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Weaving together the past, present and future in whole class conversations: analyzing the emergence of a hybrid educational chronotope connecting everyday experiences and school science

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**ABSTRACT**

In sociocultural research, many scholars have studied the relationship between students’ everyday lives outside of school and classroom learning. This article contributes to this area by focusing explicitly on the timespace dimensions of meaning making in science education. We draw on Bakhtin’s notion of the chronotope to examine how students can become engaged in science learning through telling stories of personal relevance. We analyze an especially interesting example of a whole-class conversation, and show how students’ stories become resources in the co-construction of a hybrid chronotope in which multiple students are activated and engaged in science learning.

**Introduction**

In sociocultural research, there has been a great deal of interest in researching continuities and discontinuities between students’ experiences in classrooms and in their everyday life outside of school (Beach, 1999; Erstad & Sefton-Green, 2013; Leander et al., 2010; Silseth & Arnseth, 2011). The purpose of this article, is to contribute to this line of research by focusing explicitly on the timespace dimensions of meaning making. We analyze an episode of a whole-class conversation in a lower secondary science classroom where students and their teacher make meaning of science concepts and models explaining the functioning of the pancreas. By paying particular attention to the time-space dimensions of talk, we are particularly interested in how students’ everyday experiences and school science become dialogically related in practice.

In our case study, we use Bakhtin’s notion chronotope as an analytic heuristic. According to Bakhtin (1981), a chronotope represents the patterns of movement between sites and actions in time, where time thickens and becomes analyzable, and space becomes charged with meaning and responsive action. For Bakhtin, chronotopes in a novel furnish abstract ideas about, for instance, ethics and political ideology with flesh and blood – with concrete narrative constructions of emotionally and intellectually charged experiences for the characters in the novel, and potentially for the reader. In science classrooms, a chronotope emerges through teachers and students’ talk and action.

In our analysis, we distinguish between school science chronotopes and everyday experience chronotopes. In our case, these two types of chronotopes enter into dialogue and a new hybrid educational chronotope emerges in the classroom. In school science chronotopes, abstract meanings of science concepts and models are fixed across contexts. When abstract concepts are talked and written about, they become part of instructional strategies where students are expected to reiterate abstract meanings. In the episode we consider in this article, the school science chronotopes become dialogically related to everyday experience chronotopes, enabling students to engage with the topic of
pancreas and the related disease diabetes. The everyday experience chronotopes can be found in stories from their everyday life outside school that students tell during the whole-class conversation. Thus, the concept of chronotope works as a heuristic for analyzing how the time-space dimensions of everyday experience and school science become intertwined in the whole-class conversation.

A whole-class conversation constitutes an interesting case for studying interrelationships between everyday experiences and school science. It represents an ordering of time and space where everyday and educational time-spaces are not explicitly merged, in contrast to for example, field trips where students travel to more informal learning settings or inquiry-based learning where students are engaged in activities specifically designed to create connections between everyday and scientific understandings of scientific phenomena. In addition, many scholars underscore the challenges involved in making students participate in these types of educational dialogues (Myhill, 2006; Pimentel & McNeil, 2013; Sedlacek & Sedova, 2017). We analytically demonstrate how the interweaving of the different chronotopes gives abstract science concepts and models flesh and blood, enabling the teacher and students to meaningfully engage with difficult science concepts. In this article, we will shed light on the following research questions: How do stories from students’ everyday lives become resources for meaning making in whole-class conversations in science education, and what are the consequences for students’ participation?

Creating continuities across students’ everyday experiences and classroom learning

The learning in school should be continuous with that out of school. There should be a free interplay between the two. This is possible only when there are numerous points of contact between the social interests of the one and of the other. (Dewey, 1916, p. 358)

