analysis in which we can interpret learning conversations. There is an activity-framing dimension to dialogue. As we will see, students were asked to participate in the filming of “mini conversations” in which the participation in this dialogue is the resource. This includes both the opportunity for students to work with the ideas themselves and the practice in using disciplinary language in the context of an oral exam. Finally, there is also a representational aspect of dialogues. Through the video-based mind map activity, the nested and entangled relationships between different small group dialogues develop to depict whole-class understandings. The mind map facilitates feedback and the emergence of meaning in the dialogue between groups as we seek to understand the dialogue of dialogues. In this case, we see both synchronous collaboration within small group dialogues and asynchronous collaboration between groups in which each recorded video can be understood as a single turn visualized on the mind map.

Levels of learning activity in CSCL environments

As noted, we are exploring how dialogues emerge at different levels of activity. In CSCL, we usually find studies that include small group collaboration, such as those including two to three students or studies of whole-class units. The small group unit may be considered the prototypical CSCL constellation, as it is perhaps the simplest arrangement in which collaboration can be foregrounded. At the same time, the different theoretical orientations toward learning can emphasize individual cognition within a particular constellation, the intersubjective processes of the small group up to larger groups in the form of whole-class discussions, or even cultural-historically situated communities (Ludvigsen & Arnseth (2017)). The challenge of managing these group levels is, in some cases, one of analytic perspective; certain methods are better suited for a particular unit of analysis. At the same time, there is also a design and technology aspect that is important to emphasize, that is, the digital tools mediating CSCL activity tend to highlight or strengthen the activities in particular group constellations. Combining these approaches is an important and underexplored challenge (White (2018); Stahl & Öner (2013)).

Previous research has addressed issues surrounding the examination of multiple levels of activity through different theoretical orientations, computer-supported pedagogical designs, and analytical procedures. White (2018) investigated collaborative learning across levels supported by networked graphing calculators by utilizing an analytic framework to merge the means of appropriation, mediation, emergence, and orchestration. There, students co-constructed mathematical objects owned and manipulated by individuals, small groups, and the entire class. The teacher’s attention to the objects in the collective display provided new ways to solve mathematical issues, as the objects offered dynamic resources for merging group and whole-class talk. White (2018) suggested that the “interweaving of face-to-face interactions with networked transactions such as the sharing of dynamic math representations may enable new scenarios for connecting levels of learning activity” (pp. 94–95). Stahl and Öner (2013)

also investigated the connections between the individual, group, and community levels of learning using empirical examples of mathematical work. They argued that the connections between levels can take place through the mediation of linguistic interactional resources, proposing that they can function to connect the levels under inquiry. They concentrated on small group work in which the community level of analysis became apparent in how the members modified or generated resources, externalized in the community as verifiable knowledge.

Designing transparent classroom structures that facilitate community inquiry or whole-class learning communities in ways that mediate the individual, group, and whole-class progression across levels is challenging. Tissenbaum and Slotta (2019) applied the knowledge community and inquiry (KCI) approach to investigate how two high school eleventh grade physics classes used a tablet application that allowed students to collectively solve, tag, and evaluate physics problems and co-construct a knowledge base. They found that the design of the activities reduced the teacher's orchestrational load when the real-time orchestration tablet became the conduit or channel through which the orchestration happened.

Such studies offer valuable insight for CSCL designers; however, this current study is not intended to be an evaluation of a video-based mind map pedagogical design. Rather, we explore how notions of temporality and layers of dialogue intersect in students meaning making processes over time and across levels through such a design. The above studies demonstrate ways to understand students' meaning making processes as they unfold over time through the use of video as a mediational tool across small group and whole-class level dialogues.

Methods and materials

Project background and participants

The data were collected during a design-based research (DBR) project associated with a larger project exploring video-based learning activities in professional education.¹ A video-based mind mapping activity was developed and implemented by a design team consisting of the first author, a co-researcher, and an instructor. The overall aims of the project were to explore video-based mind maps as a pedagogical tool and to analyze the large-scale collaborative learning processes. In general, we were interested in how a video-based mind map activity could be applied to support students' academic readings and collaborative discussions of the course literature ahead of oral exams, since engaging students in scholarly dialogue about their academic reading is important to generate and deepen new understanding.² Pre-service teachers specifically are entering a profession where they are expected to simultaneously communicate the use of research findings and theory, such as the use of profession-specific terminology, while considering in-service practice situations. Therefore, a key feature of the pedagogical design was to orchestrate an arena in which student groups could practice such communication. The technology was applied to allow for whole-class collaboration aiming for the student groups to gain insight from each other's talk (through video capture) and to engage in local dialogue, with the overall aim of them collaboratively learning

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² For more information about the design of the video-based mind map activity, see Beal and Hontvedt (2023).

Table 1 Core topics, group overview, and pseudonyms

Group no.	Core topic	Group names	Pseudonyms
1	Diversity and inclusivity	Divinc	Daisy, Daria, Dennis, and Don
2	Research and policy perspective on bullying	Repobu	Rhonda, Rita, Roger, and Ruby
3	Mental health and life skills	Mehels	Martha and Mona
4	Learning community	Leco	Not presented in transcripts
5	Special education work	Spedwo	Not presented in transcripts

with each other through interaction. Synchronously, the group members worked together in group rooms gaining access to video dialogues as they were uploaded to the mind map. Asynchronously, video dialogues were exchanged across groups.

The data is from the second iteration of the DBR project. Two instructors took part in the activities: one was part of the design team, and the other was the course manager and internal examiner. The students gave consent to join before data collection. A total of 22 fourth year pre-service teachers forming five groups ($N = 2\text{--}5$) participated while taking an obligatory course that was part of their teacher education program called “Pedagogy and Student Knowledge.” The group names and pseudonyms are based on the core topics assigned to each group (Table 1).

Over two sessions during 1 week, the students created, shared, and provided feedback on each other’s work in the form of group video dialogues while aiming to make an overview of their curriculum in the form of a video-based mind map that was also to serve as a study resource. Prior to engaging in the task, the students were informed that the video-based mind map would cover the core topics in the subject. These topics were previously discussed in class work and lectures during the semester (duration of 4 months). In co-constructing the mind map, students were to: (1) help each other gain an overview of the course literature in a shared resource and (2) practice discussing this course literature through video dialogues, in a type of argumentation similar to the upcoming individual oral exams. In other words, dialogues at the whole-class level could contribute to improving a shared study resource, and dialogues at the small group level could serve as a kind of discussion practice and exam rehearsal. These pedagogical motivations were made explicit to the students. Note that even though we apply the term whole-class to describe a level of the activity, we recognize that whole-class typically denotes students simultaneously being in the same space of a classroom, interacting with each other, instructors, and tools synchronously. In this pedagogical design, technology was used as a resource to create a different type of whole-class level shared space in which groups could engage in dialogue with groups—video by video—in a video-based mind map structure without the physical and temporal constraints of the classroom. Accordingly, the class also met up before, in-between, and after working on the task in their classroom, discussing their work as a whole class in the more traditional sense of the term.

