Negotiating time-space contexts in students' technology-mediated interaction during a collaborative learning activity

Kristiina Kumpulainen and Antti Rajala, University of Helsinki

Abstract

In this article, we build on the notion of chronotope (Bakhtin, 1981) to investigate how students create and manage time-space contexts in their technology-mediated interaction during a collaborative learning activity, and what this means for their engagement and learning opportunities. Drawing on a dialogic approach, the study understands chronotopes as socially constructed time-space configurations with a specific narrative character that represent cultural practices, values and worldviews, and that operationalize the framing of the interactional situation and its actors. The empirical data derive from a case study of students' technology-mediated interactions (N=21) while collaborating in writing a school musical script in and out of school. The findings illuminate the complex and dynamic nature of students' technology-mediated collaborative learning activity that is temporally extended, spatially variable, and culturally diverse with respect to value systems and social practices. In sum, the study points out how chronotopes offer a useful conceptual heuristic for researching the creation and management of often contradicting time-space contexts in students' technology-mediated interactions intertwined with institutional, relational and personal spheres of interactional activity.

Keywords: technology-mediated interaction, chronotope, dialogic approach, learning across space and time

1. Introduction

Digital technologies and mobile devices are transforming formal educational practices that extend across space and time, blurring the traditional boundaries of learning in school and out (Kumpulainen & Mikkola, 2014a; Erstad & Sefton-Green, 2013). Recent research is increasingly documenting new technology-enriched socially shared learning activities that mediate students' engagement and learning opportunities across contexts. In these new technology-enriched infrastructures for learning, many of the

traditional dichotomies concerning formal/informal, online/offline, and teacher-led/student-led activities have become more fluid and mixed.

For example, Wong and his colleagues (Wong, 2013; Wong et al., 2010; Wong & Looi, 2011) created and studied a pedagogical design framework for supporting students' mobile 'seamless learning' across contexts. The learning settings ranged from the formal school setting to more informal settings, such as the home, cinema, or streets. The students made observations and took photos in their daily encounters outside of school and associated these photos with the knowledge learned in the class. The students' photos and other learning products were then discussed online among peers and in class facilitated by the teacher. Over time, the students' learning was argued to move beyond acquisition of content knowledge to developing a capacity to learn seamlessly across contexts.

Similarly, recent studies have documented educational uses of digital tools and media that resemble students' leisure time activities, such as Facebooking and/or blogging (Lantz-Anderson et al., 2013, 2015; Vasbø et al., 2014; Vigmo & Lantz-Anderson, 2014). In these technology-mediated learning activities, students' different identities, interests, and discourses have been identified to intersect, creating both opportunities and tensions for students' engagement and learning opportunities (Erstad, 2014; Kumpulainen & Mikkola, 2014b). Research has also pointed out how traditionally structured time-space configurations of the school pose challenges for students' engagement and learning within such new infrastructures (Buckingham, 2007; Hietajärvi et al., 2014; Erstad & Sefton-Green, 2013; Ito et al., 2010).

These studies have shown that students interpret and experience technology-mediated learning activity in varied ways and these interpretations mediate what resources and discourses students consider appropriate for the tasks at hand (Erstad, 2014; Kumpulainen & Mikkola, 2014b; Lantz-Anderson et al., 2013, 2015; Vigmo & Lantz-Anderson, 2014). An example is the study of Vasbø et al. (2014) who investigated Norwegian secondary school students' engagement in a social media site that involved chatting with other students, writing blogs, and sharing videos. The study revealed that the students displayed varied learner identities and associated orientations to the social media site as a space for learning. School-oriented engagement involved a separation of the school space from other personally meaningful spaces. In contrast, out-of-school-oriented engagement involved drawing on everyday knowledge and personal experiences derived from spaces outside-of-school and connecting these to the school tasks.

Lantz-Anderson et al. (2013) study focused on students' interactions in an educationally framed Facebook group. The study unpacks how students merged the school subject of

language studies and the communicative use of language in their everyday life. It also shows that the conventional educational activity was resistant to being extended to incorporate non-school language use and that the conventional framing of the activity was sustained both by the teacher and the students. The results of the study highlight that creating extended time-space contexts for language studies involved conflictual negotiations about what counted as a legitimate framing of the activity and correct language use.