Dewey emphasized the importance of designing educational environments where the experiences in classrooms should “grow gradually out of” (Dewey, 1959, p. 23) everyday experiences. Inspired by these ideas, scholars in the learning sciences have analyzed the transitions and tensions between students’ multiple learning contexts. Studies have documented how the transitions between contexts can create new opportunities for learning, for instance, how everyday knowledge is mobilized in learning conversations in science classrooms (Barton & Tan, 2009; Furberg & Silseth, in press; Gutiérrez et al., 1999; Rosebery et al., 2010; Tsurusaki et al., 2013; Varelas et al., 2008). For example, Gutiérrez et al. (1999) demonstrated how the construction of hybrid language practices in a classroom community promoted learning; they followed a science unit over several weeks and found that the teacher encouraged students to use multiple linguistic and cultural resources when working on the subject of human reproduction. By contributing to the creation of so-called third spaces, in which the official and unofficial spaces of the classroom are bridged, the teacher promoted students’ reasoning and inquiry. In a design-based experiment, Rosebery et al. (2010) examined a science unit where learning activities where designed for explicitly connecting students’ everyday understandings with scientific explanations of the topic of heat transfer; they demonstrated that in the early phases of the project, students primarily mobilized everyday perspectives and understandings to explain the concept of heat transfer, but during the project and through teacher guidance, they started to blend everyday understandings with more scientific concepts and explanations.

Other studies have explored how objects that are familiar to students can be used as a means to support conceptual reasoning and inquiry. For example, Varelas et al. (2008) followed a teacher and group of young students working on the concept of density, where the students were expected to inquire about the characteristics of solids, liquids, and gases. They were provided with different familiar objects (such as a pencil, bar of soap, and drinking straw) as tools to think with, and the teacher orchestrated the students’ reasoning through the use of various discursive strategies. Together, this created a learning design where the teacher supported students’ learning of scientific concepts. Furthermore, in a project about food and health in science, Tsurusaki et al. (2013) examined how the objects and habits related to everyday food practices could be used to generate
critical awareness and create engagement; the study demonstrated how students’ everyday experiences with food practices and relevant data gathered at home, such as nutrition facts from important food items, became a starting point for inquiring into more scientific accounts of health and nutrition, which additionally induced positive changes in the students’ eating and drinking habits.

Research in the sociocultural tradition has shown some important benefits when it comes to invoking students’ everyday experiences when learning about science in school. However, less attention has been given to the time-space dimensions of whole-class conversations in science education where students’ everyday experiences are explicitly encouraged as resources for meaning making. One relevant study is Kumpulainen and Lipponen (2010) study of dialogic teaching in an elementary classroom. In their study, students visited a technology museum, a science center, and a forest, and the authors examined how resources from these settings were invoked in classroom dialogues. The authors provide interesting telling cases that show how students can refer to experiences gained from settings outside school during whole-class conversations in the classroom, thus creating classroom chronotopes where resources from students’ everyday lives become relevant. However, the authors do not pay attention to the time-space dimensions of students’ contributions and how classroom chronotopes emerge through sequences of interaction, nor the details of the interactional work carried out by students and teachers to realize hybrid classroom chronotopes. In our case study, we provide insights into these matters and provide a moment-by-moment analysis of how a teacher uses stories that students invoke to facilitate students’ engagement with science concepts and ideas, and how dialogic relations between school science chronotopes and everyday experiences chronotopes are created in and through interaction.

**Classroom chronotopes for engaged participation in science education**

Bakhtin (1981) defined the chronotope as “the intrinsic connectedness of temporal and spatial relationships that are artistically expressed in literature” (p. 84–85). For Bakhtin, chronotopes enable us, as readers, to make meaning of narratives and stories; that is, they are the organizing centers for the construction of meaning in a novel. A chronotope, such as the notion of a “road” or a “journey,” invoke plot structure, characters, and worldviews that together produce meaningful actions. Chronotopes give the novel’s abstract elements “flesh and blood” (Bakhtin, 1981, p. 250), thereby making it easier for readers to engage with and make sense of the story.

In educational research, the concept *chronotope* has been used as a way of talking about and analyzing how participants engage in meaning making (Ritella et al., 2020). Chronotopes are intertwined with and co-constructed in social interactions; they are not just a backdrop for such encounters (Kumpulainen et al., 2014; Leander, 2001). At the same time, chronotopes are organizing centers for significant events and provide participants with the grounds for interaction. They are contextual resources for making sense of what is going on (Blommaert, 2015; Bloome et al., 2009). In classroom conversations, students and their teachers must coordinate their interests and perspectives in relation to the content of the talk (Jornet & Roth, 2015; Silseth & Arnseth, 2016) and through the chains of interactions they co-construct the chronotopes that make this possible (Ritella et al., 2017; Van Eijck & Roth, 2010).