The groups’ specific mind map task was to video record and upload conversations in which they talked about key topics in their curriculum considering their course literature, what they knew about the topic (from research), and theoretical concepts they regarded as relevant. They were also to include ways in which that knowledge could affect their future work as teachers. The students were also encouraged to refer to work conducted previously during the semester, e.g., from lectures or course work. Alongside the video conversation, they were also instructed to create and upload a written didactical plan relevant to the topic

that could be applied in the classroom and to relate their work to relevant policy documents, a self-chosen research article, course literature, and in-service practice. Each group created a cluster of posts and commented on the other groups' work by uploading the video conversations as responses and, in the end, making a video-based mind map as a whole-class level learning activity. When co-creating the video-based mind map, the students orchestrated, to a large extent, the development of the evolving knowledge base mapping the greater parts of the disciplinary content.

The students' participation in the project was not compulsory, but the students and the instructor agreed that only those who participated in the activity would gain access to the mind map. This was decided as a fair resolution, as some students were hesitant about sharing their accumulated knowledge with peers without them reciprocating. The students were free to participate without being video recorded for research purposes, and they were aware that one of the instructors who had access to the mind map would be their internal examiner, alongside an external examiner unknown to them. During the upcoming exam, the students would first present and discuss a self-chosen question/case or dilemma, before being questioned within the subject by both the internal and external examiner. During the second part of the exam, the students would have no control over which questions they could be asked by the examiners, making it important for them to have a good overview of the course literature to be able to engage in a meaningful way. This exam activity, exam outcomes, and subsequent use of the mind map are beyond the scope of the current study, but we note this context as important framing for the mind map task.

Data collection and analysis

The primary data consist of 28 h of video recordings, including those from cameras placed in the group rooms, screen recordings, and student-created videos. We collected the video recordings of the students' work, as they allow a close analysis of the unfolding social interactions occurring over time and in different places (Derry et al. (2010)) that are essential when investigating time–space configurations in-depth. Students were placed in groups, each in separate rooms during the activity, with one fixed camera positioned in each room recording how they engaged to accomplish the task. In the process of creating the videos and mind map, the groups were instructed to use one iPad each; each iPad was screen recorded. The iPads were owned by the institution and used to uphold privacy regulations while recording. Private computers were also used by the students but were not screen recorded. Through the collected video recordings, we were afforded video data of the student dialogues that included both synchronous and asynchronous discussions among the group members as they recorded, uploaded, and viewed the student-created videos.

Working with this video data, we applied interaction analysis methods (Jordan & Henderson (1995); Derry et al. (2010)) to interpret sequences of interaction and to capture the unfolding nature of the mediated dialogues. Within interaction analysis, knowledge and action are “fundamentally social in origin, organization, and use and are situated in particular social and material ecologies” (Jordan & Henderson (1995), p. 41). This choice of method is particularly appropriate as it is a form of video-based analysis in which collaborating researchers analyze data through video review sessions, in ways resembling the students in this study. After reviewing the data

corpus and producing rough transcripts, we identified instances in which students explicitly oriented toward temporal references and how those instances intersected with and were constituted by the digital tools. In doing so, the aim was to uncover the temporal dimensions of the activity, how time was made relevant in the students' conversations, and how it impacted their meaning making activities. During repeated viewings of the data material, we content-logged the temporal references and orientations. These included, for example, references to past events or previous recordings and the situations in which the future viewers of a video became relevant. The goal was to identify the social and situated ways in which instances of prior, present, and/or future dialogues were brought to attention through verbal talk, embodied actions, tools, or resources.

While identifying and analyzing these sequences, it became apparent that the video conversations uploaded to the mind map by one group influenced the conversations among the peers in the other groups and generated new connected discussions. The whole class was given access to the conversations held by their peers and engaged in conversation with each other's contributions over time. Accordingly, we incorporated a narrative analytic approach (Engle et al. (2014); Pierroux et al. (2022)) to highlight the sequential narrative of the entire activity encompassing the trajectory of the activities and the complex interplay between the small group interactions and whole-class dialogues. Narrative here refers to the ways in which different interactional episodes unfold and build on each other over time and across spaces, making up the trajectory of events displayed in the analysis (Ludvigsen et al. (2011); Lemke (2000)). This approach allowed us to investigate the different space-time constellations afforded by the video-based mind map at the micro level through interaction analysis of specific sequences and to preserve the extended meaning making processes across these sequences. To pinpoint how these instances were connected across the groups over time and in relation to the disciplinary task, references such as the texts, names, concepts, stories, and ideas mentioned by the students were noted. Gee and Green (1998) suggested that such talk can function as "connection building" or intertextual links that can be introduced and evolve over time through how they are interactionally made relevant as the students engaged in meaning making. By following these references, an overview of the dialogues connected to one other emerged. This work is useful for approaching temporal aspects of CSCL practices by combining a horizontal perspective that includes a longitudinal timescale of connected dialogues and a vertical in-depth analysis of moment-to-moment interaction (Ludvigsen et al. (2011)). Finally, we selected the sequence of episodes to present in the analysis that formed the longest trail of conversation across groups with the aim of generating rich contextual descriptions. This sequence was connected by a story introduced by a student in one group that, in turn, generated dialogue in and across the other groups. We iteratively reduced the sequence to best capture the narrative trajectory while also allowing an in-depth analysis of key moments. To address our research questions in the below analysis, we brought focused attention to the temporal, interpersonal, and disciplinary dimensions of interaction.

The conversations were transcribed and translated to English to capture timing, overlap, and emphasis (see Appendix Table 2, Jefferson (2004)). The embodied actions of particular relevance for the analysis were portrayed with anonymized images as they unfolded during interaction. Finally, the anonymized video data and transcripts were presented in data sessions in which scholars offered valuable input improving the analysis. Also, though the transcripts are presented solely in English, several researchers have studied the translations to ensure the accuracy and overall quality. The project was registered and approved through the Norwegian Centre for Research Data and guidelines for research ethics were closely followed throughout.

Analysis

In the following, we will present a sequence of episodes in which the group conversations intersected over time as the pre-service teachers created the video-based mind map. The sequence comes from the students' work with the cluster "diversity and inclusion," shown to the right in Fig. 1. Analysis of the sequence draws on both the video dialogues made by the students themselves as well as researcher recordings of the students creating, watching, and discussing the video dialogues.

This cluster of posts was produced by three student groups working in separate group rooms on campus (Fig. 2). We briefly summarize the entire sequence before introducing analysis of the key episodes. In the first room, group Divinc's key topic was diversity and inclusion, a topic given to them by their instructor. The group first defined the concepts. Then, one of the students recalled a story from when she was a student in school about a boy who could not find his place within the classroom community and a teacher taking

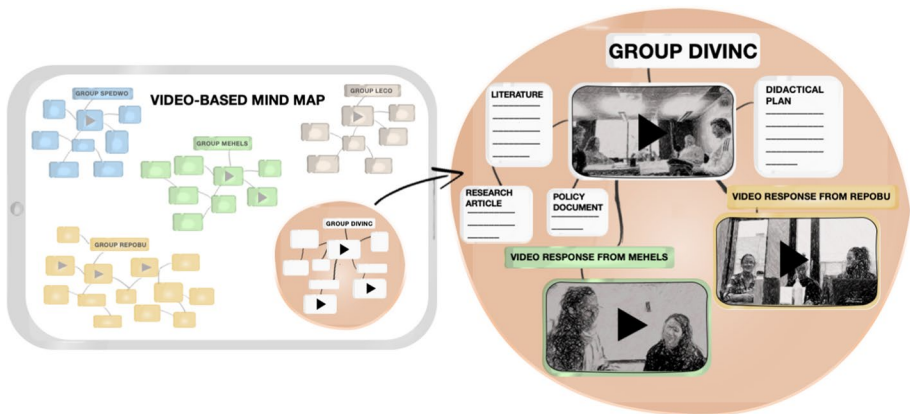


Fig. 1 Reproduced video-based mind map highlighting the cluster featured in the analysis