Overall, while there is increasing interest in the new technology-mediated infrastructures of learning that extend across time and space, researchers find it challenging to analyse how students' engagement and learning opportunities are enacted in and across contexts (Leander, Phillips, & Taylor, 2010; Nunes, 2006). At present, we lack theoretical and empirical accounts of how individuals and groups accomplish learning that is meaningful to them across settings and over time in relation to multiple cultural value systems, and how such learning is supported and/or hindered. Moreover, less attention has been given to investigating students' engagement and learning activities as negotiation and management of multiple space-time contexts (see also Ludvigsen, Rasmussen, Krange, Moen, & Middleton, 2011; Tuomi-Gröhn & Engeström, 2003). Consequently, research has called for the importance of taking a more holistic and nuanced perspective of the new technology-mediated infrastructures of learning that extend across space and time, and what they mean for diverse students' engagement and learning opportunities (Barron, 2006; Erstad & Sefton-Green, 2013). There is a need to account for how individuals and groups arrange and sometimes transform the conditions of their own learning in relation to their expectations, interests, concerns, and available resources, as well as how such displays of agency are hindered, resisted, and/or developed.

In this article, we will address the challenges of describing, defining, and analyzing technology-mediated learning activities across time and space. Namely, we will build on the notion of the chronotope (Bakhtin, 1981) to investigate how students create and manage time-space contexts in their technology-mediated interaction during a creative collaborative learning project situated in a Finnish primary school, and what this means for their engagement and learning opportunities. We are interested in how configurations of time and space are represented in these students' technology-mediated interactions and how these time-space configurations provide students with varying opportunities and constraints to act upon social and material worlds. Drawing on a dialogic approach, the study understands chronotopes as socially constructed time-space configurations with a specific narrative character that represent cultural practices, values and worldviews, and that operationalize the framing of the interactional situation and its actors. Chronotopes provide a way of viewing students' participation in a

learning activity in terms of situated, dynamic processes that evolve through the interaction of past, present, and future (Brown & Renshaw, 2006).

To this end, in this article we ask:

1. How are time-space contexts created and managed in students' technology-mediated interactions during a collaborative learning activity?
2. What opportunities and challenges to students' engagement and learning opportunities are made visible by the chronotopic analysis of students' technology-mediated interaction?

3. A dialogic approach and chronotopic analysis

The conceptual framing of our work stems from dialogic accounts of human interaction, learning and development (Bakhtin, 1986; Cole, 1996; Gee, 1996; Kumpulainen & Renshaw, 2007; Vygotsky, 1978). A dialogic approach takes social practice and discourse as its core units of analysis examining their display within personal, relational and institutional spheres of activity (Stetsenko, 2015; Holland, Lachicotte, Skinner, & Cain, 1998; Vygotsky, 1987). It focuses on tool-mediated interactions as we draw upon multiple contexts, including peer relations, family, and school, to make meaning with others (Barron, 2006; Gutiérrez, Baquedano-López, & Tejeda, 1999). Accordingly, it is in social interaction that students negotiate their experiences and knowledge to create new understanding or meaning, and it is through interaction and use of available tools that knowledge comes into use (Greeno, 2006). Learning is therefore an interactional accomplishment based on a combination of individual contributions, collective negotiation and use of mediational tools constituted by specific time-space configurations (see also Bliss, Säljö & Light, 1999; Ludvigsen, Lund, Rasmussen, & Säljö, 2011). From the dialogic perspective, novel tools and artifacts do not simply represent new ways of resourcing activities; instead, they change the activities by their use and, therefore, modify our ways of thinking and engaging in meaning-making and knowledge creation (Säljö, 1999). It is at the intersection between people's actions, the tools they use and the infrastructures they have access to that new conditions for learning arise and where new practices emerge.

By viewing context as a function of the dynamic interaction between multiple layers of activity, a dialogic view foregrounds that during joint engagement, participants are active in creating social and interactional contexts (Goffman, 1974; Kumpulainen & Mutanen, 1999; Schubauer-Leoni & Grossen, 1993). From this standpoint, interaction is not determined only by the medium or physical context; rather, it is negotiated dynamically

in social interaction. Social interaction is performative and context-transforming, facilitating the ongoing negotiation of meaning and presentation of self (Thorne, 2003).