In what has been called conventional classroom chronotopes, the sequences of instruction and the curriculum are to a large extent predefined and controlled by the teacher (Matusov, 2015). Students find it difficult to make sense of abstract concepts and experience school science as having little relevance to their own lives and interests, something that results in less willingness to engage in science activities (Brown, 2011; Russ & Berland, 2019; Tabak & Baumgartner, 2004). In our case, we identify a classroom chronotope that gives abstract science concepts and ideas flesh and blood, thereby making it easier for students to engage with the content and activities during lessons.
According to Brown and Renshaw (2006), the notion of the chronotope provides a perspective on the classroom as a dynamic context constituted through “the interaction of past experience, ongoing involvement, and yet-to-be-accomplished goals” (p. 249). Thus, the concept of the chronotope is well-suited for analyzing how students’ stories from their everyday lives can become resources for engaged science learning. Rosborough (2016) has stressed that in Bakhtin’s definition of the chronotope, meaning making “included how development from past life activities come together with present actions in a complex interrelationship and interaction” (p. 125). In situations of meaning making in the classroom, time-space dimensions of students’ past experiences become resources for making sense of ongoing activities. Furthermore, Linell (2009) argued, “In narration and memory, different chronotopes are often brought into a dialogical relation, for example, between the narrated world, the remembered events, in its time/space, and the situation of narration in its meaningful and meaning-making time/space” (p. 244). From a dialogic perspective on meaning making, every utterance relates to previous utterances and projects or anticipates possible responses (Williams & Ryan, 2020). The past, present, and future are the intrinsic features of every utterance, and the chronotope connects the temporal features of dialogue with the spatial. Focusing on stories that students tell from their everyday life, when engaging with subject matter in school science, and how a teacher uses these stories in instructional work, enables us to examine how school science chronotopes and everyday experience chronotopes are brought into dialogical relations that contribute to the emergence of a hybrid chronotope and what this means for student participation. Chronotopes become visible in and through how the participants create meaning, but they can also be inferred from interaction. The historical and structural dimensions of activities come together in and are reconfigured, expanded, and constituted through how people use language (Blunden, 2010).

As we will demonstrate in our analysis, the stories students tell and their dialogic relation to science concepts, as made visible in textbooks, models, and the teacher’s talk, together constitute a hybrid chronotope that gives the abstract science concepts flesh and blood. The ways students recall and describe the people present, the characteristics of the situation, what happened to the characters in the situation, and the teacher’s orientation to these stories, together create opportunities for engagement. Our primary unit of analysis is sequences of interaction, in which the students and their teacher make meaning of science concepts and models explaining the functioning of the pancreas, and the hybrid chronotope constitute the grounds for interaction and are constituted in interaction.

**Empirical setting and methods**

**Case description**

A whole-class conversation represents one of the most common interaction patterns in classrooms (Alexander, 2004; Wells & Arauz, 2006). Studies have demonstrated the potential of whole-class conversations since they might provide the teacher with opportunities to answer questions, facilitate shared meaning making among students, and publicly demonstrate methods of reasoning and explaining (Howe et al., 2019; Rødnes et al., 2021; Wells, 1993). Even so, several studies have documented that it is often challenging for the teacher to engage the entire class in such conversations. Students might be reluctant to talk in class, the classroom culture might not allow for productive uses of whole-class conversation, and teachers might lack the necessary skills to support productive classroom dialogue (Cazden, 1988; Mehan, 1979; Myhill, 2006; Pimentel & McNeill, 2013; Sedlacek & Sedova, 2017).

The episode of whole-class conversation we analyzed is rich in terms of the amount and character of student contributions. The episode is from a lesson on the hormone system and the function of the pancreas, and several students entered into dialogue with the teacher and their peers about the topic. We analyzed the interactional work that realized this conversation, looking at the stories that the students told and how those stories were taken up and responded to by the teacher. The entire episode lasted for approximately 12 minutes and was extracted from a larger corpus of video data collected in
the project Tracing Learning Outcomes across Policy and Practice. The episode started during the introductory phase of the lesson. The students were in the ninth grade, and the teacher was an experienced science teacher. The organization of the classroom was rather traditional, and as can be seen in Figure 1, the students were placed in rows facing the teacher, who was standing in front of the whiteboard during the whole-class conversation. A model of the pancreas that was projected on the whiteboard in front of the class is enlarged in the figure.