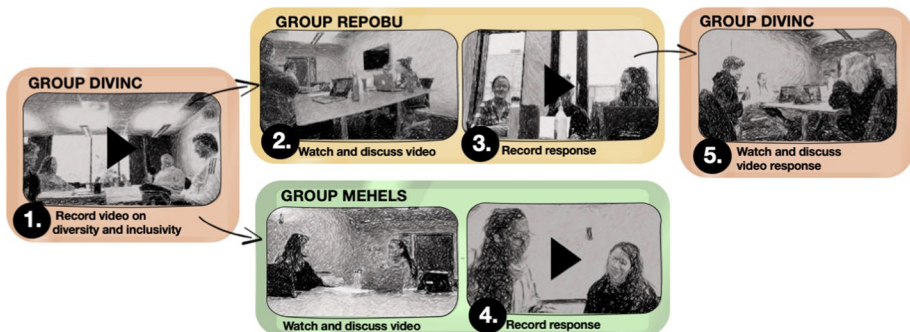


Fig. 2 Overview of the trajectory of group activities and episodes from the video-based mind map activity. The numbers represent the excerpts presented in the analysis

questionable steps when trying to help him (Fig. 2 and Excerpt 1). Divinc video recorded their conversation and uploaded it to the video-based mind map. Later, in the second room, group Repobu watched Divinc's video and discussed alternative ways the teachers could have worked to help the boy (Fig. 2 and Excerpt 2). In the third room, group Mehels also watched the initial video and suggested more precise theoretical concepts relevant to the situation. Both groups first discussed Divinc's video before they video recorded a response and uploaded it to Divinc's cluster in the mind map (Fig. 2 and Excerpts 3 and 4). Divinc then watched the video responses and talked about how their example had created discussion amongst peers that expanded on their original conversation (Fig. 2 and Excerpt 5), in turn further developing the knowledge base in the video-based mind map.

Divinc's video about diversity and inclusion

In the first episode, we can observe how Divinc—Daria, Daisy, Don, and Dennis—created their first video presenting the concepts of diversity and inclusivity in relation to both their curriculum and the different ways this knowledge could affect their work as teachers in school. We enter as the group has just defined the concepts, 3 min and 36 s into their talk. Here, Daria recalled an experience from her time as a student in school.

Excerpt 1 Divinc's video conversation about diversity and inclusivity

- 1 Daria A little input on what you ((points toward Dennis)) said about introverted students who may not have (0.5) all those (0.6) or (0.6) not necessarily lacking social antennae but (0.6) struggle a bit to make friends (0.5) because then there are a lot of teachers who want to step in (1.2) and try to fix it
- 2 Dennis Correct ((nods))
- 3 Daria But then you: have to eh: find some boundaries around it about how much one should go in. I remember when I was in lower secondary school there was a student who struggled a lot to make friends and then (0.7) the rest of us where in turn forced to be with him and then everyone was miserable not because we didn't want to be with each other but then we were like taken out of our (0.4) gang to then be with him (0.5) and (0.5) he didn't want to be with us (1.0) because he didn't like being with other people ((blurt laugh)) and we were then taken out of our gang and forced to spend half an hour with him >and that was like< measures for him to be more included >but then< we were pulled out of [the larger comm]unity
- 4 Dennis [It sounded like] (0.2) you said that he didn't necessarily want to get to know you either
- 5 Daria Mhm but then it was forced [upon]
- 6 Dennis [Yes]
- 7 Daria Because then it was something (0.4) from home about <him not being comfortable at school> but then it's a bit like where should one grasp this power of inclusion that one feels one has?
- 8 Dennis Very interesting

The first sequence begins as Daria turns her group members' attention to Dennis's earlier remark about introverted students. She connects his account to her recollections of teachers' practice in school. In line 3, we observe as Daria continues by stating the importance

of boundaries in such cases while drawing on an episode from her past of a peer struggling to make friends, which she experienced while she was a student. From a temporal perspective, Daria travels back in time by using a memory as a resource in their conversation. Daria explains that, at that time, she and her classmates experienced the teacher's handling of the case as unfortunate, as other students were excluded from the classroom community in the process. By making her experience accessible to the group, Daria introduces a piece of history and a shared reference for further discussion. In overlap, Dennis cuts her off by providing his own interpretation of the episode, continuing this orientation to Daria's past. Daria had described her understanding of how the boy perceived the situation, saying, "he didn't want to be with us" (line 3). Even so, Dennis restates by stating "you said that he didn't necessarily want to get to know you either" (line 4). Expanding on her original statement by adding "necessarily" and emphasizing, he hypothesizes about and/or modifies her interpretation of the boy's experiences. In doing so, Dennis attempts to soften Daria's claim, indicating he does not want them to make a bold and definite claim about the boy's experience. Daria approves with a subtle "mhm" and continues to support her own claim, as the teacher had forced measures on the students with which they had not agreed (line 5). She closes her account by asking, "Where should one grasp this power of inclusion one feels one has?" (line 7). Here, she asks a rhetorical question for her group, emphasizing the teachers as power holders; this prompts the video audience (classmates in other groups) to consider answering. Thus, the question has the potential to guide the peers' future conversations. Dennis closes the sequence by stating that the case in question was "very interesting" (line 8). The group moves on by discussing how the measures the teacher had used did not work and why. After, they complete the video and upload it to the mind map, making their conversation available to the rest of the class.

In this episode, time became relevant through Daria's retrieval of a school memory of the boy struggling to make friends, which she brought to her group discussion of diversity and inclusivity. As Divinc uploaded their video dialogue to the mind map, they shared the experience with future audiences with the potential to become a resource for meaning making across groups. In doing so, the in-the-moment relevance of the story also gave way to the horizontal (Ludvigsen et al. (2011)) timescale of connected dialogues which we follow below.

Repobu talking about Divinc's video conversation

In Repobu, Rita, Rhonda, Ruby, and Roger had just recorded a video of their own called "Research and Policy Perspective on Bullying." After having uploaded the video to the mind map, they began watching other groups' videos. In the following episode, they have just finished watching Divinc's video. As the video comes to a halt, Roger takes the lead in talking about it. Note, at this point, that the group members are having a private conversation, not being video recorded for the mind map (though still recorded by the in-room camera as data).

Excerpt 2 Repobu talking about Divinc's video conversation.