According to a dialogic approach, identity development is an essential element of engagement and learning across timescales and space. Learning transforms who we are and what we can do (Kumpulainen & Rajala, in press; Lave & Wenger, 1991). Identities define how we position ourselves and our actions – through which others, in turn, position us. They are also performances we enact as we interact with others, and hence identities are also multiple and shifting (Wortham, 2004; Holland et al., 1998; Nasir & Saxe, 2003). Identities are not determined by their past and present conditions; through their imagination and agency the students can project themselves to alternative futures by negotiating and authoring new identities (Francis, 2008; Gee, 2003). That is, identities are always intrinsically chronotopic. A dialogic approach thus allows researchers to analyse changes in student engagement, learning opportunity, and identity when the balance between various time-space contexts of discourse shifts (Kumpulainen & Mikkola, 2014b; Leander, 2001, 2002).

In this study, we consider chronotope as a multidimensional concept that allows investigating students' relations to and interactions with the contexts they inhabit at multiple levels while they engage in a learning activity (see also Ritella et al., 2015). Our study approaches chronotopes as movement between various time-space contexts of discourse embedded in multiple cultural value systems. Chronotopes index the relative changeability of the social world, the possibilities of individual agency, and the relations of social and individual development as each chronotope relates actors, actions, and contexts in specific ways (Ligorio & Ritella, 2010; Rajala et al., 2013; Renshaw, 2013). Consequently, our analysis of chronotopes takes account of the cultural and institutional, relational and personal spheres of activity constituted in students' technology-mediated interactions (Bloome & Clark, 2006; Duranti & Goodwin, 1992).

The concept of chronotope originates from the works of dialogic literary scholar Mikhail Bakhtin (1981), who used the concept to describe the contextual grounding of events in a literary narrative, that is, the unity of time and space where events occur. Hence, a chronotopic analysis conceptualizes space and time as intrinsically interconnected (Bakhtin, 1981; Leander, 2001). Moreover, space and time are not seen as neutral abstractions or as a background or passive context in which activity occurs, but as socially constructed and imbued with cultural meanings and practices, values, and ideology (Matusov, 2015; Morson & Emerson, 1990). Chronotopes are actively constructed in social interactions within and across sociocultural sites (Renshaw, 2013).

Although there is less research in the use of chronotopic analysis in new technology-mediated infrastructures of learning, it has been applied by educational researchers to

investigate how students negotiate their experiences, understandings, and relationships mediated by their past experiences, ongoing involvement, future aspirations, and goals (Kumpulainen & Lipponen 2013; Lemke 2004; Brown & Renshaw 2006; Bloome et al., 2009). Chronotopic analysis has also been used in educational research to explore power dynamics and students' positioning, and how new meanings and possibilities for action are created as the result of the interaction of time-space contexts in social activity (Leander, 2001). In his research, Matusov (2015) used the concept of chronotope to distinguish between different pedagogies and educational philosophies and how these afford students with varying opportunities and constraints to exercise their authority and agency. Altogether, existing research has shown that within schools and classrooms multiple chronotopes are often produced, negotiated, and hybridized in ongoing interactions that represent various communities in and out of school (e.g. peer groups and cultural groups). These different chronotopes come into contact, compete and form dialogic relations with each other in ongoing social interaction and hence create varying opportunities and tensions for students' engagement, learning and identity (Bloome et al., 2009; Morson & Emerson, 1990).

Taken together, the concept of chronotope provides a potential conceptual and analytical lens for educational research for unpacking the creation and management of space and time during students' learning activities. In particular, the chronotopic analysis can shed light on multiple and possibly contradicting space-time contexts that students produce and how these contexts interact in their interactions during a learning activity. Here, the intertwined nature of students' engagement, learning and identity becomes the analytic focus of attention. In existing research literature, this is an often over-looked approach, as researchers have often analytically focused on each aspect separately (e.g. cognition, emotion, identity as separate entities) and not as intertwined processes.

