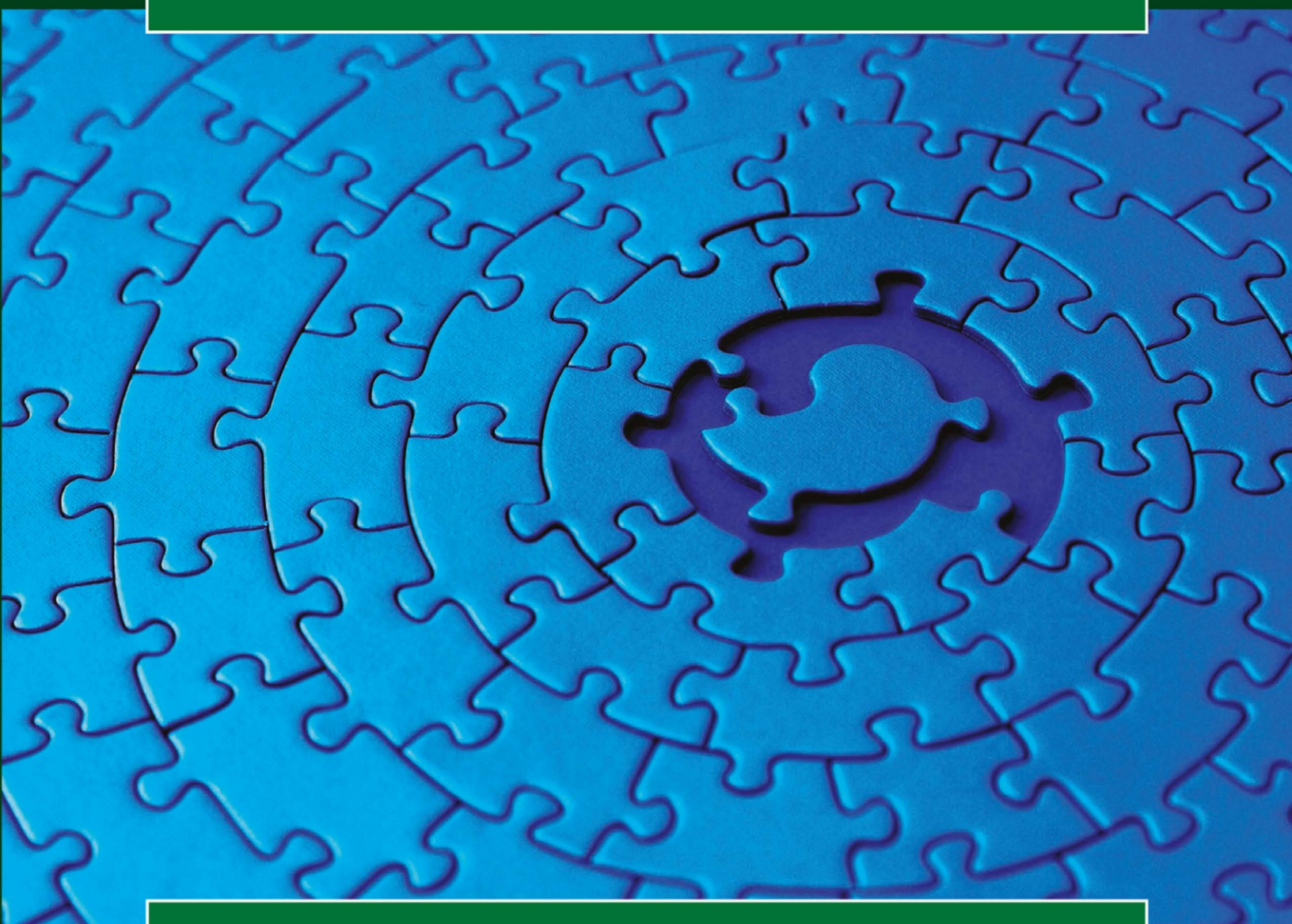
THE KNOWLEDGE ECONOMY AND EDUCATION

Learning across Contexts in the Knowledge Society

Ola Erstad, Kristiina Kumpulainen, Åsa Mäkitalo, Kim Christian Schrøder, Pille Pruulmann-Vengerfeldt and Thuridur Jóhannsdóttir (Eds.)



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Learning across Contexts in the Knowledge Society

THE KNOWLEDGE ECONOMY AND EDUCATION

Volume 9

Scope:
The aim of this series is to provide a focus for writers and readers interested in exploring the relation between the knowledge economy and education or an aspect of that relation, for example, vocational and professional education theorised critically.

It seeks authors who are keen to question conceptually and empirically the causal link that policymakers globally assume exists between education and the knowledge economy by raising: (i) epistemological issues as regards the concepts and types of and the relations between knowledge, the knowledge economy and education; (ii) sociological and political economic issues as regards the changing nature of work, the role of learning in workplaces, the relation between work, formal and informal learning and competing and contending visions of what a knowledge economy/knowledge society might look like; and (iii) pedagogic issues as regards the relationship between knowledge and learning in educational, community and workplace contexts.

The series is particularly aimed at researchers, policymakers, practitioners and students who wish to read texts and engage with researchers who call into question the current conventional wisdom that the knowledge economy is a new global reality to which all individuals and societies must adjust, and that lifelong learning is the strategy to secure such an adjustment. The series hopes to stimulate debate amongst this diverse audience by publishing books that: (i) articulate alternative visions of the relation between education and the knowledge economy; (ii) offer new insights into the extent, modes, and effectiveness of people's acquisition of knowledge and skill in the new circumstances that they face in the developed and developing world, (iii) and suggest how changes in both work conditions and curriculum and pedagogy can led to new relations between work and education.

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TABLE OF CONTENTS

Section Three: Agency and Engagement Using Digital Tools

Commentary

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This book is the outcome of three years of collaborative work, consisting of a series of seminars, among research communities in all the Nordic countries and Estonia. The authors of the different chapters are just some of the people who have contributed to the success of this Nordic network of researchers (NordLAC). In all the participating countries a number of both PhD students and senior researchers participated. There are too many to mention by name, but you all contributed in constructive ways in the discussions of the specific themes for each seminar and the presentation of ongoing research projects within this diverse field of research.

For each seminar there also were a number of keynote presentations, both by senior researchers at the host institution and scholars from the US and European Universities giving important input to our discussions and to the different chapters of this book. Among them were Julian Sefton-Green, Reed Stevens, Ralph Cordoba, Ane Hejlskov Larsen, Jonas Ivarsson, Jonas Linderoth, Mari Karm, Jaanus Harro and Gráinne Conole. This Nordic network has been organized by a team at the Department of Education at the University of Oslo, led by Professor Ola Erstad. A special thank you Kristin Aadland for being the administrative coordinator of the network, and to Øystein Gilje for his critical input in writing the proposal for the network and coordinating it together with Ola Erstad. Also thank you to Dagny Stuedahl and Kenneth Silseth for their contributions.

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1. TRACING LEARNING EXPERIENCES WITHIN AND ACROSS CONTEXTS

A Nordic Approach

INTRODUCTION

Developments within the "knowledge society," especially those resulting from technological innovation, have intensified an interest in the relationship between different contexts and multiple sites of learning across what is often termed as formal, non-formal and informal learning environments. The aim of this book is to trace learning and experience across multiple sites and contexts as a means to generate new knowledge about the borders and edges of different practices and the boundary crossings these entail in the learning lives of young people in times of dynamic societal, environmental, economic, and technological change.

Our interest in issues surrounding the theme of "learning across contexts" grows out of a broad set of influential studies that have risen from different disciplinary fields during the last decades (Cole, 1996; Duranti & Goodwin, 1992; Edwards, Biesta, & Thorpe, 2009). However, a central issue remains with respect to defining the limits and nature of a learning context. A key issue in this regard is what is particular to contexts that trigger learning processes, what these learning processes entail (to which consequences and outcomes) and by whom they are valued. This issue is also addressed in this book with a view towards the increasing role played by mobility due to the use of digital media, while looking at movement and spatiality as it pertains to literacy research (Leander, Phillips, & Taylor, 2010). For our purpose in this book, the term *across context* covers both physical movements across different places and situations, and how content, knowledge, and tools from one context is made relevant in another context. Behind many of these notions of context, time, scale, spatiality, people, things, and networks lay further assumptions about the interrelationship between individuals and society and the role of education in the 21st century.

On an overall level, the issues raised in this book concern efforts to promote lifelong learning among individuals and communities within and across formal, non-formal, and informal contexts. Questions about the role of formal education and

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 1–13.

schools have been triggered by changes in labour markets and their requirements for learning and competence in the 21st century. During the last three decades, there has been a move from jobs dominated by manual and routine skills towards more complex and abstract skills and competences (Dumont, Istance, & Benavides, 2010). The demands on schools which are related to the competences provided, as well as to the ways of learning and working with knowledge, are different. Discussions about the role of education and schools have also been triggered by a generational change in the sense that young people today grow up in a culture dramatically different from that of former generations, chiefly due to the growth of digital media (Erstad & Sefton-Green, 2013). This cultural shift has created new conditions for learning and participation, as well as for information access and creative production by young people.

The empirical research discussed in this book has grown out of a Nordic network of researchers that has organised a series of seminars in different Nordic countries. The *Nordic Research Network on Learning across Contexts (NordLAC)* is a co-operation in research and research training among six countries and seven universities (Helsinki, Oslo, Gothenburg, Southern Denmark, Roskilde, Reykjavik, and Tartu) within the subject area of "learning across contexts." Young scholars doing important and innovative empirical work have been the main focus of attention in order to cultivate the next generation of researchers who are to tackle, and hopefully solve, future learning and educational challenges in the knowledge society.

In this introduction, we raise some issues of core importance to the research of learning across contexts. Several ongoing research projects in Nordic countries and in the Nordic network mentioned above serve as the foundation for our exploration of these issues. Together, these research projects innovatively cover a broad range of learning contexts which are not usually brought together under one theoretical and methodological umbrella: we thus explore learning processes that cross contexts from a point of departure in the institutional contexts of schools and classrooms, as well as learning activities in museums that cross boundaries with a basis in these sites of semi-formal learning. This brings in a range of conceptual issues drawing on different theoretical traditions, as well as methodological challenges facing researchers doing research within this field. Furthermore, the motivation underlying this book is to contribute to an evolving field of research studying connected learning and boundary crossing as experienced by young people.

KNOWLEDGE AND LEARNING IN TIMES OF TRANSITIONS

The most interesting new factor in current discussions on education concerns the role of digital media in our culture at large, and specifically in relation to education and learning. Change forces related to advances in information and communication technologies (ICT) have created an increased interest in the social implications of these developments. Sociological descriptions of key processes in today's societies use terms such as *the information society* (Mattelart, 2003) to indicate the increased

availability of information to the population at large; *the knowledge society* (UNESCO, 2005) to indicate an escalation in the importance of knowledge building for all levels of social development*; the network society* (Castells, 1996) to denote the new ways in which organisations and people work together as the result of new technologies; and *the mediatised society* as a way to characterise an emerging social condition in which media have a formative influence on other societal institutions (Hepp, 2013; Hjarvard, 2013). All of these concepts point to the importance and impact of digital media, which raises important questions about literacy and fluency in how we use and relate to these technologies in and across diverse contexts of learning.

Learning environments, *cultural tools*, and *knowledge creation* are key terms in our explorations of how to move beyond conceptions of formal versus informal ways of learning. In the UNESCO report, "Towards Knowledge Societies" (2005), the concept of learning is closely tied to innovation and networking. Credé and Mansell (1998) have also shown how this thinking about knowledge societies and networking is fundamentally based on identifying new technological opportunities and potentials for learning and agency. Traditional learning environments often focus on mapping what students do not know at different age levels and then providing them with the proper information; less focus is directed towards creating environments that might challenge students learning and knowledge building (Scardamalia & Bereiter, 2006) and engaging them in generating personal learning trajectories.

In its implications, this book raises issues around ways of understanding experiences, engagement, and participation within and across different learning environments. A core concept in such explorations of learning is agency. Agency is located by some (e.g., Cooren, 2004) in various relationships between self and structure, or used to explicate various forms of agency, including the technological, human, and textual agency (Hardy, 2004). The important point here is that, linked to certain institutional and cultural practices, agency implies "the capacity to make a difference" (Castor & Cooren, 2006). The concept of agency may be perceived as being closely connected to the concept of identity (Hull & Greeno, 2006). Agency, in this approach, is not attributed to the isolated individual but rather to what Wertsch, Tulviste, and Hagstrom describe as that which "extends beyond the skin" (1993, p. 352). First, agency is seen as being socially distributed and shared. Second, human agency involves mediational means, or what can be termed *mediated agency*. The concept of agency will be defined and discussed in more detail in later chapters of this book.

A NORDIC APPROACH

Why are the Nordic countries interested in studying, within the broader context of knowledge societies, sites for participation and conceptions of learning? Throughout all the Nordic countries, a growing number of researchers are addressing questions related to learning processes in these new sites, as well as exploring learning trajectories

and pathways across sites. The research initiatives in the Nordic countries tend to avoid the more spectacular debates over the future of the educational institutions that tend to dominate and obscure discussions on education in the knowledge society, and which look to models of informal learning, whether in the "learning communities" of workplaces and families or in the new socio-technical spaces of the Internet, as a source of alternative educational strategies. Rather, Nordic researchers more modestly ask whether it is possible to envisage new models of teaching and learning which take seriously both the responsibility to social justice and social wellbeing, which, at least rhetorically, underpinned a commitment to mass education of the 20th century, as well as to the radical challenges to traditional educational models offered by the new socio-technical spaces and practices of the 21st century.

A number of initiatives around the world are now moving beyond formulaic and static conceptions of formal, non-formal, and informal, like policy initiatives on seamless learning in Singapore, the connected learning network of researchers in the United States, and David Livingstone and colleagues' work on informal learning among adults in Canada (Learning from Experience Trust, 2000; The Monitoring and Reporting Group, 2007). In particular, the last of these is an example in which conceptions of informal learning have been explored as different levels of intentionality or awareness and as participation in different areas, such as employment, community work, households, or areas of interest (The Monitoring and Reporting Group, 2007).

Relevant are also critical perspectives on the knowledge economy and how work can constrain or facilitate learning with or without digital tools. In the book *The Knowledge Economy and Lifelong Learning. A critical reader* (2012) Livingstone and Guile show how multiple forms of knowledge being used to facilitate improvements or innovation to products and services as well as processes of learning in the context of workplace change are both richer and more complex than advocates of the knowledge-based economy ever intimate, and that all human economies are knowledge based. As such, lifelong learning becomes a concept that is highly embedded in conceptions of knowledge and how knowledge is related to contextual settings and practices. The contributions in this book are more oriented towards the empirical data and methodological approaches that may illuminate salient aspects of the Nordic education system than towards conceptual or theoretical contributions as such; an exception is the review chapter by Rajala et al., which maps and reviews research contributions for studying young people across learning contexts.

The Nordic countries are characterised by a number of preconditions concerning the subject area, which will make this publication of great interest for an international audience of scholars and practitioners. Such preconditions for exploring learning across contexts are described as follows:

- Digital technologies penetrate all aspects of societies and models of technology development based on the Nordic welfare state (Castells & Himanen, 2002), the

distribution of mobile telephones and other digital media among young people (Livingstone et al., 2011), and a public and political awareness of the importance of access and use of new digital media related to education (Erstad, 2010).
- Traditionally, the education systems in the Nordic countries all share a common political platform emphasising equal opportunities and education for all.
- More so than most other countries, the Nordic countries have a longer tradition of connecting formal and informal ways of learning (for example, project work in schools), and long traditions of lifelong learning and distance education using different media.

These preconditions all play a role in the way scholars are bringing together a stronger research agenda that is focused on learning across different contexts. Such an approach, as highlighted in this publication, represents a view of educational issues in the knowledge society that is different from the globalised agenda on which these discourses are normally structured, both by focusing on boundary crossings and on trajectories between different contexts of learning, all of which are framed within a Nordic model of education and development.

STUDYING LEARNERS WITHIN AND ACROSS CONTEXTS

Different concepts have been used to understand the bridging, boundary crossing, and connectedness between activities and practices in and out of school, and how these relate to conceptions of learning.

Context repeatedly becomes a key issue in studies exploring the intersection between communities and schools or between online and offline settings, as experienced by children and youth. In the research literature, this type of blending of boundaries has been analysed in different ways using different concepts, such as *boundary crossing* (Akkerman & Bakker, 2011; Engeström & Tuomi-Gröhn, 2003), *boundary objects* (Star, 1989), *framings* (Goffman, 1974), *transformative learning* (Fisher-Yoshida, Geller, & Schapiro, 2009), and *seamless learning* (So, Kim, & Looi, 2008).

Beach (1999) argues that educational research has been dominated by two sets of studies on learning and learners. First, there seems to be a body of research looking at "learning in context." Such studies are usually conducted in a specific context: the classroom. Second is a series of studies of "context in learning." These studies pay more attention to how knowledge "moves" from one context to another. We will customise this distinction as it relates to debates in a specific physical place and in a non-physical space, the online environment. With this point of departure, we might say that *learning in context* emphasises how research contexts have changed in educational studies due to digitisation in general and to the Internet in particular. On the other hand, we might argue that *context in learning* foregrounds how learners perform agency in specific places and spaces as they create contexts of learning in their interest-driven activities.

Understanding learning environments as connected is supported by technological developments during the last decade (Kumpulainen & Sefton-Green, 2014). Mobile technologies provide new ways for learners to get information, communicate with others, and work on problems independent of time and place. As such, mobile technologies support trajectories and movement between contexts where learning might happen. Another dimension to this is the interrelationship between offline and online learning environments. Online resources and environments have become important by representing qualitatively different environments for learning but also as supplementary resources for face-to-face learning.

This growing interest in studying learners across different learning contexts also implies interesting changes within specific learning environments. An interest in learning across contexts does not imply a disinterest in specific sites and the important decontextualised nature of spaces in schools designed for learning. Still, the implementation and use of digital technologies in classrooms represent potential changes in the way students and teachers work with knowledge and how they collaborate. The important question is, of course, how these changes happen and how they affect students' learning. Similarly, many museums are no longer museums in the traditional sense of being exhibits and collections of artefacts. As they struggle to negotiate a balance between their historical identity as "cathedrals" and an experience economy-driven identity as "amusement parks," they increasingly define themselves as user-oriented sites for learning, experiences, and exploration. In this endeavour, they take on board an array of digital tools for enhancing the—individual or collaborative—on-site visitor experience, as well as to engage off-site users through accessible digital collections and online activities, such as games and quizzes. In this way, both schools and museums as traditional sites for learning are responding to societal calls for inclusion and outreach, and are opening up their practices to the outside world, thus creating new possibilities for collaboration between different contexts for learning.

However, a danger of studying learning within and across contexts is the issue of "the pedagogisation of everyday life," or "the didacticisation of everyday life," based on ideas from Basil Bernstein (Hamilton & Zufiaurre, 2014). These terms are meant to raise some critical remarks about how school practices, disciplines, and knowledge associated with school may become a part of, and even colonise, all spheres of life and work. This development has been seen as a consequence of the dominance of neo-liberalism. Still, it is clear that the practices of young people in the Nordic countries today are characterised by "new mobilities" (Leander et al., 2010) across different settings and situations, which challenges traditional and clear-cut boundaries between conceptions of where and when learning takes place. The role of research is then to qualify our understanding of the characteristics of learning across contexts, for instance by according a measure of power to the learners themselves, and not to celebrate such boundary crossing in naïve and uncritical ways.

METHODOLOGICAL CHALLENGES AND THE CONTRIBUTION OF THIS BOOK

Referring to methodological challenges, it is interesting to revisit George E. Marcus's seminal article (1995) "Ethnography in/of the World System: the Emergence of Multi-Sited Ethnography" in an endeavour to understand "context in learning" (Gilje & Erstad, 2014). Taking into consideration the writings by Lefebvre (1991) and Soja (1989), Marcus argues that the study of social phenomena cannot be accounted for by focusing on one particular site. One of his reasons for suggesting this new approach within ethnography was to move from a conventional single-site location. Marcus argues for a new approach within ethnography that has the capacity to make connections through translations and tracings among distinctive discourses from site to site. Also, more recently, the interest in new modes of online communication within the field of cultural studies of science and technology is another reason for re-visiting the original term *multi-sited ethnography*. In regard to research methods,

> multi-sited ethnography involves a dispersed field through which the ethnographer moves—actually, via sojourns in two or more places, or conceptually, by means of techniques of juxtaposition of data. (Falzon, 2009, p. 2)

The methodological approaches and methods used in the chapters of this book represent different ways of studying learners and contexts within such an ethnographic framework. A common approach is the use of different qualitative methods in order to study students in different settings. Some of the chapters focus on the relational aspects of meaning-making, studying collaboration and knowledge work among learners, and performing interaction analysis of meaning-making among students, teachers, and museum employees. Other chapters focus on productive practices, which provide empirical data on activities and practices in which learners are using digital technologies within different settings, thereby showing how students work with knowledge and how they are positioned as learners in different learning environments. Some studies consider learning within schools and classrooms, and some investigate other learning contexts, such as museums, while some study trajectories across schools and other contexts.

STRUCTURE OF THE BOOK

The book brings together empirical work completed in all the Nordic countries as well in the Baltic States. Because the NordLAC network has focused on PhD students, many of the chapters are written by PhD students and focus on the empirical work they do. Some of the articles are written in collaboration with senior researchers.

For quality assurance, all the chapters have been subjected to a rigorous review process in which the network's senior scholars have acted as reviewers of chapter

drafts of authors other than the ones within their own research group or community. For more than a year, draft chapters have been presented at several seminars and discussed with designated commentators in addition to obtaining reviewer comments. The reviewing process has also been done online using Adobe Connect.

The book consists of this introductory chapter and 12 other chapters, with one review chapter at the beginning, followed by three themed sections and one commentary chapter at the end.

In chapter 2 Rajala, Kumpulainen, Hilppö, Paananen, and Lipponen (University of Helsinki) present a review of empirical work central to the core ideas of the book. In their chapter, the authors discuss the outcomes of their thematic review of research literature around pedagogical rationales and associated practices and tools for connecting learning across school and out-of-school contexts. Three distinct pedagogical rationales are identified, and the challenges entailed by each pedagogical rationale are discussed. Although this review does not directly address other cultural sites of learning, such as museums, it nevertheless provides interesting insights into understanding and promoting learning across contexts and how various rationales interact and shape this process.

Thematic section one consists of three chapters and is called "Practices and Experiences of Meaning-Making in schools." Chapter 3, written by Edstrand, Lantz-Andersson, Säljö, and Mäkitalo (University of Gothenburg, Sweden), deals with the dramatic expansion of scientific knowledge in our societies due to the rapid development of digital technologies. Following Dewey, they argue that schooling should focus on generic skills and competences that are relevant across contents and settings. Their focus is on learning about scientific inquiry and how students should not only learn the products of science but also develop intellectual and practical skills for understanding critical features of the nature of science and scientific inquiry. They investigate how upper secondary school students work with a particular kind of assignment in which they do not engage in inquiry themselves; rather, the students read and evaluate research completed by others. The study concerns to what extent students are able to follow arguments using different semiotic resources and to what extent they are capable of evaluating the validity of the conclusions that are drawn, which is often referred to in the literature as science or scientific literacy. In chapter 4, Aadland (University of Oslo, Norway) uses the case of oral storytelling within a school context to look at children's participation and co-construction. The focus is on the performative relation between the storyteller, the story, and the children. Aaadland shows that the storyteller uses performative means to not only construct the narrative but also to facilitate the joint experience of the narrative and of the whole storytelling situation. In addition, the author shows that storytelling interactions are intertwined into three parts as a fine-tuned, dynamic, and mutually constitutive relation: the practices of the storyteller, the actions of the children, and the story. In the last chapter in this section (chapter 5), Amdam (University College of Volda, Norway) writes about the role and status of practical versus theoretical knowledge and informal versus school-based education within media education

research. In her empirical orientation, the author focuses on the tensions of doing production work in school within a media and communication programme in upper secondary school in Norway. By examining the teachers' interpretative repertoires about student participation and educational goals, Amdam investigates how students are positioned, not least in relation to their acquisition of 21st-century skills.

Thematic section two, comprising three chapters, is called "Boundaries and Bridges of Learning." In chapter 6, Raith (Roskilde University, Denmark) presents data from a study of students learning about human evolution, both in a museum context and in a classroom setting, using both an analogue and digital resources based on the same educational theme and linking it to the curriculum. The aim of the chapter is to analyse how the students make meaning and engage with these two versions of the same educational resource in two educational settings. The question is then how a context possibly can influence the students' meaning-making and engagement when they use the two educational resources. The next chapter (chapter 7) in this section is written by Hyvärinen, Kangas, and Krokfors (University of Helsinki, Finland). Their frame of reference is one that examines how schools open up to society and thereby acknowledge the meaning of learning in everyday situations and out-of-school environments. The idea that schools are opening to their surrounding environments requires transitions across boundaries between institutions, domains, and professions (i.e., boundary crossing). Crossing boundaries might force stakeholders to re-evaluate previous assumptions, look for new practices, and create continuities between practices. Therefore, boundaries are also seen as resources for learning. They present data from a study that was conducted within the context of basic education in two village schools that have opened up their learning practices to their local environment and built collaboration with local practitioners for a period of 20 years. In the chapter, the authors examine the village schools' extended learning environments from the viewpoint of the boundary-crossing theory. The purpose is to determine factors that can be seen as critical for developing extending learning environments in the context of basic education. The last chapter in this section (chapter 8) is written by Roth (University of Oslo, Norway). Roth investigates the creation of learning identities as part of educational trajectories based on a study focusing on two young girls' positioning rooted in cultural family networks and their funds of knowledge. In particular, this chapter focuses on how tensions emerge regarding future expectations and 'images of self', based on data from a biographical-based study from two different schools in the same community over a period of two years.

Thematic section three, comprising four chapters, is called "Agency and Engagement Using Digital Tools." The first chapter in this section (chapter 9), written by Mikkola and Kumpulainen (University of Helsinki, Finland), explores how discrepancies between learning in school and in out-of-school settings have been enriched by discourses that address the changing role of digital technologies and media in shaping ways through which young people engage, learn, and build their identities. Their work is motivated by the need to further explore conditions

that build coherence across young people's multiple lifeworlds as a part of the formal educational process. By taking *discourse* as the core unit of analysis, they examine the continuities and discontinuities that often distinguish the students' everyday discourse from that of schools and other formal institutions. They are specifically interested in the notion of *hybrid space* that can be achieved when diverse discourses embedded in young people's multiple lifeworlds meaningfully intersect. This study draws on empirical research that was conducted in a Finnish elementary school community that engaged in an interdisciplinary, year-long school musical production project; it focuses on technology-mediated collaborative writing of a school musical script in and out of school. In chapter 10, Fauville, Andersson, Mäkitalo, Dupont, and Säljö (University of Gothenburg, Sweden) propose to shed light on how students estimate their own environmental impact through documenting and analysing lifestyle questions. The participants used a digital tool, a carbon footprint calculator, to calculate, compare, and discuss their own impact on the environment (i.e., their carbon footprint in an online forum with peers from around the world). Their research interest was to explore how such a tool may sensitise young people to these issues and support more sophisticated modes of reasoning about climate change. The next chapter (chapter 11) was written by Kjartansdottir and Jakobsdottir (University of Iceland, Iceland). The authors present results from a case study on the use of tablet computers (iPads) at a lower secondary school in Reykjavík. The project they studied was initiated by a group of teachers who wished to harness new mobile technologies in order to further personalise learning and improve the digital competences of their students. This chapter explores how mobile technologies enabled teachers and students in the Nordlinga Elementary School to cross contexts. The study mainly focused on identity formation and on the development of students' agency while boundary crossing and interacting with the world beyond the classroom in connected learning. In the last chapter in this section (chapter 12), Karaseva (University of Tartu, Estonia) discusses the use of information and communication technologies (ICT) among subject teachers. This chapter aims at shedding some light on how different subject teachers in Latvia integrate promotion of digital literacy in their teaching practices. In general, the concept of digital literacy has many (and sometimes conflicting) understandings. In this circumstance, the absence of required pedagogies makes the Latvian teachers' experiences an interesting case for examining the existing practices teachers use to promote digital literacy along with promoting the subject knowledge. This chapter further continues with a brief introduction to the concept of pedagogy of connection and the notion of school subject cultures.

In the last chapter in this book (chapter 13) we have invited Julian Sefton Green to make some commentary remarks on this field of research, based on his own contributions and on his insight into the Nordic countries. He took part in the first and the last seminar in the previously mentioned Nordic network. At the same time, he takes the position of an outsider, writing within cultural and educational systems

that are different from the Nordic systems. Green offers some important reflections on researching learners within and across general contexts, which provides an important framing for this book.

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2. CONNECTING LEARNING ACROSS SCHOOL AND OUT-OF-SCHOOL CONTEXTS

A Review of Pedagogical Approaches

INTRODUCTION

Understanding and promoting learning across school and out-of-school contexts have received increased attention in recent educational research and practice. Children and young people spend considerable time in out-of-school learning settings. Whether it be outside in the park playing with friends, fishing with an uncle, taking part in everyday family chores, or engaging in virtual communities, these everyday learning environments form a rich and complex learning ecology within which children build a variety of experiences, competencies, and interests (Barron, 2006; Erstad & Sefton-Green, 2013; Ito et al., 2013; Kumpulainen et al., 2010). But to what extent (and how) do schools recognise, value, and build on young people's out-of-school learning and interests? And if they do so, what are the reasons? These questions are of great importance to present-day research in learning and education, and serve as the core focus of this chapter.

Efforts towards recognising and connecting students' learning across formal and informal contexts reflect the changing requirements contemporary knowledge societies pose for learning and education as lifelong and life-wide processes (Ito et al., 2013; Erstad & Sefton-Green, 2013; Kumpulainen & Sefton-Green, 2012). Yet, traditional practices of schooling are often unable to deal with such endeavours. There are a number of partly conflicting demands with which schools struggle. First, the increasing linguistic and cultural diversity among students contradicts the tendency of school systems to standardise student performances. It has become increasingly evident that the underachievement of under-represented students is due to sociocultural mismatches rather than to deficiencies of these students, their families, or their cultures (Gonzales, 2005; Heath, 1983; Säljö, 2012). Second, today's children and young people appear to be less committed than previous generations to accept what schools have to offer; hence, schools are starting to lose their allure in the eyes of many students—and also among some parents (Säljö, 2004). Although students have cultural experiences and personal knowledge outside of school, they can have difficulties in connecting these to school instruction (Kumpulainen et al., 2010; Moje et al., 2004). Third, technological developments generate new forms of

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 15–35.

culture and literacy and make new kinds of digital tools and virtual spaces available for engagement and learning. Students often develop expertise and interests related to these new tools in out-of-school settings; therefore, how they can connect this expertise and these interests to school instruction becomes an issue (Barron, 2006). Fourth, today's working life requires new kinds of competences from workers that are seldom addressed by conventional forms of schooling (Binkley et al., 2012; Dumont, Istance, & Benevides, 2010). Many professionals no longer encounter well-defined and clear-cut tasks and activities; rather, their work is organised around complex problems that are tackled in multi-professional collaboration (Edwards, 2010). In the midst of these social, cultural, and technological demands, schools have become sites of societal and political struggle where multiple interest groups, including students, their parents, and employers, as well as transnational organisations (e.g., OECD, UNESCO), are each aspiring to redefine what schooling should entail (and look like) in this century (Biesta, 2013).

Advances in learning research also point out the educational value of connecting student learning across contexts. From a sociocultural perspective, learning is understood as a part of living in different sociocultural contexts, and not as something that takes place exclusively in the context of formal education (Akkerman & Van Eijck, 2013; Hull & Schultz, 2001; Kumpulainen et al., 2010). Many kinds of learning modalities are at play in children's and young people's lives that they acknowledge as meaningful regardless of whether schools value such learning or validate it as legitimate (Erstad & Sefton-Green, 2013). In addition to the school community, learners simultaneously participate in multiple other communities and practices as a part of their everyday life. Limiting a view of learning to a single setting thus ignores significant interdependencies between multiple settings of learning. Learning happens as people move in and through sites of learning that are seen

> less as parking lots and more as intersections. (Leander, Phillips, & Taylor, 2010, p. 336; see also Erstad, 2012)

Viewing learning as connected to diverse contexts disrupts the taken-for-granted status of school learning and poses new questions (Erstad & Sefton-Green, 2013), including the following: Who defines learning? Whose interests do different definitions of learning serve? How are struggles between competing definitions played out in everyday interactions in schools?

In recent years, pedagogical practices have been designed, enacted, and researched to overcome the gap between school learning and students' lives outside of school (Banks et al., 2007; Bronkhorst & Akkerman, submitted, 2014; Kumpulainen et al., 2010). In addition, Hull and Schultz's (2001) early review of literature on the topic underscores the need to further examine the relationships between school and non-school contexts as a new direction for theory and research. Yet, research in the field is diverse and disconnected, and the ubiquitous nature of the defining concepts being used makes this valuable field of research hard to grasp. Hence, there is a need

to build analytical clarity and a more coherent understanding of the pedagogical approaches that support student learning across contexts, as well as their underlying rationales. In this chapter, we hold that various rationales can be identified among pedagogical approaches that aspire to connect student learning across contexts. The differences between the rationales are also likely to be reflected in how learning and instruction are organised, what pedagogical tools are used, and what is eventually learnt. A consideration of pedagogical rationales is thus essential, since talking about learning without a reference to the purpose for which something is learnt is arguably meaningless (Biesta, 2009, 2013).

In this chapter, we discuss our findings, which were derived from a thematic review of research literature on pedagogical rationales and associated practices, and tools for connecting learning across school and out-of-school contexts. Our goal is to create conceptual clarity about the topic and thus contribute to building a more coherent understanding about the nature of those practices and underlying rationales that aim to create coherence and connectedness in students' learning lives. We also aim to further pedagogical development in the field by discussing key issues and critical ways of working with boundary-crossing in practice. In line with the sociocultural perspective on learning that guides our work, we define a pedagogical approach as a purposive cultural intervention in human development that is informed and shaped by the values and history of the society and the community in which it is located (Alexander, 2008). A pedagogical approach includes not only acts of teaching but also the wider pedagogical arrangements, such as study materials and other pedagogical tools, grading and testing practices, the distribution and locus of authority, the patterning of time and space, and implicit or explicit definitions of what counts as legitimate ways of knowing and communicating.

The chapter begins with a description of the methodological approach to our literature review. This is followed by a discussion of our findings, which account for three distinct pedagogical rationales for connecting students' learning across school and out-of-school contexts. In this connection, we illuminate the pedagogical practices and tools associated with these rationales and pinpoint some challenges each pedagogical rationale entails. As a synthesis and further reflection of our findings, we conclude by considering how the three pedagogical rationales identified in this study relate to the interrelated functions that educational systems perform—that is, qualification, socialisation, and subjectification, and to tensions between them (Biesta, 2009, 2013).

THE APPROACH TO THE LITERATURE REVIEW

The data source of our thematic research review comprises empirical research publications that can be located in official academic databases. We began our analysis in March 2014 by conducting a number of systematic database searches (ERIC, PsycINFO, Sociological Abstracts/CSA) with the search terms *third space*, *funds of knowledge*, *hybri**, *seamless learning*, *boundary crossing*, *informal learning*, and

connected learning in order to build a relatively comprehensive data set of articles (years 2010–2014). The keywords were selected based on our prior understanding of the topic. We complemented this search by exploring several key journals for articles published within the years 2010–2014 and for studies that had cited some classical texts on the topic. Finally, we used our knowledge of the field and recommendations from colleagues to include articles that we deemed relevant. In our search process, we attempted to identify studies that were about pedagogical approaches that explicitly sought to incorporate students' out-of-school learning into instruction. We excluded studies that dealt with home-school connections in general but that did not address learning explicitly. Moreover, we included only those studies in which learning across contexts was one of the key foci of analysis. Altogether, our analysis covered 50 publications (see the list of references). In this connection, we want to stress, however, that due to the heterogeneity of the studies in the field and their use of conceptual language to characterise their research on students' learning across contexts, our selection process of the core papers for the analysis had limitations. It is possible that we have missed articles that would have enriched our analysis and subsequent findings.

We looked at various aspects in our analysis of the selected articles, including the rationale that was given for connecting learning across school and out-of-school contexts, types of research questions and findings, the description of pedagogical practices and tools, and the theoretical orientation underpinning the work. In some cases, a pedagogical approach was interpreted to simultaneously address more than one pedagogical rationale. In the final stage of our review process, we inductively generated categories that captured the various dimensions of our analysis. These categories also helped us to form the framework via which to examine research in the field and to envision possible new directions for future work.

The research questions of our analysis can be summarised as follows:

- What pedagogical rationales can be identified in the research literature on connecting student learning across school and out-of-school contexts?
- What pedagogical practices and tools were used for addressing these rationales?

RESULTS

Educational Equity and Inclusiveness

Our analysis shows that a predominant pedagogical rationale for incorporating student out-of-school learning into instruction is the promotion of educational equity and inclusiveness (see Hull & Schultz, 2001). This rationale involved an overarching concern for social justice and cultural sensitivity. In specific, efforts were made to empower under-represented students by addressing the mismatch between their out-of-school learning and what was officially valued as valid knowledge, and ways of knowing and interacting in school. In these studies, there was a common

understanding that the teacher's profound engagement with the diverse resources and interests of these students improved the quality of instruction for them.