**Analytical procedures**

Video records of the whole-class conversation enabled us to identify interesting sequences of student–teacher interactions that together co-constituted a specific episode of learning and teaching (Derry et al., 2010). We will first briefly describe the methodological principles that have informed our study, before we describe the unfolding of the analysis in more detail.

Our point of departure was to look at how different chronotopes became dialogically related (Ritella et al., 2020). In our work, the sequentiality of action and meaning making is an important analytic principle. Utterances are dialogically related in the stream of talk in interaction. Having said that, the meanings of utterances also depend on the meaning potentials of the concepts and categories used. We were particularly interested in investigating how students used and referred to concepts and categories about the issue of diabetes, blood sugar and the pancreas and where these categories came from. Here, tensions and connections between everyday and school science chronotopes became visible and analyzable. Second, everyday experience chronotopes can be inferred from the stories participants tell – in the time and space categories used and in descriptions of the unfolding of experienced events and the participants present at the scene. Finally, the physical and semiotic ordering of the classroom become data through careful observations of the setting, but also in how participants orient to features of the environment in and through their talk. The school science chronotope is available in text books, in the models on the whiteboard, in the teacher talk, and in other resources available.

![Organizational Figure 1](image-url)
In our analytical work, we zoomed in on specific sequences where students introduced stories from their everyday life. Then, we engaged in a detailed analysis of interaction to examine how students and teachers co-constructed meaning (Hall & Stevens, 2016; Jordan & Henderson, 1995). Even though it is not easy to define when a sequence of interaction begins and ends, since sequences of interaction stand in dialogic relationships to prior and future sequences (Marková & Linell, 1996), in this study a sequence was defined as an interactional interval where the student stories became a topic in the conversation. The analysis of the excerpts followed a two-step process, which can be called a first- and a second-order analysis (Linell 2009). First, we carefully examined how the students and their teacher sequentially oriented toward each other’s utterances and built on each other’s contributions. Second, we brought in perspectives and concepts from the theory section for analyzing how the hybrid chronotope emerged during the whole-class conversation. Here, we were concerned with how tensions and connections between everyday experience and school science chronotopes became visible in the interactions. By examining the content of the students’ stories from everyday life and the teacher’s more domain specific accounts of the pancreas, insulin and diabetes, and how the students and the teacher oriented to each other’s contributions, we were able to show how the school science chronotopes and everyday experiences chronotopes became dialogically related in ways that enabled engaged participation. The transcription convention was based on a modified version of Jefferson (2004) (see the Appendix for transcription conventions).

Creating dialogic relations between students’ everyday experiences and school science in a whole-class conversation

In the following analysis, we examine in detail how the interlocutors collaboratively created an emerging classroom chronotope moment-by-moment, where school science chronotopes becomes dialogically related to the everyday experience chronotopes, in ways that seem to motivate and support student participation in discourses about complex scientific topics, issues, and concepts. We analyze four sequences that follow each other in a trajectory, showing the diversity of the emotional orientation in students’ stories: personal experiences of (i) a friend suffering from diabetes, (ii) stories from the media, (iii) reading scientific texts, and (iv) soccer practice. In the episode, the students gradually contribute toward building a common collection of stories that work as resources for meaning making in the school science classroom.

A friend’s suffering from diabetes

The first sequence is from the introductory phase of the lesson. The teacher asked the students to pay attention to a model of the pancreas in the textbook, and displayed an image of the model on the whiteboard (Figure 1). The caption under the image said, “The pancreas produces the hormones insulin and glucagon. Insulin reduces the amount of glucose in the blood, while glucagon increases the amount of glucose.” Then the teacher invited the students to explain the model. As displayed in Figure 2, one of the students immediately raised his hand and told a story about his friend with diabetes, which became a starting point for the emergence of a hybrid chronotope in which school science and students’ everyday experiences became intertwined.