- 1 Roger Like that what do you think about that video?
 2 (2.2)
- 3 Rita I feel like it is a little like sore subject I thought it stung a
 little I (0.2) that °about that about hi:m who she had been in class
 with her° Daria
- 4 Rhonda Mhm
 5 (1.1)
- 6 Roger Yes
 7 (2.7)
- 8 Roger I thought they should have maybe:: (0.8) they talked a lot about
 inclusivity (0.7) that was of course: their topic >but< (0.5) they
 could maybe have gone more into (0.5) how they are to include the
 students (0.4)
- 9 Rita [Mhm]
 10 Ruby [Yes]
- 11 Roger It was a little like general that is (1.2) all good relations but
 that is like gene-
 12 Ruby But how do you build good [relations?]
 13 Rita [Yes cause]there is something with that
- 14 Rhonda Mh:m
 15 Ruby That one:
 16 Rita Right
 17 Ruby Takes it further there
 18 Rita Yes mh:m
- 19 Roger Yes that is they could rather draw on (1.2) students must learn to
 acknowledge each other (0.2)
- 20 Ruby Yes
 21 Roger And take it up against that
 22 Ruby Yes
 23 Roger That they must accept each other's differences (0.2)
 24 Ruby Yes
 25 Rita Yes (0.4)
 26 Roger But even so they have to learn to be (0.4) social together (0.3) in
 social interaction (0.5)
- 27 Rita Because I think if you and I don't have the same interests and then I
 can't deal with you that is all wrong
 28 Ruby Yes that becomes ve:ry
 29 Rita One must be able to do that (0.3)
 30 Ruby Yes (0.6) also I think that one could maybe have discussed then
 ((scratches head)) what one could have done instead on that measure
 she mentioned that is
- 31 Roger Mh:
 32 Rita Yes
 33 Ruby like okey that didn't work that well but what could have been done
 instead immediately I think that one could for example mapped (0.4)
 that students' interests eh: and then I think when you work with a
 whole class structure then it is nice if all work together ((moves
 hands forming a circle)) on it right if you need to improve the
 classroom environment then you have to choose activities where all
 are invited in a way (0.4) so maybe on one could if it was gaming
 that's the thing then okey had a tournament during recess then for
 example or something like that hook up (0.5) more so that he finds
 someone °who are a little more like° minded instead of that forced
 social I got a little like (0.2) is it a dog like that one should
 lock in the dog park to get to know others I got all like ((moves
 hands as if heart beating))

At an interpersonal level, this sequence begins with Roger turning his attention from looking at the screen to looking toward his group members asking, “What do you think about that video?” With the open question, Roger provides his peers an opportunity to state their thoughts. Rita describes an emotional response, noting that it was a “sore subject” and “stung a little” (line 3). This indicates that she was experiencing sympathy for the excluded boy, a story introduced by Daria in Divinc. Both Rhonda and Roger agree, as Roger turns their attention toward a more evaluative approach of Divinc’s conversation. He points out what the group could have done differently by addressing “how they are to include students” (in school, line 8). Rita and Ruby confirm, and Roger elaborates on his assessment of the video content as “a little like general.” Ruby follows, asking, “how do you build good relations?” (line 12). All the group members agree with her take (lines 13–18), indicating that it is a valid question to answer. Following this, and while receiving running support from his peers, Roger introduces some possible answers: “learn to acknowledge each other,” “accept each other’s differences,” and “learn to be social together in social interaction” (lines 19–26).

From a temporal framing, the question introduced by Ruby is past oriented, as it is asked in relation to an earlier video conversation held by Divinc, present oriented, in that it generates further elaboration in Repobu, and future oriented, in that it indicates feedback they can potentially give Divinc. Rita continues to elaborate with a morality-based account by stating that peoples’ different interests should not result in them being unable to “deal with” each other. Ruby then returns their conversation to what their classmates could have done differently. She suggests discussing alternative measures, including her take on what such measures could look like. At the end of her rationale, she offers an interesting rhetorical move: she introduces a metaphor (line 33). She compares the personal anecdote introduced by Daria (Excerpt 1) of the excluded boy to the idea of a dog being locked in a dog park to get to know others. The metaphor can become a shared reference point for the group that builds on the story. As she does so, she moves both hands in front of her heart, in and out, to indicate that they should follow her heart beating, stating “I got all like.” Her gesture and utterance indicate that she experienced heart-felt emotions concerning Daria’s story about the boy. This turn again demonstrates that the example offered by their classmates in Divinc triggered genuine emotions in Repobu.





Repobu’s talk, thus, moved between being past, present, and future oriented in discussing Divinc’s video. That initial video dialogue became redefined as a resource in Repobu’s meaning making as they evaluated Divinc’s approach to the story of the boy in relation to teachers’ future work in classrooms. At this point, Repobu’s conversation has been local, within the group level. However, after some time, and with this conversation as backdrop, Repobu recorded a video response to Divinc and uploaded it to the video-based mind map shared with the whole class.

Repobu’s video response to Divinc

In the following episode, we enter Repobu’s video response to Divinc. Here, they complement parts of Divinc’s conversation and mention the example about the boy who couldn’t find his place in the classroom, referencing it as a “very nice case.” However, the unseen, future audience of this new video creates a tension for Repobu. This next episode shows how Repobu balance resolving this issue as the group members take turns in negotiating

the disciplinary talk in providing feedback to their peers. Here, we observe a shift from positive remarks to evaluating and suggesting alternative ways to approach the case.

Excerpt 3 Repobu's video response to Divinc

- 1 Rita 
 ((Hands folded looking at the camera))
 2 Yes eh: you:: mention many good things about eh::
 3 
 (0.6) ((Looks towards peers while pointing at camera))
 4 Should I say you? (0.6) Should I speak like that?
 5 Rhonda Yes yes
 6 Rita, Rhonda & Ruby 
 ((Laughs))
 7 Rita ((LAUGHS)) Yes
 8 Rhonda *Yes° ((nods at Rita and looks at the camera))
 9 Rita 
 ((hands folded as she laughs and smiles towards camera))
 10 Rita Okay you mention many good things surrounding this about (0.3) eh: inclusivity especially, and there is a very nice case you bring up (0.8) at the end there (0.8) eh:: yes ((looks at Ruby)) (1.0)
 11 Rhonda Yes (0.5)
 12 Rita But: <yes
 13 Rhonda <We are very much> in agreement with you that like: (0.9) that it is important that all: (0.2) [accept all] [Mh: ((Nods))]
 14 Ruby
 15 Rhonda A:nd ge:ts >everyone< gets heard (0.7) and that one sees diversity in (1.1) a class that is ((Nods))
 16 Ruby That is in a way overarching that which is very important
 17 Rhonda Mhm (2.2)
 18 Rhonda Ehm
 19 Ruby But then we thought maybe that eh:: ((places hair behind ear)) one could have gone a little deeper into the case you brought up then
 20 Rita ((Nods))
 21 Ruby eh maybe worked a little with what kind of other concrete measures could have worked
 22 Rita ((Nods))
 23 Ruby Eh::m Because it became very clear that what was done didn't work
 24 Rita Y[es]
 25 Rhonda [Mh]m
 26 Ruby Ehm: and then maybe one could look at other ways to (0.6) to solve that problem (1.0)
 27 Ruby Eh::m ((looks at notes on computer screen)) also it was a nice case but we do think you have mentioned quite a bit of other literature on the side here (0.3) but perhaps one could have gone a bit more in-depth on those as well ((looks towards Rhonda and Rita))