A well-known pedagogical approach based on inclusive educational practices, known as the "funds-of-knowledge" approach, was born from a set of pioneering studies conducted in Arizona (see Hogg, 2011; Moll, Amanti, Neff, & Gonzales, 1992; Vélez-Ibáñez & Greenberg, 1992). The funds-of-knowledge concept stems from anthropological research carried out in the Latino/a communities demonstrating that households develop a wide range of expertise, bodies of knowledge, and skills essential for household or individual functioning and well-being (Moll et al., 1992; Vélez-Ibáñez & Greenberg, 1992). In these studies, a distinction was made regarding a general notion of culture that easily evokes stereotypic views of students as representatives of taken-as-static cultural groups. Instead, the funds-of-knowledge concept focuses on expertise specific to each household that is dynamically adapted to changing situations.

The funds-of-knowledge approach used in the Arizona studies involved the teachers' intentions to genuinely learn from, and about, their students and families. In the studies mentioned, the teachers were trained in ethnographic research methods and conducted home visits with a professional ethnographer. The home visits involved making observations at homes and in the neighbourhoods of the selected students, as well as interviewing the parents about the labour history and regular household activities of the family. The open-ended ethnographic research methodology that the teachers employed helped to develop a relationship of trust and a sophisticated understanding of the students and their social world. The theoretical knowledge, such as the concept of funds of knowledge, also mediated the teachers' comprehension of the social life within the households and reduced the complexity involved without compromising the attitude of serious engagement with the diversity inherent in the students' lives. As a result, the teachers reported profound shifts in their attitudes toward, and their relations with, the students and their parents.

After conducting the home visits, the teachers capitalised on their acquired understanding of the households and other community resources to reorganise their classroom instruction. The purpose was to connect the instruction to the neighbouring communities and to improve educational quality for the under-represented children (Moll et al., 1992). For example, during a home visit, one of the teachers learned that one of her sixth-grade students was involved in international commerce through selling Mexican candy in Arizona neighbourhoods. The student's capability to participate in such a demanding activity was in sharp contrast with the evaluation of the student's school performance. As the result of this finding, the teacher designed an inquiry-based learning project that engaged students to pursue their interests on the topic of candy. A parent of one of the students also came to teach the class about Mexican candies, and the class prepared Mexican candy under her tuition, to be sold at a school event. Through this project, the students' out-of-school learning was legitimated and valued in school.

The funds-of-knowledge approach has inspired a large number of subsequent research studies and pedagogical experiments striving to create inclusive instructional practices that connect students' school learning with their informal lives. Diverging from the original funds-of-knowledge project that focused primarily on adult practices and social worlds, in many of these pedagogical approaches, students are invited to bring aspects of their lives into the class (Barton & Tan, 2009; Rosebery, Ogonowski, DiSchino, & Warren, 2010; Zipin, 2009). For example, in a design experiment conducted in a low-income, urban sixth-grade classroom in the United States by Barton and Tan (2009), students participated in planning lesson activities for an instructional unit on food and nutrition. The lesson activities included the students interviewing their parents about salad recipes and visiting local grocery stores chosen by the students. The students were active in bringing their expertise and interests to their learning of school science.

Other pedagogical approaches with an interest in connecting learning for the promotion of inclusiveness and educational equity have highlighted the role of task designs and interactional practices for inviting minority students' out-of-school learning (Fitts, 2009; Haneda & Wells, 2012; Rosebery et al., 2010; Varelas & Pappas, 2006; Warren, Ballenger, Ogonowski, Rosebery, & Hudicourt-Barnes, 2001). Noticing and building on the students' emergent understandings during classroom interactions can develop into teaching opportunities and into full curricular units (Barton & Tan, 2009; Gutiérrez, Baquedano-López, & Tejeda, 1999). In addition, the teacher's personal experience as being from the same ethnic group as some of his or her students could serve as a resource to understand and connect to these students' funds of knowledge (Antrop-González & De Jesús, 2006; Upadhay, 2009; Wiseman, 2011). For example, in one case study, a Hmong teacher in the United States used her understanding of the central significance of gardening in the Hmong culture to engage her Hmong students in a school science project that involved gardening (Upadhay, 2009).

Research has also shown that engaging with the diversity of student funds of knowledge can challenge the established instructional and disciplinary practices. Warren et al. (2001) critiqued conventional school science for treating minority students' everyday sense-making practices as deficient and as obstacles for their learning and for not recognising the inherent potential of these practices for deep thought and complex argument. Through their detailed analysis of classroom interactions, the authors described the sense-making practices of bilingual minority students who imagined themselves into the phenomena they were trying to explain or who used their different languages creatively to develop contrasts among seemingly unambiguous ideas. The authors showed that by providing a space in the classroom for these ways of using language usually not recognised as scientific by the teachers, continuities were created between the intellectual work that the students were doing and canonical science practices. In fact, the limited and idealised views of scientific practice inherent in conventional school science can misrepresent what the everyday work of doing science and the talk of scientists is like (Kamberlis & Wehunt, 2012).

Existing research in the field demonstrates that the full diversity of students' out-of-school learning can be difficult to deal with within the confines of institutional schooling and its values. An example is an action research project carried out in a high-poverty, ethnically diverse neighbourhood in South Australia (Zipin, 2009). In the project, the students were asked to bring cultural artefacts from their lives outside of school that had rich personal meanings for them. These artefacts were then discussed in class, and the teacher asked the students to name and to analyse local life-world issues. However, the teachers participating in the project were reluctant to discuss some aspects of the students' lives that the students brought into the class. Zipin referred to these aspects of the students' lives that were considered dangerous or negative in school with the notion of dark funds of knowledge. Dark funds of knowledge involved issues of violence, crime, alcohol, and drugs that the students encountered in their neighbourhoods. Yet, the lesson activities of one of the teachers, which involved making clay animations about bullying and harassment, showed that attending to these dark funds of knowledge can connect instruction to vital personal meanings in the students' lives and foster deep engagement in school learning. Conversely, the avoidance of these topics, which were of central importance in some of the students' lives, seemed to alienate these students from instruction.

Students' dark funds of knowledge are risky to deal with for the teachers in at least two ways (see Gutiérrez et al., 1999; Matusov, 2009; Zipin, 2009). First, teachers need to balance conflicting needs to protect their students' well-being and to support them in reflecting on the totality of their life situations. In the case of creating clay animations, the teachers sought to attenuate these risks by asking the students to compose clay animation stories that would propose solutions to the identified problems of bullying and harassment. Second, bringing dark funds of knowledge into the classroom may disrupt the taken-for-granted institutional arrangements and be risky for the teacher, as well as for the students. This was exemplified by a study conducted among U.S. second- and third-graders by Gutiérrez et al. (1999) about a curriculum unit concerning the human reproductive system. This unit evolved from the teacher's response to a student conflict involving name-calling and sexual harassment. The unit turned into a rich learning experience that engaged students, but it also involved risks. For example, the teacher had to refute rumours that accused her of using a banana to teach the students how to wear condoms.

Providing space and time for reflection was found to be crucial for incorporating students' diverse out-of-school learning into instruction. As illustrated above, the full diversity of students' out-of-school learning is often in tension if not in direct conflict with the official contents and practices of school instruction. Reconciling this tension is an expansive process that questions established practices and transforms what counts as knowledge (Gutiérrez et al., 1999). To devise novel classroom practices, many of the pedagogical approaches have involved regular meetings between the teachers and the researchers to discuss and analyse observations and notes from home visits (Gonzales, 2005), the artefacts that students brought from their lifeworlds (Zipin, 2009) or video-recorded classroom lessons

(Rosebery et al., 2010). In some cases, the students were involved in these meetings (Barton & Tan, 2009). This reflection was crucial for going beyond and interpreting what was observed at homes and what was said in the interviews (Moll et al., 1992). It requires more effort and interpretation to go beyond mere knowledge content to recognise ways of knowing and transacting knowledge, but the latter carry deeper resonance and familiarity for the students (Zipin, 2009). Similarly, recognising continuities between canonical science and everyday sense-making practice requires a reflective process of being open to examining and expanding one's view of what it means to learn and to do science (Rosebery et al., 2010; Warren et al., 2001).

Learning Requirements and Competences of the 21st Century

In this pedagogical rationale, the incorporation of student out-of-school learning into instruction was seen as an integral part of addressing many learning requirements and competences required from learners in the 21st century. Our analysis also showed that there was variation in the pedagogical approaches guided by this rationale with respect to whether the desired competences to be promoted in instruction stemmed from the academic, working, or civic life.

First, in the approaches that were about academic learning, students' everyday reasoning and cultural practices were seen as important aspects of robust conceptual learning and engagement in authentic disciplinary practices in studies of science (Ekanayakea & Wishart, 2014; Engle, 2006; Kamberlis & Wehunt, 2012; Rosebery et al., 2010; Scott, Mortimer, & Amettler, 2011; Warren et al., 2001), music (Green, 2005), language (Wiseman, 2011; Wong, Chin, Tan, & Liu, 2010), mathematics (Cribbs & Linder, 2013), or sports (Enright & O'Sullivan, 2012). For example, Rosebery et al. (2010) showed that designing instruction on the basis of students' everyday sense-making practices in science instruction promoted more profound learning of scientific concepts of thermodynamics than conventional school instruction, determined both in terms of the scientific quality of the students' reasoning in benchmark discussion and by administering standardised science achievement tests. In this pedagogical approach, priority was given both to inviting and to recognising students' everyday reasoning experiences and provisioning the classroom with resources that made the structure and big ideas of the scientific domain visible to the students. The lessons were videotaped, and the researchers and the teacher searched for students' emergent new understanding and ideas from the videotapes. Both everyday and scientific reasoning were made objects of inquiry, and children engaged in analytic work across the borders of diverse forms of reasoning. The authors concluded that heterogeneity is fundamental for robust conceptual learning in science.

Second, some of the pedagogical approaches in this category of our analysis aimed at fostering creativity and capacities of creative production in students. Such examples include, research studies on creative collaborative writing (Kumpulainen, Mikkola, & Jaatinen, 2014), digital storytelling (Bjørgen, 2010) in primary school,

and media studies in vocational education (de Lange, 2011). In media studies in particular, this has involved a shift in conceptualising students from consumers to producers of media (Amdam, this volume; de Lange, 2011). De Lange (2011) examined vocational media studies course in a Norwegian upper secondary school. In the course, the media teachers and their students worked together to collaboratively plan, execute, and evaluate classroom-based media projects. The aim was to permit the students to address curricular goals on the basis of their informal media experiences. The findings of the study showed that the participative procedure of the course created a transactive space for students to bring in their informally developed expertise in using digital tools and to challenge the structuring of the classroom work. However, the author cautions that the students' experience in using digital tools did not guarantee a reflective or knowledgeable perspective on their own digital practice. Rather than simply developing productive strategies of digital production, it was essential that the teachers also confronted and challenged the student perspectives.

Third, the pedagogical approaches that were about civic life argued that addressing complex problems that had wide social significance and that intersected with students' lives could develop capacities of active citizenship in students. These approaches dealt with participation in local political debates concerning cycling (Rajala, Hilppö, Lipponen, & Kumpulainen, 2013), determining the students' personal impact on climate change (Fauville, Lantz-Andersson, Dupont, Mäkitalo & Säljö, this volume), or confronting affluent students' ideas about social justice issues through engaging them in mathematical learning activities (Esmonde, 2013). In these approaches, the students' personal experiences and knowledge were confronted and expanded through engaging them in pedagogical activity.

For example, Fauville et al. (this volume) studied how a digital tool for calculating a carbon footprint was used by classes of high school students around the world. The carbon footprint calculator measures the quantity of a person's carbon dioxide emissions associated with his or her lifestyle and visualises this otherwise invisible aspect of the person's environmental impact. The students used the calculator to estimate how different activities of their everyday lives contributed to their carbon footprints and compared the results to the local and global averages. Students were also prompted to reflect on how to reduce their carbon footprints. The averages of each of the participating classes worldwide were then displayed on a digital map, and the students took part in international online discussions about the topics of climate change and its mitigation. Finally, students completed a questionnaire regarding the pedagogical activity. The study showed that involvement in the activity triggered emotionally and morally charged reactions, such as pride and guilt, among the students. The pedagogical activity also allowed the students to shift their focus between local and global perspectives in ways that challenged and expanded their views about the topic. The focus on a local perspective was important because reflections at this level enabled students to feel responsible for the environment and take action. Yet, the possibility to shift to a global perspective fostered the students'

awareness of the issues at a general level, enabling them to make sense of their local life styles in the global context.

Fourth, in a number of studies we reviewed, the capacity to connect learning across contexts was seen as a valued learning outcome in itself. This argument was most visible in the seamless-learning approach (Chen, Seow, So, Toh, & Looi, 2010; Wong, 2013), whose basic premise is that students need to 'continually enhance their knowledge and skills' (Chen et al., 2010). Through a long-term process of enculturation from facilitated to self-directed seamless learning, the students' learning was argued to move beyond the acquisition of content knowledge to developing a capacity to learn seamlessly across contexts.

Wong (2013) presented two design experiments in Singapore in which seamless learning was fostered by giving primary school students smart phones that featured a digital camera and mobile learning-environment software. The smart phones functioned as "learning hubs" that the students carried with them all the time, enabling them to manage their seamless learning across contexts and activities. The pedagogical design involved a cyclical model consisting of four types of activities: learning engagement, personalised learning, online social learning, and in-class consolidation. Some of these activities took place in formal, and some in informal, settings. The first design experiment lasted eight months and involved learning idioms in Chinese, and the second one involved a series of inquiry-based science learning projects over two years. Among other things, in both projects, 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 that they created were then discussed in a virtual learning environment among peers and in class, which was facilitated by the teacher.

Whilst in both of the projects the seamless-learning design contributed to the conceptual learning of the students, indications of the emergence of limited but growing self-directed seamless learning were documented. In the first design experiment, the students, on their own initiative, started to take photos illustrating given idioms in their homes and in other locations of their everyday lives. Thus, the formal artefact creation activities "spilled into" the students' informal settings. In the second design experiment, the students started to sustain informal inquiries on topics of their own interest with the aid of the smart phones. The researchers interpreted these as indications of their success in "planting a seed of seamless learning in the children" (Wong, 2013, p. 334).

Overall, in comparison to the other rationales, in many of the pedagogical approaches addressing the learning requirements and competences of the 21st century, the students own interests and concerns were not always given a prominent role. For example, in a study by Rajala et al. (2013), it was the teachers who formed the leading theme of the students' inquiry project, and the students' interests were not heard at this initial stage of launching the activity. Other studies, on the other hand, have warned about the domestication of student out-of-school learning in which the official culture appropriates the unofficial one for its own ends (Hull &

Schultz, 2001; James, Purohit, & Walsh, 2006). In all, these challenges call forth the important role of pedagogical culture, including institutional and social norms, in mediating students' connected learning opportunities (Alexander, 2008; Kumpulainen & Renshaw, 2007).

Learner Agency and Identity across Contexts

This rationale broke out of a school-centric focus and depicted school as only one among many settings in students' learning ecologies (Barron, 2006). In pedagogical approaches motivated by this rationale, students were seen as capable of playing a role in their own development, and emphasis was placed on fostering their agency and ownership in learning. This rationale also involved a reconceptualization of learners as crossing boundaries across contexts (Akkerman & Bakker, 2011) and operating at the intersection between school and other contexts. Students were supported in negotiating their identities at the boundaries of the multiple, and sometimes contradictory, activities that comprised their learning ecologies, and in changing their participation in these activities.

Some of the pedagogical approaches advanced this rationale by creating online learning spaces that resembled those that students used in their leisure time (Erstad, 2014; Kumpulainen & Mikkola, 2014; Vasbø, Silseth & Erstad, 2014; Lantz-Anderson, Vigmo & Bowen, 2013; Vigmo & Lantz-Anderson, 2014). The aim was to let the students take these digital spaces as theirs and to enable them to use the advanced and creative media practices they had developed in their leisure time (Drotner, 2008; Vigmo & Lantz-Anderson, 2014). The digital spaces included commercially available digital tools, such as blogging (Vigmo & Lantz-Anderson, 2014), Facebook groups (Lantz-Anderson et al., 2013), and online learning spaces produced for the purposes of the research (Erstad, 2014; Kumpulainen & Mikkola, 2014; Vasbø et al., 2014). These digital tools created hybrid spaces for meaning-making in which the students' different identities, interests, and discourses intersected. However, in these pedagogical approaches, the students were not provided with deliberate support for negotiating and translating difference and managing tensions involved in these encounters.

For example, Lantz-Anderson et al. (2013) studied the pedagogical use of a Facebook group in English-learning classes; 60 students aged between 13 and 16 from Colombia, Finland, Sweden, and Taiwan participated in the study. The aim was to generate extended spaces for collaborative language-learning in educational contexts in which students merged the school subject of language-learning and the communicative use of language in their everyday lives. The task assigned to the students was designed to give maximum space for students' everyday ways of using language and to avoid the activity becoming just another regular school activity. To this end, the design allowed for participation in the group to be voluntary and instructional guidance to be kept to a minimum; in addition, students' contributions to the group were not assessed by the teachers.

The study showed 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. Students initially interpreted the task as a regular school task and their postings—framed as expository school texts—were acknowledged or commented on only minimally by the other students. However, an expansion of the activity took place through a playful interaction that challenged the formal language use in the group. A posting by one of the students that made fun of the assignment generated a lively exchange of comments that diverged from formal language use and resembled young people's everyday interactions in social media. A tension between official and unofficial language uses was evident in these exchanges, and the teacher and some of the students interpreted the divergent actions as misbehaviour. Yet, despite the seemingly unproductive nature of these exchanges, they marked a shift in the interaction pattern after which the students more frequently commented on each other's postings. The students also started to use a more casual communicative style that incorporated features from their everyday ways of interaction. The results of the study highlight that extending the official classroom space to incorporate students' everyday ways of engaging in digital media was not trivial. Instead, creating hybrid spaces of language-learning involved conflictual negotiations about what counted as a legitimate framing of the activity and correct language use.

In some of the pedagogical approaches guided by this rationale, deliberate attempts were made to support the students in negotiating the discontinuities within their learning ecologies. In a study by James et al. (2006), U.S. middle school students in New York's Chinatown were asked to document their literacy practices and events in and outside of school by keeping literacy logs. Prior to doing this, the teacher and the students discussed with the students what 'literacy' and 'literacy events' mean. A researcher then analysed the students' logs and discussed the results with the students. Based on the results, each student investigated further one student-selected literacy area, using ethnographic methods that were taught to them. Finally, the students investigated researcher-selected literacy practices in groups.

Another example of supporting students in navigating amidst different settings of their learning ecologies relied on a pedagogical culture of dialogic inquiry. Kumpulainen and Lipponen (2010, 2013; Kumpulainen, 2013) studied a third-grade classroom community in Finland that they characterised as operating according to the principles of dialogic inquiry. These principles included an emphasis on joint exploration and negotiation of meanings. Classroom members were expected to build on each other's knowledge and experiences, and in doing so, to further extend their collective thinking about the issues in question. The authors showed that the classroom interactions positioned the students with agency to initiate discussion and to negotiate, challenge, and justify ideas. The discussions provided support for the learners to revisit and reflect on their personal experiences and to weave experiences and worlds together.

DISCUSSION

Connecting learning across school and out-of-school contexts is a growing concern in educational research and practice. This concern reflects a turbulence of societal demands for schooling, stemming from constantly changing private, public, and working lives in contemporary knowledge societies (Biesta, 2013; Erstad & Sefton-Green, 2013; Kumpulainen, 2013; The New London Group, 1996). In this chapter, we have reviewed pedagogical approaches that addressed this concern by connecting school learning to students' everyday lives outside of school. In particular, we identified three pedagogical rationales that guided these approaches. We also analysed the pedagogical practices and tools that were associated with these rationales. The first rationale, educational equity and inclusiveness, had already been identified in earlier reviews of research on the topic (Hogg, 2011; Hull & Schultz, 2001). In addition to reaffirming this finding, our review extends this earlier work and brings forth the rationales of learning requirements and competences of the 21st century and learner agency and identity across contexts. Our review thus provides an extended and more recent overview of the pedagogical approaches and rationales for connecting student learning across school and out-of-school contexts.

The rationale of educational equity and inclusiveness addressed a concern that instructional and evaluative practices in schools tend to favour the knowledge and experiences of students whose backgrounds are similar to those of teachers and dominant cultural groups over the knowledge and experiences of under-represented students. This rationale therefore reconceptualises the underachievement of minority students in terms of sociocultural mismatches rather than their deficiencies. The pedagogical approaches guided by this rationale—carried out in schools of students from marginalised cultural or socio-economic groups—gave opportunities for these students to take an active part in the classroom activities and to be recognised as valued thinkers and doers. A common orientation of the teachers and researchers was to genuinely learn from, and reflect on, the diverse lives and sense-making practices of these students and to connect the students' funds of knowledge with instruction. Yet, there was variation with regard to whether students or adults determined which out-of-school learning was recognised and brought into the classroom (see also Hogg, 2011; Rios-Aguilar, Kiyama, Gravitt, & Moll, 2011). Approaches that rely on adult practices may ignore the fact that students create funds of knowledge independently of their family, including those stemming from popular culture and children's peer cultures (Barton & Tan, 2009). The pedagogical approaches guided by this rationale also varied with respect to whether they included rigorous analyses of disciplinary concepts and practices (Buxton, 2006; Rosebery et al., 2010; Warren et al., 2001) or whether they focused on the instruction in general terms and only paid close attention to students' out-of-school learning and interests (e.g., Barton & Tan, 2009; Gutiérrez et al., 1999; Moll et al., 1992; Upadhay, 2009). The promotion of inclusive instructional practice sometimes challenged the established

instructional and disciplinary practices since it involved questioning taken-for-granted values, curricular content, and instructional approaches. Its transformative nature could provoke conflicts and was thus sometimes risky for teachers and students (Gutiérrez et al., 1999; Zipin, 2009). In addition, implementing inclusive practices can occasionally reveal how the new practices themselves have been built on stereotypical cultural imagination, despite their deliberate effort to resist this. For example, Solsken, Willett, and Wilson-Keenan (2000) have demonstrated how new classroom practices that were designed to be responsive to marginalized communities unintentionally reinforced the discrete boundaries between the linguistic practices of different cultural groups. This oversight of the more complex and hybrid composition of language and cultural practices then hindered the teacher in recognizing and supporting the unique contributions of children belonging to mixed cultural families.

The second rationale, learning requirements and competences of the 21st century, involved fostering students' competences required in the academic, working, or civic lives of this century. Some of the approaches guided by this rationale questioned conventional notions of academic learning that were claimed to produce a disconnection between students' learning in and out of school. Robust engagement in authentic disciplinary practices was argued to involve teachers and children juxtaposing and merging forms of thinking, communicating, and material practices from different social and cultural contexts (Kamberlis & Wehunt, 2012). Similarly, the development of creative production competences necessitated by today's economy and working life was seen to rely on a creative process distributed in and across the different sociocultural contexts that the students inhabited. Nevertheless, the expertise that students developed outside of school, such as that in digital production, were not seen as self-sufficient but as complementary to what they developed in school (de Lange, 2011; Kumpulainen et al., 2014). In some of the pedagogical approaches that addressed this rationale, active citizenship in today's societies was seen to develop through dealing with complex problems that intersected with students' lives and had wider social significance. In these approaches, disciplinary knowledge and practices were employed to expand students' understanding of aspects of their lives (Esmonde, 2013; Fauville et al., this volume) or to take action to influence their local communities (Rajala et al., 2013). Finally, a capacity to use digital technology to sustain and bridge learning across contexts (a capacity to learn 'seamlessly') was seen as an essential competence in itself for adapting to the demands of life in this century (Wong, 2013).

The third rationale, learner identity and agency across contexts, took students' whole learning ecologies as a starting point for pedagogy. This rationale challenged the view of schools as providers of pre-defined routes towards adulthood, citizenship, and working life. In particular, granting legitimacy for a variety of literacies, practices, and forms of knowledge that the children and youth had developed and employed outside of school was considered important in this rationale (Erstad & Sefton-Green, 2013; Kumpulainen et al., 2010). Some of these approaches provisioned students

with online spaces that resembled those that the students used in their leisure time. Yet, the ways in which the virtual spaces were framed in students' peer cultures often clashed with how formal instruction framed these spaces (Lantz-Anderson et al., 2013). These approaches did not provide deliberate support for negotiating and managing difference and tensions involved in the encounters between official and unofficial identities and discourses that were enacted in these online spaces. A key challenge was that seemingly unproductive, or even detrimental, exchanges, such as playful interactions, exchange of emotional experiences, or even non-compliance, had the potential of expanding the official school framing in ways that promoted students' identities of work and creative engagement, as well as the development of a positive community of learning (Kumpulainen & Mikkola, 2013; Lantz-Andersson et al., 2013; see also Rajala & Sannino, 2015). Other approaches provided deliberate support for negotiating the tension between official and unofficial identities and knowledge (James et al., 2006; Kumpulainen & Lipponen, 2010).

The three pedagogical rationales identified in this study can be further discussed by discerning how they relate to the three interrelated functions that educational systems perform: qualification, socialisation, and subjectification (Biesta, 2009). The qualification function involves providing students with knowledge, skills, understanding, and dispositions. This function is often related to preparation for working life but is also important for other realms of life. The socialisation function serves as the sustainment of social cohesion and integration, and of the continuation of cultural forms and traditions. Socialisation can be an explicit aim of a pedagogical approach, but it often remains as an implicit pressure and guidance to conform to given social, cultural, and political orders. Thus, when promoting social cohesion and integration, it is important to pay attention to who is expected to be integrated into what and to cohere with whom, and who defines the standards (Biesta, 2013). The third function, subjectification, is potentially in conflict with the other two functions (see also Bruner, 1996) and can sometimes be very weakly emphasised in a pedagogical approach. Whereas the socialisation function emphasises adaptation and adjustment to given social and cultural practices, subjectification emphasises learners' agentive responses to the demands that are imposed on them. Thus, subjectification deals with students becoming more autonomous in their thinking and acting (Biesta, 2009).

The rationale of learning requirements and competences of the 21st century mostly revolved around the qualification function of education. The pedagogical approaches that addressed this rationale argued that the current knowledge society involved a change in what qualifications schools should provide for the students in order for them to participate in academic, working, or civic lives. In some of these approaches, the socialisation function was also emphasised: the students were, for example, guided to appropriate identities of active and concerned citizens (Esmonde, 2013; Fauville et al., this volume; Rajala et al., 2013). The emphasis on socialisation into identities that seemed somewhat defined from the outset was particularly prominent in the seamless-learning approach (Chen, 2010; Wong, 2013), which

sought to foster the student's progressive growth in a seamless-learning habit of mind. This emphasis was underscored by the aim to develop a taxonomy of seamless mobile-learning skills in order to fine-tune learning designs for nurturing students into becoming better self-directed seamless learners (Wong, 2013).

The two other rationales contrasted with the rationale of learning requirements and competences of the 21st century in that they emphasised the subjectification function more. In other words, the diversity of students' out-of-school learning and interests was seen as providing a sharper contrast and challenge to official school learning (Gutiérrez et al., 1999; Rosebery et al., 2010; Warren et al., 2001). In fact, it was precisely the differences and tensions between the official and unofficial identities, knowledge, and discourses that were seen to have the expansive potential to advance the rationales of educational equity and inclusiveness, and of learner agency and identity across contexts. The former rationale involved an attempt to challenge a process of socialisation of the under-represented students into the values and forms of thinking and communicating of the dominant cultural and socio-economical groups. In the early studies addressing this rationale, the subjectification took place at a group level, as empowerment of the families and communities of the underrepresented students (e.g., Moll et al., 1992). In the more recent work, this emphasis of adult worlds and adult practices was called into question, and the perspectives of individual children and youths were brought to the fore (Barton & Tan, 2009). In the rationale of fostering identity and agency across contexts, the subjectification of individual students was made possible. Yet, this rationale, too, involved the formation of a collective subject: that of a member of children or youth's peer culture.

Discussions around the importance of informal learning are often imbued with rather romantic notions of what out-of-school learning looks like and are also dismissive about the impact and importance of formal schooling in people's lives and the society in general (Hull & Schultz, 2001; Säljö, 2003). However, building the curriculum, largely around the practices and needs of students' everyday lives, easily dismisses the value and power that engaging with more academic practices can have in itself for the lives of students, underprivileged or not (Hull & Schultz, 2001). Critics of the funds-of-knowledge approach, for example, argue that a lack of attention to scientific concepts provided by the school may contribute to the further detriment of the under-represented students' situation, since for many students, schools are essential providers of access to scientific concepts (see Daniels, 2007; Rowlands, 2000). This criticism reflects a wider concern regarding the relationship between the local settings and of the wider society. The value of students' expertise is not only determined locally by teachers, but it is also connected to broader cultural and social systems of meaning. For example, the worth of given expertise or knowledge depends on the access such knowledge gives to particular positions in society (Biesta, 2009). It may not be enough that educational practices are informed or allowing for a wider range of

competencies to be brought into classroom practices. Rios-Aguilar et al. (2011) argue that attention should be given to the examination of processes that convert or transform various funds of knowledge into other more tangible kinds of social and cultural capital, such as better grades, higher college-enrolment rates, or higher civic participation. Yet, too much emphasis on standardisation and predefined end points of learning in schools can re-evoke the deficit perspective towards under-represented students and hinder the mobilisation of the resources they have at their disposal. Furthermore, the public sphere is increasingly becoming a space for the negotiation of differences in cultural practices and lifestyles. The private spheres are similarly going through major transitions and personal lifeworlds are becoming more diverse and overlapping, and less clearly bounded. These ongoing societal changes challenge the role of schools as providers of predefined routes towards adulthood, citizenship, and working life. Children and young people can no longer build on taken-for-granted social identities but need to engage in identity making as integral part of learning (Beach, 1999).

Overall, the findings of this study point out that the connection between school learning and other more informal learning practices is more complex than it would seem at first-hand. Our findings illuminate the multiplicity and heterogeneity of the reasons for connecting student learning across school and out-of-school contexts. The rationales we identified in this study are not necessarily mutually compatible but reflect a complex set of interests and agendas, also conflicting ones. On the one hand, the rationales provided by some of the pedagogical approaches can be traced to economic rationales according to which education systems are viewed as instruments for economic change (Ozga & Jones, 2006). Such economic rationale views learning as a demand posed on individuals—a continuing demand to adapt and adjust to the changing and inevitable economic conditions—rather than as a right that societies are responsible to guarantee for the citizens or a way to change the society for the better (Biesta, 2013). On the other hand, other pedagogical rationales stemmed from agendas for promoting personal development or democratic participation and social justice. The views of education are always based on values and beliefs about a good society and the nature of childhood. If we could not recognise the multiple rationales of education, we would negate the possibility of making political choices concerning the societies towards which we would like to proceed. Our review can be regarded as an attempt to make these educational rationales more visible for reflection and modification at this specific point in time and space.

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SECTION ONE

PRACTICES AND EXPERIENCES OF MEANING-MAKING

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3. DECIPHERING THE ANATOMY OF SCIENTIFIC ARGUMENTATION

The Emergence of Science Literacy

INTRODUCTION

The dramatic expansion of knowledge during recent decades, as well as the rapid development of digital technologies providing access to information, poses interesting challenges to established educational activities, including attempts to introduce young people to modern scientific practices and their results. As early as one hundred years ago, Dewey (1916) argued that it was no longer possible for schools to keep up with the dramatic expansion of scientific knowledge in all areas and disciplines. Instead of adding more facts and information to the curriculum, he argued that schooling should focus on generic skills and competences that are relevant across contents and settings. The contributions to this volume testify to the fact that issues of generic skills and learning across contexts continue to be important for instruction. Our example involves learning about scientific inquiry, which, following Dewey, can be considered an example of a set of generic skills that should be taught in such dynamic circumstances. When preparing to engage in scientific inquiry, students need to learn the logic of scientific work, that is, how scientific knowledge is produced, validated, and communicated. Thus, the idea behind learning through inquiry is that students should not only learn the products of science but also develop intellectual and practical skills for understanding critical features of the nature of science and scientific inquiry (cf. Lager-Nyqvist, Wickman, Lundegård, Lederman, & Lederman, 2011).

The background of this study is an interest in how students learn about inquiry and the logic and validity of scientific procedures and claims. More specifically, we investigate how upper secondary school students work with a particular kind of assignment in which they do not engage in inquiry themselves but rather read and evaluate research completed by others. The specific task for these students is to critically scrutinise the scientific validity of claims presented in two short article abstracts that concern the relation between pH changes in seawater and an increase

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 39–60.

in the numbers of jellyfish observed in the sea along the Swedish coast. The issue explored is to what extent the students are able to understand the nature of the study reported and the claims made on the basis of that study.

Our study is conducted within a sociocultural tradition in which learning is viewed as a matter of appropriating cultural tools (Säljö, 2011; Vygotsky, 1978; Wertsch, 1998). To empirically study learning from this perspective, the unit of analysis accordingly needs to include cultural tools and the ways in which people make use of them when interacting with the world (Säljö, 2009; Wertsch, 1998). In this study, the article abstracts that the students grappled with are understood as rich cultural resources that incorporate and exploit scientific language and other resources, such as diagrams, tables, and equations, to report findings and make an argument. The study concerns to what extent students are able to follow arguments using such semiotic resources, and to what extent they are capable of evaluating the validity of the conclusions that are drawn. Thus, our research concerns issues of what is often referred to in the literature as science or scientific literacy (Lundqvist, Säljö, & Östman, 2013).

UNDERSTANDING THE LOGIC OF SCIENTIFIC INQUIRY

Science literacy and *scientific literacy* have emerged as salient concepts in science education during the past decades, and they are used with a range of definitions and meanings[1] (DeBoer, 2000; Roberts, 2007). In the case of this study, the focus is on how students develop an understanding of (a) how to use scientific concepts, (b) how to connect the various modalities which science discourse utilises, and (c) how to translate one modality into another (Lemke, 2004). Examples of the terminology used in scientific discourse and practice in the context in which this study is set are *sample*, *replicate*, *control group*, *mean*, *observation*, and *comparison*. Even though such concepts are complex, and students may not initially understand them, there are signs that they begin to understand how to use them when exposed to such expressions in specific activities of science learning (Lemke, 1990). To become science-literate, it is not enough to acquire a specific terminology and learn about scientific methods and inquiry. Another aspect of learning science includes developing an ability to use textual and multimodal resources (diagrams, tables, pictures, and other representations) to understand scientific issues and to communicate and to argue about them.

Another aspect of becoming science-literate involves learning how to make claims in an expected manner. To understand and critically scrutinise scientific claims is something that students need to practice. In an experimental programme with the purpose of supporting students in their ability to make explicit reasons for making claims, Wegerif, Mercer, and Dawes (1999) found that one way of

supporting this was through "exploratory talk," in which students share relevant information within a group and negotiate an agreement before making a joint decision. This way of engaging in explicit reasoning, while following specific communicative rules, was shown to support students in their ability to identify important elements of argumentation.

In order for students to learn about scientific inquiry, several studies highlight the importance of encountering scientific argumentation in science education (e.g., Berland & McNeill, 2010; Driver, Newton, & Osborne, 2000). Scientific argumentation could be defined as a *product* as well as a *process*. The argumentative product refers to "a reasoned piece of discourse in which a claim has been justified," whereas the argumentative process

> focuses on the social interactions between participants in the arguments. (Berland & McNeill, 2010, p. 772)

This implies that for students to appropriate such skills, they would need to work with assignments that trigger them to

> articulate reasons for supporting a particular claim; to attempt to persuade or convince their peers; to express doubts; to ask questions; to relate alternate views; and to point out what is not known. (Driver et al., 2000, p. 291)

Understanding the Nature of Experimentation as Inquiry

Understanding the logic and practice of scientific experiments is crucial for the students in the context we study. Generally expressed, a part of what one has to learn is how terms are used in different social languages (Bakhtin, 1981). The term *experiment*, for instance, is used differently in a research setting as compared to classrooms or everyday parlance. In everyday language, the term often refers to a general manipulation of objects, or is used as a synonym for trying and testing something rather than as a

> methodology for studying causal relationships as part of scientific research. (Gyllenpalm, 2010, p. 26)

Furthermore, in order to be able to reason scientifically, students need to both understand a specific problem and realise how a research study can be organised in relation to this particular problem. Thus, it is not enough to learn about, for instance, scientific concepts and experimentation at a general level; it is also necessary to learn how such resources can be relevant in a particular context and in relation to a particular question (Gyllenpalm, 2010). Understanding this is to realise that experimentation represents a specific mode of organising research and

knowledge production, which may be seen as an element of what counts as being science-literate.

One problem that has been identified in school activities involving laboratory work and experimentation is that students seem to focus on completion of the concrete task rather than on understanding the procedures and concepts involved in such work (Berry, Mulhall, Loughran, & Gunstone, 1999). Various research results point to the dilemma for students to learn both how to *do* experiments in a practical sense and to learn *about* experiments as a method for investigating issues (e.g., Bybee, 2000; Gyllenpalm, 2010; Lager-Nyqvist et al., 2011). Both skills need to be practised and learnt over time (Hart, Mulhall, Berry, Loughran, & Gunstone, 2000).

In a study targeting what written tests say about pupils' skills in formulating questions that are possible to investigate through scientific methods, Lager-Nyqvist et al. (2011), analysed the activities of 32 groups of pupils (aged 12–13) working with assignments of planning and conducting empirical investigations. The results illustrate that the abilities of the groups to formulate questions that would be possible to investigate in a scientific manner were dependent on the situation, that is, if they were to formulate such questions (a) in writing as a separate task, (b) in verbal form, or (c) while conducting the investigation. The study concludes that formulating such questions solely through writing is a difficult task, while doing it in a hands-on situation seems much easier.