As a response to the teacher’s question, Tim first replied that the model has something to do with the system of the pancreas (line 3). When the teacher acknowledged his contribution (line 4), Tim moved on and shared some of his insights about diabetes (a disease that can be caused by malfunctions in the pancreas leading to a decrease in the production of insulin) and what it means to suffer from this disease, something he had learned from his friend who suffers from diabetes. First he oriented to the connection between diabetes and blood sugar in the body and made visible that for people suffering from this disease, something is at stake (lines 5–6) and that this also relates to the different levels of blood sugar in the body (line 8). The teacher acknowledged the relevance of his story, but also challenged him to elaborate (lines 9–
10). In his response, Tim provided a more elaborate account of the relationship between blood sugar and insulin and the effects on the body (lines 11–16). He also explained that if you have diabetes, you must use specific instruments and tools to monitor your blood sugar levels (lines 16–18). When Tim explained that he knows this because his friend has diabetes, the teacher once more acknowledged that these experiences and insights are both valuable and relevant.

Tim’s story and the teacher’s acknowledgment of the story contributed to the emergence of a hybrid chronotope that provided resources for making sense of the scientific model of the pancreas. The story about his friend connects the explanation to personal experiences. It was made clear that Tim’s friend’s condition requires him to use different equipment to deal with the disease. We can infer that diabetes constitutes an important part of his friend’s life, and that Tim has been in situations where he witnessed his friend using this equipment. His friend enabled Tim to learn about the complexities and practicalities of living with diabetes, and the feelings and emotions that populate such time-spaces. The time-space giving meaning to illness as an everyday experience – experiences of what diabetes actually can mean in everyday life – provide flesh and blood to make meaning of the abstract scientific model that the class is oriented toward. Experiences from the past are recruited in the present, enabling Tim – and maybe his fellow students in the classroom – to make meaning of the pancreas and its functioning. Even though Tim was the only student contributing to the dialogue, he made available a personal story as a resource for meaning making. The everyday experience of illness chronotope entered into dialogue with the abstract school science chronotope, and the story about struggle and hardship provided flesh and blood for making sense of the model about the pancreas, but also diabetes as both an everyday and scientific phenomenon. As the conversation continued, the number of student contributions increased.
Stories from the media

In the next sequence, another student, Bill, shared a story about something he watched on TV. From our observations, we had the sense that Bill seldom participated in science conversations, but it seemed that Tim’s story and the teacher’s response triggered him to participate. In the excerpt (Figure 3), the teacher explained how everything we eat is transformed into sugar – into energy that the body needs. As a response to the ongoing conversation, Bill shared a story about how to deal with low blood sugar levels.

Bill told a story about something he had watched on TV about how to manage low blood sugar levels (lines 1–4). He told the class about how you could use sugar sachets to quickly increase low blood sugar levels. The teacher acknowledged his contribution, but also signaled that he did not quite understand the example and challenged him to explain and elaborate (line 6). When Bill provided a more elaborate account (lines 7–9), the teacher acknowledged his contribution and compared Bill’s example to “soda pops” (line 13). In his response, Bill gave a quite concrete and tangible account and explained how to use the sugar sachet: “tear off the top and pour the sugar in you” (line 16). In his final move (line 17), the teacher offered a re-formulation to clarify what the student had just described.

We see how a student’s past media experience and a vivid description of the use of sugar to manage low blood sugar levels (also called hypoglycemia) was introduced into the ongoing whole-class conversation. The sequencing of the story and what happened to persons in the story made visible a particular cause-and-effect relationship. That is, the connection between sugar and blood sugar levels in the blood was made available as a resource for meaning making. In his story, Bill indicates that he, while watching TV, had witnessed how people managed low levels of blood sugar in their bodies. The episode he watched on TV, constitutes a chronotope for understanding the everyday experience of low blood sugar levels and how it can be managed. This is similar to the previous story, but here it is not necessarily related to the experience of having diabetes. Experiencing low blood sugar levels is more generic. Bill’s story about his media experience in the past became a resource for engaged meaning making in the present, and it points to an emerging future chronotope where everyday experiences and school science concepts and models become dialogically related. This emerging chronotope is built by adding a series of stories that together provide resources for making sense of the school science. The intertwining of everyday knowledge and experience with school science concepts and models provide students with resources for dealing with and understanding the phenomenon of low blood sugar levels in their future everyday lives. How to help people experiencing hypoglycemia is picked up by another student later in this emerging classroom chronotope (as seen in the fourth sequence: Soccer practice).