At the beginning of their video response, we observe in Rita's posture and gaze how she initiates the sequence with her hands folded and eyes looking intently at the camera lens (line 1). Her stance suggests she is preparing to address an audience. Her tone of voice begins professionally, but with tension. This is illustrated by her hesitant "eh:" in the beginning and end of the incomplete remark about Divinc's video, addressing the group with the pronoun "you" (line 2). As she does so, we observe minor confusion as Rita breaks character and suddenly looks toward her group members, pointing to the camera lens and asking, "should I say you?" and "should I speak like that?" (lines 3–4). This is a critical moment in which Rita reveals a challenge in how to address the audience. On a disciplinary level, these challenges are purposely built into the task, as the students are instructed to give a video response that expands on the topic of their peers' video dialogues rather than how they were to communicate while doing so. Rita seems uncertain if the video format demands a different approach to communication than that in her initial approach. Through the interpersonal perspective, she might lack experience with and/or require negotiation regarding how to address her peers on video for a transparent collaborative display. From a temporal perspective, perhaps she is unsure of where (in time) her talk is oriented. In line 2, her talk is past-oriented, as she states that Divinc "mention many good things" talking about their video dialogue in the mind map. By directing her question to her in-room peers in line 4, she knows she is talking to them in the present. As such, the break could also imply that she is struggling with the future-oriented dimension of the activity—that she is talking to Divinc as an audience, but that they will not watch her talk until later in the future. To sustain their ongoing activity, they must find appropriate ways to address their peers in different times and spaces. Consequently, the video-based mind mapping activity reveals synchronous and asynchronous conversations happening simultaneously between the groups on the screen and in the room. As Rita directs her question to Rhonda, she raises possibilities for negotiation. However, Rhonda quickly confirms that she should continue speaking as she has been. In doing so, Rhonda repairs the conflict, allowing Rita to continue with her reasoning (lines 5–8). After a loud laugh, Rita repositions herself to reenter the video conversation and continues with praise about what Divinc has done well in their video. However, the students' instructions did not say anything about evaluating the work but rather asked them to expand on it in light of the curriculum to create a mind map as a resource for their upcoming exam. In evaluating the work as "good," she positions her group as one holding epistemic authority—as knowing how a good disciplinary conversation regarding the topic appears.

Rhonda elaborates on the positive aspects of Divinc's video by agreeing with some of their contributions (lines 14, 16, and 18), receiving affirming nods by her group members. Finally, in lines 22–31, Ruby resolves their struggle to provide constructive criticism when she states their opinion that "we thought (...) one could have gone a bit deeper into the case," "looked at other ways to solve the problem," and "gone a bit more in-depth with the literature." At an interpersonal level, addressing suggestions for improvement as something

“one” could do (instead of using the pronoun “you,” as previously done by Rita when providing positive feedback), combined with hesitation and long pauses, could indicate that they are uncomfortable when providing criticism or negative feedback to Divinc. They seem to solve the issue by establishing a distance from whom the active agents of change have to be to improve the work—not necessarily the students in Divinc but any “one” discussing the case. The literature mentioned by Ruby “on the side here” was placed in a reference list in a separate post on the mind map but not discussed in Divinc’s video (line 31). Note that Roger, who was the most engaged in sharing his opinions about Divinc’s video after having watched it, is completely silent. During their video response, however, his prior opinions shared with his group members concerning what Divinc could have done differently were conveyed by other group members. This was often the case across the groups.

A few moments later in their video response, Repobu revisits the case and comments how Divinc’s example of the excluded boy has become a resource for their own work and continues to make suggestions for how they would approach the issue themselves. In doing so, they model how Divinc could have approached the case themselves. At the end of their video response, Rhonda praises Divinc’s work by giving a thumbs up and saying, “good work.”

In short, Repobu used Divinc’s video dialogue and the story about the excluded boy as an opportunity for evaluation, feedback, and reinterpretation. From the perspective of whole-class meaning making, Repobu drew on individual and group expertise (both their own and Divinc’s) and created a distance to whom the active agents of change had to be, making their comments relevant across student groups in the mind map.

Mehels’s video response to Divinc

Repobu was not the only group sending a video response to Divinc. In another group room, Mehels—Martha and Mona—worked on the same task. Earlier, they had made a video about mental health and life skills before watching the other groups’ videos in the mind map. While watching, they also found Divinc’s video interesting and decided to create a video response.

In the following episode, we enter into their video response. Martha and Mona are sitting next to each other, both facing the camera. They converse about the relevant theoretical concepts Divinc could have applied in their video, drawing on the example about the excluded boy. Just as the students finish, Rita from Repobu walks into the room. She enters behind the girls, making herself visible to their video recording. She looks at the camera and smiles as she walks by. So far, the groups have only been able to engage in the corridors; when performing the disciplinary task, they have done so separately in group rooms.

Excerpt 4 Mehels's video response to Divinc

1 Rita



((Walks into the room, behind Martha and Mona, while smiling and looking at the camera))

2 Martha Eh: and then we thought a little bit about because we have seen eh your video (1.0) A:nd you do: mention this about the quiet students for example (0.9) and then the bullying in kindergarten and school becomes a bit: relevant

3 Mona



((Holds up relevant course book and nods. Martha points towards it))

4 Martha In relation to or you mention that about being introverted (1.0) what actually that is

5 Mona ((smiles at Rita placed behind the camera lens))

6 There one could have used subject terms as well from (0.9) from >yes< that it is both from the book here and Jore and (0.2) that which they call internalizing difficulties externalizing difficulties and then they call it (0.5) introverted students or students acting out (0.3) that would have been interesting (1.4)

8 Martha Eh:: and then you included the nice example <tha:t eh::m (0.7) I think Dari:a mentioned> (0.6)

9 Mona Yes

10 Martha Eh: from from the school context (0.6) and then we thought about that about mental health

11 Mona ((Holds up relevant course book))

12 Martha It was rather (0.4) we were talking a little bit about it that it was a very (0.9) very unfortunate way to try and solve that problem (0.8) Eh::

The presence of Rita in the first line creates an interesting situation from a spatiotemporal perspective. For one thing, Rita's looking at the camera and smiling and Martha's hesitant "eh:" indicate a disruption to the established pattern of only interacting through the mind map. Until now, the group's physical presence, despite being in adjacent rooms, has not really been an arena for whole-class interaction in the current task. Rather, the mind map itself is the site for whole-class discussion. Rita's presence breaks the illusion of Mehels solely talking to Divinc, as a peer from Repobu is present, challenging the

transparency of the video-based mind map activity. In addition, and perhaps most interestingly, Rita's presence provides a sense of time travel. To a later viewer of the mind map, Rita might be occupying two (or more) sites concurrently, raising questions of chronology. As Rita settles down in a seat off-camera, Martha continues, "and then we thought a little bit about because we have seen your video." Here she is referencing two different points in time: when Mehels watched the video and the outcome of their talk after having watched it and before recording their response. In doing so, she paraphrases and shows that Mehels are familiar with what Divinc have talked about in their video, manifesting it as grounds for the upcoming evaluation. She continues to recollect Divinc's video and connects it to the relevant literature in their curriculum: the bullying in kindergarten and school. As she does so, Mona holds up the book in question (line 3). Martha continues before mentioning the example about the excluded boy. The girls connect the example to mental health literature, as they describe how they have already talked about it as a very unfortunate example (lines 8–12). They, thus, position themselves epistemically in how they demonstrate that introducing an example is not enough because the literature needs to be applied as well.