A somewhat similar conclusion was reached in a study of the use of a virtual lab in environmental-science teaching (Petersson, Lantz-Andersson, & Säljö, 2013). The study focused on students' written answers to a specific environmental problem that they were to address by describing an experiment. The findings from this study pointed to some interesting differences in how the students approached the task. A major difference concerned whether they suggested a solution to the problem by outlining an experiment, or if they engaged in discussing the environmental concerns involved. Some students were successful in formulating the problem in terms of a research design, while the majority responded to it as a practical, political concern (Petersson et al., 2013). The results point to the complexity of learning *about* experiments and experimentation as modes of generating knowledge and to communicate about this (formulating questions, defining and manipulating variables, interpreting data, etc.) in writing.

In the present study, the students engaged in a different kind of science literacy assignment for which they were asked to scrutinise the validity of research claims in two texts, designed as research article abstracts. So, rather than describing a research design to study a scientific problem, they were to scrutinise *a scholarly text* and take a stand on the validity of the conclusions drawn. From a sociocultural perspective, the assignment accordingly presented students with a range of

established science literacy practices and tools in text, and the intricate problem of making sense of, and evaluating, how they have been used. The analytical question, accordingly, is how students, under such conditions, are able to understand and critically scrutinise scientific claims.

THE STUDY

Setting and Participants

The study is part of an extensive research project, called Inquiry-to-Insight[2] (I2I), which is a large-scale, binational collaboration between schools in the United States and Sweden dealing with issues of climate change. This case study is based on empirical material from an upper secondary school class in Sweden engaged in activities related to climate change as an environmental problem. The class worked during one school year with various digital resources (e.g., a virtual lab and a carbon footprint calculator), along with written assignments aimed at triggering students to collaboratively reason about research and environmental issues related to climate change. The students also visited a marine station, where they met with marine biologists in order to learn about ongoing experiments at the station. The curricular context was marine biology, a subject of choice of the students included in the study.

The activity analysed in the present study includes data from 15 students (aged 17–18) who worked during one half-day lesson comprising reading, discussing, and reporting on two research article abstracts. The student assignment is explained in detail below. The teacher introduced the activity in the class. After the introduction, the students worked on the assignment in pairs or in small groups. Since the students were to send their reports to the teacher by email, they worked with a portable computer. In general, the student placed in front of the computer navigated the computer mouse and was in charge of the keyboard.

Student Assignment

At the beginning of the lesson, the students were given the two short research article abstracts (Figure 3.1 and Figure 3.2). The problem reported on in the abstracts concerns correlations between an increasing amount of jellyfish in the waters on the Swedish west coast (in a body of water near to the school) and a change of pH conditions due to ocean acidification.[3] As can be seen in Figure 3.1, Abstract 1 includes a design based on a series of longitudinal measurements of the prevalence of jellyfish.

Abstract 1: Increase in jellyfish abundance in the Local fjord

Using the data obtained since 1990 from the continuous plankton recorder, the relative abundance of jellyfish during the spring bloom in the Local fjord was plotted. A significant linear relationship ($p < 0.001$) was observed between the abundance of jellyfish and the year following the equation: Abundance = 0.0935xTime – 179.63.

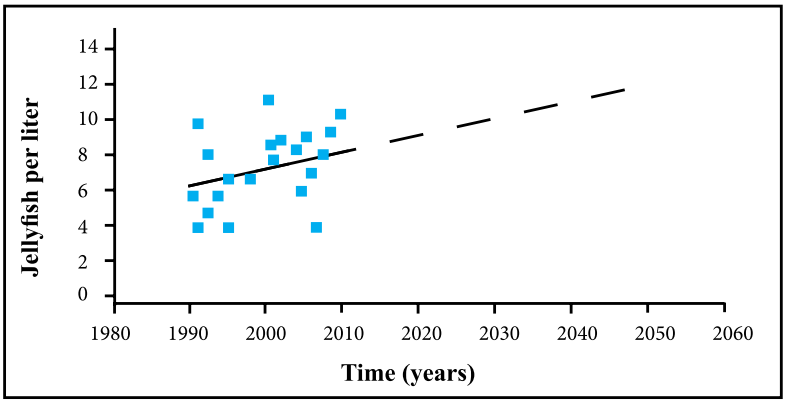

Figure 1: Relationship and prediction of jellyfish abundance in the Local fjord between 1990 and 2050.

Using the equation, it has been calculated that the abundance will double by 2050 (12 jellyfishes per litre) compare to 1990 (6 jellyfishes per litre). This increased abundance seems to be correlated with other parameters of the seawater, such as pH decrease due to ocean acidification.

To conclude, it is very likely that ocean acidification is responsible for the observed trend and that if pH continues to decrease in the near future (pH predicted to decrease from 8.1 to 7.7), more important jellyfish blooms will occur in the Local fjord.

Figure 3.1. Article abstract 1: Increase of jellyfish abundance in the Local fjord

Abstract 2 presented an experimental investigation in order to test the conclusion made in Abstract 1 (see Figure 3.2).

Abstract 2: Decreased pH does not affect growth of jellyfish

The researcher in Abstract 1 concluded that the decrease in pH may be responsible for the spring jellyfish bloom observed in the Local fjord and that future predicted pH changes (from 8.1 to 7.7) might increase this trend.

This claim was tested using jellyfish collected in the Local fjord. Twenty jellyfish were collected in February 2010. Ten were kept in control pH conditions (pH 8.8), and ten were kept under low pH conditions (pH 7.7) for a period of two weeks. Animals were fed during the whole experiment ad libitum.

Animals were measured at the beginning and at the end of the experiment, and a growth rate was calculated as the gain in size in mm per day.

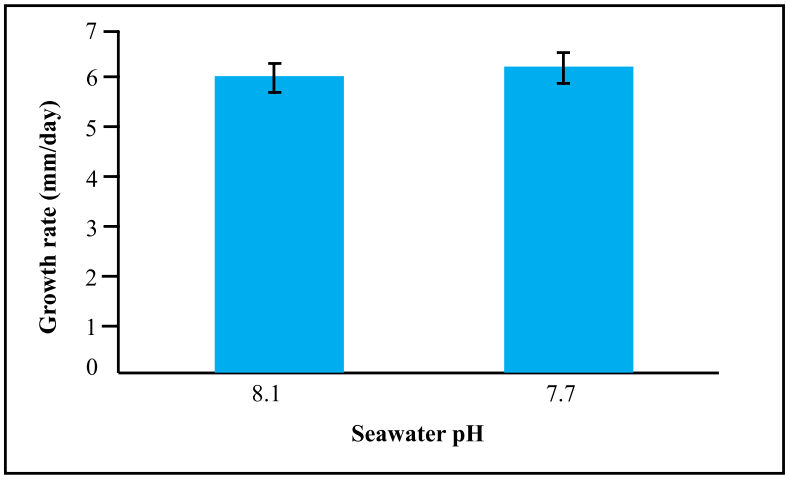

Figure A: Impact of pH on jellyfish growth rate.

No significant difference between the two pH was observed ($p = 0.876$). To conclude, pH does not have an impact on jellyfish growth and the effects observed in Abstract 1 may be attributed to the change of another environmental parameter such as temperature increase due to global warming.

Figure 3.2. Article abstract 2: Decreased pH does not affect growth of jellyfish

As can be seen, the abstracts present results using resources such as equations, graphs, tables, and text. Student meaning-making involves incorporating information from these different types of inscriptions. The abstracts were designed and formulated

by a marine biologist researcher working with the I2I project. Both Abstracts 1 and 2 are designed to be open to various interpretations. The abstracts intentionally include some problems regarding the data, such as possibilities for replicating the study, sample size, timing and duration of data collection, etc. The abstracts were designed in this manner in order to trigger the students to deconstruct and reason about the validity of the arguments and claims.

The assignment included questions of whether the two abstracts are scientifically accurate and if the abstracts present correct conclusions; that is, the students had to decide if the claims are valid in scientific terms.

Data and Analysis

The data analysed are approximately four and one half hours of video documentation focusing on how students interpret and evaluate scientific claims. The video cameras were positioned on tripods behind the students in order to capture non-verbal activities (pointing at the paper with the assignment, pointing at the computer screen, etc.). Additionally, the program ScreenFlow was used to record the computer screen. In this way, we were able to follow students' activities on the screen by observing both their non-verbal activities and their actions on the keyboard and computer mouse (for illustration of video data, see Figure 3.3).

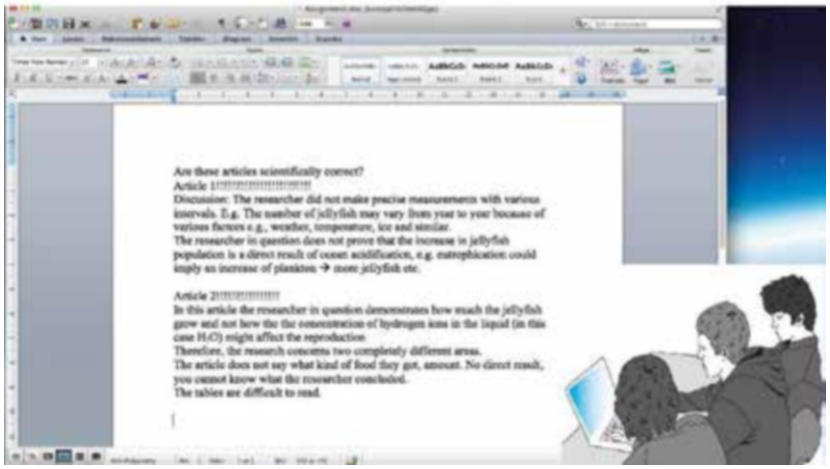

Figure 3.3. Illustration of the video data where the film of the students and the screen recording of the students' document have been synchronised into one film

In order to investigate how students scrutinise the information and evaluate the conclusions in the abstracts, the analysis will focus on students' reasoning and arguing about the validity of the claims. As mentioned earlier, "talking science," in

Lemke's sense, relies on the ability to combine, compare, and interpret information expressed in different modes and formats.

The data corpus consists of video recordings of four groups of students. As was described in the previous section, there are some problems regarding data collection and conclusions in both article abstracts that the students have to grapple with. Tables 3.1 and 3.2, which were formulated in collaboration with the marine biologist who designed the student assignment, provide an overview of the aspects that could be questioned. In addition, the tables indicate whether the problems were brought up by the students (marked as X in the tables) or if they were not (marked as – in the tables).

Table 3.1. Overview of problems with data collection and conclusion in Abstract 1

Problems with data collection and conclusion in Abstract 1				
	Group 1	*Group 2*	*Group 3*	*Group 4*
The correlation between time and jellyfish numbers is not very convincing.	–	X	–	–
It is scientifically inaccurate to extrapolate from a 10-year data series to the following 40 years.	–	X	X	X
It is claimed that the increase in jellyfish abundance is correlated to pH, but no direct evidence is provided.	X	X	X	X
Alternative problems are not mentioned by the expert marine biologist.	–	X	–	–

Table 3.2. Overview of problems with data collection and conclusion in Abstract 2

Problems with data collection and conclusion in Abstract 2				
	Group 1	*Group2*	*Group 3*	*Group 4*
There is no replication, and the sample size is small (n = 10).	X	X	–	X
Duration time was short (two weeks).	–	–	X	–
Animals were overfed, which could potentially hide a real impact.	–	–	–	X
Only one single parameter (growth rate) was observed.	X	X	–	X
Only one life cycle was considered (adults, but larvae may be more sensitive).	–	–	–	–
Alternative problems are not mentioned by the marine biologist.	–	X	–	X

The last row of the tables indicates that, in some cases, students mentioned issues that were not foreseen by the expert marine biologist. For instance, one group of students noticed a lack of information about what kind of jellyfish species the study in Abstract 1 included. The same comment was made by some students in relation to Abstract 2, and they also mentioned that they lacked specific information about the type of food, salinity, and water temperature.

In this chapter, we focus on the discussions in three groups. The reason for selecting instances of interaction from three of the four groups was that these groups had more elaborate accounts in their work of critically scrutinising the two article abstracts. The data from the fourth group was therefore not as informative in terms of *how* they understood the problems they identified in the abstracts.

STUDENTS' DECONSTRUCTION OF SCIENTIFIC ARGUMENTATION

The results are organised around three themes that concern students' considerations of (1) the data-collection procedures used, (2) the measurement procedures, and (3) the justification of the conclusions. These themes are empirically derived and illustrate the types of reasoning in which the students are engaged when scrutinising the scientific argumentation in relation to the article abstracts. The themes, along with examples of students' interpretations of scientific claims made in the abstracts, are presented in Table 3.3.

Table 3.3. Types of student reasoning about scientific claims in the article abstracts

Themes	*Examples of students' interpretations*	*Issues raised*
Scrutinising procedures of data collection	cause here it's no wonder that they grow as much since they are fed (Simon)	Validity
	well it ((the increase of jellyfish abundance)) could for example be due to eutrophication (Jim)	Selection
	so ten jellyfish isn't really (.) enough (Philip)	Quantity
Scrutinising conditions for measuring	the researcher has not performed exact measurements during different intervals full stop here (Tom)	Time range
	but I think this (.) other ((abstract)) he only conducts it ((the experiment)) during two weeks (Ella)	Duration
Scrutinising validity of conclusions	i- i- if you have measured this from nineteen ninety (.) to two thousand ten then it's twenty years and it's really difficult to calculate (.) fifty years ahead in time using just twenty years[4] (Jim)	Prediction
	it will probably be more jellyfish but you can't say that based on this abstract (Peter)	Validity

Each theme will be further elaborated in the following sections.

Scrutinising Procedures of Data Collection

The following two excerpts illustrate how students in their group discussions scrutinise the procedures of data collection in both abstracts. Examples of such group discussions that consider the argumentation in this respect concerned (a) sample size, (b) how the jellyfish were fed, and (c) other parameters that are not taken into consideration in the studies according to the abstracts, such as eutrophication and temperature (see Table 3.3 for quality of data collection). In the first excerpt, Jim and Albin reason whether the abstracts presented in the assignment are scientifically correct or not. After a discussion about how they are to write the report (what headings to use, in what font size the text should be presented, etc.), the boys, including the third member, Tom, begin to question the quality of the abstracts.

Excerpt 1: Sample size

01. Jim:	okay are both (.) abstracts scientifically correct
02. Albin:	NO they're not
03. Jim:	why not?
04. Albin:	cause they're so damn it's so few ((jellyfish)) calculated if it would've been scientific they should've had a thousand (inaudible)

As a reply to Jim's question, if the two abstracts are valid, Albin emphasises, in utterance 02, that "they're not." By taking Abstract 2, which is based on an experimental investigation, as an example, Albin begins (in 04) to explain why the abstracts are not scientifically correct. Abstract 2 aims to investigate whether a change in the water's pH value (a change from 8.1 to 7.7) would have an impact on the growth of the jellyfish. The experiment includes ten jellyfish in control pH conditions (pH 8.1) and ten jellyfish under low pH conditions (pH 7.7) for a period of two weeks. The outcome of the experiment showed no significant difference between both pH values that were observed with respect to the jellyfish growth rate. An experiment with a sample size of ten jellyfish is problematic, since the absence of effect in the experiment might be due to a low power and low resolution of data. This implies that generalising the results from the experiment in Abstract 2 could be misleading because of too small a sample size. Thus, Albin has a point, as he stresses that "they're so damn it's so few ((jellyfish)) calculated."

Albin continues his line of reasoning, suggesting that in order to be able to draw such conclusions in a scientifically valid manner, "they should've had a thousand" jellyfish. Even though Albin's suggestion of using a thousand jellyfish could be seen as indicating a lack of knowledge as to what is possible within the frame of an experiment, his point that the sample size is too small is relevant. Without using scientific terms such as "sample size" and "statistical power," etc., Albin stresses that in order for something to be scientifically acceptable, experiments of this kind need to contain a larger number of jellyfish. In everyday language,

Albin shows an understanding of the meaning of sample size as he responds to Jim's questions about the validity in the two abstracts. Albin's suggestion that the experiment should include a larger sample size (utterance 04) is not further elaborated. Instead, Tom shifts focus to that of questioning the validity of the claims made in Abstract 1.

Several instances in the empirical material show how students find the sample size of ten jellyfish in Abstract 2 problematic. These objections, however, are never further discussed or questioned by the fellow students. Rather, the ways in which the students object to the design choice of using only ten jellyfish suggest that the problem is obvious to them. In such instances, students emphasise their points by using a louder voice, for instance as in utterance 02: "NO they're not," or by exaggerating the sample size as in utterance 04: "they should've had a thousand." Abstract 2, accordingly, is responded to as problematic for this particular group of students. Earlier they have been practising virtual experiments and other activities that might have contributed to an insight into the significance of sample size.

In Excerpt 2, we introduce Simon and Peter, who are scrutinising the quality of the data in Abstract 2. For instance, Simon questions the way in which the jellyfish were fed during the experiment.

Figure 3.4. Simon and Peter are scrutinising the quality of the data collection

Excerpt 2: Feeding the jellyfish as part of the experiment

01. Simon: I don't like how they were fed (.) this way they get absolutely ultimate conditions (.) both of them (.) it's hard to say since (.) their surrounding is also affected by the ph change and that means then that maybe (.) the one with lower ph might develop more since it has more nourishment and stuff (.) than what the other had

02. Peter: what did you say (.) the one that
03. Simon: th- the ones with lower ph (inaudible) in recent years this could mean that since the ph has decreased that several predators and stuff have disappeared [and there's more food for them ((jellyfish)) (.) then there will be more
04. Peter: [yea:h:
05. Peter: yea:h
06. Simon: but they ((jellyfish)) haven't got the same cond- but now they get the same conditions

In this excerpt, Simon questions the way in which the jellyfish were fed by saying "I don't like how they were fed." Simon continues by explaining why he does not approve of how the jellyfish were fed, as he argues that "they get absolutely ultimate conditions (.) both of them." Here, Simon questions the choice of feeding the jellyfish during the entire experiment, as this will affect the quality of the data. To feed the jellyfish in the experiment *ad libitum* implies that they were overfed, which is something that would not happen under regular living conditions. According to Simon, the experiment could be misleading since the one with a lower pH value might develop more since "it has more nourishment and stuff," which means that the possibilities of identifying the pH effects from this experiment would decrease as a result of too similar conditions for both groups of jellyfish. Here, Simon touches on the important and experimentally relevant term/procedure of comparing (Lemke, 1990). This is an important remark when it comes to determining the validity of the scientific claims drawn, since they do not consider the feeding conditions. As Simon puts it, "their surrounding is also affected by the ph change." So, if the jellyfish were to have the same feeding conditions, comparing them to each other would have consequences when it comes to the validity of the results presented in the abstract.

Additionally, in utterance 02, Peter asks Simon to clarify what he just said about the jellyfish placed in the water with a low ph value. Simon then develops his line of reasoning further by commenting on what a decrease in the ph value might do to predators: "this could mean that since the ph has decreased that several predators and stuff have disappeared [and there's more food for them ((jellyfish)) (.) then there will be more." In the interaction between Simon and Peter, Simon is talking himself through the validity issue of Abstract 2 as he is trying to make sense of what it implies to set up an experiment in which two groups of jellyfish have the same food conditions. Simon indicates that the experiment might not be trustworthy because it fails to study the indirect effects of pH through the food web; that is, a decrease in the pH value could influence the supply of food in the real world. In this way, Simon connects several aspects of the marine environment, including both jellyfish and other organisms, to the content—which is what the experiment in Abstract 2 is about—as he tries to make sense of the consequences of the feeding conditions of the experiment.

In this section, two examples of how students scrutinised aspects of data collection and data quality in Abstract 2 were illustrated. The students' reasoning concerned questions regarding quantity and validity. When it came to issues of quantity, the student in Excerpt 1 had strong opinions about how an experiment would need to use more than ten jellyfish. In terms of validity issues, the students in Excerpt 2 found it problematic that the two groups of jellyfish had the same conditions. The students' reasoning touched upon the fact that jellyfish are not the only marine organism that will be affected by a change in water condition, but rather the change will alter the entire ecosystem, which in turn would be significant for the species in its natural habitat.

Scrutinising Procedures for Measurement

This section presents two excerpts illustrating how students scrutinise the conditions for measuring as they reason together with their fellow students about scientific claims made in Abstracts 1 and 2. Re-addressing Abstract 2, John and Ella, in Excerpt 3, object to the procedures of measuring with respect to the duration of the study. In the excerpt, John sits in front of the computer keyboard and writes; at the same time, he reads aloud what he is writing.

Figure 3.5. John and Ella are scrutinising conditions for measuring

Excerpt 3: Duration of the experiment

01. John:	*still we think that [tw-*
02. Ella:	[he could have done it ((the experiment)) a bit longer
03. John:	*two weeks*
04. Ella:	yea:h
05. John:	*is too short a time*

In utterance 01, John starts to formulate a sentence concerning the problem of the duration and what this implies for the validity of the study and the claims made. Ella agrees as she, in utterance 02, interrupts John by saying: "[he could have done it ((the experiment)) a bit longer." John, in utterances 03 and 05, continues the sentence by writing that two weeks "*is too short a time*." In the same manner as Albin's objection to the choice of the sample size in Excerpt 1, John and Ella do not negotiate further why a period of two weeks is not enough to study the effects of a change in pH value on jellyfish. Rather, the reasoning about the duration of the study reported in Abstract 2 stops without any continuation of the discussion. However, even though John and Ella do not elaborate on this, they show a sensitivity regarding the matter by signalling that the duration is a problem in relation to the claims made. For instance, for an experiment of this kind to be valid, it should have covered at least one generation of jellyfish, or, preferably, several generations, since there can be a transfer of effect between generations. However, this represents complex knowledge about experiments, and whether this is known to John and Ella is not apparent since it is not explicitly communicated.

In the excerpt below, the students discuss Abstract 1 and argue that a study of the kind presented there would need to be more systematic regarding conditions for measuring.

Excerpt 4: Variations in sea conditions

01. Jim:	so if you take for example june tenth every year
02. Tom:	m:
03. Jim:	one year it was like nothing in july but lots in ju::n:e (.) yea:(hh) like it all depends on the fluctuations
04. Tom:	and they should take like in one mo- ((month)) here they have one month or ((Tom and Jim look at the assignment))
05. Jim:	that we don't know cause it doesn't say in the scientific report
06. Tom:	no cause you have to have a certain range that you ta:ke that you take tests anyway (.) so (.) same year so that you should be able to get something out of it you can't just take like and now it's lots of jellyfish though it's in <u>march</u> and not in july then they will be different

The students' reasoning about the timing of the data collection constitutes an interesting element in Excerpt 4, both in terms of time of the year when the registration of plankton took place, as well as by raising the issue if there were more than one empirical data collection during the year. Jim starts by pointing to how the amount of jellyfish could vary from one month to another and also from one year to another, because it all depends on the fluctuations. Tom continues this line of

reasoning by suggesting that the researcher should "take like in one mo- ((month))." Tom interrupts himself and asks if the plankton recording took place every month. Jim responds: "that we don't know cause it doesn't say in the scientific report," stressing that there is a lack of information in the abstract when it comes to the timing. To address such issues could be seen as an instance of emerging science literacy skills. Put differently, Jim and Tom, in their reasoning, point to what information would be relevant to include in the abstract and which clearly is not there. Thus, they think in terms of what is required for something to qualify as an experiment. Furthermore, through referring to their concerns in terms of time and fluctuations in the sea, Jim and Tom demonstrate their knowledge of how sea conditions vary across time and season. The sea cannot be studied as a unit that is constant when addressing a question of this kind. In this way, the students clearly consider the complexity of the object of study—the sea—as they target variations in conditions over the year.

Furthermore, Jim and Tom discover that in order for something to be used as data, it must be produced within a time range. Tom, in utterance 06, explains that "you have to have a certain range that you ta:ke that you take tests anyway." In this way, Tom questions the design of the study in Abstract 1, which plotted only the relative abundance of jellyfish during the spring bloom. In doing so, Tom adds that "you can't just take like and now it's lots of jellyfish though it's in <u>march</u> and not in july [then they will be different," which implies that data would be more representative if measurements within a certain time range were to be taken into consideration.

The kinds of objections and reflections we see here are indicative of a specific kind of literacy practice in which the status of terms, arguments, and claims are questioned.

Scrutinising the Justification of the Conclusions

The last excerpt illustrates how the students reasoned about the results of the research reported in the abstracts and the conclusions drawn. The study reported in Abstract 1 predicts a significant increase in the future occurrence of jellyfish. According to the abstract, the increased abundance seems to be correlated with parameters of the seawater, such as pH decreases due to ocean acidification. In Abstract 2, on the other hand, this conclusion is tested in an experiment using jellyfish collected in water on the Swedish west coast. The experiment shows no significant difference between the two pH conditions that were observed. The conclusion drawn from the experiment in Abstract 2 implies that pH does not have an impact on jellyfish growth.

In Excerpt 5, Jim and Tom evaluate what a lower pH value in the ocean would imply for jellyfish in the future.

Excerpt 5: Evaluating the long-term effects of a decreased pH value in the ocean

01. Jim:	something <u>long-</u>term (.) if you think long-term (.)
	what does- what does lower ph really mean (.) so it

takes less energy to digest their ((jellyfish)) food (.) they have more energy left (.) then it can grow faster as (inaudible) also

02. Tom: they will become (.) in that case they will become larger and more (.) as they are not affected as much by ocean [acidification

03. Jim: [but

04. Tom: they would- will they even be affected by the ocean acidification since they are like just water

05. Jim: yea:h but they eat (.) so their plankton have calcium carbonate shells

06. Tom: yea:h

07. Jim: and they ((plankton)) can't keep it up ((shells)) and it takes really lots of energy if they still have it then anymore (.) so there would probably be really really few plankton

Jim, in utterance 01, evaluates the conclusions drawn in the abstracts by making predictions of what would happen in the long-term: "if you think long-term (.) what does- what does lower ph really mean." Jim's answer to this is that if the pH value decreases, the jellyfish will have more energy to grow as a consequence of their food being weaker. Tom agrees with Jim that the jellyfish will grow larger, and the abundance will increase. However, Tom, continues by questioning if the jellyfish will be affected by changes in pH conditions at all, since jellyfish consist of a large proportion of water (utterance 02: "they are not affected as much by ocean [acidification," and utterance 04: "will they even be affected by the ocean acidification"). Tom has a point here, since jellyfish have shown qualities of adapting well to changes in the ecosystem, which would imply that the jellyfish might not be strongly affected by a decrease in pH.

In utterance 05, Jim returns to his reasoning regarding the food: "yea:h but they eat (.) so their plankton have calcium carbonate shells." In utterance 07, Jim, develops his line of reasoning as he explains that plankton in a lower pH range would need to use a lot of energy to form their calcium carbonate structures. According to Jim, this would imply that "there would probably be really really few plankton." This way of reasoning is also relevant when it comes to the evaluation of the conclusions in abstracts 1 and 2. In Abstract 2, for instance, the experiment seeks evidence if jellyfish will be affected by a change in pH conditions. However, by ignoring ecological interactions the experiment fails in its design. This is something that the students, on a number of occasions, return to. In other words, the abstracts do not answer questions about ecological interactions, which is something that the students notice and discuss, although they do not explicitly use the term/concept ecological implications (or an equivalent). Thus, according to the students there are several factors, and not only pH conditions, that correlate with the amount of jellyfish

on the Swedish west coast such as ecological interactions, temperature, salinity, eutrophication etc.

This last section includes an example of how students scrutinised the validity of conclusions in abstracts 1 and 2. The students reasoned on a more general level about what would happen to marine organisms, jellyfish, and plankton, particularly in the future when the pH value will be lower than it is today. In this kind of reasoning, the students used their knowledge about ocean acidification and its consequences to verify their statements, thus displaying emerging science literacy skills regarding what claims can be made and what claims that are not justified.

DISCUSSION

In this study, we explore how students interpret and scrutinise scientific claims in the context of working with an assignment requiring them to evaluate research reported in two scientific article abstracts. The analyses focused on how the students discussed the logic of the research practices described in these abstracts and the validity of claims made on the basis of them. The results show that the students deconstruct scientific claims through questioning matters, such as data-collection procedures and data quality, ways of (and conditions for) measuring, and the validity of the conclusions. In their reasoning, the students point to shortcomings in the abstracts. In doing so, they show sensitivity to how scientific claims need to be articulated in particular ways and an awareness of the fact that claims have to follow certain rules in order to be accepted as valid.

A variable that stood out as important for the students concerned the jellyfish quantity, which they argued was not convincingly handled in the studies reported in the abstracts. However, while the students questioned the quantity, they did not further elaborate on the role of this factor. This implicit nature of the argumentation was also the case when a group of students questioned the duration of the study. It is, of course, difficult to interpret what the students might have left as unspoken explanations, or for what reason they did not elaborate on their critique of the experiment. An explanation could be that the variables involved were more or less obvious for the students, and that an assessment of the experiments thereby would be irrelevant. Nevertheless, the situation could also have been that the students identified problems with the design of the experiments but had difficulties in scrutinising and formulating the underlying causes, and therefore left such issues without further comments. Similar studies on students' understanding of experiments illustrate their problems of (a) formulating questions that are possible to investigate, (b) of planning and conducting experiments, and (c) of describing such practices in writing (e.g., Hart et al., 2000; Lager-Nyqvist et al., 2011; Petersson et al., 2013). This is one indication of the complexity of learning the logic of inquiry, which in this case means that the students need to learn that not all kinds of experiments require a large sample size, but that it depends on the aim of the specific investigation. Even if the students might be aware of the logic of sample size, they need to learn that, in

order to make a scientific argument, such issues should be elaborated on and not be omitted as taken for granted. The implications of this suggest that the complexities involved in becoming science-literate require that students practise and learn through activities specifically designed to target such insights and skills. This implies that in order for students to develop an understanding of experiments and develop skills in articulating their understanding, they need to have opportunities to practise such skills over time (Lemke, 1990).

Other manners in which students deconstructed scientific claims in the two abstracts were to embed their critique when commenting on arguments, for example by questioning data collection and validity, by asking questions, expressing doubt, and by suggesting alternative views (e.g., Driver, Newton, & Osborne, 2000). The students were engaged in reasoning that concerned plankton and asked questions about what would happen to this marine organism in the future when the pH level in the ocean decreases. Plankton provides food for jellyfish, which probably is the main reason for the students' obvious interest in the variable that concerns the pH effects on this specific organism. The students also engaged analytically with their task as they reasoned about fluctuations and variations in the ocean. In this regard, the students questioned the validity by stressing that variables other than pH-level and time were ignored in the two studies. In their reasoning, students showed skills of thinking within particular thematic patterns (Lemke, 1990), and they were on their way to appropriate a mode of reasoning about the question, for example when questioning if jellyfish will or will not increase in the future due to ocean acidification. This particular question forms the foundation for the two abstracts, and when the students used their knowledge about the ocean and issues of ocean acidification, they showed signs of emerging science literacy. Furthermore, grasping what kind of parameters are relevant to measure and compare in an experiment is also a matter of understanding specific domains of knowledge that are relevant for the investigation. For the students in this study, this implies that they need to have more than a general understanding of scientific experiments and about conditions that need to be considered when using experimental data and comparing two conditions. They thus need to have knowledge about the ocean and ocean acidification. The results from the study show how the students, in their reasoning, applied such domain-specific knowledge by using marine biology terms and concepts that they have appropriated through studying marine biology in school.

Deciphering the anatomy of scientific argumentation requires insight into, and knowledge about, the nature of scientific inquiry. Put differently, students need to learn and develop an understanding of the procedures and language for how to observe and codify the world in scientifically relevant manners (Wickman, 2004). This was one of Dewey's (1916) arguments for why inquiry represents such a productive method for learning. That is, if students learn how inquiry is done within certain areas, they will develop generative skills and insights that carry across contexts and situations. Even though students in this particular study did not engage in scientific inquiry in its practical sense, they still needed to

understand it as a method in order to be able to decipher the anatomy of scientific argumentation.

As we have already mentioned, the students deconstructed scientific claims in different ways. The students presented explicit reasons for what they regarded as problematic in the abstracts, as well as suggesting and considering alternative views (Wegerif et al., 1999). However, the students frequently also pointed to problems in scientific claims without any further explanations. Making claims explicit is not something that people necessarily do in their everyday lives. Instead, in colloquial conversation, we often express opinions without explicitly providing substantive reasons for those opinions or specifying on what grounds we make our claims. However, in institutional learning practices, as well as in research, supporting and explicitly justifying claims are some of the "ground rules" for communication (Edwards & Mercer, 1987). This conclusion points to an interesting potential link in communicative practices between school and research, which should be much more emphasised in the contexts of learning science and scientific inquiry.

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NOTES

[1] The term *science literacy* was first used in the late 1950s (DeBoer, 2000), and it has since been used in the public debate on education; one also finds the term in research studies, policy documents, curricula, etc. (Roberts, 2007). Various studies point out that the concepts *science literacy* and *scientific literacy* have different meanings, but there are also studies that do not emphasise this difference. For studies that do emphasise the different meanings, *science literacy* implies that people have a general knowledge about issues within the field of science education and that they are conversant with science and scientific knowledge. The term *scientific literacy*, on the other hand, emphasises a civic-directed literacy, which implies that people are familiar with issues in a range of areas, but that they understand and are able to apply these skills in a science context (see Mayer, 2002).

[2] The Inquiry-to-Insight (I2I) project, started in November 2008, is a collaboration between Stanford University, California, and the University of Gothenburg, Sweden and their respective marine stations: Hopkins Marine Station and Sven Lovén Center for Marine Sciences-Kristineberg. The I2I project offers an educational programme combining ICT, social networking, and pedagogy directed at environmental issues. The I2I idea is to pair classes from different countries within a social network. The students compare views, attitudes, and lifestyles around three environmental issues (climate change, environmental pollution, and habitat preservation) and increase their understanding of those issues with different educational tools that are based mainly on ICT. http://i2i.stanford.edu/

[3] As a consequence of ocean acidification, the pH level in the ocean is predicted to decrease from 8.1 to 7.7.

[4] In this utterance, Jim miscalculates the number of years from 1990 to 2050 to be 50 instead of 60 (see Figure 3.1).

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TRANSCRIPTION LEGEND

(.)	Shows just noticeable pauses.
TEXT	Indicates shouted or increased volume in speech.
<u>text</u>	Emphatic voice.
?	Inquiring intonation.
((text))	Comments made by the researchers or a description of an activity.
(inaudible)	Inaudible word/s.
[text	Shows co-occurring talk where the square bracket indicates where the overlap starts.
tex:t	Shows that it is a stretched sound.
text-	A sharp cut-off.
Text	Shows when a person writes and reads out loud what is being written.
te(h)xt	Talk with a laughing tone.

KRISTIN AADLAND

4. THE PERFORMATIVE RELATION BETWEEN STORYTELLER, STORY, AND CHILDREN

INTRODUCTION

Studying an oral storytelling situation taking place within a school context gives us the opportunity to look at the situation as a narrative event facilitated for children's participation and co-construction. The oral storyteller does not only use language to tell a story. She has certain performative means through which the narrative is shaped in interaction with the children participating in the situation in which the story is told. In this chapter, I demonstrate that the storyteller, through these performative means, not only constructs the narrative but also facilitates the joint experience of the narrative and of the whole storytelling situation. I further show that storytelling interactions comprise an intertwining of three parts as a fine-tuned dynamic and in a mutually constitutive relation: the practices of the storyteller, the actions of the children, and the story. This is what I capture as performative facilitation of the children's participation in a situation of oral storytelling in which co-construction and meaning-making happen. To analyse this performative relation, we need categories that include the performative.

According to sociocultural and dialogical theory, stories are cultural tools with which to remember, understand, and make sense of what happens (Bruner, 1986; Wertsch, 2002). We make meaning through linking events together with causality to create a plausible story (Bruner, 1986). The events that are portrayed are experienced by the storyteller or by others. Through the story, the storyteller shares these experiences with the listeners, who can integrate the told experiences to their own (Benjamin, 1969) and thereby make meaning. Storytelling skills, as a part of children's language development, are studied in educational research (e.g., Aukrust & Snow, 1998; Gjems, 2006). Cobley (2013) distinguishes between the terms *story* and *narrative*, and says that the narrative is the representation of the story. Meanwhile, from a folkloristic point of view, Bauman (1986) calls the oral storytelling situation a *narrative event*. This concept points to a role of context for meaning-making in storytelling situations and includes a focus on the performative relation between storyteller and listener.

Making sense of stories is something that must be learned (Bruner, 1997), and abilities such as imagining and comprehending stories are important in making it possible to use stories for meaning-making. In our time of digitally transferred images, there is a need for teaching children to create their own inner images

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 61–84.

through experiencing oral storytelling (Wardetzky & Weigel, 2010).This points to a need for studies of children's participation and co-construction as a part of narrative events.

Through the National Oracy Project in the UK (1987–1993), narratives found their way back into British classrooms, and storytelling became one of the focus areas in the project (Howe & Johnson, 1992). Storytelling was seen to contribute to learning areas such as spoken language development and performance, development and achievement in literacy, and acquisition and communication of knowledge and understanding in different areas within the curriculum (Howe & Johnson, 1992).

Since 1995, oral storytelling has been a subject in Norwegian universities and university colleges as a part of drama and theatre studies. Over the years, an increasing number of storytellers have made their living from telling stories in different situations, schools being only one of them. Some teachers have completed additional education in storytelling and use it in their teaching. Many school children meet professional storytellers through Norway's programme for cultural experiences in schools, "The Cultural Rucksack[1]." Some schools also directly hire storytellers for temporary or permanent engagements, arguing that storytelling provides tools for active language use, identity development, and reflections. This is especially valuable in classes of children with mixed cultural backgrounds[2]—as stories come from all over the world.