4. Empirical Study

The empirical data of this study are drawn from an ethnographic case study of a yearlong school musical project in a Finnish primary school community of 240 students (grade levels one through six) and 16 teachers in the Helsinki district. All students in the school participated in a communal musical production, and during a period of one year, worked together with their teachers and collaboratively produced a number of poems, short movies, audio-visual effects, animations, stories, a school musical script, and a composition of the musical melody using various technological tools and devices. The outcome of the students' work, the fantasy school musical "Magic Forest Musical," was performed on the anniversary of the school's founding. The musical production was an integral part of the official curriculum of the school and not an extra addition.The data

discussed here come from a three-month phase in the musical project during which 21 fifth- and sixth-grade students (ages 11 to 12) took part in writing the school musical script.

The students worked in 10 small, self-selected teams of two to three students, with each team writing one part of the script. To enable the students' collaborative creation of the script in and outside of school, they were given small, one-to-one computers set up with a 24-hour wireless Internet connection. The laptops were equipped with a collaborative writing tool called *VisciPad*, which included a chat channel. VisciPad enabled students to simultaneously edit the same text document, that is, work in real time. VisciPad is a web application based on the open source software, EtherPad (Ellis & Gibbs, 1989; Vähäkangas & Pyykkö, 2012). It enables users to edit the same document simultaneously, that is, a pad or a page in real time, and to create an unlimited number of independent pads. Since the writing service was freely available online, the pupils could use their own computers for the writing project if they wished. The students' chat interaction was automatically saved on a server as a by-product of the VisciPad service. The times were recorded using millisecond granularity, and the timestamps were synchronously assigned by the server (Vähäkangas & Pyykkö, 2012).

The students were allocated two one-hour sessions every week to write the script at school. Yet, the student teams were able to organize their writing as they wished without any prefixed daily schedules or teacher control. The only obligation was that the scripts had to be completed within the three-month time period for the musical project to proceed. As a final result of the project, the students produced 14 different scripts; some were relatively short, for instance, those to be performed by second graders, some had music and lyrics, and others had more dialogue. The musical scripts were written in Finnish, the language of the musical performance. The pupils' chats were in Finnish, but we also detected some English words within the Finnish discourse, and the lyrics sometimes contained complete sentences in English.

Our earlier research on the school musical project focused on the spatio-temporal organization of the students' technology-mediated learning activities (Kumpulainen, Mikkola, & Jaatinen, 2014). The study showed significant use of the collaborative writing service *VisciPad* and its chat facility outside the two weekly 1-h sessions allocated to collaborate on writing the musical script at school. Almost 70% of the students' script-editing events ($n = 56,578$) and 43% of all the online messages ($n = 8657$) fell outside the scheduled lessons. Also, the chat messages were distributed over every hour of the day, from 6 a.m. to 10 p.m., with almost 2400 from the end of the school day at 1 p.m. and after. In a similar vein, 14% of all script-editing events and almost 6% of the chat messages were sent during the weekend. These findings give evidence of the students' learning activity having concretely extended across time and space unlike in more

traditional school work that is typically confined to the school's timetable and defined by specific hours.

In this article, we extend our earlier research and focus more closely on the chat interactions of 10 student teams (N=21, 4744 messages) while while they collaborated in writing a school musical script. In our analysis, we follow Duranti and Goodwin (1992) and understand chronotopes as focal events within fields of action with a specific narrative character that operationalizes the framing of the interactional situation and its actors. That is, we stretch our analysis of chronotopes displayed in the students' chat interaction by taking account of the institutional, relational and personal spheres of the students' interactional activity within which the interactional focal events are embedded. We examine how students construct focal events embedded in these three spheres of activity by building on each other's interactional behavior to create meanings, social relationships, and accomplishments (Bloome & Clark, 2006). This requires paying attention to the content and temporal organization of the students' evolving interaction.

Table 1 below defines the three spheres of interactional activity – institutional, relational and personal – that guided our analysis of the students' negotiation of time-space contexts in their technology-mediated interaction interaction. It should be emphasised, however, that these categories are analytical distinctions. As our finding will also demonstrate, these spheres typically coexist and co-interact in the evolving interactions of the students.