Following this exchange, Mehels continue to reference the literature and terminology from their earlier work regarding mental health and life skills (their video dialogue uploaded to the mind map). Mona and Martha draw on their own expertise and apply it to Divinc's topic of discussion. Rita then enters the conversation by introducing a concept discussed during Repobu's earlier discussion. As Mehels uploads the video response to the mind map, it is evident that the three groups' meaning making has influenced the conversation now shared with the class.

This episode displays that even though the general chronology of the video-based mind map activity involved groups being in dialogue with groups, the vertical (Ludvigsen et al. (2011)) moment-to-moment analysis shows that when individual students break this illusion it does not seem to disrupt Mehels' conversation. Mehels continue their account and position themselves epistemically through introducing specific theoretical concepts and relevant literature. In associating the cluster "Diversity and Inclusivity" to "Mental Health," Mehels also offer classmates a connection between concepts for their upcoming exam, displaying a dynamic relationship to their negotiation of meaning in the subject.

Divinc talking about video response from Repobu

In the final episode, we revisit Divinc. The group has just finished watching Repobu's video response to their work, and Daisy starts by describing her opinion of it. They orient their talk to the past; both their own video dialogue and their peers' video response to it.

Excerpt 5 Divinc talking about Repobu's video response

- 1 Daisy No I take what they said (0.3) but then I also think that if we had taken all this into it then we would have talked for over half an hour (0.5)
- 2 Dennis Eh: yes (0.2) we would have
- 3 Daisy <We we said we said that we would not talk so long (0.4)
- 4 Don
- 
- ((looks at his computer and moves arrow around in the mind map as he speaks))
- 5 Daisy [but] [So] then there is a reason for us not getting everything
- 6 Don But yes: (0.3) we are the only ones who are under 10 minutes though (0.2)
- 7 Daisy Yes
- 8 Don So we could <have [spoken a little longer> ((laughs slightly))]
- 9 Daisy [>Yeah yeah< but we did say that like] that we didn't want to have that long because of- (0.7)
- 10 Don No no
- 11 (1.0)
- 12 Daisy Like that (0.2) we (0.3) it's not tempting to watch a half-hour video (0.8)
- 13 Dennis Yes, no we [haven't seen their-]
- 14 Daisy [When you can discus]s when you can discuss things yourself like
- 15 Daria <Yes like> we have started (0.9) a video
- 16 Don Mh:m
- 17 Daria And they have gotten good discussions out of that video (0.3)
- 18 Dennis [That is a]ctually eh::
- 19 Daisy [<Yes yes>]
- 20 Daria THAT IS THE POINT ((raises hand towards Dennis))
- 21 Dennis GOOD WORK YOU GUYS ((looks and points finger towards all group members))
- 22 Daria
- 
- YE:S ((claps and raises hands))
- 23 Daisy ((Slight laugh))
- 24 Dennis ((LAUGHS))

Daisy opens the conversation, as she states she “takes what they said,” indicating that she acknowledges Divinc’s input. Even so, she promptly says “if we had taken all this into it then we would have talked for over half an hour,” implying that the issue is video length rather than the topic of conversation or how they spoke about it, as indicated by their peers (line 1, Extract 1). Dennis agrees with her and, as Daisy goes on, she stresses “we we said that we would not talk so long” (line 3). Through her double use of the pronoun “we” she defends their approach and establishes joint accountability. As she speaks, Don is looking through the video-based mind map to get an overview and contradicts her with emphasis by saying, “but yes: (0.3) we are the only ones who are under 10 minutes though” (lines 4 and 6). Thus, he demonstrates a willingness to hear the feedback, receiving an affirming “yes” from Daisy (line 7). Don continues to elaborate on his perspective, as Daisy, in overlap, restates her position, cutting him off (lines 8–9). She is still concerned with defending how the group solved the task in relation to the video length, perceiving long videos as not

“tempting” to watch; she would rather they discuss things by themselves (line 9, 12, and 14). The long gaps leave room for her peers to acknowledge her perspective (line 9–15).

Based on their exchange so far, it is fair to assume that Daisy favors group level dialogues. Sharing her opinion could indicate that she is open to her peers’ reflections on or confirmations of the disciplinary dimension of the activity—the overall aims and nature of engaging in whole-class video dialogues. Daria then offers her thoughts when she highlights that they have “started a video” that peers got “good discussions out of” (lines 15 and 17). Dennis and Daria finish each other’s sentences, loudly stating, “that is actually (...) that is the point.” Dennis points toward his peers as Daria’s hand movement indicates a newfound awareness of the overall aims of the task as a whole, in how they zoom out on the “point” of it (lines 18 and 20). Here the group members defend their work and give an account of their perspectives. When facilitating whole-class dialogues, a general aim is for students to engage in and develop new insights based on each other’s shared contributions. Dennis compliments the group’s work (line 21) as Daria joins in with an emphasized “yes” and a loud clap before raising her hands in praise. Her gestures, accompanied by Dennis’s loud laugh, could indicate that their newfound perspective has released some tension caused either by the video response or their conversation about it. Notably, the group does not engage in great depth with the details in the feedback, such as the concepts mentioned or relevant measures for the case in question, as requested by Repobu.

After this exchange, the group moves on to discuss Repobu’s response to their case about the excluded boy. They compliment Daria for introducing it in their initial video and describe Repobu’s video response as a “good elaboration of us.” Daria then brings up a larger issue—that she perceived the video response as being given in the “form of criticism,” whereas Dennis suggests that they “look past it.” As such, Divinc’s conversation shifts from them justifying their choices to praising what they’ve done well before touching upon the video response being in the form of criticism. From a temporal perspective, this move distances the students from orienting toward the future and talking more in-depth about improving the quality of how they engage in dialogue about the disciplinary task ahead of their individual exams, as intended in the task design and suggested by their peers.

To summarize the narrative analysis, it becomes evident that the story Divinc introduces in their video about the excluded boy became a shared point of reference for the groups’ and whole class’s collaborative learning processes. As Repobu and Mehels center their meaning making around the story, they expand upon the prior understanding by offering alternative angles, introduce metaphors, ask rhetorical questions, and draw on the individual and group expertise, to some degree developed during the project work. By manifesting their dialogues into videos that are made available to Divinc and the whole class, they hold the potential to promote their collaborative learning process. Yet, by analyzing Divinc’s discussion about the response, we can observe that the video dialogue challenges their socioemotional process, hindering their work with the feedback given and, by extension, their learning process. While the mind map brought all the groups’ video-based collaborative learning processes together, it became apparent that receiving video response from peers based on their groups’ negotiation of meaning was sensitive work, as the student interactions affected both individual and group emotions. This corresponds with prior research that found that students, to a large extent, prefer and enjoy giving peer feedback to receiving it (Su and Huang (2021)). Divinc resolved their issues by acknowledging peers’ constructive criticism, supporting each other, complimenting individual contributions, and promoting group contributions as meaningful to the overall aims of the disciplinary task.

At the end of the project work, the instructor summed up the events during a whole-class discussion. The instructor highlighted that the video-based mind map now aimed to

function as a joint resource the students could use during the upcoming self-study week before the individual oral exams were to take place. The students offered positive feedback on the activity and described the task as meaningful and that it had helped them prepare for the exam. Finally, they wished each other good luck and headed off for final preparations.