Another argument for bringing oral storytelling into schools is the focus on oral skills in Norwegian curricula ([KD], 2006, 2012, 2013). The Norwegian Directorate of Education and Training defines oral skills as "creating meaning through listening and speaking (…) It includes being able to listen, respond and be conscious of interlocutor while speaking" ([KD], 2012). Further, the policy document defines oral skills as a "precondition for exploring interactions in which knowledge is constructed and shared." So far, oral skills have received less attention in educational research than, for example, literacy (Svenkerud, Klette, & Hertzberg, 2012). Studies of oral storytelling situations will therefore be important in learning more about orality in educational settings.

Meanwhile, storytelling events are important for children also for other reasons. This chapter shows how narrative events contain performative acts that involve several social and cultural learning interactions. In these, children can learn to master dialogic situations, appropriate multimodal communication, and develop an ability to connect bits of information and to cultivate listening skills. These learning interactions inherent in storytelling events are different from those studied in classroom studies and would need a different analytical lens than studies of social interaction based on interaction analysis or conversation analysis (e.g., Furberg & Ludvigsen, 2008; Lund & Rasmussen, 2008; Mercer, 2004). The professional storyteller uses language, but just as important to the co-construction of the narrative is performance, interaction, and context. These aspects are often left out in research (Greatbatch & Clark, 2010; Lwin, 2010).

The present ethnographic-based study reports from the first grade (ages 6–7) in a Norwegian school that experiences regular visits from storytellers. To see why it is important for children in school to be introduced to oral storytelling, this study aims to go beyond the results of the storytelling situation—often shown in the pupil's achievements—and looks at the interaction in the storytelling situation itself. The aim of my study is to focus on the performative relation between storyteller, story, and listener.

The research questions are as follows: How is the performative relation between the storyteller, the story, and the listener established? Which means does the storyteller use to invite the children to participate? How do the children respond to the invitation to interact and to co-construct? The categories I will use in the analysis are taken from an analysis of a performing storyteller, developed further for a multimodal analysis, and then finally adapted for this study where the performative relation is the unit of analysis.

RESEARCH ON STORYTELLING AND LEARNING

Several studies within different fields have shown the importance of stories and storytelling, for development and learning. The studies span themes such as children's familiarity with storytelling, the educational effects of storytelling, the methodological concerns of studying oral storytelling, and the role of listeners as co-constructors, as well as the verbal, vocal, and visual means of storytelling.

Wardetzky and Weigel (2010) have studied professional storytellers who regularly, and over time, visit the youngest children in a multicultural school. The authors conclude that children who are familiar with stories represented by computers and TV need time and experience with listening to stories to manage to create inner pictures and to imagine the stories. When this is learned, the children improve their own retellings and the storytelling. After studying a class working with a storytelling teacher, Kuyvenhoven (2009) relates how children in fourth and fifth grades went from talking, to thinking, and to "imaginating"[3] with stories as the storytelling situations became more familiar to them. In this process, they went from being on the *outside* of the story, via *creating* pictures, to *being immersed in* the story. This ability to see or to be in the story helps their engagement with, and their understanding of, stories but also improves their ability to retell or to tell stories, and to co-construct in the situation. It also affects learning areas, such as oracy and literacy.

Many educational studies look at the effects of stories on children's learning of oral language and literacy. A methodological concern is that many of these studies seem not to distinguish between telling a story and reading it loud. Isbell, Sobol, Lindauer, and Lowrance (2004) point this out, and show that storybook reading and children's language-learning is much researched. Though some things are similar, telling a story and reading a story each has its own advantages. The most significant differences are the absence of the book and the independence from the written words in storytelling. This facilitates eye contact and the improvising of verbal and

non-verbal interaction in the situation. Isbell et al. (2004) conclude that children listening to story-reading perform better with respect to language complexity and telling a story based on pictures. The children who have heard the same stories told by storytellers show a higher degree of story comprehension and perform better on retelling the story, as well as on their imaginative recollection of it. This suggests that experience with storytelling can help the children's own storytelling, literal as well as oral. Improvement in written storytelling is also shown in Kuyvenhoven's study (2009).

In everyday conversation, storytelling happens with the listeners' responses and abruptions, and so the listeners participate in constructing the story. In a psycholinguistic study, Stivers (2008) shows how peer listeners in a conversation align or affiliate with the story, verbally and non-verbally. The storyteller gives the listener access to the experiences that set the background for the story. In the current study, I am looking for verbal and non-verbal initiatives from the storyteller, and verbal or non-verbal responses or interruptions from the listening children. By meeting the experiences through a performative relation in a narrative event, the children learn to co-construct and make meaning of the experience and of the story. And their responses might show whether they have attained the access they were given to the experiences.

Greatbatch and Clark (2010) study organisational storytelling, observing the same storyteller telling the same story to two different audiences. They focus on performance-based aspects, such as paralinguistic and visual cues. The authors conclude that "stories emerge through a process of interaction between storytellers and story recipients" (p. 116). Through this verbal and non-verbal interaction, the meaning of the story is negotiated. When isolating the text from the performative context, they find that the storytelling situations, and the experienced meaning of the story, appear more similar than they actually were. A similar negotiation might happen in a group of children participating in an oral storytelling situation with a fairy tale, as in the present study.

Swann (2002) uses verbal, vocal, and visual features as categories for analysing this performative context of a professional storytelling performance. Lwin (2010) completes a multimodal analysis of a storytelling situation with school children based on these categories. By modifying Swann's categories, Lwin analyses how the storyteller uses these verbal, vocal and visual features to manipulate the audience to construct certain interpretations and meanings of the story. However, the empirical evidence of the audience's reactions is limited to certain verbal responses. The focus stays mainly on the storyteller's features. In contrast, my study departs from storytelling as a mutual event between storyteller and listener—and in my case, I am specifically concerned about the children's role as listeners and co-constructors of the narrative[4]. In order to find out how the narrative event is shaped by interaction between the storyteller, the children, and the story, I examine the children's embodied as well as verbal responses.

THEORETICAL AND METHODOLOGICAL FRAMEWORK

According to Wertsch (2002), narratives represent events, actors, and settings of the past. Bruner (1986) shows how meaning-making happens when connecting events—true or fictional—together with causality, to a story, in a narrative mode of thought. Bakhtin (1981) says there are two events linked to the work of writing: "the event that is narrated in the work – and the event of narration itself" (p. 255).

Cobley (2013) further defines the narrative as different from story—and plot. The story is all the events that happen to the character(s) and the (causal) connections between these. The plot is described as the circumstances that have placed the character(s) within the event, or within the "chain of causations" (p. 5), while the narrative is the representation, also mentioned by Wertsch (2002). By making the distinction between the story and the narrative, Cobley (2013) implies that the narrative of a story is different with a different storyteller or with a different medium for telling the story.

Since my study focuses on an oral storytelling situation as a performative event that facilitates interaction and relational meaning-making, I will add a folkloristic perspective to the sociocultural and dialogic. Bauman (1986), building on Mikhail Bakhtin's and on Roman Jakobson's work, adds the context as a dimension of the event of narration. Bauman studies orally told stories. He distinguishes between the *narrative event*: the situation in which the story is told, and the *narrated event*: the events that lay behind the story. The *narrative* is the text and the representation, and these three form a triangle of oral narrative performance. The narrative event is central to my analysis, as it contains an interplay between participants, expressive means and features employed in the performance, social interactional rules and norms, and strategies for performance and criteria for interpretation and evaluation, as well as the sequence of actions that make up the scenario of the event (Bauman, 1986).

In my analysis, the storytelling situation as a narrative event is more prominent than the narrated events and the narrative. Still, the distinction between story and narrative (Cobley, 2013) is needed. The storyteller knows the story well before she meets her listeners, and it is unlikely that she will change the causal connections between the events, the circumstances, and the characters. However, she will adapt the words and actions to the situation (Dahlsveen, 2008; Sturm, 2008). In this way, we can understand the narrative to be co-constructed as the storyteller, the children, and the story interact with each other during the narrative event.

Bauman shows how different narrative events with the same narrative, based on the same narrated events and told by the same storyteller, change and hence make the narrative sound different. This is confirmed by studies of organisational storytelling (Greatbatch & Clark, 2010). Important to what makes the narrative events different from each other, even if the story is the same, is the performance. Performance is central to representation, interaction, and negotiation of meaning (Bauman, 1986, 1992; Greatbatch & Clark, 2010). Bauman (1992) defines performance as "an

aesthetically marked and heightened mode of communication, framed in a special way and put on display for an audience" (p. 41) and the analysis of a performance "highlights the social, cultural, and aesthetic dimensions of the communicative process" (p. 41). Bauman describes the performance as a mode of communication and a way of speaking. He looks at the performance and not just the text, but his focus is still on verbal performance.

Nonverbal performance is highlighted in the study of Greatbatch and Clark (2010); the authors include the physical enactment and say that when the audience laughs, it might just as well be from something the storyteller did as from something he said. They call these means *paralinguistic* and *visual*, or *kinesic*. Swann (2002), and later Lwin (2010), use the terms *vocal* and *visual features* to describe the same non-verbal features but also keep the verbal features. Swann (2002) also suggests music as a separate category.

Sturm (2002) describes the interaction that happens in a storytelling situation. The storyteller accommodates the story for the audience, but each listener's experience can be different. The narrative event is seen as a cycle. First, there are storyteller and listeners, and the story still is not present. The storyteller then introduces the story. For a while, the storyteller and the listeners have an interaction during which the story still is outside. The story then becomes more and more a part of the interaction, until they are all "one." The state of consciousness might alter, and the participants become a part of the story. The listener's experience is dependent on the storyteller, on the story, and on the communication between the storyteller and the listener (Sturm, 2000). After a while, gradually, this unity between the storyteller, the listeners, and the story is again dissolved (Sturm, 2002), and the awareness of the surroundings is back to normal. Sturm shows that the interaction in the performative process is both individual and collective.

I adapt the features presented above for my analysis (Lwin, 2010; Swann, 2002). To point out listeners' participation, I identify their performative responses using the same categories as is proposed for the study of the storyteller features.

Categories

The purpose of my study is to analyse the interaction in the narrative event. The interaction happens between storyteller, listeners, and story. The storyteller has the main responsibility for the interaction, and she has different performative means to facilitate the interaction. Some of these performative means will, however, also be seen in the children's responses and participation in the interaction. To capture these performative means and to see how they can contribute to a co-construction, I have adapted the main aspects developed by Swann (2002), which have further been adapted and used by Lwin (2010). The three main aspects from Swann and Lwin, which we have previously considered, are *verbal*, *vocal*, and *visual features*.

The first main aspect, *verbal means,* concerns all oral expressions. Derived from the study of Lwin (2010), there are especially three categories in use in our excerpts:

Discourse markers are expressions that make it clear with which kind of discourse we are dealing. *Expressive elaborations* are used in Lwin's work on the descriptions of characters; in my study the term also covers descriptions of landscapes and surroundings. The last verbal category from Lwin, *dialogue quotation,* is used when the storyteller quotes characters' dialogue. The most visible verbal means for invitation are, however, *questions* posed directly to the children, a category missing in Swann and Lwin's framework. Questions are sometimes posed directly to the children to check the attention and understanding of the story, and sometimes as an encouragement to participate in a joint activity, for instance song and music, which is another main aspect. This is a category that is not used in Lwin or Swann's work, but that is obvious when going through the present data.

The children's *verbal responses* are answers to the verbal questions, or to invitations that are not questions. Verbal responses are also seen in Lwin's work. Some of the children in my study, however, also asked *questions* themselves, or participated in a *verbal dialogue* with the storyteller.

The second main aspect is *vocal means*. Lwin (2010) divides these into six categories, three of which are studied here: *manipulation of pitch, volume,* and *pause*. It is mainly the storyteller who uses vocal means in the excerpts of analysis. For example when she manipulates pitch, she does it to *imitate character voices*.

The third main aspect is *visual means.* The visual categories cover gestures and facial expressions, and I have also added gaze. Lwin (2010) divides gestures into four groups: *mimic gestures* (illustrating the speech content); *metaphoric gestures* (emphasising an abstract idea); *beats* (rhythmical moves according to speech); and *deictic gestures* (pointing—abstract or at objects). All these gestures are used in my analysis. *Facial expressions* are also used in Lwin's work. In addition, I find *gaze and eye contact*—as empirically derived categories under visual means.

When attending a storytelling situation, much of the reaction from the audience is visual or *embodied* rather than verbal or vocal. The storyteller is the leader of the situation, and the other's role is to listen. Still, reactions and answers can be seen in positioning, stillness or calmness, and in facial expressions. These kinds of reactions are not mentioned in the referred works of Swann and Lwin, and are therefore empirically driven categories.

Swann (2002) mentions another performative category relevant for my analysis, namely the one of *song and music*. Song and music is related to vocal and visual means. Singing can be interpreted as a vocal feature. Clapping, or as in our fairy tale, drum-beating, could be seen as visual. Still, as Swann also argues, I choose to keep song and music separate, since music has a special way of establishing rhythm that is different from the quality of the speaking voice or from non-verbal acting with speaking. Our storyteller uses song and music in combination with the use of *artefacts*. She sometimes also uses an artefact without music but always in combination with at least one of the other mentioned categories. We will also see *musical responses* from the children.

In addition to these categories, the study will add two central concepts. Much of the interaction in the present storytelling situation happens without breaking out of this "story experience"—the unit between storyteller, listener, and story—or the possible altered consciousness. I call this an *inclusive* interaction. Sometimes, however, the storyteller approaches the children with *direct* verbal invitations to interaction, often a question. These indicate a break from the storytelling itself, and it is up to the storyteller to make sure that the break does not become too long, so that the children maintain their experience and possibly can go back to an altered consciousness.

CONTEXT, DESCRIPTION OF PARTICIPANTS AND METHODS

It takes time to master the imagination and understanding of the storytelling situation (Wardetzky & Weigel, 2010). For several years, the Norwegian school in the study has used storytellers. Inspired by the work of Wardetzky and Weigel (2010), the storytellers in the spring of 2012 decided to have a special focus on the youngest children. Fifty-four first-graders (6–7 years of age) were therefore gathered almost once a week for four months (from February to May) for a total of 12 times. This high degree of frequency made this an interesting group for a case study, since these children, by the end of such a semester, obtained more experience with these narrative events than did other Norwegian first-graders. However, the high degree of frequency makes it an unusual, rather than a representative, case (Flyvbjerg, 2007). The case was studied with observations of eight storytelling situations and with interviews of six students, a teacher, and two storytellers after the last storytelling situation. For this article, the observation of the last storytelling situation is the focus. The storytelling occurred at school, but the teachers and pupils left their classrooms and went to the school library, which the storyteller had prepared for the situation.

Going through the data, it seems clear that the children not only have similar responses but sometimes react individually or to different kinds of invitations. It is too cumbersome a job to represent 54 individual responses. By choosing two children, Alik and Ibrahim, as focus children for the analysis, the idea is to illustrate some of this variety, as the two, in different ways, both interact with the group and have clear, individual interactions with the storyteller and with the story. Hence, they represent a variety of interactions. Alik is a girl whose parents are from the Middle East. According to the teacher, she knew little Norwegian when she started school but is, in general, a quick learner. Ibrahim is a boy of North-African origin. He is described by the teacher as orally active and dominant in the classroom. They are both among the six children picked by the teacher as interviewees for other parts of the study. The teacher was asked to pick children who demonstrated diversity within the group.

Four different storytellers alternated throughout the semester. I chose to analyse the last session, during which the storyteller who was present at most times was there. Because I had observed her several times, I had background information that

enabled me to comment about what the children had or had not seen before. The storyteller has much experience in storytelling for children in all age groups and for adults. She brings to the stage some artefacts, among these seven bells in the colours of the rainbow and the tones of a scale. She has used these bells in each of her storytelling sessions throughout the semester.

The children had in total 12 storytelling situations, eight of which I observed and video-recorded. Because I chose the last session for analysis, the children had become used to the kind of event and to having me around. Also, for the last two sessions, I obtained access to better technological equipment. By choosing the latter of these two sessions, the participants were more used to the cameras and seemed ready to ignore them.

Two controllable IP cameras were used to film the situation, one aimed towards the storyteller, and one aimed towards the children. Unfortunately, the room was arranged in a way that made it impossible to capture everyone in the picture. In addition to the two cameras, we had two clip-on microphones: one clipped onto the storyteller and one clipped onto the blanket behind her and facing more towards the children. The cameras and the microphones were connected to a computer, and could therefore be controlled from the side without disturbing what was going on in the room. There was one audio file for the two microphones. The two video recordings were subsequently played in parallel alongside the audio file in order to better understand the interaction within the storytelling situation.

I used a transcription system inspired by Jefferson,[5] with signs and the use of brackets and parentheses.[6] I numbered the turns for easier referring. The transcripts show the storyteller, Alik, Ibrahim, and the children—as a group—as interacting subjects. A few times, an unspecified, single child also makes a comment. Much of the speaking and the non-verbal "comments" are in unison, but, as previously explained, it would still be too cumbersome to include all the individual actions.

As an observer coming into a group, it is difficult to know what effect that had on the situation (Fangen, 2010). I had a relatively passive position, but I was still coming into the group as an extra person with cameras. The use of cameras, while necessary for analysing interaction, continues to be debated among researchers (Derry et al., 2010). Challenges associated with the use of video are related to all stages of the study: the *camera effect* on the observed; the *selection* of the camera position(s), events, and excerpts; the *analysis* and the potential for sharing the recording; access to, and quality of, the *technology*; and *ethical* concerns (Derry et al., 2010; Jordan & Henderson, 1995).

To study the performative facilitation of children's participation in a narrative event, I needed to capture the verbal and non-verbal acts with respect to both the storyteller and the children. Roth and Bautista (2011) discuss the verbalisation of gestures in interaction analysis, which makes them look more intended than they are. Due to challenges regarding the informed consent from parents in a similar study, I chose to not share the video recordings with other researchers in this study, and I still have to trust the transcriptions. Video recordings make it possible for more detailed

transcriptions to be shared and discussed. After such discussions, I went back to the recordings and confirmed transcriptions or analysis.

ANALYSING PERFORMATIVE FACILITATION IN A NARRATIVE EVENT

Three data excerpts are analysed here, to get an understanding of the interaction in the narrative event. They are a part of the same storytelling event, and of the same story: the first from the very start of the story, almost five minutes into the situation itself, the second from the middle of the story, and the third from a point towards the end of the story. The excerpts are chosen to show a variety of facilitations to interaction and responses from the children. By spreading the excerpts over the length of the story, we can also look for changes or developments in the children's participation. The analysis of each excerpt is divided into episodes.

The situation took place in the school library. The 54 children sat in chairs and on the floor in front of the storyteller. The teachers sat behind the children, and to one side. The storyteller had covered the bookshelves behind her with a blanket, and she had a chair, from which she sometimes rose; next to her was a table with some artefacts. The situation lasted about 35 minutes and included some retelling in the beginning, and two stories. This paper focuses on the first one.

The story is about a beautiful African village with nice, colourful flowers and birds, and where vegetables and fruits are growing. The rain stops falling, everything turns dry, and people get hungry. A mother gathers all her children and tells them to search for food. The two eldest sisters are twins. One is beautiful and considers herself too important to look for food. The other is ordinary looking. She searches, gets help, and through coping with tests and challenges, gets a magic drum which, when played, fills tables with food. She feeds and arranges a party for the whole village, while the sister becomes jealous and tries to be better. But doing everything wrong, she ends up with a drum that gives her abscesses and rashes, and no food.

Part 1: Defining the Narrative Event

The narrative event of our study starts with the storyteller asking the children what they remember from earlier storytelling situations. They speak together about the stories. Most of the children participate. There is some unrest among some of the children. Some are sitting the wrong way on their chairs, some are constantly changing positions, and some are occupied with each other. Others are contributing to the conversation.

Alik sits on a little chair in the middle of the pictures. She first tries to move the chair, and looks in different directions, sometimes towards the person speaking, sometimes not. After a while, she grips the ends of her belt, and starts to fiddle with them[7]. Ibrahim sits on a bigger chair in the back row. He is moving his legs, and at a moment, play-fighting with the boy sitting beside him. He is gradually paying more attention to the speaker, now with his legs crossed on the chair. He participates in

some of the retelling. Then, after a little while, the storyteller marks the transfer from retelling to storytelling, and our first excerpt starts.

1	Storyteller:	[((*plays a little tune on her bells*))]
2	Children:	[((*gradually turn to the storyteller*))]
3	Alik:	[((*fiddles with her belt, looks up at the storyteller*))]
4	Storyteller:	Once upon a time (..) a long time ago (..) there was this beautiful African village
5	Children:	((*continue to find their positions, more and more towards the storyteller*))
6	Alik:	((*looks down again, still fiddling with her belt*))
7	Storyteller:	[In that village there were flowers in all the colours ((*plays the bells again*)) in the whole world ((*holds her hands out, smiles*))]
8	Alik:	[((*looks up at the storyteller again, still fiddling with her belt*))]
9	Storyteller:	the entire rainbow. Ahh (.) and they had such a lot of food… ((*throws a plastic pear up and catches it*:)) They had - ((*looks at the children, holds the pear lifted*))
10	Children:	App (.) pear
11	Alik:	((*keeps her eyes on the storyteller, not touching her belt, participates in some of the following namings*))
12	Storyteller:	((*throwing and catching an orange*)) They had - ((*looks at the children, holds the orange, lifted*))
13	Children:	Orange
		(… repeats with banana, melon, squash)
22	Storyteller:	((*throwing, catching*)) They had -
23	Children:	Potato
24	Storyteller:	((*holds up a hazelnut*)) And then they had -
25	Children:	Ha? Nuts
26	Storyteller:	Nuts
27	Children:	Nuts
28	Ibrahim:	Is it real nuts?
29	Storyteller:	And (.) Yes (..) it is a hazelnut (.) They had so much to eat, they had beautiful flowers, they had nice animals ((*pointing at a little wooden deer, at the table by her side*)) and they had beautiful birds ((*puts a knitted finger doll bird on her finger and "flies" with it*))

(Continued)

30	Alik:	((*still looking at the storyteller, fiddling a little with the belt—smaller movements than earlier*))
31	Children:	Ooohh
32	Girl1:	Have you knitted that?
33	Girl2:	Yes
34	Girl1:	Can you knit one for me?
35	Storyteller:	But (.) ((*holds her index finger* up, *looks at the children*)) one day (.) [they looked at the sky (..) there wasn't one cloud] [((*looks up, lifts her hands*))]
36	Alik:	((*stops the fiddling*))
37	Children:	((*most of them now sitting still, many, including Alik, with mouths half open and wide-open eyes looking at the storyteller*))
38		((*storyteller continues with the story, while Alik, and many of the others, keep sitting leaned forward, with eyes wide open, looking at the storyteller until next excerpt, about four minutes later*))

In this first part of the story, the story and the rules for the collaborative and co-constructional activity are introduced. The analysis divides this part into three episodes. The storyteller introduces the storytelling in episode 1; in episode 2, she introduces the interactional activity, and in episode 3, she moves on with the story itself.

Episode 1: Turns 1–8 – the hook. The storyteller has already introduced the storyteller theme with the retelling session. Then the bells (turn 1), which can be seen as artefacts, work as musical instruments, and the *music* played is a performative mean bringing the group together and preparing for the story event that is about to happen. The children (turn 2), including Alik (turn 3)—though still fiddling with her belt—respond by turning to the storyteller. These are *embodied reactions*, signs for the storyteller to go on. She uses the most common way of opening a fairy tale: the *discourse marker* "once upon a time." The children have attended storytelling before and know these words. Bells, words, and the recognition of situation and storyteller tell them that they can expect a story to come. They continue to wind down (turn 5), though Alik is looking down at her belt again (turn 6). The storyteller, sensitive to the *embodied reactions* of the children, understands that she can continue. She gives an *expressive elaboration*—of the village as beautiful (turn 4) and as colourful as the rainbow (turn 7). Again (still turn 7) she uses the bells, which all together represent the colours of the rainbow, and again Alik immediately responds to these performative means by looking at the storyteller (turn 8).

This little episode consists of the storyteller's musical and verbal performative acts, which she combines. The children respond *embodied* to all means, but Alik

so far responds more to the musical means, though we have no proof that she is not listening to the storyteller's words.

Episode 2: Turns 9–34 – invitation to interaction. After introducing the narrative event, the storyteller continues with a direct invitation to participation. She throws up and catches a plastic pear (turn 9), says "they had –," and looks at the children while still holding the pear. The children understand that they are supposed to answer (turn 10). The pear becomes an artefact supporting or manipulating an oral dialogue between the storyteller and the children. The storyteller's performative means therefore becomes a combination of an *expressive elaboration*, the use of an artefact, which is a visual use, maybe a *mimic gesture*, and the vocal use of *pause.* Alik participates in the joint *verbal response* from the children and has let go of the belt, again an *embodied reaction*. The *participation in dialogue* continues with other fruits (turns 12–27). To bring the story further, it would have been sufficient to say that the village had a lot of fruits and vegetables growing. The narrative event includes the dialogue between the storyteller and the children. The detailed listing of fruits becomes an *expressive elaboration* of the surroundings and a part of the narrative. This scene sets an interactional agenda, ensures the children's understanding of certain concepts— fruits and vegetables—and of the tragedy in the story, and starts the co-construction of the narrative.

The storyteller sets some interaction rules for the rest of the session: she wants the children to participate, under her control. Ibrahim interferes with a *question* about the nut (turn 28), which she briefly answers (turn 29), although it is not really a question about the story. Some children then start talking about the knitted bird (turns 32–34). The storyteller responds by ignoring the questions because they are not relevant to the story. These children might have misunderstood the rules of the interaction. The storyteller answers by going on with the story (turn 35). She shows that she is in control of the interaction by answering or neglecting the children's initiatives. Alik has let go of her belt for the entire fruit dialogue, but starts to fiddle a little after the introduction of the bird (turn 30). Maybe the dialogue lasted too long, or maybe the dialogue with Ibrahim about the nuts was too much for her.

Episode 3: Turns 35–38 – going on with the story. It can seem like the dialogue and the artefact leading to misunderstanding becomes a signal for the storyteller to move on with the story (turn 35). She does that with a "But (.)", while holding her index finger up. After the brief *pause*, she continues. The pause works together with the *deictic gesture*—the pointing—as a way to re-establish the joint focus on the plot and the story. After the short pause, she immediately (still turn 35) continues by telling about the lack of clouds while using her *gaze* to look up and performing a *mimic gesture,* holding palms up in search for raindrops. In this action, she makes sure to keep the children interested in the story: enacting for understanding. She also shows that she is the one who is to control the narrative event. Again, Alik stops fiddling (turn 36). She and most of the children lean forward, with wide-open

eyes and half-open mouths; they remain that way until long after this excerpt. These *embodied reactions* work as signs to the storyteller that the children are with her and that she can move forward with the story.

We have seen the storyteller combining pause, deictic, and mimic gestures as performative invitations for children to interact. Alik seems to respond better to the musical one, while Ibrahim asks question in a verbal dialogue. It might be that combining the two gives the storyteller a greater chance to engage everyone in the narrative event. She has further, through different performative means, established a contract of interaction that the children have accepted, showing that the children are welcome to participate, but she is the one to control the participation. Through embodied reactions, the children have shown that they are ready to join the event.

Part 2: Keeping the Interest

About ten minutes into the event, and six minutes into the story, the storyteller continues to tell about the mother who sends her children to look for food. The ordinary one of the twin sisters finds three nuts and tries to crack them open to eat them, to gain strength. But, one by one, they slip out of her hand, and fall down into a hole in the ground. She jumps after them, to another world, where she meets an old woman. During this part of the storytelling, the children are sitting relatively still, Ibrahim included; Alik looks down at her belt just a few brief times.

1	Alik:	((*fiddling with her belt again, for a short while looking down*))
2	Storyteller:	And the old woman said ((*old woman's voice*)): "Why have you come here?"
3	Alik:	((*lets go of her belt, looks up again at the storyteller, leans forward*))
4	Children:	((*some small movements, but quiet; the majority are still facing towards the storytelling, with wide-open eyes and many with open mouths.*))
5	Storyteller:	((*young girl's voice*)) "I have come here because I… because I need food for my whole family." ((*old woman's voice*)) "Then you have come to the right place. Take this basket, and go to that field over there ((*points to the right*)), and there you will find potatoes. You have to dig up the potatoes, but remember ((*points with her right index finger*)) Do not take the big potatoes, just take the small ones."
6	Children:	((*still quiet, wide-open eyes and half-open mouths, many leaning forward*))
7	Ibrahim:	((*legs crossed on the chair, looking at the storyteller constantly*))

8	Storyteller:	[She went to the field and put down the basket, started to dig in the ground.] [((*rises up, still looking at the children; places a little basket on the floor and starts doing digging movements*)) And over the whole place she heard voices] ((*Changing her voice between a deeper and higher tone, turning the head and her eyes after which potatoes are speaking*)): ((*deep*:)) "Eat me." ((*high*:)) "Don't eat me." "Eat me." "Don't eat me." She dug up potatoes. ((*Pretending to dig, and bends down to pick them up*)) And some were big and giant ((*Pretending to lift up a big potato with both hands, looking at it*)), and they said ((*deep:*)) "Eat me"…and others were small ((*pretending to lift up a small potato between thumb and index finger, looking at it*)), and they said ((*high*:)) ["Don't eat me."
9	Ibrahim:	[((*smiles*))
10	Storyteller:	((*looking at the children*)) But which should she take (.)?
11	Children:	The small ones
12	Storyteller:	Yes, correct. GOOD! You are good listeners. ((*holds her hands, with palms up, lifts them up, puts them down, and looks at the children*)) So she took tiny potatoes, and went back to the old woman.
13		((*The storyteller continues the storytelling, about 1–2 minutes before the next excerpt. The children continue to face towards her, with wide-open eyes and mouths; both Ibrahim and Alik are among those who sit the most calmly.*))

In this part the story continues, and it is important for the storyteller to keep the children's interest. This she does by including different vocal and visual performative means in the verbal telling. The analysis of this part is divided into two episodes.

Episode 4: Turns 1–10 – enactment. From the start, Alik is again occupied with her belt (turn 1). When the storyteller *imitates the voice* of the old woman (turn 2), Alik immediately lifts her eyes towards her again and lets go of the belt (turn 3). The storyteller goes on *imitating the voice* of the old woman, of the girl (turn 5), and of the different-sized potatoes (turn 8) by *manipulating the pitch* from high to low. The storyteller also uses verbal means here by *quoting dialogue* whenever she *imitates voices*, to which Ibrahim responds with a smile (turn 9). The storyteller also uses visual means. She uses *deictic gestures*, pointing towards a direction and holding the finger up to make a statement, both as the old woman (turn 5). Further she uses *mimetic gestures*, playing out the girl's movements (turn 8). In this work, she also uses an *artefact*, a basket (turn 8). All these verbal, vocal, and visual means paints

a thin line between a storyteller and an actor, but the description and the referring sentences in between are still kept in the storyteller's normal voice and with the eyes on the children. It does not seem like any children are confused as to when she is acting and when she is being the storyteller. And the children, including Alik and Ibrahim, respond with wide-open eyes and mouths, while leaning forward towards the storyteller and seemingly paying attention (turns 3,4,6,7, and later, 13).

Episode 5: Turns 10–13 – asking a question. The storyteller goes directly from the enacted dialogue between the girl and the potatoes, holds up a pretend potato, looks at the children, and *asks a question*: "But which should she take (.)?" (turn 10). The children show in their immediate *verbal response* (turn 11) that they know she is speaking to them, no longer being "in the story," but in the room with them. They also show that they remember what she has said a few lines back (turn 5). Her confirmation to them that they are being good listeners can serve as a confirmation of correct understanding, and encouragement for them to keep on paying attention and to keep on giving answers. The confirmation is given by a verbal response, supported by the *visual gestures* of palms held up, in *beating* movements, and the *vocal raising of volume* when saying "GOOD," and emphasising that they are being "good listeners" (turn 12).

The storyteller re-establishes the interactional contract with the children, as described in episode 2. Had this been a normal classroom situation, we could have expected a follow-up question from the teacher, asking how they knew that she was supposed to pick the small potatoes. By having this direct interaction, however, the storyteller has already broken out of the storytelling role, and it is probably more important for her to ensure that the break is not too long so that the children will stay focused on the narrative event.

Part 3: The Listeners as Storytellers

During the next few minutes, the storyteller tells about the girl and the old woman preparing and eating a dish made from potato peels. She continues using the gestures and voice imitation, and the children react with laughter and outcries. The girl is asked to pick a normal drum, among many big and decorated ones. The drum is magic and gives food when it is played. The storyteller then shows the children her own little drum.

1	Storyteller:	Then she started beating. And if you want to, you can join in on your legs, like this ((*shows drum-beating on her own legs, plays her own drum, singing:*)) Dittiti, dittiti, [dittiti …]
2	Children:	[Dittiti … ((*most children play and sing, repeatedly louder and louder until the activity ends*))

3	Alik:	((*smiles and looks at the storyteller, starts playing, then stops, smiles, and looks at the storyteller*))
4	Storyteller:	((*singing repeatedly*)) [Louder, and LOUDER AND LOUDER -]
5	Alik:	[((*starts playing again, smiling more*))]
6	Storyteller:	"SET"! [Oh! ((*looks down at the floor, places the drum on the floor, and then looks at the children*)) The whole floor was covered with food! There was so much good food. ((*hands in beating movement in front of her*)) Juicy tomatoes, big, tall (pyramids?) with steaming, warm rice, chicken, chocolate cake, milk.]
7	Children:	[((*some movement, soon back to normal*))]
8	Storyteller:	Everything you could imagine. Oh. The girl went and opened the door and shouted out to the whole village ((*stands up and pretends to open an imaginary door. Raises her voice and holds her hands like a funnel*)): "COME IN! We have got food!" ((*sits down again*)) And everyone came in, and they started eating. And they ate it all. And when they were fully satisfied ((*holds her hand on her stomach*)), they thought: "We should have a party." Do you know what they do in Africa when they have a party? When they have eaten a good meal, how do they party?
9	Children:	(undefined mumbling)
10	Ibrahim	((*raises his hand*))
11	Storyteller:	Yes ((*pointing at Ibrahim*))
12	Ibrahim:	They do it again ((*drumming on his legs*))
13	Storyteller:	Yes. They played again ((*beats the drum*)), and they started to sing and dance.
14	Ibrahim:	And they started to fill the plates with food ((*pretending to fill a plate with his hands*))
15	Storyteller:	Yes, they did
16	Ibrahim:	Many
17	Storyteller:	A lot (.) So! We can also sing. Shall we?
18	Children:	Yes!
19		((*The storyteller starts singing and clapping, and makes the children repeat. All except Ibrahim seem to be participating. The storyteller continues to tell, and the children to listen. The story goes on about the beautiful sister's reactions, and her failed attempts to do better*))

This is the part of the story in which the task is solved. Here I focus on two episodes: In episode 6, the children are invited to participate in the acting of the story—entering the story world by joining in the singing and playing. In episode 7, we see the dialogue between the storyteller and Ibrahim, in which she allows him to tell how an African party is held.

Episode 6: Turns 1–7 – being in the story. The storyteller introduces the drum and verbally invites the children to play and to sing with her, follows with a musical invitation by starting the activity (turn 1). The children immediately respond musically by joining in (turn 2). Alik starts and stops the drum-beating (turn 3). She keeps her attention towards the storyteller, and as soon as she gets louder (turn 4), Alik participates again (turn 5), smiling more, as if the louder playing was a reminder to join in. This is a verbal and musical invitation to a musical interaction, and it is accepted by the children as such. The situation is provoking smiles and eagerness among the children. By inviting the children to join the drumming and singing, it can seem like the storyteller briefly goes outside of the story, but it can also be seen as an invitation for the children to enact the girl. As soon as they are finished, the storyteller immediately continues the storytelling. From the word "SET" (turn 6), she shows that she is in the story world, and she continues with the story. The children react by very quickly calming down after the activity (turn 7). Again, the storyteller takes control of the activity. Yet she has let the children into the story world, and they seem to understand what is happening. By so promptly going back to the story, she makes sure that the break is not too long, so that the magic world of the story can be maintained.

Episode 7: Turns 8–19 – a listening child as storyteller. When the storyteller asks how they party in Africa (turn 8), Ibrahim immediately has an answer (turns 10–16), maybe feeling invited because of his North-African background. The question is similar to the one about the potatoes (episode 5). Maybe the storyteller expected the same kind of response—the children saying in unison: "Singing again." But Ibrahim raises his hand, and the interaction turns into a dialogue between the storyteller and Ibrahim. In this way, he participates in telling the story, and the storyteller accepts his suggestions, probably, in part, since they fit with her plan to introduce a song. Ibrahim uses verbal *expressive elaborations* and visual *mimic gestures* when telling (turns 12 and 14).

Because the children were allowed to play and sing as participants in the story, and because Ibrahim was allowed to do some storytelling, we can see that it is now not only the storyteller who is performing but also the children. They can be seen to have gone from outside the story to inside the story: co-constructing the narrative.

DISCUSSION

This study shows that the storyteller uses different ways of performative facilitation to invite children's participation. The analysis focuses on the following research

questions: How is the performative relation between the storyteller, the story, and the listener established? Which means does the storyteller use to invite the children to participate? How do the children respond to the invitation to interact and to co-construct?

I have used theories and analytical framework from folkloristic and cultural anthropology and the field of storytelling to approach a storytelling event in school as a performative event in which children are a part of co-constructing the narrative.