Table 1 Institutional, relational, and personal spheres of students' interactional activity

Spheres of students' interactional activity	Description	Example
Institutional	Involves interactions that address the opportunities and constraints institutionalized social practices (e.g., school and family/home) create for students' engagement in their joint learning activity.	Lauriina: I DESTROYED MY LIFE Lauriina: :) Emppu: why? Ella: how come? Ella: ??????????? Ella: ??????????? Ella: ???????????? Ella: ????????? Ella: :D Lauriina: well since I sent that nice email to the teacher Ella: :D good luck Emppu: aaa okkei Lauriina: she will take me to the social workers soon... embarrassing

Relational	Involves interactions in which students negotiate and manage their relations and collaboration.	Enni: Nice we have talked about squirrels and then exams and then flying=) Enni: yeah Pinja: we are so versatile people Enni: and same thoughts Pinja: jep Enni: hih
Personal	Involves interactions in which students negotiate their identities and personal preferences as students and young persons	Pinja: we must visit harry potter site to look up good sites;) Pinja: I want to go to scotland! Enni: what??? Enni: where have you visited??? Pinja: you can find a good site on traveling from there and good sites for potterists

5. Findings

Next, we will demonstrate with some rich cases (Mitchell, 1984) from the data how students created and managed time-space contexts in their technology-mediated interaction during their collaborative writing activity. In our analysis, we will situate the students' space-time negotiations within institutional, relational and personal spheres of interactional activity as a means to understand the negotiation of various layers of activity and how these create opportunities for students' engagement and learning.

5.1 Negotiating institutional spheres of interactional activity

In the following extract (Table 2), the students discuss the next steps in their writing the script. Through planning the future course of their writing activity, the students project themselves in and across time-space contexts situated in their school and home. The extract demonstrates how students are active in creating and managing opportunities to pursue their writing activity that is intertwined with the more stabilized institutional activities of home and school, including their practices and rules. It shows how emergent chronotopes of students' chat interaction interacted with more stabilized institutional (e.g., school, home) chronotopes during their technology-mediated collaborative writing activity.

Table 2. "Are you taking this home?"

Insert Table 2 here

After establishing their social presence in the chat room (Lines 1-2), the students start communicating about the contents of their script, thereby making the digital writing space in which the script is materialized relevant for their joint work (Lines 3-4). However, the students soon realize that they need other resources (papers) that are essential for their writing (line 6). The need for the papers triggers an exchange that extends the time-space contexts of the students' chat interaction spanning the whole school as well as their homes, including the rules, actors and values associated with these contexts. As the extract shows, the institutional practices of the school and home creates a tension that the students have to manage in order to pursue their writing activity. This is demonstrated in Sofia's message in line 11 in response to Megan's question (line 8). Sofia's question evidences the complexity involved in the extension of the creative writing activity beyond the school; taking the expensive mobile devices to home involves a risk that they will be broken. Yet, the other technological resources in Sofia's home permits her to use her own laptop to continue working on the script at home. We can again trace active negotiation of the home and school practices in the students' chat interaction as students' manage their collaborative writing activity.

A chronotopic analysis of Sofia's message in line 15 evidences further how the chat interaction creates a site for the students to negotiate and manage the demands that the regular school practice on one hand and the creative writing project on the other pose on them. In the chat interaction, the school space is imbued with the meanings and rules of the school involving the segmentation of the school time into lessons and recess time. During the recess time, the students are usually expected to be in the schoolyard but now they plan to negotiate an exception to this rule with their teacher to be able to continue their joint work on the scripts. Thus, regular school practice is laminated with creative writing, which is distributed across time and space and has to take place in the margins of the regular school chronotope. Here, lamination refers to a way in which different chronotopes are layered on top of one another potentially creating tensions and ambiguity to the activity (see also Leander, 2002) while the actors need to take into account possibly conflicting meanings and rules associated with the laminated chronotopes.

5.2 Negotiating personal and relational spheres of interactional activity

A chronotopic analysis of our second illustrative episode (Table 3) discloses an active negotiation of the students' relational and personal spheres of activity, while they relate to one another and negotiate their identities both as students and young persons. Here, the students move across past, present and future, dealing with their writing activity, managing their online collaboration, and then considering their school choices and academic futures.