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Figure 3. Stories from the media.
Reading scientific texts

As the whole-class dialogue about the pancreas continued to unfold, we observed that more students were eager to participate in the conversation and that the number of hands raised in the classroom continued to increase. Then, as can be seen in Figure 4, another student, Mary, introduced a more scientific account into the conversation. The students had been encouraged to read about the topic in their textbooks, and they had immediate access to these textbooks. As a response to Tim’s story and account of how to deal with low blood sugar levels, references to scientific knowledge and concepts from the textbook were made explicit by Mary.

As seen in lines 2–3, Mary pointed out a contrast between the concept as used in the book and the concept as used in the previous classroom talk. Thus far, the students had been using everyday language such as “blood sugar” to talk about processes in the body. By referring to the textbook, Mary introduced more scientific concepts, and the teacher acknowledged that glucose is a more scientific term. He reformulated Mary’s contribution by stating that glucose is a term describing the type of sugar existing in the blood stream (lines 4–5). Then, Mary contributed with a lengthier account, where she introduced the concept of glucagon and provided a scientific account of the central concepts and processes explaining the functioning of the pancreas. Glucagon is a hormone that stimulates the liver to release glucose. She provided a detailed account about an important quality of insulin, that is, that it enables the use of glucose in the blood (lines 11–12). The teacher acknowledged the relevance and importance of Mary’s account.

In this moment of the whole-class dialogue, the bodily processes in the pancreas described in textbooks became an important resource for meaning making. Mary’s contribution represents a school science response to the more everyday and emotional experiences by Tim and Bill. She presented a more scientific interpretation of the concepts glucose and insulin to the whole class, creating a dialogic tension between the everyday experience chronotopes and the school science chronotopes. This became a resource that enabled Mary and the teacher to orient the class toward more scientific explanations. Her past experiences with science encountered through reading the textbook became woven together with the time and space of the present, along with the more personal stories from Tim and Bill, charging the emergent hybrid chronotope with a rich reservoir of resources available as potential resources for meaning making. Everyday stories constitute emotionally engaging accounts that enable the students to connect to the science and perhaps gradually develop their understanding through engaged participation in the classroom. The dialogic relation between the everyday and the scientific constitutes an opportunity for engaged meaning making that is less abstract and decontextualized.

![Figure 4. Reading scientific texts.](image-url)
**Soccer practice**

In the final sequence, we look at how a story from soccer practice was mobilized and became part of the emerging classroom chronotope. Leisure activities are situated in social practices, where students participate with peers who share similar interests, and stories from such activities represent personal experiences. The class continued to discuss and make meaning of the pancreas, insulin, and diabetes, and as shown in Figure 5, yet another student joined the ongoing conversation. Daniel had not participated earlier in the episode, but inspired by how others shared stories, he told a story about a dramatic event he witnessed during soccer practice some time ago.

As seen in lines 1–2, Daniel started to tell a story about something he experienced during soccer practice when he was younger, when something dramatic happened to his coach. When the teacher acknowledged the relevance of his contribution, Daniel continued and told a vivid story about his coach, who was suffering from diabetes; one day at the soccer field his coach had a hypoglycemic attack, collapsed, and started to cry (lines 4–5). Daniel also mentioned another coach who was present on the field that day who helped the suffering coach by offering a sandwich to mitigate the effects of his attack. Then, in lines 11–14, the teacher built on Daniel’s story and related it to processes in the body, the need to increase the level of blood sugar if it is too low, and that food is a way to achieve this. As a response to Daniel’s story and the teacher’s orientation to bodily processes and ways of dealing with low levels of blood sugar, Tim reentered the ongoing dialogue and once more referred to his friend and mobilized his experiences pertaining to the issues presently being discussed (lines 15–19). Their stories share similar features about cause-and-effect relationships between low blood sugar and eating food or sugar. Daniel’s story was even more dramatic and emotionally charged because it involved an adult falling on the ground crying. This emotionally charged chronotope giving meaning to the story of his coach’s experience of hypoglycemic attack, constitutes a powerful resource for meaning making in the emerging classroom chronotope where everyday and schools science chronotopes interrelate.