We have seen that the storyteller combines different means and includes invitations from all categories proposed by earlier studies of storytelling that do not—or do to a small degree—include the relational perspective between storyteller and listener. Further she is sensitive to the group and to individual children's reactions. The children respond to the invitation individually and as a group. Their participation is mainly embodied and verbal, and, in general, they seem engaged in the situation. The responsibility for the listener's experience of the story and the narrative event lies with the storyteller, as we have seen from Sturm (2000, 2002). We see here that the storyteller takes charge and facilitates the performative relations through different kinds of invitation, by varying the use of means and invitations. In short, we can say that in part 1 of the analysis, the storyteller and the children establish the interaction that makes the children co-constructors of the narrative; in part 2, the children confirm their ability for meaning-making, and in part 3, the children fully participate in the co-construction and meaning-making in a performative relation with the storyteller.

The study shows how the storyteller uses different *verbal, vocal, and visual means*, and song and music, as invitations. She *enacts characters* and potatoes in the fairy tale, using different vocal and visual means, but she is also clearly speaking as herself, the storyteller. Almost from the start, the storyteller sets an *interactive agenda* (episode 2) by combining verbal and visual means. She continues to invite the children to participate by *using questions* (episodes 5 and 7) and *verbal encouragement* to musical interaction (episode 6). These episodes are answered with unisonous verbal (episodes 2 and 5) or musical/embodied (episode 6) *replies or dialogue* with a single child (episode 7).

These performative categories, sorted under the main aspects—verbal, vocal and visual means, and song and music—work as a way to identify the storyteller's performative facilitation of the interaction in the storytelling situation, and also the children's responses and participation.

However, the study shows a need to further distinguish the ways in which the *invitations* to interaction are posed. This has to do with the quality and the purpose of the invitational interaction, and is not currently covered by the theoretical framework of the studies that focus on the storyteller solely. The study shows how much of the interaction in the present storytelling situation happens without breaking out of the "story experience"—the unit between storyteller, listener, and story—or the possible altered consciousness (Sturm 2000, 2002). I have chosen to call this an *inclusive* interaction. Sometimes, however, the storyteller approaches the children with what I

have chosen to call *direct* invitations to interaction. These are often verbal, and often based on questions. They indicate a break from the storytelling itself, and it is up to the storyteller to make sure the break does not become too long, so that the children maintain their experience and possibly can go back to an altered consciousness. The *direct* invitations are mainly used to secure an understanding and *inclusive* invitations to keep up the engagement with the story and the narrative event.

The *direct* invitations are often questions directed to the children (episode 5) or verbal invitations to activity, such as naming fruits (episode 2) or drumming and singing (episode 6). The purpose of these episodes often seems to be to ensure the children's understanding of words, of the narrated event, or of something else in the story. The musical activity in episode 6 can also, as we have seen, be a bit of both kinds, since it can be viewed as a way to make the children participate in the life of the story. An additional purpose for the activity is, as we see in episode 7, to make children, in this case Ibrahim a storyteller or co-constructor. This is demonstrated when the storyteller asks a question about an African party. When the storyteller puts in her questions and other direct invitations, she makes sure not to make the break from the storytelling too long (episodes 2, 5, 6, and 7).

Throughout the whole session, the main purpose of what I call *inclusive* invitations is to keep the children engaged with the story and with the narrative event. These invitations are performed through different kinds of gestures and facial expressions, manipulation of voices, and the use of music and of artefacts. From the very start (episode 1), the storyteller uses the melody on the bells and the discourse marker "once upon a time" to introduce the story. The children, responding by finding their positions, tell the storyteller to continue, and gradually, the story becomes a part of the situation, as is seen in Sturm's model (2002). The storyteller is aware that it is her responsibility to keep the children's interest. She does this by using her different means, keeping eye contact, and taking in signals from the children. We see, for example, how she reintroduces the bells by the end of episode 1, and how this makes Alik again look up from her belt and stay focused on the storyteller. Further, in episode 4, the storyteller continues, and increases, the use of enactment, mimicking persons and potatoes with the use of different verbal, vocal, and visual means. The children answer by being quiet, and by wide-open eyes and half-open mouths directed towards her. This might indicate that some of them may be somewhere on their way into an altered story consciousness (Sturm 2000, 2002).

The identification of the direct and inclusive invitations can, to some extent, be connected to the "altered consciousness" described in Sturm's work, as the direct invitations might cause a higher risk of breaking out of the altered consciousness, or the "magic" of the "story world." Direct and inclusive invitations can also be related to the inner pictures, or to the "imaginating" that we saw in the works of Wardetzky and Weigel (2010) and Kuyvenhoven (2009), respectively, but none of these concepts include the ongoing and performative process of maintenance

of interest and engagement during the storytelling situation. Invitations are active performative means that build a central condition for engagement in storytelling and should therefore be further explored.

Further, the children react and respond as a group, but also individually, as exemplified by Alik and Ibrahim. For instance, it does seem like Alik responds more to the vocal and visual means, performed *inclusively* to increase engagement. Ibrahim, on the other hand, is active in the *directly* initiated dialogues, which, in the last episode, even turns him into a storyteller. The different children have their own reactions and bring in their own earlier experiences. It might therefore seem clear that though they are all part of a communal co-construction of the narrative, there will also be individual elements of the experience of the narrative event, or the construction of understanding of the story. This is also one of Sturm's conclusions (2000, 2002).

CONCLUSION

In this interaction between the storyteller, the children, and the story, co-construction of meaning, and thereby the narrative, happens. We have seen that the participants, despite their joint activity, have individual reactions to what is happening. They are together in the situation, but the "imaginating" is happening individually, as they all have different experiences as a reference for meaning-making and become engaged through the use of different *inclusive* and *direct* performative invitations and means. Thus, it can seem like the co-construction is both a collective and an individual process in which the participants construct a narrative together, and at the same time make meaning together and individually. These reflections have to be studied further. One attempt will be via an interview study on which I am currently working. Interviews were done after the here- presented observation, where among other children, Alik and Ibrahim were asked about what they remember from the same storytelling situation. In these interviews, we obtain confirmation that these two have different memories from, and understanding of, the story and the situation. Moreover, the different ways of interacting (*inclusive to engage* and *direct to ensure understanding*) need to be studied further.

By performative means and constant attention towards the individual's reactions and ensuring of the communal engagement and understanding, the storyteller facilitates a situation whereby children can learn to master a dialogic situation, to appropriate multimodal communication and listening, and to develop an ability to connect bits of information. In this way, the oral storyteller situation becomes one in which meaning-making can take place. The storyteller acknowledges the children and recognises their contributions through the use of performative means and invitations. Further studies should be done, also, to see how teachers could make use of the same kinds of tools and acknowledging activities in a normal school situation.

NOTES

[1] http://kulturradet.no/english/the-cultural-rucksack

[2] This study also was completed using a class with a mixed cultural background, and there are many aspects of storytelling for such groups that will be interesting to do. However, the focus here is on performative relation and interaction, and multicultural issues therefore are not covered.

[3] Kuyvenhoven (2009) consequently uses the word "imaginating" for the state of giving oneself totally over to the experience of storytelling. The word was coined by one of the children in her study (p. 53).

[4] In the theoretical framework, I discuss the difference between the terms *story* and *narrative.*

[5] http://www.transana.org/support/onlinehelp/team1/transcriptnotation1.html

[6] See transcription legend at the end of the chapter.

[7] Throughout the whole storytelling situation, Alik comes back to the belt. In the interview for the next article (in progress), she shows that she is aware of this fiddling, but she also shows a very detailed memory of the story she listened to despite lack of Norwegian vocabulary.

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TRANSCRIPTION LEGEND

Symbol	*Name*	*Use*
[text]	Brackets	Indicates start and end of overlapping speech or action
=	Equal sign	Indicates the break and subsequent continuation of a single utterance
(.)	Micropause	A brief pause, usually less than .2 seconds
(..)	Minipause	A brief pause, usually less than 1 second
-	Hyphen	Indicates an abrupt halt or interruption in utterance
ALL CAPS	Capitalised text	Indicates increased volume in speech
Underline	Underlined text	Indicates the speaker is emphasising or stressing the speech
(text)	Parenthesis	Speech which is unclear or in doubt in the transcript or summary of interaction
((*italic text*))	Double parenthesis	Annotation of non-verbal activity*

**includes all visual means, but also the vocal mean voice imitation, to emphasise the complexity in this voice manipulation, as more than pitch and volume*

SYNNØVE H. AMDAM

5. THE DANGERS OF HAVING FUN – DOING PRODUCTION WORK IN SCHOOL

Tensions in Teachers' Repertoires on Media Education

The role and status of practical versus theoretical knowledge and informal versus school-based education have been the main themes of media education research since the last century. Starting with audience and effect studies in the 1960s and 1970s, media education research has expanded from a focus on how formal education should inoculate children from the negative learning of everyday media use, to how motivation and knowledge from everyday, out-of school media use can be utilised for learning and emancipation in the classroom and beyond (Erstad & Amdam, 2013). The underlying discourses of the research field thus thematise broader educational issues of learning across contexts.

In this chapter, I explore the tensions of doing production work in school. I investigate this issue by exploring how teachers perceive a concrete case of media education, the Media and Communication programme (MC), for 16–19 year olds in upper secondary school in Norway. The teachers' perspectives provide an important insight into the broader context of "doing" school. Through examining the teachers' interpretative repertoires on student participation and educational goals (Potter & Wetherell, 1987), we can investigate how students are positioned. In addition, the underlying historical media discourses are thematised within an institutional framework.

The MC programme qualifies as vocational certification for photographers and media designers *and* provides general education for university-level studies. Having a strong emphasis on both practical and theoretical approaches, it has an interesting hybrid position, both within media education internationally and as an educational programme within the national school context (Erstad & Gilje, 2008). Since its beginning in 2000, the programme has also had among the highest entry grades and completion rates across programmes in upper secondary in Norway, implying that the programme has qualities the students find valuable (Vibe, Frøseth, Hovdhaugen, & Markussen, 2012). Vocational education in general, and practical media education specifically, is however not necessarily a high-status educational area, neither nationally (Erstad & Gilje, 2008) nor internationally (Buckingham, 2010; Quin, 2003b).

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 85–108.

The research question this chapter thus seeks to answer is the following: As exemplified in the MC programme, what are the tensions in and between interpretative repertoires teachers use in discussing student participation and educational goals within a context of production work in school?

Supported by national survey data on what the media teachers see as the most important goals of the programme for the students (n = 384), this chapter explores the research question through focus groups and individual interviews with teachers at two case schools. I first discuss student participation and goals in historical media education discourses that focus on media production, both in and out of school. I then present the analytical framework, methods, and materials. Finally, I elaborate on student participation and educational goals in the findings, on both a national and local level, and discuss the tensions found in and between interpretative repertoires on doing media production work in school.

HISTORICAL DISCOURSES ON PARTICIPATION AND EDUCATIONAL GOALS FOR MEDIA PRODUCTION IN SCHOOL

The historical discourses on media production in formal education have different roots in different parts of the world. Australian media education, which started in the 1970s, has had a focus on student activity with media production as a main goal from the start (Quin, 2003b). British and American media education traditions, on the other hand, started with a more analytical approach quite early in the last century and gradually developed towards a more production-oriented understanding (Buckingham, 1998; Masterman, 1998). The Norwegian, as well as the Nordic, media-education development has had an historical trajectory quite similar to the British and American development (Erstad, 1997; Stigbrand, 1989; Tufte, 2007; Tønnessen, 2002). Three parallel discourses have been, and still are, important within the Nordic context, both in policy development and in user-oriented research (Erstad, 1997; Gilje, 2002; Tønnessen, 2002).

Protecting the Media Consumer

The inoculation understanding of protection linked to Leavis and Thompson (1933), describes teaching against the media: "educators would allow a little media material into the classroom only in order to inoculate students more effectively against it". (Masterman, 1998, p. viii). The "popular arts" perspectives, on the other hand, focus on teaching students to discriminate within the media instead of against them. Masterman (1998) described this as a paradigm of judgment, which originated from Hall and Whannel (1965). The main message in this discourse is that even within popular cultural media products, there are differences in quality of which students need to be aware. Both of these discourses emphasise a passive student position, the position of the consumer of media messages. The teacher has to show the students what is good for them, thereby protecting them from harm.

These discourses of protection have been, and still are, prevalent in policy-oriented perspectives within both a Nordic and an international context, and it is concerned with the consequences of media developments for the individual, using regulation, legislation, and curricula to state the importance of media literacy and media education (Erstad & Gilje, 2008).

Building the Active, Critical Citizen

In the representational discourse, the focus changes to semiotics and studies of ideology. Masterman sees this as the dominant paradigm in a British-American educational context through the 1980s and 1990s, reorienting media teachers from aesthetic judgments towards political awareness and asking the question: "What constitutes an effective democratic education for majorities of future citizens" (Masterman, 1998, p. x).

In a Nordic context, this understanding has competing perspectives in the focus on critical theory and "bildung". Researchers, such as Jan Thavenius (1995), Svein Østerud (2004), and Soilikki Vettenranta (Vettenranta, 2004; Vettenranta & Erstad, 2007), use media education as an example of subjects that highlight a redefinition of "bildung" more attuned to the media cultures and shifting roles of young people in our societies, as positioned by their media use.

These discourses position students as active knowledge constructors that develop a critical understanding of media messages from a citizen perspective, through production work and education. The media is conceived of as an agent in the construction of social reality and the audience as an active participant in the construction of textual meaning. Although the students are still predominantly positioned as consumers, they are critical consumers.

Motivating the Creative, Reflective Producer

With the advent of, and development in, digital technology, a production understanding of media education became more apparent within British and American research. The implications involve a shift to analysis in production, or to use David Buckingham's words: "Best practice in media education involves a combination of 'hands-on' creative production and critical reflection, which seeks to build on students' existing pleasures and experiences of media." (2007b, p. 112). This discourse is linked to cultural studies, and emphasises the role media play in young people's lives in more diverse cultural ways than in the former perspectives (Buckingham, 2007a; Burn & Durran, 2006; Kist, 2005).

However, within a Nordic context, the production part of media education has a longer tradition, especially in Denmark (Drotner, 1991; Erstad, 2010; Tufte, 1998). This user-oriented perspective, more so than the former discourses, positions the teacher and students as equal in the learning process, and also emphasises collaboration, co-construction, and project work, often starting with the interests

of the students and building critical understanding through a combination of production, analysis, and reflection (Erstad & Gilje, 2008; Kotilainen & Arnolds-Granlund, 2010; Tufte, 2007).

As digital technology and media production tools have gradually converged and become more available, a discourse originating outside school, and especially in research on social media, has become an influential perspective on media education internationally (Davies & Merchant, 2009; Itō, 2010; Jenkins & Purushotma, 2009). In this discourse, children and youth are seen as active creative social agents, and school as only one of several sources for learning through media production. For instance, Itō (2010) positions interest-driven media production out of school as a part of peer-based exchanges providing "highly active forms of learning" (2010, p. 291). Media production in school, on the other hand, is positioned as being "for school". The audience for school production is seen as limited to the teacher and, possibly, to the class. Most classroom projects are also seen as not driven by the interests of the participants themselves, but as following a deferred-gratification model: "where they are asked to accept that their work in one institutional context (school) will transition at some uncertain time to what they imagine for themselves in the future (work)." (Itō, 2010, p. 351). This discursive understanding shifts the focus of media education from production and critical reflection for emancipation as citizens to emancipation as developing creative vocational producers.

These different and coexisting discourses on media education form an axis on student participation that positions the students as passive, uncritical consumers on the one hand, and as active, creative producers on the other. At the same time, school, as a context for learning in media education, is on the one hand seen as instrumental for educating citizens in a media-saturated world; on the other hand, the school context is seen as limiting in educating active, creative media producers.

MEDIA PRODUCTION WORK WITHIN THE BROADER SCHOOL CONTEXT

Whereas Itō et al. see emancipation through collaborative interest-driven media production as a main function of media education *out of* school, several media education researchers have contemplated the role of media production *in* school. However, the discourse on production work in school is perceived to have a serious drawback within the broader school context in many countries, namely a lack of status.

Vocationalising and Academising Media Education

The discourse of reflection in production was influenced by practical production work in vocational education, as production work was seen as valuable in building links between "theoretical" and "practical" elements of the media subject (Buckingham, 1995; Connell & Hurd, 1988; Stafford, 1990). With the recent development of participatory media and the knowledge society, however, researchers have raised

concerns regarding the vocational development within media education. They fear that media education may be reduced to a form of technical training, in which the critical dimension of media theory is lost. David Buckingham voices this concern related to the status of secondary education in the UK:

> In the case of media, there has always been the hope that young people from economically disadvantaged backgrounds would somehow be able to "cash in" their cultural capital – to use vocational media courses as a way of turning their expertise with media and popular culture into something that can be accredited and, hence, lead to employment [...] However, the fact remains that such courses are likely to be perceived as "low achievers". (2010, p. 296)

Quin's (2003a) critique of media education in Australia resembles that of Buckingham. In Australia, teachers embraced practical work from the start because they believed it engaged students in a way that reading and writing did not. Learning how to do the media was given priority over learning about the media. However, through this retained focus on production over reflection, Quin claims, media education can never be more than a low-status subject area in school. To support this claim, Quin references educational research such as Young's (1971) discussions on the organisational features of academic subjects and Goodson's (1993) descriptions of the heightened status of subjects such as geography and biology through strengthened theoretical focus. Quin claims that as long as media education focuses on production as a goal in itself, it will have problems qualifying for higher education, as is the case in Australia (2003a).

Vocational Pedagogies as Academic Future?

The claims of ongoing vocationalisation and the need for academisation are contrasted by a discourse that is linked to the development of participatory media during the last decades: the discourse on 21st century skills. The frameworks within this discourse all focus on collaboration and communication, digital and media literacy, and social and/or cultural competencies, such as creativity, entrepreneurship, critical thinking, and problem solving, as needed skills for the future work force (Griffin, MacGaw, & Care, 2012; Voogt & Roblin, 2012). In contrast to the academic understanding described by, for instance, Young (1971), learning to apply knowledge is seen as equally important as learning abstraction in school. The student is positioned as an active collaborative learner in cooperation with both peers and teachers. Originating in a vocational understanding, the discourse on 21st century skills has gradually been integrated into educational research (Erstad, Amdam, Arnseth, & Silseth, 2014). It has also had an impact on the policy level in many countries, including the Nordic countries. In Norway, the last educational reform in 2006 included a distinct 21st century skills understanding of the goals of education (Hølleland, 2007).

In summary, the discourses on media production in school pull in different directions. First, it is claimed that a focus on student participation based in

interest-driven media production threatens the critical reflection in media education, thus keeping the status of the subject low within a traditional academic understanding of learning. However, at the same time, the discourse on 21st century skills aims to heighten the status of the same vocational qualities of learning that are seen as less valuable in a traditional school context. So, from a teacher perspective, how do these different discourses play out in a programme that has a hybrid position within the school system, educating for both media vocations and further university studies?

TEACHERS' INTERPRETATIVE REPERTOIRES ON MEDIA PRODUCTION

Researchers have explored the impact of everyday experiences with media and digital tools on the students' production practices in the Media and Communication programme (Erstad & Gilje, 2008), and have also examined the production practices more closely (de Lange & Lund, 2008; Erstad, Gilje, & de Lange, 2007; Gilje, 2011). However, through examining the teachers' interpretative repertoires on student participation and educational goals, we can investigate how students are positioned and the underlying historical media discourses that are thematised within an institutional framework.

A discourse is here seen as a set of statements around a topic that act to both constrain and to enable what we can know about the topic (Foucault, 1974, 1977). Discourses are produced by specialists, such as teachers, to make authoritative statements about an event or object of knowledge, such as students. They are historically contingent and subject to change (McHoul & Grace, 1993, p. 31). Interpretative repertoires are relatively coherent ways of talking about these objects and events in terms that are already provided by history (Wetherell, Taylor, & Yates, 2001, p. 198). Interpretative repertoires thus function as discursive tools teachers use to tell themselves and others about their understandings of, for instance, student participation and educational goals (Potter & Wetherell, 1987). It is worth noting that people generally draw upon different repertoires to suit the particular needs at hand (Edley, 2001; Wetherell & Potter, 1988). The repertoires belong to the culture, but different individuals from different sociocultural groups in different situations may draw on these resources in different ways, in what Potter and Wetherell describe as "pre-figured steps that can be flexibly and creatively strung together in the improvisation of a dance" (1987, p. 138).

Thus, different teacher groups in different school contexts may thematise student participation and educational goals differently while providing insight into the tensions surrounding production work at school.

METHODS AND MATERIALS

This chapter draws on data from an exploratory research project on the Media and Communication programme. It focuses specifically on two data sources whereby

the first serves as background for the second: (1) quantitative descriptive data from a national teacher survey and (2) qualitative case study data from two schools.

The teacher survey was a national online survey, conducted in the spring of 2012, which was sent directly to the individual email addresses of the media teaching staff members at 77 schools with the full three-year program. There are in total 106 public and private schools with some form of an MC programme in Norway. Of the 587 teachers, 384 responded, resulting in a 65% response rate. The material was further analysed using SPSS. The survey material used in this chapter concentrates on descriptive data of perceived educational goals of the MC program, measured through a five-point Likert scale battery of statements with the reply range of *is not important* to *is very important*. The scale was developed based on literature reviews of the media education research field (Erstad & Amdam, 2013), the MC curriculum, and thematic analyses of the focus-group interviews (DeVellis, 2011, p. 187). The scale was piloted with six media teachers from different age groups and from different educational and vocational backgrounds. These data do not provide direct input to the discourse analysis; they rather provide a broader social framing of local discursive practices, or what Jimarkon and Todd call a quantitative "framework to guide the main qualitative analysis" in discourse analysis (2011, p. 45).

The case schools were selected based on theoretical replication (Yin, 2009), with similarities in school and program size and school context, and differences in educational orientation. One school mainly has vocational study programs, while the other has mainly academic programs, which allowed for investigation into the institutional social practices as a factor in the MC program. The material from the two case studies includes focus groups with 11 media teachers and individual interviews with 15 media teachers and seven general education teachers involved in the program, in mathematics, language, and social sciences. The author facilitated the two focus group conversations with the media teacher collegiums in February 2012. The teacher interviews, conducted by the author in April 2012, were semi-structured, guided conversations of about one hour (Kvale & Brinkmann, 2009). The focus group conversations and interviews were transcribed verbatim and analysed thematically using NVivo 10 (Joffe, 2011).

The target of empirical discourse analysis is "not institutions, theories or ideology – but practices – with the aim of grasping the conditions which make them acceptable at a given moment" (Foucault, 1991, p. 76). In the qualitative analysis, I first thematised conceptions on students' roles and participation and on educational goals, and how the teachers related these to each other in an inductive way, investigating how "systematic clusters of themes, statements, ideas, and ideologies come into play in the text" (Luke, 2000, p. 456), forming interpretative repertoires. These thematic occurrences and non-occurrences were then compared to the historical discursive framework described above to get an understanding of what is perceived as common or natural and what are conflicting understandings and constructions within the discursive practice (Fairclough, 2012; Foucault, 2003).

NATIONAL TENDENCIES ON PARTICIPATION AND EDUCATION GOALS

In the national media teacher survey, the teachers were asked to choose what they saw as the most important qualifications the students received from the three-year MC programme (Figure 5.1). The constructed claims are not exclusive to one historical media-education discourse, but have more importance in some discourses than in others.

Figure 5.1 shows the teachers' answers to this question – their responses and the mean values and standard deviations of each item. All the constructs scored close to 60% or higher on being perceived as an important or very important outcome of the programme. This indicates that the historical discourses on media education are indeed represented in the teachers' interpretative repertoires. However, there are some constructs that have rather higher positive scores and negative scores than the other constructs, implying that some understandings are given more weight among the teachers than are others.

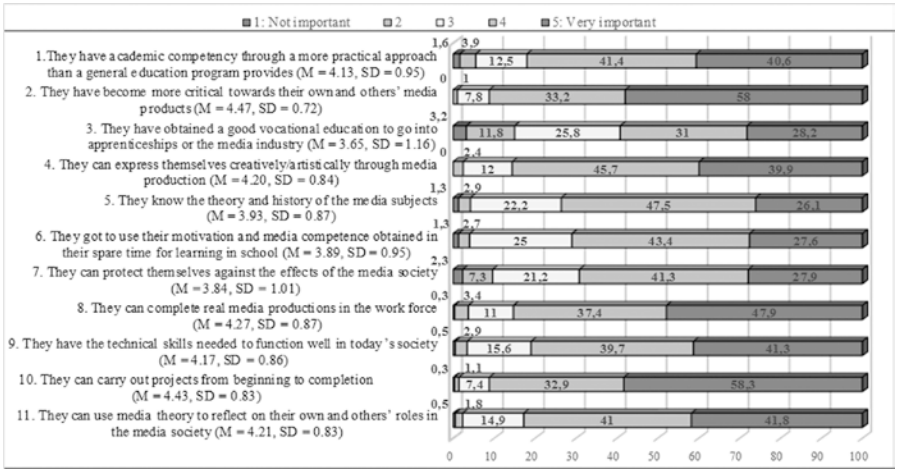

Figure 5.1. From what the students can obtain through the MC program, what do you think is the most important? Percentages

Student Participation

Two of the constructs scored more than 90% on being important or very important as educational goals: the students becoming critical consumers and producers (construct 2: c2) and the students having the competence to complete projects (c10). These were followed rather closely by the students being able to express themselves creatively/artistically through media production (c4, 85.6% important/very important) and being able to complete real media productions in the workforce (c8, 85.3% important/very important). These constructs had the most emphasis on

production, indicating that the teachers positioned the students as active participants and producers in the programme.

The focus on active participation and production was strengthened by the second tendency in the material, i.e., by what was regarded as *not* important. Almost 10% of the teachers saw protection from the effects of the media society (c7) as not important or of low importance as an educational goal. This construct also had among the lowest scores on being very important (27.9%). Seen together, the high positive and negative scores indicate that the passive consumer perception of students was less dominant in the teachers' understandings than the active producer perception. On the axis of historical media research discourses on student participation, the teachers here seemed to put more weight on the discourses focusing on active, participant, and producing students.

Nonetheless, both the critical and the creative perspectives were given weight. Contrary to what has been found internationally (Buckingham, 2010; Quin, 2003b), there was no clear tendency to give the production perspectives more weight than the critical perspectives in this material. Critical perspectives and production perspectives were seen as most important, and equally important. As much as 82.8% also saw using media theory to reflect on their own and others' roles in the media society as important or very important (c11). This indicates that the historical discourses on creative, reflective producers may have a dominant role in the teachers' interpretative repertoires on how they position their students, but also that citizen perspectives are important when it comes to educational goals.

School as a Context for Learning Media Production

Even though the most important outcome of the programme was perceived to be active, critical, and creative producers, obtaining a traditional vocational education was not as important. 15% of the teachers, the highest negative score, found obtaining a good vocational education to be not as important or of low importance (c3) in a programme that is classified as vocational. This statement also had the lowest positive response rate, with only 59.2% perceiving this as important or very important. Far more teachers perceived the programme to be a more practical approach to academic competences (c1, 82% important/very important); 81% of the teachers also saw obtaining the technical skills to function well in today's society as important or very important (c9), again pointing to citizen perspectives.

It may seem remarkable that obtaining a vocational education was the least important goal in a vocational programme. This may also seem contradictive to the rather higher positive response rate on being able to complete real media productions in the work force (c8, 85.3%) and the lower positive response on the importance of theory and history (c5, 73.6%). However, these seeming contradictions may indicate a perceived qualitative difference between vocational education as a structural feature of the Norwegian school system and vocational qualities as a part of the specific programme. Completing projects and being able to do "real" media productions do

not just belong to a vocational education discourse, but are also a part of some of the more academic historical media education discourses, especially those focusing on the creative, reflective citizen, and also the more general educational discourse on 21st century skills.

The tendency that vocational qualities were seen as more important than vocational education per se could also indicate that the discourse of professionalising out-of-school media producers through formal media education, as thematised by Itō (2010), has less dominance among the teachers. The construct on using motivation and media competence from out of school for learning in school (c6) scored 71% on being important or very important, and 4% on being of low or no importance, leaving this understanding in a lower middle position. This indicates that the understanding is a part of the teachers' interpretative repertoires on educational goals but is not the most important. However, to better understand how the different discourses on the creative, reflective citizen (Buckingham, 2003), on 21st century skills (Griffin et al., 2012; Voogt & Roblin, 2012) and on professionalising out-of-school producers (Itō, 2010) interact through the educational practice of production work, we get a fuller picture through the interpretative repertoires utilised in the qualitative case materials.

LOCAL INTERPRETATIVE REPERTOIRES ON STUDENT PARTICIPATION AND EDUCATIONAL GOALS

Three main repertoires on student participation and educational goals exist across the schools and across gender and age groups in the media teacher interviews, all focusing on the active, participant, and producing students. These are the repertoires of (1) reorienting the students from reproduction to creative reflection, of (2) motivating the media-savvy and school-tired students, and of (3) providing second chances. While the general education teachers across the media programs use elements of these repertoires to some extent, they have a fourth dominant repertoire, (4) the repertoire of academic achievement.

1. Creating the Critical and Creative Citizen – "Peeling the Reproduction off Them"

The first interpretative repertoire concerns working and learning in ways that foster creativity and critical reflection. The media teachers at both schools claim that in the first year, they have to reorient the students towards working with projects and productions in which there are no predefined solutions. The statements of Peter (in his 30s)[1] and Andrew (50s) are illustrative of how student participation is perceived. When asked what kind of students they prefer, Peter answers: "Reflective and creative students. But they probably have little experience in being that, so we have to teach them that too." Similarly, Andrew says:

> You have to be able to work independently, project-based and in groups. You can't sit with your book and yellow things out: "Now I have done this, now I have done that". You have to be active yourself. Not everyone can deal with that in the first semester.

This reorientation towards more active, cooperative, and independent learning is by most media teachers perceived to help develop more self-confident and responsible students. Diane (30s) verbalised a typical understanding: "Here the students have to take more responsibility. […] When we work on a project where the students have […] a deadline to work against, they also become very preoccupied with having the time and means to complete the tasks."

Reflection and creativity is also linked to failure and to cooperation in this repertoire. Teachers at both schools focus on teaching the students that it is okay to fail. Rebecca (20s) in the academic school points out that: "For some the fear of failure is larger than the need to succeed, […] and I see that many of those that are at risk of dropping out are the ones that demand extremely much of themselves." Several of the teachers also emphasised a focus on the students finding their strengths and weaknesses together, using each other as resources in learning.

The media teachers typically see the previously high-achieving students as having the most challenges in becoming active, creative, and practical learners, and in failing. Peter (30s) and Rebecca (20s) exemplified this in the focus group when discussing different student groups:

> *Peter:* I have had book-savvy students and then it's about sorting them out. They are very preoccupied with: "Is this correct, have I done all I was supposed to do now," to do things by the textbook. But here you are supposed to reflect, there is no correct answer. Often that is as great a challenge as (weak students).
>
> *Rebecca:* (nodding) Peel the reproduction off them and get them to reflect, that's often what we start with. Often. Brutal choice of words, but still...

"Peeling the reproduction off" students may seem harsh, but is perceived as necessary to obtain the educational goal of creating active and reflective learners – and citizens. Particularly in the academic school, they draw on a discourse of "bildung" as an educational goal in this repertoire. Several of the teachers link student participation to the overarching principles of the curriculum for secondary school. As Stuart (30s) puts it: "To be critical of what they have learned. […] To reflect on what they do, why they do what they do. […] Well, maybe that is more about "bildung" than education, but still, that's what upper secondary is about."

However, this notion of active learning to educate future citizens also provides the most prominent tension in this interpretative repertoire. The tension is between reorienting the students in the media classes, and keeping the focus on more traditional ways of learning in the general education classes. Most of the general education teachers in the program agree with the media teachers in perceiving the

high-achieving media students as creative, reflective, and responsible, also more so than many students in academic programs. James (40s) exemplifies this:

> Among the most motivated, you find much more than average creativity. […] They understand new (digital) tools very quickly and easily, and they have fewer problems in integrating them in their work. […] They are more into politics, they are often more updated on news, and often also other kinds of news than what is common.

The other language and social science teachers also see advantages in how the media students work. Harriet (50s) pinpointed how: "they are great at keeping deadlines, good at keeping focus. Excellent at making presentations and holding oral presentations," while Carl (40s) emphasised how he can be more of a partner in learning with these students because they are used to working more freely and with projects.

The perceived downside to working and learning as they do in the media classes particularly concerns the students that are *not* the "most motivated," as James puts it, i.e., the students that are seen as low-achievers in the general education subjects. The tension in this repertoire is particularly about structure. The teachers mostly link motivation to a larger interest in the media subjects than in the general education subjects. However, whereas the media teachers focus on how structure means being able to structure your own work and time through developing and completing projects, structure in many general education subjects seems to mean being able to do what is expected by the teacher within a given, often short, timeframe. Many of the general education teachers thus see the media students as unstructured and not using enough effort to obtain this goal, as exemplified by one of the mathematics' teachers:[2]

> I see that they are very dependent on working together […] and I see that this is not ideal within the given timeframes. […] So I forced them to sit one and one […] because they need to learn things without always having to talk to the one next to them. […] We have so few classes that we have to demand that a lot happens in those few classes.

Most of the general education teachers relate this argument of limited time to getting through a specific curriculum, mostly specified as certain textbooks. Thus, the focus on learning in the general education classes to a larger degree seems to position the students as individual consumers of knowledge, contradicting the goal of creating active, reflective, and collaborative learners in the media classes.

2. Motivating the Interest-Driven and School-Tired – "Getting in Touch with Reality"

Even though the MC programme has many previously high-achieving students, the typical student is perceived to be what Roy (40s) calls "school-tired, *but*

school-savvy." After ten years in school, the students want something that fits their interests or just something more practical. The media teachers in this repertoire focus on student participation as both being motivated *for* the media programme and to grow to become motivated *by* the media programme. The first group is typically interest-driven, while the other group is more difficult to motivate. However, it is a prevalent understanding that they can be motivated by production work. As Caroline (50s) puts it: "My experience is that if I get them to communicate, get them published in the paper or something good like that, it's a kick start […] they become motivated to work more independently." This way of motivating students through doing productions "for real" is an understanding prevalent at both schools, but most dominant at the vocational school. Oscar (40s) sums up this understanding:

> The best arenas for learning are when they work in relation to real life. Instead of pretending to be journalists or playing with their own ideas […] they do cooperation projects with businesses and have assignments through youth entrepreneurship.

The main motivation is perceived to be that the projects are not just for school. As George (30s) at the vocational school says: "to work with real employers […] not just school projects that they hand in to the teachers and sign off, but that they have external feedback."

In addition, the students that come into the programme with a lower interest in media studies, or with very particular interests in narrow fields of the media, are perceived to develop a gradual motivation for the wider field of media studies through this approach. Peter (30s) gives an example of this development:

> You have quite a few, typically boys, that come here and think this is computer entertainment, and don't want to listen to what we say. […] That you actually need to have a message, to tighten the target group, that you need to give reasons why you use certain effects. They don't get it. […] But […] by the third grade he is suddenly genuinely interested in all kinds of communication theory.

The educational goals in this repertoire concern relevance for the future work force. However, even though the programme is placed within the vocational structure of educational programmes, none of the teachers see the media programme as providing the final education for students that want to work in the media industries. The media industries are perceived to demand higher education, and continuous education, based on the technological development. The MC programme is also perceived to have a vocational value beyond the media industries. As George (30s) points out: "I don't know if even half of the students will go into further media education afterwards. But still you have people with a very special competence […] digital competence and media competence, […] that can help them in many jobs, I think." Most of the media teachers share this understanding of the programme as

vocational in a more general sense. Stuart (30s) pinpoints how this difference from other vocational programs is related to how the media industries function:

> It is different (from other vocational programs) in that you have a much higher level of reflection and also theory around the productions. Because they are so connected to society, you have to have broader theoretical reflections around the productions you do than in a concrete car mechanic context. There the car is isolated from society, but we can't think of media productions as isolated from society.

This hybrid position of media education provides the main tension in this repertoire. Several of the media teachers have a strong need to defend the programmes' placement in the school system as somewhere between traditional academic and vocational programmes, relating this defence to how others perceive the programme as a "light" version of both traditional academic and vocational programmes. Andrew (50s) gives a typical comment on this in a focus group:

> It has been said that the general competence has less value than the one from the academic programmes. We, who sit here, say the opposite, that the cooperation and the way to think and work is very useful in the work force, and in […] interacting with others […] instead of sitting with your own textbook and working individually.

However, also within the media teacher collegiums at both schools, there are tensions about the academic and vocational qualities of the programme. The media teachers with an academic background tend to see the programme as lacking some academic qualities, while the teachers with vocational backgrounds view it as lacking vocational qualities.

3. Getting the Lost Students through School – "New Doors and Second Chances"

The last of the three main repertoires among the media teachers concerns the students that come into the media programme on special terms, because they have special needs or have dropped out of the traditional academic school system. The focus on student participation in this repertoire is on helping students see value both in themselves and in school. Richard (50s) expresses the core of this repertoire when asked what he thinks the focus on production means to these students:

> Well, it gives them competences. And it gives them pleasure and motivation to work. Plus, the programme is so wide that you see people discover new sides of themselves, and that opens new doors that you would not find in more theoretical studies.

The idea that students can find and use new sides of themselves is a prevalent understanding in this repertoire. Several of the teachers see the production work as an arena in which so-called theory-weak students can blossom and regain trust in

themselves, or as Irene (40s) puts it: "They can master things here. Instead of taking academic programmes and not accomplish anything."