Table 3. "Hopefully you will make it to the school =)"

Insert Table 3 here

The episode in Table 3 begins by the students making their social presence visible to each other (lines 21-22), in order to manage their co-presence in the chat room. In Line 26, the students' interaction shifts to their writing task. Here, Enni explains and organizes the writing activity. This chat interaction reflects relational work as the students invite each other to revise the text and express their liking of each other's contributions to the script. Line 27 responds to an earlier message in which Sonja on her part shares what she has done to the text, and again invites Pinja to revise the text if she wants to.

The personal sphere of activity is evident when the students also use the chat room for negotiating their identities. In this extract, identity negotiations span to future educational contexts, while the students consider their academic futures. In line 40-45 the students' discuss their school choices and preferences. Through sharing their hopes and aspirations, the students explore alternatives and encourage each other, as well as provide emotional support to face a possible disappointment of a failure not becoming accepted to a preferred school. Here, dealing with future school choices invoked in their identity work intertwines with relational spheres of activity.

5.3 Blurring the boundaries between spheres of interactional activity

A chronotopic analysis of our third extract (Table 4) further exemplifies the students' active managing of institutional, personal and relational spheres of of their interactional activity through complex configurations of time-space contexts. The task of creative writing spanning several time-space contexts invited the students to intertwine negotiation of their relationships (relational sphere) and identity work (personal sphere) to the given task and its demands (institutional sphere), also blurring their off-task and on-task engagement.

Table 4. Manga eyes

Insert Table 4 here

The extract in Table 4 illuminates how the students' writing of the school musical script was also about relating to and negotiating their personal music and movie preferences and hobbies, illuminating how the negotiation of space-time contexts in chat interaction interacted between the students' school work and everyday non-school lives and

cultures. For example, in lines 322-323, Lena talks about her drawing activity and watching movies. Sini, on the other hand, wants to shift the topic of discussion to their taste of music. Soon, the conversation shifts to this topic and the students share and compare their music preferences. Thus, the chat interaction provides the students with opportunities to negotiate and perform their identities as consumers of popular culture and as members of informal peer culture.

The openness of the learning activity to incorporate out-of school experiences and interests into the relational space create a fertile ground for the students' identity work as well as maintaining and strengthening joint engagement and sense of togetherness. The chronotopes invoked in these negotiations appeared to serve the students' building positive relations and managing their collaborative creative work (see also Kumpulainen & Mikkola, 2014b; Vass & Littleton, 2010).

6. Discussion

Challenges of researching and understanding students' social interaction as part of new technology-mediated infrastructures of learning that take place across various time-scales and spatial contexts are increasingly recognised in current educational research. At the same time, it has been acknowledged that to understand students' engagement and learning opportunities, we need to analyze how they simultaneously inhabit and interact with multiple contexts at various spatial and temporal scales. To address these challenges, in this paper we have explored the potential of a chronotopic analysis to disclose how students' create and manage time-space contexts during their technology-mediated collaborative learning activity and how this is intertwined with personal, relational and institutional spheres of their interactional activity.

Our study shows how various time-scales were taken up and interacted with one another in the students' technology-mediated interaction creating varying opportunities for engagement and learning. The chronotopic analysis depicts a nuanced picture of the students' negotiation and management of spatial and temporal contexts, accounting for their experiencing of the learning context as well as what it means to participate and learn in this context. The findings illuminate the complex and dynamic nature of students' technology-mediated interaction that is temporally extended, spatially variable, and culturally diverse with respect to value systems and social practices. In all, the findings of this study illuminate how negotiating institutional practices and values, social relationships and identities all became both a means and an end of the learning activity.

At an institutional sphere of the students' interactional activity, our analysis reveals the complex interplay between established and emergent chronotopes of learning and education (see also Brown & Renshaw, 2006); the technology-mediated collaborative

writing project representing an emergent new chronotope. The emergent time and space configurations associated with this learning activity including its purposes, meanings, values, and student agency was more expansive in nature contrasting with the more bounded time-space configurations of conventional school practices (see also Rajala et al., 2013; Engle, 2006). In addition, our analysis highlights the interactional work that was needed from the students to navigate between these emergent and established chronotopes in the institutionally framed time-space arrangements of the school. These negotiations addressed the lamination of different layers of chronotopes, the collaborative writing being positioned in the temporal and spatial margins of the regular school activity. Following Lemke (2004) and Bloome et al. (2009), we hold that within schools and classrooms there exist not only institutionally established chronotopes but also new, emerging forms of chronotopes. In addition, new chronotopes do not simply replace the old ones; instead, conventional and novel chronotopes can live side by side in contemporary schooling (Leander, 2001).