Discussion

Our findings offer an in-depth understanding regarding how dialogues intersect and shape collaborative meaning making over time as mediated by the video-based mind map structure. The analysis demonstrates how participants coordinated their actions toward prior conversations and extended the present reality by engaging in future-oriented talk intertwined in and enabled by their use of the digital platform. As such, their interactional accomplishments were nested in retrospective, present, and prospective talk. While the students collaborated, they used their peers' videos as artefacts and engaged in dialogue across groups—dialogues that, in turn, were saved and made available to their peers and instructors. The mind map gave presence to the other groups in the students' face-to-face conversations, where the adaptive nature of the design and the software tool played a significant role in framing the groups' interactional accomplishments. Through close analysis of talk, we were made aware of how the temporal dimensions of the collaborative understanding of a knowledge domain interplay within a practice in which the students draw on emergent meaning making. Furthermore, we observed the dialogues expand beyond the immediate conversational setting to become part of a network of emerging dialogues in the larger student community, connected by the students' use of resources becoming shared points of references.

Space–time constellations supported by video-based mind maps

The analysis offers insight into a trail of small-group-level dialogues developing synchronously over time, all constituted and influenced by conversation at the whole-class-level learning activity mediated asynchronously by the video-based mind map. Our first research question asked “What kinds of space-time constellations are supported by video-based mind maps?” In the analysis, we see a variety of such constellations becoming entangled with each other. Perhaps the most apparent are the small group constellations in which the students are engaged in the present moment with synchronous conversations with each other as group members. This constellation resembles many other kinds of the small-group face-to-face conversations explored in the CSCL literature (e.g., Ligorio & Ritella (2010)). Sometimes, the students introduced memories of past events or expectations for the future, enabling the conversations to drift back and forth in time. Other times, the digital resources mediated the disciplinary content of talk offering shared points of reference. We observed the small groups engaged in the present moment with synchronous conversations with each other as group members. This arrangement, though, was disrupted by the act of making a recording for the other groups that were not physically and temporally copresent. As the participants shifted between referencing past events to the present discussions in this environment, they offered possible entry points for future discussions. The group members balanced the in-room dialogues and the dialogues with the other groups and the entire class in

the mind map simultaneously. They did so in different ways, as illustrated in the contrast between the more unstructured conversations held in rooms with only group members (and the researcher) and the video responses recorded for and shared in the collaborative display, indicating that these conversations demanded a different approach to communication for the participants. This “recording for others” context could be understood as a different kind of constellation with a distinct significance in which a group conversation is intentionally oriented toward other groups who will view the video in the future. This is still a synchronous conversation, but the turns unfold with participants being aware that the main audience will be listening in the future. When Mehels recorded a video response, they oriented and addressed their talk toward Divinc rather than the entire class audience, which created the impression of a group-to-group conversation in the mind map. This pattern was common across all the groups. Such arrangements can create tension, as in Excerpt 4 when Rita from Repobu entered Mehels’s space in the present, perhaps overhearing the video recording as it was made and potentially listening to it with Repobu in the future as an audience. All of these kinds of dialogues were still occurring generally at the small-group level. Zooming out, we can also see a kind of space-time constellation occurring between the groups asynchronously. This dialogue is mediated almost entirely by the mind map itself, where each “turn” is actually a recording of a dialogue. Looking solely at the video recordings in the mind map, we arrived at these nested dialogues in which an individual utterance can be part of a video dialogue that, in turn, serves as an utterance by another group at the class level.

We can question how alternative constellations could have impacted the students’ meaning making, such as the instructors becoming a greater presence by uploading their own contributions to the mind map. However, the disciplinary task aimed to prepare the students for oral exams where they were expected to stand their own ground to discuss the disciplinary matters in dialogues with others, placing the student dialogues in the foreground. The analysis demonstrated how the video-based collaborative activity held the potential to display how the students’ future discussion and thinking were influenced by their peers. For example, stories (experienced episodes), perspectives, metaphors, and rhetorical questions were introduced, mediating the present discussions within the groups; these were preserved as resources for future viewers of the videos. In line with Arya et al.’s (2014) study on video case discussions which displayed that in-service teachers were most able to support peers in knowledge-construction processes when they had prior knowledge about the content in the videos, other temporal dimensions were also already embedded in the mind map task design. Students were encouraged to use accumulated knowledge retrieved throughout the semester, as well as discuss their potential future work as teachers. Daria recalled an experience from her past, initiating the trail of video conversations across groups. In Ludvigsen et al.’s (2011) study, they found that patients use everyday experiences as resources and that students “take actions based on their interpretation of the artifacts and other students’ actions” (Ludvigsen et al. (2011), p. 118). In our analysis of connected dialogues, the story about the excluded boy exists as a resource on the horizontal dimension, emerging from Daria’s childhood. In that sense, her memory develops new meaning as a learning resource over time for the whole class. At the same time, through the vertical dimensions of the analysis, we see how the story is made the object of dialogue within and across groups, in which the same resource gains meaning across the two dimensions—or emerge as “gap-closing processes” in which the dimensions intersect (Ludvigsen et al. (2011)). In the current study, the creation of such objects transformed the collaborative meaning

making practice as students not only prompted their peers in the larger classroom community to consider building upon their contributions, but they also suggested possible discussion points for their upcoming exams and potential questions that could be asked by the examiners. The students were not instructed to evaluate each other's work, but they did so by offering their peers valuable input for the exam. Although our interest here did not lie in measuring the effect of the activity, we did notice that some students continued to work with the video-based mind map after the project work and during their preparations for the exam.

Stahl and Öner (2013) stated that we should consider designing CSCL environments that support the use of resources, as they found that the members modified or generated them, externalized in the community as verifiable knowledge. In the current study, the community level of analysis also became apparent by examining the way in which an entire class of student groups engage in the joint activity. In this case, we can see how this particular pedagogical design supported the dialogues to move across the group and whole-class levels simultaneously. A group could be in dialogue with themselves, building off of each other's ideas and responding to each other in meaningful disciplinary talk, while also directing this dialogue to other groups and even responding to earlier versions of themselves. We see the dialogues within the groups, across the groups, and collectively at the whole-class level contributing to the field of CSCL by expanding our understanding for dialogue as a mediational tool that moves across spatial and temporal dimensions.

Yet, some students demonstrated challenges in how to navigate this way of talking (Excerpt 3, line 4), indicating in the video recordings of their conversations that something was also at stake for the students, as the conversations moved from free and private group conversations to being manifested as whole-class transparent ones. Such features could be connected to the task design, for example, of the instructors having access to the mind map or the students' commitment to create high quality video dialogues. The analysis suggested that Rita in Repobu struggled with grasping the relevant features of talking in "video mode," though she repositioned her body toward the group members seeking assistance in resolving the issue. With the repositioning of her body and the accompanying gesture of pointing toward the camera while still looking at her group members, she created a stronger distance from the audience, demonstrating the challenges in traversing the levels of the small group dialogue and whole-class level conversation. In Mehels's video response (Excerpt 4, line 1) we observed a break in the illusion of the groups conversing with other groups as Rita entered the room and Mehels's video recording. Mehels's method of resolving the issue was to hold their fixed positions and continue their talk as before, indicating a clear conception of what was required to fulfill the task. In doing so, Mehels also refrained from the alternative of stopping and making a new recording, indicating that they understood the video dialogues to be naturalistic, free-flowing discussions, rather than re-recorded "perfect" versions that the task design did not intend.