This repertoire also comes with several stories of individual students that have made it through upper secondary school, despite bad odds. Richard (50s) tells a typical story:

> She started in the academic programme, and everything fell to pieces. Now she is studying to be a lawyer. But the point is that she could have become a loser in society. We gave her a bridge that lifted her up and forward. […] Students go in so many directions […], and I am absolutely certain that many of the students here had never thought of the media channels or options that they discover here, that can become important to them.

Providing second chances for "lost" students is a motivation and an educational goal for several of the teachers at both schools. This understanding is also seen as an educational goal of the MC programme within the broader school context. The administrators are perceived to trust the media teachers to help students that need second chances, as in Andrew's (50s) words: "We have had a few students that were really damaged when they came here and left with their heads held high. […] (The administration thinks:) If this student is to succeed anywhere at this school, it is in the media programme."

At both schools, this understanding is also used to argue for the future of the media program. Andrew states that:

> Our completion rate is very high, we do not lose students, we get them through secondary school. If they drop out it is much more expensive for society. A place in an institution is a million a year, there are many that drop out, that can't handle school, that have to start over.

Similarly, Richard (50s), at the vocational school, argues that: "Seeing these programs in a societal perspective […] we make a very good buffer between the traditional vocational programmes and academic programmes. The students can change programmes, but again, we contribute to the completion rates."

The general education teachers in the programme also comment on getting students though secondary school as an educational goal of the MC program. James (40s) exemplifies this:

> For some students, I think (the media programme) is a breathing space, that is, it is a way to express yourself and be creative in school. Something that they unfortunately have not had much of in lower secondary school. […] In that way, the media programme and the media teachers fill in something that should be in upper secondary school.

However, this educational goal is not thematised by the general education teachers as applying to the general education classes in the MC programme. When asked how they adjust the general education classes to the MC programme, few of them

do any kind of adjustments at all. They use the same teaching materials and methods in all the different programmes they teach. The reasons given are that they do not have the time or subject knowledge to thematise the curriculum based on the overall goals of the study programmes. Thus, the students' lack of motivation for general education classes is the main tension in this repertoire, but is tacitly perceived as a problem specific to the media programme or to the students not being motivated for the subject contents of general education classes. It is seldom attributed to how the general education subjects are taught or organised.

4. Getting the Students to Achieve Academically – "Not Using Their Potential"

The fourth repertoire is almost exclusively presented by the general education teachers. When describing and discussing the media students, the general education teachers typically use an interpretative repertoire connected to academic achievement. For most of these teachers, the students are perceived as divided between high and low achievers. This polarisation is connected by several teachers to both grades and effort, and is linked to the students' sociocultural backgrounds and to their ability to structure themselves and their school days.

As described in the repertoire on creating the creative and critical citizen, the language and social science teachers perceive the high-achieving media students as creative, reflective, and responsible, even more so than many students in the academic programmes. However, these positive qualities are not necessarily seen as a result of the students attending the MC programme. Instead, these qualities are perceived by most of the general education teachers as inherent qualities in the high-achieving students who chose to attend the MC programme. They are therefore thought to be better off taking an academic programme. Some of the general education teachers say this explicitly, but most of them only imply this by statements such as "many think they should rather take academic programmes" (Harriet, 50s) or "there have been discussions on whether these students should rather do an academic program" (Monica, 40s).

When asked why these students should take academic programmes rather than the MC programme, the arguments mainly concern economic issues or educational goals of having general knowledge, as Monica exemplifies:

> If you think about social economy […] it is cheaper to let them take a general education programme, and that's their goal anyway. […] I think it would strengthen the media programme if it was closer to general education […] because if you are to be in the media you need general knowledge!

However, there seems to be a tacit understanding that the academic, general education programmes provide the best competence for further studies or work, without a conscious understanding of what this competence consists of or should be used for. Thus, the students are somehow valued more by what they *do not* learn

with respect to traditional academic subjects than by what they actually learn in the MC programme.

Several of the general education teachers also think that the media students are not using their academic potential. Whereas the academically high-achieving students are perceived to have inherent positive qualities regardless of the study programme they attend, the lower-achieving students are perceived to underachieve because of taking the MC programme. The practical work in the MC programme is perceived to take up too much of the students' time, attention, and effort, at the expense of the general education classes. As Carl (50s) puts it: "It seems like, when they get a camera on, they are so important that they don't have to show up for general education classes." Similarly, one of the math teachers puts it this way:

> The ones that are good students, the very, very best […] they stay on that level. […] The mathematics here isn't harder than in lower secondary. Maybe some parts, but there are no drastic leaps. The ones that work on it manage well, but the ones that do not, that could have achieved better, they don't. So there are many that are not using their potential here.

The focus on academic achievement is a main point of tension between the general education teachers and the media teachers at both schools. Many of the media teachers see the general education teachers as too rigid or even deterministic in grading students based on academic achievement, not focusing enough on motivating the students. Caroline (50s) exemplifies this:[3]

> The general education teachers often sit and say, this is a typical four-student, and he will never be more. And this is a typical five and a three and […] they don't have the abilities for more. I totally disagree! […] Suddenly, in the media classes, they show a side of themselves that is absolutely excellent […] but they have to be motivated to work on it.

Thus, the tensions in this repertoire are particularly linked to the perceived goals of education. Whereas the media teachers emphasise contributing to educating creative, critical citizens and employees, the general education teachers emphasise subject knowledge linked to a general education tradition. This tension makes some of the media teachers try to lower the academic pressure on the students, actually promoting lower academic achievement to avoid students dropping out. Rebecca (20s) voices this tension:

> I feel that I often work against what I experience as a culture in school – that most other teachers all the time are preoccupied with: You can do better, you can do better, you can do better! Come on, this is not good enough! Therefore, I rather try to say things like: A four is a good grade! Better to get a three than nothing. […] Why is getting a six so important to you? Does it say anything about who you are, or do you just feel you have to? […] Many girls, but also boys, they don't dare to try, out of fear of failing.

This understanding of potential dropouts as being students at all academic achievement levels is only thematised by the media teachers.

TENSIONS IN AND BETWEEN REPERTOIRES AND HISTORICAL DISCOURSES

Student Participation

The three first local interpretative repertoires mirror the picture presented by the national quantitative data. The media teachers position the students as active and participant learners in line with understandings present in the last two historical media education discourses presented initially. The fourth repertoire, however, positions the students within the broader school culture, and has a different focus on student participation that creates a main tension both in and between teacher repertoires.

The first two repertoires focus on critical reflection as a result of doing production work. The first of these repertoires describes repositioning or reorienting students towards active learning. The media teachers here perceive that they create more creative and critical learners that also become better equipped as future citizens and employees than in the academic programmes. This is in line with the historical media education discourse on "bildung," interpreted as media education contributing to active, critical citizens (Vettenranta, 2004; Østerud, 2007). However, the focus on project work also connects to the Nordic tradition of project-based learning in media education (Erstad, 2010). The general education teachers seemingly support this understanding in how they describe motivated MC students. Nevertheless, the qualities the media teachers see as a consequence of attending the MC programme are often described as inherent qualities in these students by the general education teachers, meaning that the MC programme and teachers are not credited for how they work with student participation. This issue points to tensions within the broader school culture on how ways of organising educational activities are perceived to contribute to student learning.

The second repertoire, that of motivating interest-driven and school-tired but school-savvy students, feeds right into the discussion on production work in school as being "for school" (Itō, 2010). This repertoire shows that the teachers perceive doing things "for real", that is, working on real media productions with external clients, as motivation both for the interest-driven and the school-tired. This motivation is not just related to becoming better producers as described by Itō (2010), but is used pedagogically to raise students' interest in theoretical knowledge. How the teachers and students work together in the production work of the MC programme is portrayed as very similar to what Itō describes as learning both from exploring, collaborating, and getting authority-based feedback, providing validation in the here and now (2010). However, the national survey data, in which using motivation and media competence from out of school for learning in school does not score so well, may indicate that this repertoire is less dominant at other schools.

The third repertoire to some extent mirrors the description of Buckingham's (2010) fear for media education, that media education may become a place where young people from economically disadvantaged backgrounds may "cash in" their cultural capital to achieve future employment. However, media teachers in this Norwegian programme do not share this understanding. Instead, they see the inclusion of these students as a part of a broader educational context of helping students get through upper secondary school. For the media teachers, this is not linked to the status of the programme but rather to how they have created a culture for learning that makes it possible for these students to attend school. To the general education teachers, on the other hand, these students are far more problematic, pointing to how Buckingham's (2010) and Quin's (2003a) perceptions of low status may still apply to how the MC programme is perceived within the broader school context.

The main tension is thus between the educational goals of the media teachers and the general education teachers. This is particularly explicit between the third and fourth interpretative repertoires. Whereas the media teachers seem to emphasise that all students have strengths and weaknesses that should be considered in helping them through upper secondary, the educational goal of individual academic achievement among the general education teachers is perceived as rather deterministic by the media teachers. In the opposite direction, the perceived lack of focus on academic achievement by the media teachers is linked to student underachievement among the general education teachers. This finding resonates well with the findings within Australian media education research emphasising that as long as media education focuses on production work, it will not have status within the broader school context (Quin, 2003a). As long as the perceived positive qualities of the high-achieving students are seen as inherent qualities in these students, and the negative qualities of the low-achieving students are attributed to the MC programme, the production work focus cannot gain status within the school context.

Educational Goals

The local interpretative repertoires may explain some of the seeming contradictions in the national survey findings on educational goals. The national survey shows that even though the most important outcome of the programme is perceived to be active, critical, and creative producers, obtaining a traditional vocational education is perceived as the least important of the proposed educational goals. The local findings point to how this contradiction is linked both to how the media industries are perceived to function and to the educational goals of being vocational in a broader sense. Through the first two repertoires, the teachers emphasise how the MC programme has the educational goals of creating creative, critical, and collaborative learners, as well as citizens with a broad media competence and work-related project experience. Though not explicitly thematised, this understanding is explained by several of the media teachers as being very similar to those of 21st century skills frameworks (Griffin et al., 2012).

At the same time, there are some differences between the two case schools concerning these two repertoires. Whereas the academic school collegium seems to emphasise educational goals related to "bildung" through a media education discourse of reflection through production, the teachers in the vocational school draw more on elements of entrepreneurship from the discourse of creating the professional producer. There is little tension between these repertoires; they seem to represent a continuum of positions that draw in the same direction, but concern different students within the same student group. Both the academically high achievers and the low achievers are reoriented towards production work as the means to obtain these educational goals. However, as described in the second repertoire, even though the goal of reflection through production is the dominant understanding at both schools, there are teachers that think the programme is too academic and teachers that think it is too vocational, pointing to the underlying tension of doing production work in school presented by Buckingham (2010) and Quin (2003a).

The main tension between the third and fourth repertoires on educational goals concerns a broader understanding of what serves society economically. The media teachers emphasise how the MC programme gets both overachievers that risk dropping out due to a fear of failing, as well as interest-driven and school-tired students through upper secondary school, thereby saving society from spending money on the rehabilitation of school dropouts. The general education teachers, on the other hand, who consider the MC programme to be a very expensive study program, claim that since most of the students want to go on to further university studies, society could save money by placing the higher-achieving media students in general education programmes. This again indicates that several of the general education teachers only see the value of the MC programme for the low-achieving students, without reflecting on the complexity of the group of students that drop out or on how the MC programme contributes to society in ways other than getting students through upper secondary school.

THE DANGERS OF HAVING FUN – DOING PRODUCTION WORK IN SCHOOL

Quin argues that the focus on production will always give media education a low school status because this focus renders the subject as "fun" in the minds of students and teachers (2003a).

The present findings about the MC programme suggest that the media teachers' interpretative repertoires on production work are framed by theoretical and pedagogical reflections connected to media education discourses that thematise a broader societal development that has mainly happened after Quin's study in 2003. The development in social media and increased availability of media production tools has changed the premises of doing production work outside of school (Erstad, 2010; Itō, 2010). At the same time, the way the general education teachers see the MC programme gives a good indication of how the programme and production work are perceived in school.

As described in the introduction, the MC programme has had high entry grades and completion rates. It also has a distinct 21st century skills focus, both in student participation and production work, and in the perceived educational goals of educating creative, critical, and media-competent citizens. Both the learning activities and the educational goals are also very much in line with the goals of the latest Norwegian educational reform, the Knowledge Promotion Reform from 2006 (Hølleland, 2007).

However, in the spring of 2013, the MC programme was decided to be changed into an academic programme by the autumn of 2016. The main argument for this change was that 97% of the students took the MC programme to qualify for further studies. The Norwegian Ministry of Education and Research argued that the programme thus required more academic classes in history, geography, religion, and third-language training because the students, compared to other general education programs, had a: "weaker starting point for higher education" (2013, p. 114). The 21st century skills-qualities of production work were put forward as assets of the MC programme that should be kept in the revised program. This led to a proposal to create a new hybrid programme with academic and vocational elements, this time based within the academic programme tradition. It will be interesting to follow this process further, to see if production work in school is a possibility within an academic upper secondary tradition, and in that case, if this will somehow change the status of doing media production work in school.

NOTES

[1] To retain anonymity, the teachers are given generic names and age is indicated by age groups. Teachers between the ages of 30 and 39 are thus said to be in their 30s and so on. Age group and gender is kept to show the diversity in the use of interpretative repertoires.

[2] To retain anonymity, the two math teachers will not be identified by school orientation, gender, or age.

[3] In the Norwegian upper secondary grading system, the best grade is 6 and the lowest passable grade is 2.

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SECTION TWO

BOUNDARIES AND BRIDGES OF LEARNING

SANNE RAITH

6. THE MEANING OF CONTEXT

Upper Secondary Students' Meaning-Making and Engagement with Analogue and Digital Artefacts in the Museum and at School

INTRODUCTION

Since the 1960s, museums and galleries have increasingly embraced the new means of communication that technology holds (Parry, 2007). According to Falk and Dierking, the media represents an "important and powerful way that museums can offer choice and individualised learning options to visitors" (2008, p. 20).

Hereby, the new media have the potential to reach old and new audiences on their own premises, in accordance with contemporary constructivist learning theories (Giusti, 2008).

Although museums, since the 19th century, have sought to reach out to their audiences outside the museum's physical space (Mulryan, 2001; Schwarzer, 2006), museum research has traditionally favoured studies taking place in the museum. With the digital turn in the museum world that has happened, especially in recent years with the increased Internet access, new studies have emphasised the changing boundaries of the museum space (for instance, via video conferencing; e.g., Barshinger & Ray, 1998; Sederberg, 2013) and how museum education resources can be used in schools (e.g., Marty, Sheahan, & Lacy, 2003; Vavoula, Sharples, Rudman, Meek, & Lonsdale, 2009; Wyner & DeSalle, 2010). However, this is still an under-researched area, which therefore calls for research on how students make meaning of different versions of educational resources but in different modalities, digital and analogue, and how schools and museums provide similar or different conditions for how such resources might be used.

In Denmark, the use of technology has expanded, and the museums are now offering a wide range of online-based learning resources to schools as a response to the need for digitally based educational-outreach programmes. For schools situated geographically far away from the museums, or for schools with limited economic resources, digital access can be a way of "visiting" a museum and, for the museums, a way to reach the school audiences where they are. This chapter investigates how upper secondary students make meaning with two diverse artefacts in two diverse contexts, namely the museum and the classroom. The present study, conducted in the spring of 2014, investigated the same students and how they are making meaning with two diverse artefacts in both settings; their classroom in the upper secondary

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 111–130.

school and the Natural History Museum of Denmark, specifically, the Zoological Museum.

The two resources are digital and analogue, respectively; in essence, however, they comprise the same educational resource, as they are based on the same content and measurement tasks. Both also have the same learning goal: to teach upper secondary students about the evolution of man.

The aim of the chapter is to analyse how the students make meaning and engage with these two versions of the same educational resource in two educational settings, as the context will always influence a museum visit in both a sociocultural, a personal, and a physical way (Falk & Dierking, 1992, 2000). Yet, not only the context has an influence on the meaning-making taking place: studies have also shown that in museum and school partnerships taking place in both contexts, students increasingly benefit from learning with "analogue" museum objects in a hands-on-based way (Melber, 2003; Sturm & Bogner, 2010). As Anderson says, the crucial point is

> that digital encounters will provide informational benefits, and that they will encourage curiosity about the original, but that they cannot provide the *visceral thrill* of being in the presence of the original. (Anderson, 1997, p. 22)

Drawing on Falk and Dierking's different contexts, the question, then, is how a context possibly can influence the students' meaning-making and engagement when they use the two educational resources. According to Lawson and Lawson (2013), student engagement is

> to depend on "students" prior knowledge, experience, and interest at school, home, and in the community […] as well concerning "the organizational structures and cultures of school," (p. 433)

which is relevant to the discussions in this chapter.

Consequently, the chapter asks questions surrounding the idea of what happens when the museum educational resource is digitalised and used in a classroom without the museum educators to teach the content; does it become something else? Or more precisely, what happens when the material artefact—for example, the Vernier caliper travels out of the museum and into a classroom as a digital artefact—a specific piece of software? How do the students engage with each one of them?

In order to see how the students make meaning when they engage with digital and analogue artefacts in the different settings, this chapter presents video data of social interaction to see what takes place during the sessions. This is supplemented with excerpts from interviews with the students to gain in-depth knowledge of their experiences with the educational resources. Through the engagement with the data, I ask two questions:

- How do the two contexts encapsulate the museum resources?
- How do the students make meaning and engage with the analogue and digital mediating artefacts?

The chapter presents its argument in three sections. First, in the theory section, it discusses context by drawing on previous research in museum studies. Then follows a discussion on mediation as a concept in order to understand how students can make meaning of the two artefacts provided to them. The second part presents the data and gives a detailed presentation of each artefact, the analogue and the digital. In the third section, video data and interview data are presented in each context. The final discussion will focus on how each context relates to the meaning-making with the artefacts, as presented in the excerpts. The chapter ends with some remarks on the possible implications for teachers, as well as museum workers, in connection with digital and analogue museum education.

MUSEUM AND SCHOOL AS LEARNING CONTEXTS

DeWitt and Osborne (2007) highlight the differences between the school classroom and the museum learning space in terms of

> scale, class management issues, student independence, curricular structures, (p. 687)

as these two learning contexts always will have different impacts on the students' learning. As anyone who has taught in museums knows, the museum's physical setting can have an influence on the visitor's behaviour and experience at the museum.

From a museum-specific perspective, Falk and Dierking expand the term *context* into three different contexts, which they believe a visitor will always "meet" the museum with. These are the *physical*, the *sociocultural*, and the *personal* (1992, 2000). First, the personal context is what you bring with you to the museum, your personal interests and your beliefs, which are all part of your motivations for the visit, or the reverse. This again is in line with your prior experiences, all of which are unique to the individual. Second, Falk and Dierking state that the physical context, for instance, can have a great influence on factors such as how visitors move around inside the museum during the visit. Third, visits to museums always occur within a sociocultural context, as you will always be situated in the surrounded world. Hereby, every visitor, student or teacher, comes with his or her own cultural background and perceptions of a museum, which at all times can have an influence on what they experience at and engage with the museum (or in the classroom for that matter).

However, it is not only the physical surroundings that can affect a visitor's experience. Drawing on Vygotsky's sociocultural approach, Cole points out that one of the main characteristics of a cultural psychology is that it

> emphasises mediated action in a context. (Cole, 2008, p. 23)

This means that the context is not only the physical surroundings but context is what "weaves together" (Cole, 1996, pp. 132–137), much as Falk and Dierking also point out. One cannot analyse an entity in an activity without looking at the

whole context as it unfolds, hereby looking at "goals, tools, and setting" (Erstad, 2013, p. 169). Consequently, understanding how tools are used in mediated action becomes ubiquitous.

UNDERSTANDING MEDIATED ACTION

One of the central themes in Lev Vygotsky's (1896–1934) sociocultural approach is the concept of *mediation*, which concerns how humans act and interact with different cultural tools or mediating artefacts (Daniels, Cole, & Wertsch, 2007). These could be either psychological (thoughts) or technical (language, computers etc.) (Vygotsky, as cited in Wertsch, 1991) and were used to explore how humans act with mediating artefacts in their everyday lives and learning situations (Erstad & Wertsch, 2008).

Another point is that these mediating artefacts, which are acted upon in mediated actions, will always be situated in a certain context when humans seek to make meaning of something in an activity. This chapter therefore seeks to explore the students' interactions with the mediating artefacts in a dialectical interplay, as these cannot be seen as separate, as mediation permeates every action in every context. Hereby humans, mediating artefacts, and the contexts in which these are situated, are always interrelated.

Vygotsky's notion of mediation can be divided into two different forms of mediation, "explicit and implicit mediation" (Daniels et al., 2007, pp. 181–182). The explicit mediation refers to observable mediational means; the mediating artefacts, such as a computer or a ruler one uses to mediate a certain topic in, for instance, a school activity. The implicit mediation refers to intra-personal processes (e.g., thoughts), and thereby this type of mediation is harder to recognise as it does not show up clearly in an analytical context as the explicit does.

For the same reason, the students were also interviewed in order to let them voice their thoughts on working with the mediating artefacts. Hereby drawing on Wertsch, the unit of analysis is "agent-acting-with-mediational-means" (Wertsch & Erstad, 2008, p. 24). Wertsch also points out that "new mediational means transform mediated action," which implies that digital means can transform an analogue action or experience through its new mediational form (Wertsch & Erstad, 2008, p. 24).

By looking at how the students are making meaning and engagement with the mediating artefacts in each context, the analysis focuses on how students are able to use the analogue and the digital resources. Thus, there is a necessity to understand and to discuss how contexts may shape how students make meaning of them.

THE CASE STUDY

In the present case study, a Danish upper secondary school class[1] (one teacher and 22 students) was observed during its visit to the Zoological Museum, the Natural History Museum of Denmark,[2] as well as a week later in the school classroom, in the spring of 2014. First, the class was observed when visiting the Zoological Museum at the Natural History Museum of Denmark, at which the class attended a session on

the evolution of man, taught by museum staff. Here the students worked together in groups in a museum education room that was separate from the exhibition space. The session took one and one-half hours, with the students being in the room for almost the entire time except for the last ten minutes, which were used in the exhibition space. The overall task during the session was to measure the different sizes of (plastic) skulls (called authentic copies) in order to see the evolution of man. A week later, the class was observed again in its own classroom in the school in order to see how the students now used a digital version of the educational offer they had tried at the museum. Again the goal was for them to learn about the evolution of man, yet only now in a digital version, which also meant that the measurement tasks now happened with the computer's curser-operated ruler and not with a physical ruler.

The study used both video data and interviews in order to gain a deeper perspective of the students' experiences during the sessions. The video-data method was chosen in order to help create a detailed view of how meaning-making and engagement with artefacts happens in different learning contexts. Interviews before and after the different sessions (approximately one and one-half hours in total per session) were conducted to further explore what happened during the sessions to see how the students and teachers spoke of their experiences in the different contexts. Four students (two boys and two girls aged 17–19 years old)[3] gave consent to participate in the case study, which meant that the cameras used for the observations would predominantly be turned towards them. They were asked to wear microphones in order to capture their speech while they talked about the tasks and worked with the artefacts during the sessions, and after each session, they were interviewed. In total, the sessions explored in this chapter consist of approximately three hours of video data and approximately two hours of interviews.

A central part of the analysis in this chapter is the artefacts, which the students used for learning about evolution. Two educational resources, "The Human Animal" and "The Evolution of Man," were used in the study. The latter was presented in the museum, and "The Human Animal," a digital resource, was presented and used by the students at school; both resources were developed by the Zoological Museum. Although bearing two different names and offered in two different versions, the two resources concentrate, as mentioned, on the same tasks and content (see Table 6.1).

Resource 1: "The Evolution of Man"

This is an analogue resource on 'human evolution' that is taught by museum staff at the museum. The session is concentrated on the evolution of man and the education staff uses plastic copies of real historical skulls to teach this. The skulls are of a chimpanzee, "Australopithecus Afarensis", "Homo Erectus", and "Homo Sapiens". The session is divided into first, a talk about the skulls and the evolution of man, followed by a measuring task where the visiting students with Vernier calipers measure the skulls to see different variations in the evolution of man. The measurements are then written down on paper in a system of coordinates as well as on the blackboard

Name	Resource 1 The Evolution of Man	Resource 2 The Human Animal
Context	Museum	Classroom
Illustration		
Materiality	Analogue	Digital
Properties	Vernier caliper Measurements written by hand	Curser-operated ruler PDF-file with measurements

Figure 6.1. The two educational resources

so the whole class can compare the different groups' measuring results and variations in these. The session with the students in this project lasts 1.5 hours where approximately 80 minutes takes place in a "museum classroom" resembling a school classroom, except for jars with animals in formaldehyde, and the last ten minutes takes place in the exhibition hall where different skeletons are displayed.

Resource 2: "The Human Animal"

This is a digital version of resource 1 to be used outside of the museum space in upper secondary classrooms. The digital resource can be used as a stand-alone educational resource without a visit to the museum or as a pre-task or post-task in connection with a museum visit. When used in the classroom, the schoolteacher teaches the digital version by using the teacher manual made by the museum, which is available on the resource's website. In this version, all four skulls are measured with a digitalised version of the Vernier caliper to measure the variations between the same four skulls as in Resource 1. Also, instead of papers with a system of coordinates, the digital resource offers the user to write the measurements as well as notes on the site, which can be converted into a PDF-file.

METHODOLOGY

When doing participant observations in complex learning situations such as in a classroom (Madsen, 2003) video data is a very useful method to use to gain rich

descriptions from several different perspectives (Miettinen, 1999). In this case study in both contexts, three cameras (GoPro cameras) were used in order to capture the classroom in its full context as much as possible. Also microphones were placed on the four students in order to hear what they said during the sessions. After each session, a semi-structured interview guide was used in order to interview the students (Kvale & Brinkmann, 2009).

Analysing several hours of video data is as Bødker calls it "a complex matter" (Bødker, 1996, p. 10). Therefore drawing on her coding strategy, "interesting situations" were selected in the data where something happens with the students' understanding of and engagement with the museum resources. Such a situation consists of *breakdowns* where the learning process is interrupted by something (for instance the Internet connection breaks down) or *focus shifts* where the change of focus is more deliberate than at a breakdown (for instance a student deliberately shifts his focus to something else than the task) (Bødker, 1996, p. 6).

Hereby the video data allow for the researcher to go over the data in detail to see when meaning-making occurs and what happens with the students' engagement during the sessions. Examples from the video data are supplied with interview data whenever applicable in order to give a more broad insight of the students' experiences with the two museum resources.

Ways of Engagement—Meaning-Making in School and at the Museum

In the first session at the museum, the students were placed in the "museum classroom" in groups of four or five with the four plastic skulls lined up on each table. After about an hour's talk on the skulls and human evolution in general between the museum educator and the students, the museum educator gave an introduction to the measuring part of the session giving clear instructions on how to use the rulers:

> You will use this [holds the ruler in front of him], which is called a Vernier caliper, and you use it for measuring, and on it you can read how much you have measured with it. I'll help you with this (…) Now I'll give you all a paper for you to write your measurements on (museum educator, video observation).

The museum educator shows the students how to use the Vernier caliper (the mediating artefact), and also distributes and shows the students the cards with the different tasks on them, as well as the papers they will need in order to write down their measurements. While explaining to the students how to measure, the educator is very engaged and holds up the different things he wants to explain to them in order for everyone to see.

The students then start to measure the skulls in order to learn about human evolution while the museum educator walks from table to table to see how the students are doing. The following describes an explicit mediation situation in which the students are talking about the task of measuring the skulls with the Vernier calipers, which are the mediating artefacts the students used to measure the different skulls:

Julie:	What can you measure here?
Maria:	I don't think anyone knows [laughs].
Peter:	3.7. How much was yours [measurement]?
Casper:	3.
Peter:	From zero?
Casper:	Yes, from zero to zero.
Julie:	Gosh! I'm really bored…oops, we're being recorded… snout … should I measure the snout? If you measure the snout, then you'll measure here! [points towards a skull]. Do you want me to measure it? It's 10 cm…where should I write it down?
Peter:	I think it's fucking funny… 5 [cm]… 5 [cm] I hate this…
Maria:	Yes, measure that one.
Peter:	Aaarh! I feel like pizza! It doesn't make any sense but still, that's the way it is…
Maria:	You know what?
Peter:	What?
Maria:	I had pizza yesterday.
Casper:	Nice! I had hot dogs … 3.5 [cm] … so we have 3.5 and 3.6 [cm] and 3.7, and this one 3.5 [cm]. (Video observation at the museum)

In the described activity, the students are working with the Vernier calipers, as instructed by the museum educator. The activity of this excerpt may be divided into three parts. In the first six lines, the students compare their measurements, perhaps except Maria, who makes fun of the task by interjecting that she does not think anyone knows what they are actually doing. Julie then tags along and breaks away from the activity by uttering that she is really bored, but upon realising that she is being recorded, reorients herself towards the task. However, Peter then goes off-task, as well, and talks about food; he is followed up by the other students, before Casper, in the third part, refocuses on the activity by summing up the measuring results.

There are two interesting topics in this excerpt. First, even if the students possess previous knowledge of rulers, the Vernier caliper they now use is different, which therefore means that the mediating artefact is not helping them to understand the task immediately. Although the museum educator had carefully instructed them how to use the Vernier caliper, the first part of the excerpt indicates that it is hard for the students to make meaning of the mediating artefact (the ruler) provided to them for the task. This could be the reason for the students' shift of focus when they suddenly start to talk about other things, such as food they would like to eat, as well as express their feelings of boredom during the activity. However, by the end of the excerpt, the students agree to write down the measuring result (3.7) on the hand-out sheets, as shown in the transcript above. Although the museum educator has explicitly shown them how to measure with the rulers, this situation can be described as a breakdown, as the students struggle with the activity due to the Vernier calipers. Still, throughout

the session at the museum, the four students weave in and out of engagement with the mediating artefact, therefore describing this excerpt as a typical situation in the video data.

The second session that occurred a week later in the classroom was an early morning session, and only Maria and Casper were present at the beginning of the class, with Julie and Peter showing up later. At the beginning of the session, the teacher explained the day's task, which was to try the digital resource, "The Human Animal," in order to measure the (now digital) skulls as they had done the week before at the museum. The students had hereby already tried to measure the skulls with the Vernier calipers at the museum, and therefore knew and understood what the aim of the activity was.

Once Julie had arrived for class, she, Casper, and Maria were all working on the task together at their table. Maria was the person in charge of the measurements on the computer, while Casper and Julie were sitting next to her talking with her about how and what to measure:

Maria: Aaah…okay it's 43 [cm]. Is your measurement, too?
Casper: It's 44.3 metres.
Julie: Kilometres.
Maria: Millimetres (laughs).
Julie: Spoilers!
Casper: Yes.
Maria: It also says so there.
Julie: This is so smart.
Maria: I have such a stomach ache right now! (…) This is a nice report, isn't it?
Julie: This is great fun (they giggle).
Maria: So! [she has now completed one of the measurements] now this is a well-done task. Oops, do these all go together or what?
Julie: You'll just do the jaw. Oh, you already did that one.
Maria: That was a free assignment. Snout.
Julie: Its nose.
Maria: Yes, but how do we know what we need to measure?
Julie: You have to press like this [points to the screen] on the other side, and then you need to measure down there [points], so you measure up here and there.
Maria: From here?
Julie: No, not there. Where the nose begins, and then up. No, not up there, up there.
Casper: No, you need to go up here and then there.
Julie: Ah yes, that's right! So you have to get to there and then there.
Maria: Now it [the curser-operated ruler] won't move.
Casper: Does anyone have a spirit level? (they laugh).

Maria: But how should I measure from up here?
Julie: One thumb.
Maria: And from here to here or what?
Casper: A thumb.
Julie: Thumb and spirit level (laughs).
Maria: Was it from here?
Casper: Do you think of a carpenter's ruler? (Julie and Casper laughs).
Maria: But it won't go out here, can get it out here but in addition, it will not.
Casper: I didn't mean to be cheeky.
Maria: I simply don't know how to do the others, I can't find out how to do it (laughs). This is going really well.
Casper: Why is it we have to do it when we have done it in reality?

In this excerpt, three things seem to stand out. First, all three students seem to have a playful approach to the activity and to each other, teasing each other with "millimetre" and "kilometre," and again by the end of the excerpt, which indicates that this excerpt, to some extent, mirrors the excerpt from the museum, as they once again, throughout this whole excerpt, joke with each other and exchange sudden exclamations, such as Maria's interjection about her stomach pain. Second, it seems as if Maria faces some difficulties using the mediating artefact, although the others assist her by pointing and telling her where to place the curser-operated ruler. Maria still struggles, so Julie then takes over, although not taking the computer itself, but guides Maria on how to measure. Again, this indicates that they do engage with the activity and the digital resource but still, just as at the museum, weave in and out of the process of making meaning with the content of the measurement tasks. However, a lack of concentration seems to be more dominant in their own classroom. Third, by the end of the quote, Casper asks (rhetorically) why they have to do the task again when they have already done it "in reality" the week before, which indicates that there is a discrepancy between doing a task digitally and "in reality." It would seem as if Casper does not understand their teacher's aim of why they have to do the task again at all, as they have already done it. However, his statement also clearly shows how he perceives the digital resource to be less "real" than the hands-on based tasks that the students tried the week before at the museum.

Later during the session, Peter shows up just in time to finish the digital measurement tasks with the rest of the group. Once they had finished these tasks, the teacher asked the whole class to measure one of the students' heads in order to link the digital evolution tasks to their own lives:

> Now listen up! We're going to do another task. Everyone is going to measure Alexander's head [Peter looks at Alexander and laughs], and you'll have to remember, to the millimetre, what you have measured, and then we can see how great the measuring variation is. (Teacher, video observation in school classroom.)

> However, Peter was not sure exactly what to do and asked the teacher for more information.
>
> Peter [to the teacher]: What are we measuring?
>
> Alexander [says to the whole class]: I do have some very masculine features [laughs].
>
> Teacher: why are we going to do this?
>
> Peter [to the teacher]: What is it we're going to measure? Is it his head or?
>
> Teacher [answers Peter's question]: The perimeter of his skull (…) everyone will measure this, and then everyone will tell Jenny [another student], who then will see how much variation there is between the measurements. But the difficult thing is [Peter starts to make loud sounds as if he's playing the bass guitar, which goes on for several minutes] to see the different variations…[the teacher continues to explain the task]. (Video observation in school classroom.)

Throughout this excerpt, Peter seems very distracted, asking the teacher directly what they were going to measure, although the teacher had just stated it to the whole class. Furthermore, he and Alexander, who is going to have his head measured, are joking and disturbing the teacher with a comment about his "masculine features," indicating that he has been chosen for the activity because of these. By the end of the quote, Peter is not listening to what the teacher says but instead starts making loud sounds and does not pay attention to what the teacher says.

Although the learning context was different and the task of measuring skulls was digital, which perhaps could have provided a different learning environment, the above quotes shows how the students seemed slightly restless during the classroom session, showing a somewhat lack of interest in both the digital resource activities as well as the hands-on task of measuring Alexander's head.

Although the students did engage with the digital resource and eventually solved the different measuring tasks, they did not start working on their biology report using the digital resource and the museum visit experience for this, as asked by the teacher but continued to be restless and to lose interest in the different tasks.

Instead of starting on the biology report after finishing the tasks, the students engaged in conversations with each other. In the interview with the students after the session, Maria said, "and then I was just sitting there not having anything to do for the next 40 minutes." This lack of concentration caused a focus shift as the students, for the next 40 minutes until the end of the lesson, talked about everything else but the digital resource they were to use for the biology report. This means that even though they did complete the measuring tasks and thereby to a certain extent fulfilled the teacher's goal of the activity, it would seem as if the students' own goal was different from the teacher's, as they never started on their reports. So what caused this shift of focus?

Casper asked in the former extract, why they had to do the same task again, when they had already done it 'in reality'. In the interview, the other three students, Maria, Julie and Peter,[4] wondered the same, mirroring Casper's thoughts on the matter. In the interview, they further stated that they expected the teacher's aims to be a repetition of what they had already learned because of the upcoming exams, but still they found it boring to do the same task again and thought that it had been more interesting the first time when they tried the analogue version at the museum. So what was the difference between the analogue and the digital version according to the students? Were they appropriating the content differently, and which one did the students prefer?

TANGIBLE AND INTANGIBLE MEDIATING ARTEFACTS

In the classroom, Maria and Casper were the only ones present at the beginning of the session but started right away to engage with the mediating artefact, the digital ruler. However, Casper did not seem interested in engaging with the tasks, which left Maria more or less left to herself to solve the tasks; this did not happen without some difficulties. First, she had problems getting online, and when she finally was engaged with the digital resource online, she had to ask the teacher for help as to how to use the digital ruler. However, the teacher would not help, stating that she had to work it out herself, as "it is part of the learning process" (video observation). Maria explains:

> Maria: I think it was more confusing to do it [measuring] on the computer because there was not much guidance provided on how to do it, so I was a little insecure about everything…about how to measure. Some of the tasks were already shown of how to do them, which made it a bit easier, but it was much easier to sit with the skulls in your hands because then you knew what you were going to do, but on the other hand, the measurements here were perhaps also more imprecise.

In this quote, there clearly was tension regarding how the teacher seemed to expect Maria to be able to use the digital resource right away and without help. The question, then, is whether the teacher indeed was able, or not able, to use the resource himself. If not, this could be the reason why he did not want to help the students getting online, as perhaps he found the mediating artefact difficult to use. Ultimately, this lack of help from the teacher could be a reason for why Maria (and the other students) seemed to lose interest and engagement with the topic during the session.