At a relational sphere of the students' interactional activity, our chronotopic analysis demonstrates how the students actively built, managed and negotiated their relations and collaboration. The students' active negotiation and management of time-space contexts was identified to serve an important role for establishing a mutual ground for joint writing, including negotiating social relationships (see also Kreijns et al., 2003). In addition, our analysis shows how the time-space contexts of the students' interaction informed and shaped evolving interactions and the learning activity, and how the students coordinated such actions as writing of the script, composing the music, and staging of the play across a range of interactional spaces (see also, Çakır, Zemel, & Stahl, 2009).

The chronotopic analysis also points out the demands and constraints of online interaction for managing socially shared work and learning across space and time. In specific, this concerns how the students achieve a sense of coherence and community in their interaction taking place across extended spaces and time. Moreover, it entails how the students enact, adapt, and invent ways of coordinating their joint work by means of the technological affordances that they find at hand. These observations resonate with existing research that has reported making joint meaning in online interaction to be complex and challenging (Blommaert, 2005; Zemel et al., 2009). These challenges included establishing a shared understanding and common ground for joint work while managing indexical references to non-present contexts.

At a personal sphere of the students' interactional activity, our chronotopic analysis reveals that in their technology-mediated interaction the students positioned themselves as actors and authors, rather than merely executors of teacher-defined activities and instructions (see also Brown & Renshaw, 2006). They also routinely switched between

friendship-related and task-related contexts (see also Erstad, 2014; Ito et al., 2010). Here, the students did not only stay in the present context but created spaces to ground their negotiations in the past and in imagined futures. This was achieved by juxtaposing alternatives in a shared chronotope by drawing on and revoicing multiple times, spaces, and authors, taking on identities as agentive participants in collaborative work. The students were also identified to perform identities of members of peer cultures and of consumers of popular culture as part of their collaborative work. Overall, the analysis revealed multiple, co-present space-times in student's technology-mediated interaction that gave rise to the students' active negotiation of their past, present and future selves. These time-space contexts resulted from the production, negotiation and hybridization of the 'here-and-now' and the 'there-and-then' of the situation, positioning the students in various identities (Marková, Linell, Grossen & Salazar Orvig, 2007). These findings portray students as agentic individuals with multiple identities, interests, intentions, and purposes, which intersected during their joint online activity.

It is clear that researching technology-mediated learning activities that extend across across space and time and are characterised by open-endedness raises serious methodological challenges. The complexity and hybridity involved in these settings, as evidenced by the chronotopic analysis of our empirical cases, ruptures the dominant idealization of formal education that has traditionally sought for predictability and uniformity in defining what counts as "productive" educational engagement and learning. Without adequate methodological tools, we may be unable to attend to the nuances of meaning and function of students' technology-mediated interactions in their learning activity that may from the outside only appear chaotic and pointless. In particular, the forms of student engagement and discourse – more typical to students' leisure time contexts – that new digital tools and spaces typically invite may appear unfamiliar and unproductive from institutionally framed perspectives (Lantz-Anderson et al., 2013). However, a detailed chronotopic account can unpack young people's perspectives into their technology-mediated engagement and learning opportunities, and show how they invoke and produce multiple personally relevant contexts and integrate these with task-related engagement. Moreover, a chronotopic account can show how students relate to and navigate in a mid of multiple laminated temporal and spatial configurations. Understanding these nuances is likely to advance scientific research on technology-mediated learning across space and time.

It can be concluded that the chronotopic analysis has given us access to understanding students as part of multiple social practices, and, attending to the relation between everyday and school-based experiences and discourses. It has also enabled us to discern what takes hold as students and practices move across time and space in their evolving interactions (Gutiérrez, 2008). These findings challenge normative definitions of learning that rely on simple and static categorizations of students and contexts of

learning. They move our attention beyond reductive dichotomies and point out toward research endeavors that focus on multiple social practices and discourses embedded in sociocultural contexts in which young people learn and develop.

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