Meaning making across levels in a network of dialogues

Our second research question asked "How do these configurations mediate meaning making across levels in a network of dialogues?" To address this question, it is worth applying a dialogic lens to the trajectory of the whole-class level. If we treat each video as a move within a whole-class dialogue between the groups, it becomes apparent how video-based

mind maps afford whole-class meaning making free from the traditional classroom's physical and temporal constraints. In Excerpt 2, we observed Repobu discussing Divinc's video. Following this, in Excerpt 3 from Repobu's video response recording, we observed that they were having the same conversation again, this time framing the content of their talk differently. Consequently, they were having the same conversation twice—the first time with each other in group and the second time directed to Divinc. This is also apparent for all the participants in the mind map activity. Subsequently, their video response functioned as a response to their first in-room conversation, offering the members of their own group feedback as they revised it. The individual members in Repobu framed the response as a mutual understanding as they took ownership of the other members' feedback and delivered it as the group's. As such, meaning making occurred in the revision and repetition of dialogues, where some of these dialogues were manifested in the digital platform.

An additional way to consider the mediation of meaning making in this practice is by looking at the whole-class dialogues in relation to each other. In the above analysis, we saw that the historical case introduced by Divinc (the childhood memory in line 3, Excerpt 1) became a shared reference point for the larger classroom community regarding how it was passed back and forth between the groups as a mediational tool for the entire class. If we are to treat this entire trajectory as a potential "dialogic exchange" (Baker et al. (2021)), we might consider Divinc's first move to be the initial presentation in an exchange. Repobu received this presentation, considered it, and explained how they found it relevant by expanding on the possible interpretations of the case. Through the dialogic exchange lens, this move can be thought of as a reaction, expressed in lines 22–29, Excerpt 3. The third element of a dialogic exchange, the ratification, adds complexity to the analysis. In Excerpt 5, in which Divinc received and discussed Repobu's interpretation of the childhood memory, we see that they were pleased to have this contribution acknowledged. We might interpret this acknowledgement by Divinc as a kind of ratification demonstrating the completion of a "unit" (exchange) of dialogic meaning making. This hints at a possible intersubjective understanding of the initial move. On the other hand, the asynchronous nature of this discussion, along with the fact that this conversation by Divinc was not recorded, means that Repobu was not made aware of Divinc's interpretation of their interpretation. Repobu can only assume that Divinc received their reaction in the way that it was intended. In fact, Divinc's defensiveness regarding the length of their video suggests that mutual interpretation was not fully achieved. As a result, this dialogic analysis at the class level poses a bit of a challenge. However, by zooming back in on the small group level, we can see how the individual moves were interpreted and iterated on.

We see this analysis as an important contribution to the research on dialogues in CSCL as it adds to the understanding of learning across levels and the balancing of small group interactions to whole-class discussions. A flexibility in levels is required to move back and forth between whole-class and small group understandings. Were we to solely examine the dialogic exchanges within a single group in this activity, we would miss many of the developing ideas within the class. At the same time, considering class-level exchanges to be back and forth moves between the groups (treating each video as a single turn equivalent to an utterance) misses out on the complexity of the unfolding interactions in the various group rooms as students engaged with the activity (not video recorded for the mind map).

The video-based mind map displayed the large-scale collaborative work representing the class's meaning making processes over a specific duration of time; however, it was also future-oriented in how the task design aimed for it to become a resource for the students' upcoming exam. In prior studies, the teacher attention and orchestration have been shown to be imperative for the successful interweaving of levels (White (2018); Stahl & Öner (2013)). Yet, the analysis presented illustrates how the instructor orchestration in the current design is more related to task design rather than procedural work throughout the collaborative activities, as the students often managed the shifts and connections between the levels themselves. The instructor was not present as the students engaged in dialogue; also, we saw an example of how a student strove to manage communicating across the levels on their own (e.g., Extract 3, line 4). Of course, it could also be said that the task and the mind map as a shared resource are, in fact, mediating these kinds of shifts. Prior studies have shown that combining collaborative pedagogies and video technologies can contribute to student engagement and support them in dialogue, discussing new ideas and applying new knowledge to change their teaching practices (Cattaneo et al. (2022); Ramos et al. (2021)). In the current practice, the use of video served several purposes—the video was embedded in the design of the activities by the manner in which the students created and shared the video conversations as a collective disciplinary task. In turn, the student created videos mediated verbal and nonverbal interactions with peers during their collaborative work, supporting the collaborative learning practice and influencing how the participants made meaning of and engaged in scholarly dialogue about their academic readings.

Concluding remarks

With this study, we contribute to CSCL perspectives on levels of learning (Stahl & Öner (2013)) and temporality (Ligorio & Ritella (2010); Ludvigsen et al. (2011)); we demonstrate how dialogues might move between levels of learning activity and how temporal orientations become entangled in student meaning making when mediated by video. Meaning making resources can both be rooted in the present, in-the-moment interaction while also contributing to longer developmental trajectories. Our study has been situated within a very specific video-based activity which makes these entanglements and orientations visible. At the same time, we hope that future CSCL work can explore nonlinear meaning making processes further. These might include implications for the treatment of video as a learning resource, on technology-mediated activity design more generally, and in terms of analytic points of view toward dialogue. At a practical level, the study also shows how this video-based mind map activity can provide educators the opportunity to facilitate whole-class and group work simultaneously, where students can orchestrate the activity and collaboratively learn from and with each other over time. Perhaps most significantly, the analysis shows that the access to and transparency in using shared video dialogues in this CSCL environment can afford educators insights into the manifested shared reference points and how these potentially stimulate the students' meaning making, which, in turn, can provide insights that can be used to coordinate and adjust one's teaching accordingly. Future CSCL research may delve deeper into how video-based mind maps can be designed to further support students confronting and negotiating their ideas with others and connecting small

group and whole-class meaning making. For future research it would also be interesting to explore similar video-based mind map learning activities across different educational settings as well as taking a more evaluative approach to video-based mind map design.

There has been a call for studies that design for variation in CSCL settings involving the open-resource choices of learners engaging in them and how such factors can implicate students' collaborative activities (Ludvigsen & Steier (2019)). This design-based research has shown that, as student groups engaged through video dialogues in both physical and virtual spaces over time, the students' contributions were expanded upon by peers becoming shared points of references as they traveled across and connected the small group and whole-class levels of learning. In doing so, their large-scale meaning making practice was distributed to all the participants, where the video-based mind map supported the interactional relationships between the groups and the collective. This analysis contributes to our understanding of the temporal and spatial aspects of students' meaning making in CSCL by introducing an interaction and narrative analytic approach to studying small group and whole-class dialogues enabled by the video-based mind map activity.

Appendices

Table 2 Transcription key

Symbol	Definition and use
[Word] [Word]	Overlapping talk
(1.2)	Time between talk
(.)	Brief interval
<u>Word</u>	Emphasis
wo::rd	Prolonged sound
?	Question being asked
WORD	Syllables or words louder than surrounding speech
°word°	Syllables or words distinctly quieter than surrounding speech
word-	A cut-off
>word<	Increased speaking rate (speeding up)
<word>	Decreased speaking rate (slowing down)
(word)	Uncertain words
((Movement))	Descriptions of embodied actions such as gesture or gaze

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