An interesting aspect was how the mediating artefacts were perceived in the two different contexts. The students struggled with the digital measuring tool in the classroom, as they did with the Vernier calipers at the museum, again not being able to master and to appropriate these tools without some difficulties. During the interview after the classroom session, the students talked about how they perceived the different resources:

Maria: It's the fact that you're holding it in real life, right?

Peter: It very quickly just becomes theoretical in my head if I'm stuck with working on the computer…some people like this better but it's just not my thing. I'd rather have the other [analogue version]. I just get restless so I just sit and do something else instead. If I sit at a computer I'll end up sitting, being bored or something like that…I definitely think it's more fun to sit with it in your hand because you get a better sense of it and (…) you'll get a better insight into the topic when you see it (…) I concentrate much better if I sit with it in my hands.

These excerpts show how Peter and Maria both liked being able to hold the mediating artefacts in their hands. Again, this could indicate that the tangible Vernier calipers mediate the content of the task in a more comprehensive way to them than the digital version does, as the Vernier calipers are easier to comprehend through touch; Maria's thoughts seem, to some extent, to mirror Casper's thought on the "real" versus the "digital." However, Julie stated that she preferred the digital version to the analogue version, as she found it easier to use the digital programme than the Vernier calipers (interview with students). Still, it is perhaps worth noticing that she did not directly use the digital resource as much as Maria did but merely looked at the screen while advising Maria on how to use it. Nevertheless, this shows that students had varied perceptions of the mediating artefacts they used in both contexts. Some perceived the Vernier calipers to be more tangible and thereby more approachable, and Julie stated that she preferred the digital to the analogue artefact.

Following this line of thought, it was not only the mediating artefacts that were perceived as tangible or intangible by the students. In the museum context, even though the students were only in the museum exhibition space for approximately ten minutes at the end of the session, they expressed some thoughts on visiting the museum exhibition:

Maria: I had actually thought that we were going to look at all the skeletons we saw just now in the exhibition, but we have just been sitting up here the whole time.

Julie: I also think it would have been better if we had been downstairs looking at the skeletons there, when we were there [in the exhibition]. I thought it was a bit more interesting than up here.

Peter: Yeah, he [the museum educator] told us a lot just in the ten minutes we were down there, but he could definitely have used some more time down there.

The above quotes show that even though the session at the museum took place in the museum classroom, the students would have liked to have spent more time in the actual exhibition space, as they preferred this to the museum classroom due to the museum objects on display, thereby mirroring Anderson's words on

> the *visceral thrill* of being in the presence of the original. (Anderson, 1997, p. 22)

Yet, the skulls are not the "original" but plastic versions of the original. Still, this indicates that the students perceived the tangible plastic skulls to be easier to engage with than the digital ones. Thus, when the activities were hands-on-based, the mediated action taking place at the museum with the tangible artefacts possibly created better potential for learning for these students. Still, as mentioned, Julie preferred the digital resource, which for her mediated a better understanding of the activity.

This could also indicate that there is a correlation between the museum classroom and the students' own classroom, which to some extent overlap in appearance, as the students in both spaces need a more tangible approach to the museum resources. In the museum classroom, they would like to be more often surrounded by the museum objects they encounter in the exhibition space and in their own classroom; they, with the exception of Julie, lack a more tangible approach to the digital resource, as the resource is not hands-on-based.

DIFFERENT LEARNING CONTEXTS

The context of the activity is central to the analysis when concerning museum education. As pointed out in the introduction, Falk and Dierking state that the physical context can have a great influence on museum visitors, as a museum's physical building often has an impact on the visitor's behaviour at the museum (1992, 2000). So could the physical context have an influence on how the interaction with the skulls was mediated in the two contexts?

As stated earlier, there seemed to have been tension between the teacher's goal of using the digital resource in the classroom and the students' understanding of this goal, as they believed the activity to be a bit boring due to its repetitive nature. Perhaps because it was the second time they tried the resource, and because of the presence of "school-fatigue," as Peter stated (interview), this can perhaps explain why the students were reluctant to engage with the digital resource. Still, the students stated that they enjoyed working with digital media in general but this, on the other hand, does not explain why they did not appreciate doing the activity within the more loose instructions in their classroom than the ones they were given at the museum. Their own teacher's way of teaching in the classroom gave way for a mediation of the digital content that gave the students both space and time to work on the tasks. Again, this could perhaps have something to do with the teacher's lack of attention, in general, and a room full of noise and talk almost throughout the session, which was in contrast to the session at the museum. As Maria says:

> Maria: When we were there [at the museum], then it was him [the museum educator] who needed our attention, and then I just think that you don't…there you can't allow yourself to just sit and fool around. You just don't do that when

> you're at place like that. And when you're in the classroom [in school], you should behave like this as well but you just don't do that.

The quote shows that, as Maria explains, the students behaved differently at the museum than in their own classroom, as they were guests and therefore felt that they should behave in a different manner. Conversely, their own teacher's way of teaching was more unstructured back in the classroom when compared to the stricter museum educator, who had a schedule and a manuscript to follow. This indicates that the fact of being in another physical learning space, such as the museum, as well as having a different teacher, would have had an influence on the students' behaviour and attention. This implies that the "rules of behaviour" that apply to the museum space are different from those in their own classroom. This could be the reason why a shift of focus happens once the students are back in the classroom: they were then "home" and therefore had a more unstructured way of behaving there? Also, their more relaxed behaviour in the classroom could have something to do with their own personal and sociocultural contexts, as these perhaps are more overt when in a familiar setting.

Another example of how the physical context can have an influence on the learning is found in the students' thoughts on the museum and on classroom space, as stated in the interview after the museum session:

> Peter: I think it's the actual feeling of where you are. I think that it makes a huge difference! (…) I just feel like this is totally standard biology education [classroom].
>
> Julie: it's just that we're on tour, and then we're being put in a room again that looks like our classroom.

The two students reflect on how the physical space makes a point in a learning situation and how they would have liked to spend more time in the museum's exhibition space. Although Peter enjoyed the session, he compares the museum classroom to what he calls a "standard" biology space, and Julie wants to actually see things when being on tour. The fact that they were placed in a room that resembled their own classroom in school, along with the fact that only Peter had ever visited the Zoological Museum before, meant that the students, except for Peter, had no prior experience with the actual exhibitions. In a way, this caused the museum itself to become intangible to the students and indicates that the physical context had a great influence, as the museum classroom did not explain that they in fact were in a museum until their last ten minutes in the museum space.

The week after, following the in-school session, when asked if they had reflected on the fact that the digital resource came from the museum they had just visited the week before, only Peter said yes, and added:

> Peter: It's just that it has more credibility (…) it [the Internet] can still give you false information, so if it was Westboro Baptist Church that had made it [the

resource], then they would probably have said that we could not use it because they do not believe in apes or something.

Peter hereby believes that using a digital resource made by the Zoological Museum gave it more credibility when compared with other resources found online. Maria and Julie thought differently:

Maria: Oh no, I didn't. (…) I didn't even notice where it came from (…) I just pressed on the link.
Julie: No, no, I didn't [laughs] (…) I think it was called "human" something.

Maria and the others, on the other hand, had not given any thought at all to where the digital resource stemmed from and neither could remember the name of the resource they had just used in the session. For these three students, this could perhaps indicate that when the museum's physical exhibition space is not present as such, allowing them to be encircled by the museum objects, it can be difficult for them to understand the context as a whole. But again, this lack of reflection does not necessarily mean that the meaning-making of the content does not take place during the sessions. The students state themselves, that they for instance are all tired of school and perhaps therefore not as engaged and reflective as they otherwise would have been.

In the two contexts, it would seem, within the students' personal contexts, as if the students transfer their prior knowledge of the school as a place of learning to the museum as they describe the museum classroom as a school classroom hereby again making the "school" element the dominant figure, which also happens in their own classroom without the museum's physical space. Thus, it seems as if it is somewhat difficult for the students to separate the two learning contexts due to the learning contexts' physical space. Or again, as Peter reflects on the digital resource coming from the museum, and Julie prefers the digital resource, perhaps they are indeed able to separate the two learning contexts; still, it would seem as if they become too alike, overlapping each other.

This could especially have an impact on the second session in the school, as this one is similar to the first session also taking place in a "classroom" and, to a certain extent, a repetition of the first session. Falk and Dierking state that museum visitors will always meet the museum with their own sociocultural context (Falk & Dierking, 2000), which could mean that the students in a way stayed in their sociocultural context (their own classroom context) and thereby did not cross between the two learning contexts.

It would therefore seem that even though there were two learning contexts, the museum and the classroom, each provided a different form of mediation of the museum resources; this in turn had a different influence on the students' engagement with the resources and thereby perhaps also their meaning-making.

This also suggests that these two types of mediation had an influence on the students' awareness of being in the museum

classroom, which for some of the students perhaps became a mirror of their own classroom. It would therefore also seem as if some of the students were in need of a more tangible approach to the museum education resources, perhaps a more significant exposure to the museum exhibition space to help provide more tangible information on the context.

CONCLUSIONS

The intension of this study was to analyse how the students make meaning and engage with the two museum resources in two different contexts by asking two research questions:

- How do the two contexts encapsulate the museum resources?
- How do the students make meaning and engage with the analogue and digital mediating artefacts?

The analysis shows how Danish upper secondary students make meaning from the same type of knowledge and methods in order for them to understand the evolution of man. For this, they have used two different mediating artefacts, the digital and analogue rulers, used in the two different learning contexts. Within each of the two learning contexts, the content on the evolution of man is being mediated in different ways through different mediating artefacts. However, as shown in the analysis, despite the difference between the two contexts, both still have similarities (e.g., breakdowns and focus shifts), which cause the students to sometimes lose attention and potentially not be able to learn about the evolution of man in the way sought by their teacher.

The analysis suggests that in spite of the students' focus shifts and breakdowns, the museum context at the Zoological Museum provides the students with a mediation of the topic on evolution, which comes across as interesting to them. This especially has something to do with the museum teacher, who is very engaged and structured. Furthermore, the novelty of the visit to the museum can perhaps have some impact, as the students enjoy being on tour and getting out of their normal classroom setting. The museum context also has a positive effect on the students' behaviour, as there they are much calmer and more engaged than in their own classroom. The museum classroom, on the other hand, makes it somewhat difficult for the students to clearly experience the museum, as they seem to lack a more physical side of the museum, as they all state they would have liked to spend more time in the actual exhibition space in order to get closer to the museum objects. This suggests that the students bring with them their own sociocultural school space to the museum classroom and that they are not completely able to separate the two.

Back in the school classroom, the physical space also seems to play a role. Even though the students have just visited the museum the week before and thus must be expected to know what the goal and tasks are for the lesson, the students engage with the resource but eventually seem to lose interest and engagement. It almost

seems as if the digital museum resource's context is not transferred with it into the classroom, as the two girls both just click on the link given to them by the teacher without reflecting on its origin. Peter alone states that it is important to know where a source comes from, and puts forward the view that a museum such as the Zoological Museum is highly trustworthy compared to other sources one might find online.

Concerning the mediating artefacts used to make meaning with the topic on evolution, the analysis suggests that for these specific students, the use of Resource 1 at the Zoological Museum provided a context in which the students, in a fruitful way, could make meaning and engage with the topic on evolution of man due to the hands-on tasks, much in line with other museum research studies, as outlined in the chapter's introduction. This means that the students, perhaps with the exception of Julie, were able to blend their own personal contexts and engagement with the museum context. In contrast to the digital resource, Resource 2, the students also seemed to perceive the tangible skulls as being more interesting and approachable, as three out of four students preferred the physical artefact, the Vernier caliper, to the digital ruler. As the physical ruler provided a physical mediation of the knowledge the students were meant to learn, they seemed to better be able to understand and to appropriate the measurement tasks. On the other hand, the digital version provides a digital artefact with which to measure, which changed the physical ruler into something more intangible, thereby also changing the students' meaning-making and engagement with the measuring task.

However, it would seem as if it is not only the "changed" mediational artefact, the digital ruler, which had an influence on the students' engagement and meaning-making in their own classroom. The students' own teacher seemed to play a role regarding the breakdowns and shifts of focus which happened in the classroom, as the students spent 40 minutes doing something else during the school session. However, this is, again, also due to the students' own lack of engagement during the session, as they did not follow the teacher's instructions to start on their biology report once they finished the different measurement tasks. Although there were also breakdowns and focus shifts during the visit to the museum, the students engaged more here and perceived the learning as more exciting due to the mediating artefacts' more tangible nature, the more structured teaching, and perhaps also the freshness of getting out of school for the day. In the classroom, however, the teacher was not as present as the museum teacher was at the museum, and the students could more easily slip away from the tasks there. Still, the students also stated that they saw the second session as a repetition and contrasted the digital version to the hands-on museum session, which, according to Casper, could be seen as the "reality." Perhaps the teacher, on the other hand, saw the repetition as a good thing, as he then believed that the students would already know how to solve the tasks because of the museum visit the week before and would therefore be easily able to appropriate and to instantly use the mediating artefacts. However, as the analysis shows, this was not always the case during the classroom setting, in which the use of Resource 2 did perhaps not have the best opportunities for being used in the classroom lesson.

To sum up the study's implications for museum education being mediated in two different contexts, it would seem as if the more structured and tangible nature of Resource 1 benefitted the students' meaning-making and engagement in a comprehensive way when visiting the museum. However, although the video data show the students to be especially engaged during the museum session with the mediating artefacts, more time spent with the museum exhibition could help to mediate the Zoological Museum and its context in a more comprehensive way to the students in order for them to get a more substantial understanding of the museum's context and the content of the sessions as such. This means that the session taking place at the museum should perhaps be more integrated with what the museum also *is*, the physical exhibition space and not just the museum classroom.

Conversely, although the students engaged with Resource 2, it would seem as if the digital resource would benefit from a more structured and tangible approach from the teacher using it when taught in the secondary classroom, as well as for the students. However, in the school classroom, the challenge is then how to make a digitally based museum resource become more "tangible" outside the museum's physical and sociocultural space.

NOTES

[1] All students (or parents) had given their written consent to participate in the research study.

[2] The Natural History Museum of Denmark is one of seven state museums in Denmark hosting approximately 150,000 visitors each year (Kulturstyrelsen, 2014). The museum itself consists of three institutions, the Zoological Museum, the Geological Museum, and the Botanical Gardens, all of which are located in the city centre of the capital of Denmark, Copenhagen.

[3] All students are anonymised and given new names: Casper, Maria, Julie, and Peter.

[4] Casper was not present in the second interview.

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7. PRIMARY SCHOOLS CROSSING BOUNDARIES

A Study on Extended Learning Environments in Two Finnish Village School Contexts

> School is an organization where children participate in the life which surrounds them.
>
> (Vygotsky, 1994, p. 24)

INTRODUCTION

One of the most-discussed topics in the educational research field is how schools open up to society and thereby acknowledge the meaning of learning in everyday situations and in out-of-school environments (e.g., Sefton-Green, 2011; Yamazumi, 2014). It has been thought that without changing their educational practices or, for instance, acknowledging the significance of informal learning, schools are going to isolate themselves from the rest of society (Engeström, 1991; Resnick, 1987). One way to look at opening schools up to society is to see the surrounding environment and various collaborating sites of learning outside the school as a part of the school's learning environment. In the Finnish context, it has been predicted that education is going to be increasingly based on the use of out-of-school learning environments and multi-professional collaboration (e.g., Kangas, 2010; Smeds, Krokfors, Ruokamo, & Staffans 2010). This shift requires not only educational policy decisions but also research that sheds light on what it means to develop extended learning environments, that is, to use out-of-school learning environments and multi-professional networks in educational practices.

The idea that schools are opening to their surrounding environments requires transitions across boundaries between institutions, domains, and professions (i.e., boundary crossing). In the educational-research field, boundary crossing is often associated with learning processes in which the various views, knowledge, and sociocultural practices confront each other. Crossing boundaries might force stakeholders to re-evaluate previous assumptions, look for new practices, and create continuities between practices. Therefore, boundaries are also seen as resources for learning (Akkerman & Bakker, 2011; Engeström, Engeström, & Kärkkäinen, 1995; Konkola, Tuomi-Gröhn, Lambert, & Ludvigsen, 2007; Wenger, 1998.)

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 131–144.

Through recognising the connection between boundary crossing and learning, the interest in researching boundary crossing has increased in recent years. Boundary crossing has been researched in professional and educational contexts, mainly focusing on collaboration between different groups (e.g., Daniels, 2011; Edwards, 2011; Kerosuo & Engeström, 2003) in business or in higher education (e.g., Finlay, 2008; Garraway, 2010; Tanggaard, 2007). However, boundary crossing in the context of basic education has been the focus of very little research. For instance, in Akkerman and Bakker's (2011) literature review on boundary-crossing practices, only one study (from the 182 research articles) dealt with the basic education context (see Matusov, Smith, Candela, & Lilu, 2007).

The present study was conducted within the context of basic education in two village schools that have opened up their learning practices to their local environment and built collaboration with local practitioners for a period of 20 years. In this paper, we examine the village schools' extended learning environments from the viewpoint of boundary-crossing theory. Our presumption is that boundary-crossing theory can help to interpret the long-time development processes of pedagogical practices in extended learning environments. The purpose is to find out factors that can be seen as critical for developing extending learning environments in the context of basic education. Our data consist of interviews of two school teachers who have had a significant and initiating role in developing the schools' practices.

BOUNDARY CROSSING AND LEARNING MECHANISMS

The question of boundaries and boundary crossing has been a pivotal topic in the social sciences for a long time (Guile, 2011). The meaning of boundaries in learning has been examined in research on both innovation and creative thinking. The theory of open innovations (Chesbrough, 2003), for instance, is based on the concept of development and creativity that emerges from the interaction of different sites. In addition, educational research has a long tradition of researching boundaries and their effects on learning. For example, in cultural-historical activity theory, it is emphasised that the cooperation of different activity systems might lead to generating meaning and changing shared practices (e.g., Engeström et al., 1995). In his situated learning theory, Wenger (1998) emphasises that crossing boundaries can prevent communities of practices from becoming too static. Yamazumi (2014) refers to hybrid learning activities when talking about collaboration between various partners inside and outside the school.

Even though boundaries are seen as learning resources, their learning potential is often not thoroughly described. To clarify the idea of learning through boundary crossing, Akkerman and Bakker (2011) conducted a comprehensive literature review on boundary crossing and identified four learning mechanisms that can take place in situations of boundary crossing: *identification*, *coordination*, *reflection*, and *transformation* (see also Akkerman, Bruining, & van den Eijenden, 2012; Akkerman & Eijck, 2013).

Identification

Boundary crossing can lead to a process of identification whereby the intersecting sites and cultures are (re)defined in light of each other. In this process, existing sociocultural practices are questioned. The learning processes of identification are *othering* and *legitimating co-existence*. When one practice is defined in comparison to another, it is termed *othering*. Thus, the differences between the two cultures and, thereby, their complementary characteristics, are defined in order to justify their co-existence. Akkerman and Bakker (2011) point out that boundaries between the practices can be encountered and re-defined without actually crossing the boundaries.

Coordination

When different organisations, such as a school and a local partner, aim to find effective ways and educational practices to enable cooperation, it is termed *coordination*. Processes of coordination on both sides can emerge in the sense that effective routinised means and procedures are sought to allow diverse practices to cooperate effectively, even in the absence of consensus. Typically, coordination requires a *communicative connection* between diverse practices or perspectives. In coordination, diverse practices establish new exchanges and routines to align their activities and to make transitions smoother (Akkerman et al., 2012). Moreover, coordination processes entail *increasing boundary permeability* and the *routinisation* of practices. In addition, different boundary objects supporting building cooperation might be essential.

Reflection

Reflection is *making* and *taking perspectives*. In reflection, differences and similarities are being observed and defined; intersecting practices lead practitioners to value and to take in one another's perspectives (e.g., schools start to look at their practices from the perspectives of non-school actors). Thus, reflection enables one to see his/her practices from the others' points of view. The reflective mechanism enables the building and comprehension of new perspectives. Although identification and reflection mechanisms might seem similar to learning mechanisms, their focuses are different. While identification seeks to define sociocultural differences, reflection aims to provide wider points of view and, hence, new boundary encounters and crossings.

Transformation

Transformation refers to changes in practices or even to the creation of new synthetic practices. Here, the boundary crossing has led to a permanent change that is stronger than the previous learning mechanisms. The permanent change comes

into effect by creating new practices and renewing existing ones. Typical processes in transformation include *confrontation*, *maintaining uniqueness of intersecting practices*, and *continuous joint work at the boundary*.

Next, we present our methodological choices and the analytical process in which the concepts of identification, coordination, reflection, and transformation were used.

METHODOLOGICAL CONSIDERATIONS

The schools that participated in the research are situated within village communities, one of which is in Southern Finland and the second of which is in Western Finland. There are about 70–100 pupils in both schools. The schools have a long history of developing learning environments together with their local communities. The data for this research consist of interviews with two teachers, who were each interviewed twice during the years 2010–2012. The length of the interviews varied from 35 minutes to an hour. The recorded interviews were transcribed in detail for the data analysis. The thematic interviews dealt with descriptions of how the processes of cooperation emerged, the organisation of pedagogical practices and models of the schools, the organisation of teaching, the models of cooperation and networks of the schools, and the positive effects and challenges of cooperation, as well as some general questions on education and teaching. The themes of the interviews were based on the previous literature on the development of learning environments and multi-professional cooperation in basic education (e.g., Kumpulainen et al., 2010; Smeds et al., 2010).

The interviewed teachers have a long history of working in their schools and have actively participated in the development of the schools' learning environments. Hence, the teachers have had an essential role in building new collaborations and partnerships with village community members. We can assume that the development process of an extended learning environment is best understood by interviewing those teachers who have a crucial role in developing the pedagogical practices of the school. Moreover, hearing teachers' voices is important: when a school opens up to society, it often entails a change in the job description of its teachers. Teachers' work thus includes increasing organisation and multi-professional cooperation.

The networks of both schools include companies, organisations, groups, and individual members from the village community. The schools' central aims have been creating a linkage between the school and the surrounding village community as well as utilising the expertise provided by the village. The pedagogical practices of one school include workshops for children, museum visits, and projects led by professionals from a variety of fields. The other village school, in turn, has developed its practices and the everyday life of the school along the lines of sustainable development. Its practices include teaching in different cultural locations around the village, on nearby farms, and in nature.

We started the data-analysis by searching the teachers' talk for descriptions of all learning activities and processes which we interpreted to contain signs of boundary-crossing practices. We then classified the findings thematically according to the learning mechanisms. Finally, we named the assemblages to depict the central factors related to the schools' extended learning environments and their development processes. In each phase of analysis, researcher triangulation was used to increase the validity of the research findings.

DEVELOPMENT OF EXTENDED LEARNING ENVIRONMENTSAND RELATED CENTRAL FACTORS IN THE VILLAGE SCHOOL CASES

In Table 7.1, we have listed the learning mechanisms and characteristic processes defined by Akkerman and Bakker (2011). In addition, the table presents the central factors found in the study. The central factors can be seen as critical in developing extended learning environments and related pedagogical practices. The central factors are presented according to the learning mechanisms, starting with identification and ending with transformation. However, it is worth mentioning that we found the borders between learning mechanisms somewhat blurred in the data, and therefore it was not unambiguous as to how the findings should be classified. For this reason, the classification should be seen as a theoretical tool that helps to structure the multi-dimensional phenomenon of boundary-crossing activities in developing extended learning environments.

Table 7.1. Learning mechanisms and related central factors (cf. Akkerman & Bakker, 2011)

Learning mechanisms	*Characteristic processes*	*Central factors*
Identification	Othering Legitimating co-existence	*Time and locality*
Coordination	Communicative connection Efforts of translation Increasing boundary permeability Routinisation	*Shared goals* *Teacher's pedagogical expertise*
Reflection	Perspective-taking Perspective-making	*Learning for life* *Learning in community*
Transformation	Hybridisation Crystallisation Maintaining uniqueness of intersecting practices Continuous joint work at the boundary	*Changing roles* *Shared place-consciousness*

Identification: Time and Locality

In the beginning of the development of extended learning environments, the old sociocultural practices were questioned. Teachers in schools had realised that there is a need to value children's knowledge gained in informal learning environments and to leave one's own comfort zone of teaching to provide students with more authentic learning experiences by extending schoolwork to the local environment. Societal development and discussion on changing learning environments, such as the increased use of technology and the talk of formal and informal learning, played a significant role in questioning the old practices:

> Children learn, in any case, most of the things somewhere else than at school, so in that sense I can be part of the out-of-school learning… I have really wanted to step outside the boundaries and move to a less comfortable teaching method and thus see what children can get from an extended learning environment and how can I help children to analyse the knowledge acquired from extended learning environments and informal learning. (Teacher B)

This kind of reflection can be interpreted as the first step and as a kind of prerequisite for starting to create boundary-crossing practices between the school and the local environment. In addition, old practices came to be questioned in the other school some time ago, when it was under the threat of closure. The school staff and the local people started to ponder new practices for keeping the school functioning. Thus, the threat of closure led to the need to identify their own specialties and those of the other side (i.e., the local community), and this gave rise to opportunities for developing the schools' learning environments together. This meant that the school's local partners also started to identify their work in relation to the school and provided their expertise to help teachers create authentic and extended learning environments:

> Yes, I have also been happy that people [locals] have come to say that they are working with this kind of stuff and asked if they [their knowledge and resources] had some value in our school work. (Teacher B)

As the quotes above show, the school and local partners identified a need for collaboration. However, instead of speaking of identification in the sense of a learning mechanism, we can assume that the developing understanding that learning processes also happen outside of the school, as well as local circumstances and needs, can be seen as a pivotal trigger for evolving boundary-crossing and identification processes. This is to say, we could not explicitly define identification processes itself in accordance with Akkerman and Bakker's (2011) formulations, which describe othering and legitimating co-existence as the characteristic processes of identification. This could be due to the schools' long tradition of extending their learning environments and a long history of ongoing boundary crossing that might have been difficult to reach in the interview situations.

Hence, based on triggers we could identify in the teachers' talk, we concluded that *time and locality* seemed to be central factors for the emergence of boundary-crossing activities and cooperation between the teachers and the local participants. Here, *time* refers to the rapid changes in society and new understandings of learning. *Locality* refers to the local circumstances and both sides' emerging awareness of the meaning of the local environment for schoolwork. Identifying the unique location of the school compelled participants to start dialogical processes of identification, re-assessing existing practices, and determining a need to establish more informal learning practices, as well as expanding school activities to out-of-school contexts.

Coordination: Building on Shared Goals and Pedagogical Expertise

Developing extended learning environments through boundary-crossing activities emerged in the interviews as determining *shared goals* for collaboration between the schools and their partners. This can be associated with coordination. The building of collaboration was initially based on the need to find a communicative connection:

> Of course there has to be some kind of initial idea… I think both cooperative sides must have similar needs and only then the collaboration is fruitful. So we can't just buy it as if it was a service. (Teacher B)

It can be argued from the teacher's speech that both the school's initiatives and shared needs are important in building new practices. Furthermore, teachers described how flea markets, art projects, and the communal recycling centre provided opportunities for collaboration. In coordination, these shared opportunities can be viewed as important boundary objects which can support cooperation and defining shared goals (Akkerman & Bakker, 2011; Konkola et al., 2007).

Particularly in the beginning of the collaboration, the schools and teachers were more engaged in seeking and establishing partnerships. Little by little, as the boundary-crossing practices became routinised, the cooperation became more reciprocal, and the out-of-school partners took on a greater role in building the cooperation:

> Step by step as the years went by, what has happened is that local practitioners outside the school contact us…they would call our school to ask if we wanted to go to pick up berries. And we went to pick up berries. That's how the collaboration little by little started expanding. (Teacher A)

The description can be interpreted as the routinisation of the collaboration and the development of an implicit shared understanding of educational goals. As the teacher's example in the quote shows, cooperation can be developed with organisations as seemingly disconnected from education as a berry farm. In the light of multi-professional collaboration, coordination between teachers and out-of-school partners can be associated with the relational expertise presented by Edwards

(2011). Thus, in boundary crossing, the ability to recognise both resources and the possibilities for shared expertise are combined.

Even though picking berries, for instance, can easily be interpreted as distinct from the learning goals of formal education, teachers emphasised how out-of-school activities can actually nurture curriculum-based learning and afford possibilities for cross-curriculum learning. This relates to *teacher's pedagogical expertise*, which we found to be a central factor in coordination. As a pedagogical expert, a teacher is responsible for building the boundary-crossing practices and creating a pedagogical framework that defines the aims of teaching and the relation between activities and the curriculum. Sometimes they need to create a dialogue between the sites about the means and procedures for coordination. Pedagogical expertise, however, is seen to be responsible for establishing learning processes that are pedagogically justified and curriculum-based:

> They should always construct a sort of entity…or even if they are sort of single moments, one would like to have a clear goal, like this time we get to know this and this and they relate to that and that. (Teacher A)

Furthermore, the teachers' pedagogical expertise appeared while working as "interpreters" in learning situations in which there are, apart from the teacher, several experts from outside the school:

> Well, a teacher's essential task as a pedagogical expert is to ask detailed questions that steer children's thinking. And…to steer the workshop leader's speech to a direction that fits with the age level of the children. (Teacher B)

When working as an interpreter, a teacher can be perceived as a boundary broker that enables the interaction between the students and the outside expert (Akkerman et al., 2012; Konkola et al., 2007). The teacher's pedagogical expertise is important in coordination and even more essential in enabling and maintaining the boundary crossing.

Reflection: Learning In and Out of School

From the teacher's talk, we identified signs of boundary-crossing activities that can be linked with reflection. The teachers reflected on the pedagogical practices and their effects on learning, especially from the pupils' and the out-of-school partners' points of view. Central factors related to reflection appeared to be *learning for life* and *learning in community*. For instance, teachers described how learning in extended learning environments can offer the students unique possibilities for learning a wide range of skills (cf. 21st-century skills, LPOP, 2014):

> And exactly experiencing and learning by doing and at the same time the social part of learning, and meeting people… And also behaviour and good manners

> get practiced since we are on someone else's land and tutored by someone else than the familiar school staff. (Teacher B)

From this quote, we can see that the advantages of boundary-crossing activities include the richness of the teaching situation and the fact that extended learning environments make learning possible in real-world situations. Learning in extended learning environments enables students to meet different people and to encounter intersecting cultures and create authentic situations for learning the skills needed in life. In addition, it provides possibilities for students to look at out-of-school practices from the perspective of the school traditions. According to the teachers, the learning that takes place in extended learning environments provides benefits such as enabling students to gain respect for work, give constructive peer feedback, apply learned knowledge in new contexts, respect diversity, and recognise the abundance of "right" answers. The concept of learning for life seemed to show up in the students' everyday behaviour at school:

> If they [children] notice that the hallway is pretty shabby…they also start to be aware of the state of the environment and they are like "Hey, can I get the key for the cleaning closet because we'd like to clean that floor?" So these kinds of things are happening as the years pass by. (Teacher A)

The increased student initiative described by the teacher can be explained by the existing possibilities for students to participate in the school's community of practice and to show their initiative in daily life at school. In light of these examples describing reflection, these schools' cultures seem to effectively serve the development of children's knowledge, skills, attitudes, and agency.

Furthermore, the findings show that activities in extended learning environments are learning affordances also for collaboration partners. For example, the professionals leading the workshops told the teachers they felt the school collaboration had a positive impact on their work and that they were learning in the collaboration process:

> And some of these artists have even said that this work they are doing with our students is also supporting their artistic work, because the students give a fresh point of view to new things…and to what they do. (Teacher B)

Hence, the collaboration offered possibilities for making and taking new perspectives (i.e., reflection in the sense of boundary crossing). The mechanism of reflection highlights the thought of creating learning possibilities through collaboration and supporting the learning of others by contributing one's knowledge and skills as a learning resource.

Transformation: Changing Roles and Shared Place-Consciousness

Working in extended learning environments requires continuous joint work at the boundary and development of pedagogical practices. Continuous joint work

at the boundary (i.e., transformation) was realized in both village schools by including the expanding school activities and local learning environments in the school curriculums. This meant that each grade was linked to special out-of-school activities, workshops and learning places that were locally determined. Table 7.2 provides examples of the schools' curriculum content.

Table 7.2. Examples of the schools' curriculum content

Grade	*Out-of-school workshops*	*Out-of-school environments*
Preschool	Paper workshop	The school yard
1st grade	Wood workshop	Nearby nature
2nd grade	Paint studio	Nearby lakeside
3rd grade	Knit studio	Nearby forest; national landscape
4th grade	Ceramic studio	A bog and specially-built cultural environments
5th grade	Smithery	Nearby stone-age dwelling sites
6th grade	Glassblowing workshop	Forest, desert areas

We found two central factors that we connected to transformation: participants' *changing roles* and *shared place-consciousness*. Transformation seemed to be linked to the formation of different roles for students, teachers, and partners in the learning situation. Depending on the learning environment, any one of the participants can have an expert or learner role in the situation. For example, teachers can see themselves as learners in teaching situations in which the partner has the knowledge expertise. The role change from teacher to learner can enable the teacher to see the teaching situation from the student's perspective:

> And then you learn from the point of view of a child what it's like to be a pupil because you are in the same position compared to this expert as the children are in comparison to the teacher. (Teacher B)

This role change might seem like a self-evident phenomenon, but in order for it to take place, we see that it needs both active role engagement and, on the other hand, letting go of the traditional roles. In boundary-crossing practices, role changing is closely related to learning and identity development. Boundary in social situations is not a firm line or a distinction but ambiguous, representing simultaneously a neither/nor and a both/and situation:

> When people cross boundaries their position is one of belonging to multiple worlds, but also one of being a marginal stranger to each of these worlds. (Akkerman & van Eijck, 2013, p. 63)

The other central factor seemed to be related to both sides' mutual understanding of the possibilities that the local environment offers for learning. Teachers described

the village environment as affording potential for learning and emphasised the value of the local environment for both schools and school partners:

> And then, of course, we have such a great environment because we have all these possibilities… (Teacher A)

> We have activities that cannot be done anywhere else; you cannot move the school because we have here something so valuable, and this location. So we decided [with locals] to bond the teaching to this location. (Teacher B)

This type of awareness of the learning possibilities offered by the local environment and people we call *shared place-consciousness*. Place-consciousness is shared when the school and its partners have a common understanding of the local environment as a meaningful learning environment. This shared place-consciousness blurs the boundaries between formal and informal learning.

Shared place-consciousness also emerged when the teacher described the relationship between school activities and seasons. Seasonal changes influence the lives of local farmers and hunters, which in turn affect schoolwork. Thus, the schoolwork intertwines with life outside the school, highlighting place-consciousness (cf. Lanas, 2011). Shared place-consciousness can be seen to enable the out-of-school partners to see connections between their actions and expertise and schoolwork. Hence, shared place-consciousness created conditions for diversifying the boundary-crossing practices of the school. Shared place-consciousness can be seen as a way to maintain the uniqueness of intersecting practices, which are typical for transformation. When the local environment and people are legitimated as environments and agents for formal learning, practices and spaces can be created that make the encounters of intersecting practices possible (cf. boundary zones, Konkola, 2001).

The locality of education itself is not a special character of boundary-crossing practices, since place and locality always partly structure education through the local physical environment, neighbourhood, and residents. In the village schools we investigated, the locality of education was very special due to the importance of the physical and social environments, which were consciously taken as a resource for teaching. Moreover, it was seen as an active part of the school culture and curriculum-based teaching. Thus, the local environment is seen as a boundary object enabling reciprocal cooperation in transformation.

CONCLUSION

In this article, we examine the development of two village schools' extended learning environments from the viewpoint of boundary-crossing theory as defined by Akkerman and Bakker (2011). We found learning mechanisms useful in the research context, although some challenges appeared. Learning mechanisms helped to structure our understanding of the development process of expanding the schools' learning environments and made visible the importance of everyday actions in

the continuum of boundary-crossing practices. However, interpretations were not always apparent or straightforward to perform. One reason is that boundary-crossing practices are, in many cases, overlapping and multi-dimensional. As Akkerman, Bruining and Eijnden (2012) suggest, boundary crossing can simultaneously take place at institutional, interpersonal and intrapersonal levels.

As a result, we found that the central factors can be seen as critical in developing extended learning environments and boundary-crossing practices in basic education. The findings indicate that extended learning environments can provide possibilities for reciprocal learning in a whole village community. Working at the boundary can reach all the participants: the students, the teacher and the out-of-school partners. Thus, the benefits of the boundary-crossing practices in the context of basic education are not only indirect. This observation offers a new perspective for justifying the meaning of extended learning environments in education.

Notably, shared place-consciousness, meaning schools' and partners' mutual understanding of the local environment as a place of learning, emerged as a central factor in extending learning environments. Through place-consciousness, the boundary between formal and informal learning could be blurred. When the local environment is perceived as a learning environment and associated with formal school teaching, the everyday experiences of the students become important from the point of view of the school and vice versa. At the same time, the shared place-consciousness can be assumed to decrease the tensions between the school and home cultures. Lanas (2011), for instance, has found out that tensions tend to form in situations when the pupils feel that the school does not value their life outside the school, such as the values represented at home.

In our school cases, the school cultures exemplified shared place-consciousness, which emerged through the crossing of traditional boundaries of formal education. This consciousness was also seen as an important factor in diversifying new collaborative practices. Shared place-consciousness, in fact, offers a new perspective in research on boundary crossing in the context of basic education. Furthermore, it encourages us to evaluate the impact of not only the social environment but also the physical environment on learning and developing learning environments. This idea is supported by the socio-material approach, which holds that the social and the material simultaneously influence action and thus are inseparable (e.g., Fenwick, Edwards, & Sawchuk, 2011).