In this final sequence of the emergent hybrid chronotope, we can see how the story about the suffering coach provided the teacher and students with resources for making meaning of diabetes and complex bodily processes. In the story, Daniel gave an eyewitness account of a real person who suffered from a hypoglycemic attack. Here, a person that we might assume meant a lot to Daniel in this period of his life, laid down on the grass and cried, but also received help from another person present. This chronotope constitutes a resource for making sense of what it means to suffer from diabetes, and how you can help and support people experiencing attacks. The chronotope giving meaning to

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1. Daniel: When eh: yes when I was younger I went to soccer practice
2. and I had this coach,
3. Teacher: Yes,
4. Daniel: And he had that [diabetes] (0.3) and he suddenly suddenly
5. laid down on the ground and started to cry,
6. Teacher: Yes,
7. Daniel: And then another coach came with a sandwich with sausage
8. (0.2) and he had to eat that.
9. Teacher: Had to eat a sandwich yes (0.4) yes,
11. Teacher: Yes bu:t (0.1) that’s what helps because (0.6) if you have
12. too little sugar in your blood (0.6) then we have to increase
13. the level (0.3) and it is through the food we do that (1.4)
14. yes,
15. Tim: Eh: when my friend has low levels of blood sugar it’s like
16. (0.5) he gets really exhausted he gets really tired (0.4) he
17. gets like get stomach pains and the like (0.6) and then we
18. just have to (0.3) go back to the boat and give him a lot of
19. candy and stuff.

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**Figure 5.** Soccer practice.
hypoglycemic attack as an everyday experience provide flesh and blood to understanding what diabetes can mean in everyday life. It contributed to an emotionally charged classroom chronotope, creating an opportunity for the students to become emotionally engaged with the subject matter. Thus, the everyday experience of hypoglycemic attack chronotope entered into dialogue with the abstract school science chronotope, something that provided flesh and blood for making sense of hypoglycemia as both an everyday and scientific phenomenon. The teacher built on Daniel’s story and used it as a resource for orienting the entire class to the importance of having the right level of blood sugar and how one can manage low blood sugar and provide help. Thus, the insights and knowledge about how to handle and support people who suffer from hypoglycemic attacks is a resource that can be used by the students in new chronotopes in their future lives. In addition, the everyday and scientific accounts of blood sugar and diabetes became dialogically related, providing a framework for making sense that might spark engagement in seeking more scientific explanations in the future.

**Discussion and concluding remarks**

In the current article, we have examined how stories from students’ everyday lives become resources for emotionally engaged participation in whole-class conversations. Through an examination of different interactional sequences in a whole-class conversation where the teacher and his students talked about the pancreas, insulin, and diabetes, we showed how the chronotopic features of their stories contributed to creating an emerging hybrid chronotope where everyday and scientific explanations and accounts became dialogically related, that is, they challenged or informed one another, without scientific concepts necessarily replacing everyday understandings and experiences as some kind of conceptual change.

Previous research has shown the difficulties associated with engaging students in whole-class conversations (Cazden, 1988; Mehan, 1979; Myhill, 2006). For instance, many students might be reluctant to participate verbally in these types of educational dialogues, because these discussions are experienced as challenging, both cognitively and emotionally, and teachers might find it challenging to include and manage the different perspectives, contributions, and interests of their students in these conversations (Pimentel & McNeill, 2013; Sedlacek & Sedova, 2017; Snell & Lefstein, 2018). Our chronotopic analysis demonstrated that many students contributed to the whole-class conversation, because their stories were acknowledged as relevant contributions to dialogue and they were all held accountable, which is made apparent in the way the teacher requested elaboration and clarification. Their stories became meaningfully integrated in the ongoing dialogue about bodily processes related to the pancreas.

Our chronotopic analysis also showed how students can be enabled to engage with science concepts through storied life-world experiences. The importance of establishing classroom practices where students are able and willing to engage in the academic discourse has been emphasized in the learning sciences (Brown, 2011; Russ & Berland, 2019; Tabak & Baumgartner, 2004). To become members of a classroom learning community, students need to participate in the science discourse and find ways, in dialogue with teachers, to interact with concepts, ideas, perspectives, and models that at first seem abstract and difficult to grasp. According to Bakhtin (1981), the chronotope gives abstract elements flesh and blood. In our case study, everyday experience chronotopes are resources for making sense of the experience of disease or pain. It is precisely the time-space features of these everyday experiences, the vivid descriptions of the place, the people present and what happens to them that matters. In the classroom these everyday chronotopes become crucial resources for emotionally engaged meaning making of how these phenomena can be explained more scientifically.

Chronotopes are constituted in and through social interaction, but through the interactional efforts of interlocutors, they become organizing centers for the events and contextual resources for meaning making (Blommaert, 2015; Kumpulainen et al., 2014; Leander, 2001). The chronotopic analysis showed that the teacher’s orientation to the model of the pancreas and the student’s response to this orientation and invitation to engage with the model contributed to
establishing a hybrid chronotope that became a contextual resource for all the participants present attuning them to the possibility of recruiting storied life-world experiences as legitimate ways of participating. The students mobilized different types of stories and narratives, that is, they found personal ways into making sense of the more abstract model of the pancreas. The hybrid chronotope taking place in a school science lesson that we have analyzed is characterized by how multiple resources are talked into being and how the past, present, and future come together in social interactions.

The analysis showed that the students were enabled to engage emotionally with the subject matter. Previous research has documented that mobilizing students’ everyday knowledge and experiences support student participation when learning science (Kumpulainen & Lipponen, 2010; Rosebery et al., 2010; Tsurusaki et al., 2013). For example, studies have shown that everyday knowledge can be invoked to make science more tangible and easier to deal with, and how objects that are familiar to students (such as soap, drinks, food) can be used as resources to support conceptual reasoning and inquiry. The present study builds on the insights from these previous studies but also extends previous findings. By specifically looking at the time-space dimensions of students’ contributions, and the interactional work carried out by students and teachers to realize the emergence of a hybrid classroom chronotope, we have provided knowledge about and insights into how dialogic relations between school science chronotopes and everyday experiences chronotopes contributed to engaged participation for the students. Bridging everyday experiences and school science can provide for more engaged meaning making, but instead of seeing this as cognitive development, where more scientific concepts replace everyday concepts, as the voices become visible in classroom talk, we have demonstrated how they interanimate one another. That is to say, the chronotopic features of everyday events became resources for making meaning of science concepts and vice versa: science concepts became resources for making meaning of everyday events.

This interanimation is not simply a revoicing strategy or a contextualization of abstract concepts. Only referring to interests and discourse that are familiar to students from their everyday lives, such as music, movies, TV series, and games, is often not enough to engage students in science learning. Such references need to be coupled and intertwined with science content in meaningful ways (Furberg & Silseth, in press; Silseth, 2018). In our analysis, everyday experience chronotopes and more abstract school science chronotopes became intertwined in and through social interaction in the hybrid classroom chronotope where the everyday and the scientific become dialogically related. In and through the intermingling of stories from everyday life and references to scientific explanations and models, the tensions and connections between the voices created opportunities for emotionally engaged participation. The stories involved different characters who had roles in the stories being told; some of these were important persons in the students’ lives and those individuals’ experiences with different issues related to the topic of pancreas, insulin, and diabetes had a dialogic function in the whole-class conversations. In our case, the teacher orchestrated a learning situation where the everyday and scientific discourses were allowed to interanimate each other, and storied experiences became powerful resources for emotionally engaged science learning.

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References


**Appendix  Transcription conventions**

<table>
<thead>
<tr>
<th>Starting points of overlapping speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0.4) The time, in seconds, of a pause in speech</td>
</tr>
<tr>
<td>(.) A brief pause, usually shorter than 0.2 seconds</td>
</tr>
<tr>
<td>Falling pitch or intonation</td>
</tr>
<tr>
<td>Moderate rising pitch of intonation</td>
</tr>
<tr>
<td>High rising pitch or intonation</td>
</tr>
<tr>
<td>An abrupt halt or interruption in utterance</td>
</tr>
<tr>
<td>Underline Emphasized or stressed speech</td>
</tr>
<tr>
<td>::: Prolongation of a sound</td>
</tr>
<tr>
<td>((text)) Annotation of a nonverbal activity</td>
</tr>
</tbody>
</table>