The central factors found in the village school cases might help us to understand issues that matter in developing educational practices in extended learning environments. In both schools, the premises for the extended learning environments were included in the school curriculum. Hence, the schools have created sustainable, and at the same continuously developing, boundary-crossing practices which reflect transformation. These findings encourage one to evaluate the role of the national core curriculum in enabling and fostering boundary-crossing practices within basic education. Notably, the draft of the Finnish National Curriculum for Basic

Education for 2016 (LPOP, 2014) called for schools to recognise a variety of learning environments and cooperate with the local environment.

In the future, it would be important to research the viewpoints of other stakeholders of extended learning environments. For instance, it would be essential to examine how students experience extended learning environments and what kind of impact they have on students' school satisfaction and motivation. Further, studies on boundary-crossing practices in other primary school contexts would be essential for finding more possible central factors in terms of extended learning environments.

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8. EXPLORING FUNDS OF KNOWLEDGE DURING EDUCATIONAL TRANSITIONS

Learning Identities, Positionings and Future Trajectories

INTRODUCTION

In Norway, there is a renewed public interest in the ways that girls born in Norway, and who have immigrant parents, construct their lives within their families and view the possibilities represented by education (Kavli & Nadim, 2009). Hegna (2013) found that young girls with immigrant backgrounds who are enrolled in Norwegian lower secondary schools have strong educational aspirations. Nevertheless, these girls are at greater risk of experiencing the learning environment in secondary school as less supportive. This may affect their well-being and learning outcomes. The Norwegian education system is in line with the Nordic educational model, which has been rooted in socio-democratic educational policies that have proclaimed equal opportunities for all within the public school system since the 1930s (Telhaug, Oftedal, Odd, & Aasen, 2006). As a part of this education model, the students are encouraged by guidance counsellors to select proper programmes in secondary school in order to pursue a future occupation. The school system in Norway consists of primary school (ages 6 to 12), lower secondary school (ages 13 to 16), and secondary school (ages 16 to 18). Primary school and lower secondary school are compulsory, while secondary school is optional. More than 95% of students enter secondary school immediately after lower secondary school (Eriksen, 2013).

My ethnographic PhD project investigates the everyday learning of young Norwegian girls living in the Grorud Valley, a multiethnic suburb in Oslo, Norway, and how they understand themselves and their learning identities and positionings across contexts and over time, constituting future trajectories. This article explores how two young girls' learning identities and positionings (Holland, Lachicotte, Skinner, & Cain, 1998) change based on the funds of knowledge (Gonzales, Moll, & Amanti, 2005) that are exchanged across their contexts of family life, leisure time, and school. I investigate the ways in which funds of knowledge create tensions and are used as resources when taking learner positions and creating futures during educational transitions. The girls' reflections about future "images of self" become more visible during these transitions, when they have to make decisions about future trajectories. The research question informing the study is as follows:

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 145–159.

- How does young Norwegian girls' everyday learning across funds of knowledge networks construct learning identities and positionings that constitute future trajectories?

I apply a biographical approach and present case history illustrations in order to study the girls' learning trajectories during educational transitions. I investigate how their cultural practices are used in the creation of learning identities and positionings towards futures in an increasingly multi-ethnic and globalised society. It is important for teachers and guidance counsellors to note how non-academic cultural factors from family exchange networks construct young girls' learning identities and positionings as well as their future orientations; such knowledge can help them support young learners and to identify and catalyse future educational trajectories in a Norwegian school context. The case narratives of two girls will be used to shed light on how everyday practices and available positions become visible in educational transitions. For one girl (Ndey), a well-defined educational trajectory emerges during the transition phase, while the other girl (Maria) postpones her educational plans. The way they change their learning identities and positionings is central to their future trajectories.

EVERYDAY LEARNING: THEORETICAL FRAMINGS

Researchers and educators have addressed many of the challenges facing educational systems within contemporary knowledge societies. A central challenge involves how to define educational trajectories to best support learners over time. I therefore define learners and their learning in a broad sense, encompassing the social and cultural practices and activities in which they are involved across contexts (Ludvigsen, Lund, Rasmussen, & Säljö, 2011) that have implications for their learning at school and for their educational trajectories. Several researchers have highlighted the importance of everyday learning and social interaction across cultural contexts in constructing learning identities (Edwards, Biesta, & Thorpe, 2009; Rogoff & Lave, 1984; Thomson, 2009). In a "funds of knowledge"-based study of primary-school-aged minority children in the UK, Andrews and Yee (2006) found that cultural practices learnt in the family constructed the students' future images of occupations. Despite their good intentions, the teachers were not aware of students' family-based future orientations. According to Andrews and Yee (2006), the support from teachers regarding students' future orientations might have created a "motivated" learning identity or positioning in school. Other studies focus on learning among young people and how they position themselves as learners across contexts (Erstad & Sefton-Green, 2013; Roth & Erstad, 2015). As such, a key question is how everyday learning and interaction across contexts are linked to the girls' learning identity, positioning, and construction of future trajectories in order to support learners in school and in their educational trajectories.

Understanding Learning Identities and Positionings towards Future Trajectories

A concept relevant to the discussion is the notion of "identity position" in figured worlds, as developed by Dorothy Holland (Holland et al., 1998) in her ethnographic approach. According to Holland et al. (1998), individuals can inhabit many incoherent self-understandings and changeable identities, both as "figured in practice" and as "positions," embedded in the social and cultural context, that is, figured worlds. These worlds are socially produced, culturally constituted activities in which people come to produce new self-understandings. Furthermore, identity is not bound by prescribed categories, such as gender or ethnicity; rather, it is negotiated and socially produced in situ. Identity position is an analytically separable counterpart to figuration; when positioned, people engage less in self-making and instead focus on accepting, rejecting, or negotiating the different offered or provided identity positions. People can also be provided different identity positions across figured worlds, which can create tensions. Identity as position can reveal how social interaction contributes to the formation of persons as positions and sites of identity (i.e., people's own understanding of themselves; Holland & Leander, 2004).

This chapter focuses on individual aspects of identity positions, how identity positions are understood as dynamic entities that are a part of social interactions between people within contexts, and how people might change positions across contexts and over time. Actually, in using cultural resources to present identity positions, people can act upon past experiences to transform their identity positions as an "act of the moment" (Holland et al., 1998).

Identity position will be investigated in the context of how two young Norwegian girls understand themselves and their different future positions as created in the family figured world. In this respect, it is important to understand how the girls understand the future positions that are proposed in their family-figured worlds and how these positions make them understand themselves and construct or transform their learning identities and positionings in school.

Funds of Knowledge Networks

The concept of funds of knowledge (Gonzales et al., 2005) describes the interplay of how the individual understands her own position *and* uses cultural resources available in social interaction as a response to the current position. Funds of knowledge can explain how everyday learning in family networks provides cultural practices that can be used to solve tensions, creating learning identities and positionings, as well as decisions on future trajectories that open or close possibilities.

Funds of knowledge was first used to examine family-based cultural practices within immigrant areas in the United States in order to understand how the everyday practices could be used as resources in the school setting (Hogg, 2011). Gonzales et al. (2005) frame funds of knowledge as being possessed by the living networked resources emerging through action and on which a community bases its practices.

Within families' funds of knowledge are reciprocal networks of cultural know-how that are created to solve everyday challenges. Changing life situations and environments bring forth the everyday knowledge possessed by individuals within a given network. Funds of knowledge work as a resource inside the family network due to the network's support mechanisms and can therefore be applied safely. The concept also directs attention towards people's intellectual side, including the attitudes, values, and cognitive and cultural resources that enable their participation and learning (Gonzales et al., 2005). Indeed, young people's everyday practices and knowledge (i.e., their funds of knowledge) are built in diverse communities and brought to the school (Kumpulainen et al., 2010).

In the analysis, the concepts of *identity position*, *figured worlds*, and *funds of knowledge networks* will be used to analyse the tension between young Norwegian girls' everyday learning and future possibilities, as well as the constraints and expectations they experience through their family networks and sociocultural norms. I am especially interested in identifying the girls' identity positions when they cross between transnational family networks and the impact on their understanding of their learning identities and positionings towards future trajectories. It is important to study young girls' positionings in the context of developing future trajectories; doing so helps to reveal how engagement in learning occurs, how the girls envision the future, their world of possibilities, and their views of society. In the following section, I present the methodological and analytical processes in which the concepts of positioning, figured worlds, and funds of knowledge were used in the construction of the case histories.

THE STUDY OF EVERYDAY LEARNING: DATA COLLECTION

This ethnographic study started in 2011, when the ten girls were in 10th grade in lower secondary school—the last year before beginning upper secondary school—and ended in 2013. In January 2011, I began studying the everyday learning trajectories of the young girls (aged 15–16) from two lower secondary schools in two different neighbourhoods in the Grorud Valley. I also studied their transitions to different upper secondary schools inside and outside of this community. The field work and data collection lasted two years. The students were 17–18 years old at the end of the field work period (2013). During their last year in lower secondary school, the students were observed, both inside and outside of school, using participation observation. In upper secondary school, they were observed only using participation observation after school hours.

All participants, with the exception of one girl, were born in Norway, with two immigrant parents. The parents were originally from Sri Lanka (Tamils), India, the Republic of Gambia, Eritrea, Turkey (Kurds), Pakistan, Vietnam, Morocco/Comorian, and Norway. All the participants belonged to religious groups: Muslim, Christian, Sikh, or Hindu. The participants' names have been changed in order to protect their anonymity. Interests have also been anonymised. I did not begin

conducting interviews until I had first spent time getting to know them and building relationships with them in lower secondary school. The two girls presented in this article were chosen because their cases give examples of how family networks are used as funds of knowledge for the girls' learning identities and positionings towards the future; one girl experienced a challenging school situation, and the other girl had a positive educational trajectory.

Using ethnographic techniques (Rysst, 2008), I conducted two interviews with each participant while they were in lower secondary school and another three interviews after they had transitioned to upper secondary school. I also interviewed the students during participation observation of leisure activities, walks in the neighbourhood, and in Oslo's inner city. I followed them in café visits with their friends. Seven of them were also interviewed with their parents/caretakers. The interviews focused on everyday practices and interests, funds of knowledge networks, their reflections on learning identities and positionings, and future orientations (cf. Erstad, Gilje, Sefton-Green, & Vasbø, 2009). Issues of importance for documentation were turning points and "rich points," during which either the participants or the researcher were confronted with insider information (Spradley, 1979). The two case histories used in this article are based on one individual formal interview with each participant (10th grade) and field notes from open-ended interviews during participation observation. The interview sequences were recorded (audio).

Using a theme-based interpretive frame, the data were analysed by reflecting on previous interviews and field notes to organise the data (Thomsen, 2009). Next, the data were analysed for themes connected to family history, everyday social and cultural practices, learning and interests within and across contexts, and thoughts about the future. Furthermore, the girls' reflections about learner identities and positionings, and their expectations regarding future trajectories, were central to the analysis. The material was compiled into case histories (Clandinin & Connelly, 2006) using Thomsen's (2009) model to connect the biographical individual with the social interaction. The resulting patterns with similarities and differences across the case histories can then become visible. The cases were analysed according to how they fit into the theoretical framework of funds of knowledge (Gonzales et al., 2005) to uncover everyday learning, learning trajectories (Ludvigsen et al., 2011), and change of positionings. This approach focused on social interactions as interrelated practices connected to the capacity for adapting to changing roles (Holland et al., 1998).

In my analysis, I identify the students' tensions regarding future positioning and expectations in everyday lives across funds of knowledge networks and their own family-figured worlds. The way they use tensions as resources in their everyday learning and positionings are analysed by the way they express and describe their learning identities and positionings inside of school when constituting future trajectories. Their development as learners is visualised during the transition from lower to secondary school, where the girls had to make decisions about the future, including which educational trajectories to pursue and whether to stay in the local community or to leave it.

ANALYSIS: EVERYDAY LEARNING, LEARNING IDENTITIES AND POSITIONINGS THAT CONSTITUTE FUTURE TRAJECTORIES

In 10th grade, I found that all ten girls had a future educational plan (cf. Hegna, 2013), and four of them already had an occupation in mind; two of them chose vocational studies, and two chose general studies. The six girls who had no clear occupational plans chose general studies. During the first year of the study, five of the six girls identified interests based on funds of knowledge that initiated educational trajectories. One of the girls did not identify any future educational plan, and one of the girls lost interest in education. The girls' academic levels in lower secondary school were not crucial for their results in secondary school. None of the girls mentioned the counsellor's advice as important for choosing a programme in secondary school.

The following two cases were chosen because they illustrate how transnational family networks and figured worlds provide future positions, tensions, and dilemmas that were crucial when constructing learning identities and positionings, and future trajectories. In addition, they illustrate how everyday learning was used as resources in their way of positioning as learners and towards future trajectories. The cases show how teachers can contribute to the ways in which the girls change their positionings as learners. The two girls described in the following cases experienced different changes in their learning identities and positionings in the transition between lower secondary and secondary school. For one girl (Ndey), a well-defined educational trajectory emerged, while the other girl (Maria) postponed her future plans.

Maria: Family Networks as Funds of Knowledge and Future Orientations

In lower secondary school, Maria's primary interest was handball, and she had many friends in the handball club. Maria said that important team values were based on mutual respect and unity. However, Maria said she stopped playing handball before secondary school because she wanted more free time. However, during secondary school, Maria reduced the number of her social engagements and focused on schooling.

Maria's family history (i.e., immigrants from Eritrea, who succeeded as a result of completing their adult education in Norway) was a strong history in her life. Having succeeded, themselves, her parents had aspirations for Maria:

> I: My parents had to flee from Eritrea to Italy when they were young. They went to school in Italy. Later, they went to Norway, and my father studied to be a nurse and met my mother, who studied to be a caretaker. [formal interview 1 (2011)]
>
> I: My parents encourage me to choose an educational trajectory, vocational or general; I can decide myself […] they believed having friends outside our Eritrean network is important. […] my mum says I do not have to marry an Eritrean. [formal interview 1 (2011)]

It is interesting to see how Maria is positioned in her family network and figured world (i.e., to focus on education and to have friends of different ethnicities). The funds of knowledge, in this context, were to look outside their own ethnic community while making a life in Norway. Obviously, Maria did not immediately accept the position her parents gave her, nor their wishes regarding her education.

In lower secondary school, Maria said her grades were "good enough" but that she could have done better if she had put forth more effort. Maria said she did not have a future occupation in mind, and she therefore chose general studies in secondary school. From this, one can interpret Maria's learning identity and positionings as "laid-back" and "confident."

During the summer holiday before secondary school, an important "rich point" (Spradley, 1979) for Maria was visiting her relatives in Eritrea with her parents. Maria thought Eritrea was a beautiful country; however, being there distressed her parents, she said. They were concerned about their relatives' situation. The family discussed the political situation and the major contrast between Norway and Eritrea. Maria mentioned her feeling of lack of future possibilities for her cousins:

> I: One day I went with my cousins to bring water to the family. After a long time, I got tired. My cousins put me on the donkey and continued walking themselves. [field notes 2 (2011)]

Maria did not precisely explain her feelings regarding this event. Obviously, she understood that one of her cousins' future responsibilities was to bring water to the family. At the same time, she was moved by her cousins' compassion based on Maria's interpretation of their living conditions compared to her own situation in Norway.

It is of interest to see how, during this trip, Maria started questioning her cousins' future possibilities and experienced emerging tensions about their differences. The tension that arose from this period of travel was rooted in her awareness that her cousins did not have the same educational and occupational opportunities as herself.

Back in Norway, the traversal made Maria study Eritrean and African history and how the political situation, according to her, limited Eritreans' future possibilities. Maria browsed the Internet for information and engaged in discussions with her relatives, using social media as a resource to understand these different possibilities. Maria said she was interested in why Eritreans left Africa, explaining that this interest led her to choose the social science programme during her second year in secondary school. One can see her "image of self" as increasingly questioning equal possibilities. Maria used this tension as a resource in positioning towards a programme relevant for her new interest.

In the social science class, the following event was of great importance (this was before this matter caught the media's attention in Norway[1]):

> I: I presented an assignment of my own choosing. I talked about the perilous journey of people fleeing from Eritrea via Egypt to Europe […] Young Eritreans

> pay smugglers to take them through Egypt to Israel or to Western countries. Many never reach their destination. Instead, they end up in the clutches of cynical criminals […] I thought the presentation went well, but I only got a 3 (D). The other students said it was a good presentation. [field notes 3 (2012)]

One can see how Maria felt about the teacher not giving her project any attention; she interpreted this as the teacher's lack of interest in her presentation. This created tension regarding school; Maria said she felt that secondary school was challenging.

Again, one can see how Maria reverts to her family network to solve increasing educational challenges. Maria discussed future possibilities with her relatives using social media, and they advised her to study African history in the United States. Maria remarked as follows:

> I: Seeing these possibilities gives me hope. [field notes 3 (2012)]

Her transnational network provided her funds of knowledge about educational possibilities, which she used to position herself as a learner and for the future. Here one can see that the family network is a resource in supporting Maria as a learner.

The next summer, Maria went to the United States with her family to meet her Eritrean network there. Maria discussed Norwegian and U.S. integration practices with her relatives. She said it was interesting to see people who had integrated positively in the United States, while also managing to keep their Eritrean identities. Maria said that immigrants in the United States were connected to the society because they had to work. She also argued that work was a good way of integrating people in the society. As a result of this trip to the United States, Maria's educational preferences changed; she said that it was more important to focus on local immigration topics than on studying African history in the United States.

One can see how Maria used funds knowledge from the experience of travel to position herself towards her future. Here she follows her parents to connect to a multi-ethnic society and to pursue her education. Despite her experience of secondary school as challenging, Maria decided to stay in Norway to complete her education there. Maria observed as follows:

> I: To be honest, secondary school has been more challenging than I thought it would be. [field notes 4 (2013)]

In the future, Maria said that she saw herself living in the Grorud Valley and working with integration and social issues.

An essential point in Maria's case is how she changes her learning identity and positioning from "laid-back" and "confident" to that of a "struggling" student. Experiencing a lack of support from her teachers with respect to her funds of knowledge-based interests and future goal is important in this transformation. However, her family network helped her to not give up.

Ndey: Family Networks as Funds of Knowledge and Future Orientations

In lower secondary school, Ndey was very interested in hip-hop, and she had many friends in the community who she regarded as "almost family." Ndey said that important hip-hop values for her were feeling accepted in the community regardless of whom you are and where you are from. However, during secondary school, Ndey reduced the number of her social engagements and focused more on schooling.

Ndey's family history was based on her mother and father coming to Norway as immigrants from the Republic of Gambia. Her father returned to Gambia, and her mother raised Ndey alone while becoming increasingly ill.

> I: My parents grew up in Gambia […] I was born and grew up in Norway. My dad moved back to Gambia before I was born […] we used to go to Gambia. My family is spread everywhere; the US, Europe, Africa, and some even in Asia…that's kind of cool. I can travel to these places. […] I like the multicultural atmosphere in New York, so many impressions […] I remember I walked in Times Square with mum. [formal interview 1 (2012)]

This shows that Ndey has an interest in the hip-hop lifestyle, Gambian culture, and multicultural perspectives. One can see her "image of self" as a multicultural-oriented person based on an interest in both differences and unity.

Her mother's illness and death formed strong histories in her life:

> R: What have you learnt from your mother?
> I: My mother raised me alone. Everything I know I have from her, lots of small things. Like how to take care of my little sister. My mother used to say that one day she would be gone, and then there would be no one to take responsibility. […] I was always at home. I watched how she did things and learnt from it. [formal interview 1 (2012)]
> R: How old were you?
> I: I was 13 or 14. I learned everything about cooking, how to look after my sister, her homework, and what to do in particular situations. [formal interview 1 (2012)]

Ndey also explained how her mother taught her the importance of building strong family bonds with relatives worldwide as a safety net for her sister and for herself. She also taught her to maintain product conduct, to dress nicely, to value Gambian traditions, like cooking and celebrations, to adapt to life in Norway, and, particularly, to focus on education.

It is interesting to see how Ndey was positioned towards the future: to maintain and draw on their transnational family network, and to pass on these values to her younger sister in the future. The funds of knowledge were the importance of education and looking inside and outside of the network to create a safe future.

In lower secondary school, Ndey said she wanted to apply for vocational studies (i.e., the "business and service program") because she liked the multicultural

atmosphere in airports. She also felt that she had the necessary computer skills. Ndey said she felt the programme matched her school results, which she described as "could have been better." Ndey thought that math, in particular, was very demanding.

One can see how Ndey described her position as a learner as "not very school smart." However, it is of interest to see how Ndey positioned herself towards a school programme that was relevant for her interests. She continued the future position provided by her mother: education. Ndey connected her family network experiences and the values transferred from her mother (i.e., funds of knowledge) to her choice of programme.

As a student in the business and service program, Ndey said she was very satisfied with her new school and, in particular, with one teacher. He had made her aware of the experiences and knowledge she had developed on her travels around the world:

> I: He understands us and talks to us about the interests that we have. And which subjects to choose and our futures and so on. […] I do better than before. Math, however, is still difficult. [field notes 2 (2012)]

Ndey explained how, in the new program, she was able to draw on her English language skills, travelling experiences, and cultural understanding. During the second year in secondary school, Ndey set new future professional goals. This position was created in cooperation with her teacher:

> I: My ambition is now to be an air stewardess. I have even chosen Spanish. Languages are important when being an air stewardess. My teacher says I should consider that occupation. [field notes 3 (2013)]

Ndey also said she felt secondary school was better than expected.

One can see how her teacher functioned as a guidance counsellor by matching a future position to her existing funds of knowledge. Obviously, Ndey felt that the teacher helped her draw on her experiences, and one can see how this support was important for her position as a learner and in daring to set new educational goals.

During the last interview, Ndey talked about a trip to Gambia that had meant a lot to her. Ndey had not seen her father since she was eight, and on this trip, she showed up unexpectedly at his shop. He recognised her immediately. Ndey helped her father in a childcare home, where he worked as a volunteer. During her stay in Gambia, Ndey discussed her future with her father and uncle:

> I: My uncle studied tourism in Europe, and he is doing well in tourism in Gambia. I have decided to apply to a university college offering cultural studies and tourism in Norway. I want to work as an air stewardess, but I will pursue my college education as a backup plan. My father encouraged me to go back to Norway to study. Later, I can come back and do something in Gambia [tourism]. I also thought about working as a volunteer in the childcare home next year. […] My father encouraged me to go back to study.

After this trip, Ndey viewed education more seriously, and she understood that the educational possibilities in Gambia were slim. Ndey described it thus:

I: In Gambia we do not have such possibilities. [field notes 4 (2013)]

The visit to Gambia created tensions. The dilemma was whether to study to become an air stewardess, to stay in Gambia, or to study tourism at the university level. Ndey took the position proposed by her father in order to contribute by working in the tourism industry in Gambia in the future, which demanded increased effort in school.

One can see how Ndey experienced the different future positions provided in the transnational family network; she saw these positions as positive possibilities and did not express any negative thoughts. Ndey chose an eager positioning of her learning identity. Her family network provided her funds of knowledge about future possibilities; this network was a resource in supporting Ndey as a learner.

Ndey said she had good enough grades to enter a general studies programme the third year of secondary school, which would allow her to study in a college later. Ndey said she would focus on education and schooling and not, for example, work part-time or engage in too many social activities. School would be her main focus. Ndey continued to dream about working as an air stewardess in the future and living in a multi-cultural city like New York.

What is essential in Ndey's case is how she changes her learner position from "not very smart" to a that of a "motivated" student. Her teacher's identification and support of her funds of knowledge is important in this transformation and in enabling her to reach her educational goals.

DISCUSSION AND CONCLUSION

This article shows that the Grorud Valley is an interesting micro-cosmos for exploring the everyday learning, learning identities and positionings, and educational trajectories of young Norwegian girls with immigrant parents. The practices that we see in this suburb can indicate girls' views on the future in an increasingly globalised Norway (Rattansi & Phoenix, 2005).

The two case narratives illustrate how the everyday lives in this multi-ethnic community provided the girls with a multitude of cultural practices and leisure activities (Vestel, 2003). The social and personal circumstances in which the girls found themselves and how they interacted with the different sorts of learning in which they were engaged were used as resources for the construction of their learning identities and positionings (Holland et al., 1998) and were manifested after particular "rich points" (Spradley, 1979). The girls' understanding of their positionings can be traced to transnational family networks (Gonzales et al., 2005) and figured worlds (Holland et al., 1998) initiating insights and activities transferable to other settings.

The research shows how the young girls' learning identities and positionings and futures developed across family networks and figured worlds.

In this work, the concepts of positioning, figured worlds, and funds of knowledge are combined in order to explain how everyday learning can be a resource in learning identity and positionings inside of school during educational transitions. Funds of knowledge are grounded in everyday learning and describe the exchange of cultural practices inside a network. Figured worlds explain how the young girls are provided a position in the family and help in understanding the construction of, and change in, positionings and future trajectories. Funds of knowledge, figured worlds, and positionings become analytical lenses for understanding non-academic factors and tensions that the girls experience and use in daily life to solve everyday challenges. The argument is that these factors can be resources in formal learning and in helping students choose an educational path.

The two girls' funds of knowledge that were related to their ethnic exchange networks were linked to creating a safe future. The girls learned to build strong family bonds with their relatives worldwide. In that way, they learned to support each other and to focus less on their ethnic background or on a particular national identity but rather on a transnational family belonging (Eriksen, 2013). The girls described belonging in the context of these transnational family networks (e.g., between Norway, Eritrea/Gambia, and the United States). Their cultural traversals brought forward knowledge and tensions about different cultural practices and multi-ethnicity, integration and inclusion matters, and refugee and economic equality—from local, national, and global perspectives. In light of these practices, the girls saw the need for future education. These family-based everyday learning processes across contexts became particularly important and were used as resources for the girls' creation of learning identities and positionings in school. In addition, one can see the connection between teacher support of funds of knowledge and funds of knowledge-based future educational trajectories on the one hand, and a positive development as learners on the other.

In the case of Maria, one can see a change between her positionings in lower secondary to upper secondary school, from a "laid-back" and "confident" positioning to a "disappointed" positioning. The change happened because she could not connect her interest with school. Furthermore, the teachers and guidance counsellors did not seem to identify her funds of knowledge-based aspirations or support her as a learner or her interests. However, the educational position she gets from her family network inspired Maria to pursue an educational trajectory in line with her interests. From her family traversals, she clearly sees the global differences, which again enables her to understand what great future possibilities education can provide her. It seems this also makes her see the importance of having a job with which to contribute to society. The support from Maria's family network also helps her when she experiences challenges at school. The family network's support helps her to stay motivated and to postpone her future educational trajectory. The illustration

underlines that Maria's future trajectory was constructed in, and supported by, the immediate family-figured world and across the transnational family network.

In the case of Ndey, one can see how her learning identity and positioning improved when her interests matched her schooling after the transition to secondary school. The change in positioning can be seen in the way Ndey (in the new school) described herself as a "motivated" learner. Ndey's teacher also functioned as a guidance counsellor by matching a future position to her existing funds of knowledge. This probably catalysed her development by providing her a position as a "skilled" student. The educational position provided by her family network inspired Ndey to pursue a more ambitious trajectory. In addition, seeing the global differences and educational possibilities made her understand the importance of pursuing what education could provide her. Her personal tension was whether to follow her own dream or to choose an education that would enable her to contribute to Gambian society in the future. Nevertheless, the tension worked as a resource, as it enabled Ndey to become a devoted student with a clear future goal. The illustration underlines that Ndey's future trajectory was constructed in the immediate and extended-family network. She viewed herself as a global citizen.

The girls' traversals provided both global knowledge and tensions about events and opportunities that shaped other people's lives. The tensions caused them to orient towards becoming globally engaged citizens, which was visible in their choices regarding their educational paths. Hull and Stornaiuolo (2014) found that exploring students' different cultural practises in an increasingly multi-ethnic society can enable teachers to create school communities in which the students can share experiences. These school activities can contextualise and help students understand both their own and others' cultural practices. Therefore, this research shows that funds of knowledge should be taken into account when teaching in multi-ethnic societies.

Norwegian education is in line with the other Nordic countries that proclaim equal opportunities for all. Equal opportunities, however, depend on a supportive school system. It has been reported that immigrant girls in Norway have high aspirations in lower secondary school but are at greater risk of experiencing the learning environment in upper secondary school as less supportive. Hegna (2013) suggests that the following factors might be important for why these girls experience upper secondary school as less supportive: increased level of difficulty, the teaching methods, new friends, the environment, and the new student identity, all of which must be addressed to provide the student with confidence and school motivation.

The cases of Maria and Ndey illustrate the importance of how teachers can help students to see and to understand their funds of knowledge in order to catalyse well-being and learning, and to assist in the positive development of their learning identities and positionings, as well as in the educational trajectories in the transition between schools. For example, Maria's teachers were not aware of the learning trajectory she experienced from lower to upper secondary school. When teachers

understand the relationship between students' funds of knowledge, interests, and formal learning, they can help them to connect everyday learning and future trajectories to gain increased self-understanding and motivation in the process of reflecting on their futures.

Guidance counsellors are frequently used in the transition between lower secondary school and secondary school to aid the students in choosing a future educational trajectory. My findings show that the girls did not mention that they received help to identify future trajectories based on input from the guidance counsellors. Rather, their educational trajectories developed in family exchange networks. Schools (including their guidance counsellors) may benefit from increased knowledge about how the students' everyday learning plays a role in students' learning identities and positionings, and the connection to how they develop educational trajectories.

These realisations can provide schools with insight to support learners in developing futures that are meaningful and worth fighting for. In the context of the renewed interest in understanding women's futures, this paper shows that multi-ethnic girls in Norway are interested in public work as a way of contributing to and transforming their multi-ethnic societies. Important factors in future life decisions may include everyday learning, learning identities and positionings, teacher support, and funds of knowledge transferred to school.

NOTE

[1] http://www.bistandsaktuelt.no/nyheter-og-reportasjer/arkiv-nyheter-og-reportasjer/har-intervjuet-500-tortur-ofre-tortur-er-et-vanlig-pressmiddel: young Eritreans pay smugglers to take them through Egypt to Israel or to Western countries. Many never reach their destination. Instead, they end up in the clutches of cynical criminals.

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SECTION THREE

AGENCY AND ENGAGEMENT USING DIGITAL TOOLS

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9. LEARNING AS A HYBRID

Educational Engagement in the Digital Age

INTRODUCTION

Lately, examinations of the discrepancies between learning in school and out-of-school settings have been enriched by discourses that address the changing role of digital technologies and media in shaping ways in which young people engage, learn, and build their identities. Concerns about the growing disconnect between the "digital learner" and the school have revitalised public conversations and academic research on the mismatch between in-school and out-of-school learning (Erstad & Sefton-Green, 2013). Efforts motivated by the need to make schools relevant for 21st-century learners and, on the other hand, to make learners ready for this century, have resulted in explorations of the ways in which to meaningfully and powerfully bridge discourses, literacies, and social practices of the "Net Generation" or "digital natives" with formal schooling (Hung, Lee, & Lim, 2012). In these efforts, learning is understood as a part of living in different sociocultural contexts, not as something that takes place exclusively in formal education (Hughes, Jewson, & Unwin, 2007; Ramsten & Säljö, 2012). This view also indicates the salience of emotional engagement in creative activity and thus calls for the combined consideration of the cognitive, affective, and social aspects of human experience (Craft & Wegerif, 2006). Here, the emotional content of social interaction is regarded as significant for positive and productive collaboration and learning.

In the digital social worlds, or so-called "affinity spaces" (Gee, 2004), learning often takes place serendipitously in peer communities whose members are connected via a shared interest to a common object of activity. In the digital worlds, working processes, as well as their products and outcomes, are open for wide audiences, increasing the authenticity, potential impact, and communication of the work in question. Generally, engagement in these more informal media resources and communities is spontaneous, flexible, passionate, and innovative, and generates a sense of belonging, satisfaction, and fulfilment. It is usually associated with high levels of intensity, knowledge and value, positive emotions, and increased reference value (Oblinger & Oblinger, 2005). These characteristics contrast sharply with the dominant forms of formal education that are being increasingly criticised for their inadequacy to motivate and engage the young generation in authentic, agency-driven learning (Facer, 2011; Sharples, 2006).

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 163–177.

This chapter focuses on education efforts that aim to disclose the discontinuities between young people's in-school and out-of-school learning. Namely, our work is motivated by the need to further explore conditions that build coherence across young people's multiple lifeworlds as a part of the formal educational process. In our work, we draw on the concept of *boundary crossing* in order to make an analytic distinction between various discourses in the students' technology-mediated collaborative learning activity. Moreover, by taking *discourse* as the core unit of analysis, we want to examine the continuities and discontinuities that often distinguish the students' everyday discourse from that of schools and other formal institutions (Gee, 2004). We are specifically interested in the notion of *hybrid space*, which can be achieved when diverse discourses embedded in young people's multiple lifeworlds meaningfully intersect. From this orientation, the most significant issue is the interrelationships between various discourses in social activity and what is accomplished by these boundary crossings (Colley, Hodkinson, & Malcolm, 2003).

We draw on empirical research situated in a Finnish elementary-school community that engaged in an interdisciplinary, year-long school musical production project. We focus on a three-month phase in the musical project during which 21 fifth- and sixth-grade students (ages 11 to 12) took part in technology-mediated collaborative writing of a school musical script in and out of school. The priority in our analysis is on the discourses that take account of the students' computer-mediated social activity, explore their relationships, and identify their effects on young people's engagement and learning. To this end, we ask

- What is the nature of boundary crossing of discourses in the students' chat interaction while they engage in technology-mediated collaborative writing activity in and out of school?
- What opportunities and tensions are created in the students' intersecting discourses during their technology-mediated social activity and how do these "hybrids" mediate their engagement and learning activity?

We summarise our research by illuminating features in the educational design that can potentially explain the interplay of various discourses in the students' social activity. We conclude our chapter by considering the educational implications of hybrid learning for students' engagement, learning, and identity-building.

Boundary Crossing of Discourses: A Sociocultural Perspective

Our work draws on the sociocultural aspects of human learning and development (Cole, 1996; Kumpulainen & Renshaw, 2007; Vygotsky, 1962, 1978). The sociocultural framework guides our analyses of the ways in which individuals learn within and across contexts and how what is learned is co-figured by the specific types of activities they participate in, as well as the social, symbolic, and material resources they use. Focusing on the social practices and discourses of learners

directs our analyses of both the affordances of, and constraints on, participation and learning in and across diverse settings.

We hold that meaning-making in technology-mediated interactions is enacted through discourses that mediate the social activity (Wertsch, 1991). Discourses are considered an integral part of everyday lived, talked, enacted, value-and-belief-laden social activity that is carried out in specific places and at specific times (Gee, Hull, & Lankshear, 1996). They are enacted through the practices of the communities in which people participate and offer membership in communities that involve ways of being, valuing, and speaking (Wenger, 1998). It follows that discourses can be understood only within the sociocultural context from which they originate (Gee, 2000). From this perspective, language-in-interaction is not a neutral medium appropriated by a speaker, because every word holds the cultural meaning of the multiple contexts in which the word has lived its socially tuned life (Bakhtin, 1981; Bloome & Clark, 2006; Cazden, 2002).

The sociocultural perspective advocates that learning is a complex, reciprocal process dependent on constructive, culturally relevant interactions between learners and their social ecologies that vary across temporal, contextual, and cultural spaces (Barron, 2004). It follows that all contexts of learning, both physical and virtual, are considered centres of multifaceted and complex activities: they are places where social, cognitive, and cultural mediation occur as knowledge, and where subjectivities meet, cross, and resist each other (Rex, Steadman, & Graciano, 2006). By viewing context as a function of the dynamic interaction between multiple layers of activity, the sociocultural view foregrounds the fact that during collaborative work, participants are active in creating social and interactional contexts (Goffman, 1974; Kumpulainen & Mutanen, 1999; Schubauer-Leoni & Grossen, 1993). In this view, semiotic tools, characteristics of the task, and the sociocultural context of the activity, including participants' intentions and interpretations of the situation, shape the nature of the collaboration and emerging interactions (Moschkovich, 1996; Roschelle & Teasley, 1995). Canagarajah (2005) introduced the term "shuttling" to illustrate the ways in which individuals move between social–textual conventions during their participation in various communities and how they make use of semiotic resources to achieve personally relevant goals. From this standpoint, interaction is not determined by the medium or physical context; instead, it is negotiated dynamically in a social context. It is performative and context-transforming, facilitating the ongoing negotiation of meaning and presentation of self (Thorne, 2003).

In our work, we define boundary crossing as a process that entails managing and integrating multiple and divergent discourses in social activity and meaning-making (Walker & Nocon, 2007). In contrast to approaches to learning that focus on one-time and one-sided transitions between contexts and on the mere progression in the level of participation in social activities, boundary crossing refers to ongoing, reciprocal actions and interactions between contexts. Following Bowker and Star (1999), we view boundaries as a means of communication instead of division and

illustrate that they are an essential part of the circulation of knowledge and meaning across the social world (Wenger, 2000). We are specifically interested in the boundary crossing that creates hybrid spaces in which students' discourses intersect and merge (Bakhtin, 1981; Gutiérrez, Baquedano-López, & Tejeda, 1999). According to Gee (2010), a hybrid space is one in which students' primary discourses, which are used in the home, community, and informal social interactions, and students' secondary discourses, which are endorsed by school and other formal institutions, intersect to form a subsequent, "in-between" space. In this space, oppositional categories work together to open up both possibilities and tensions in social activity and in meaning-making. A hybrid space can thus be both productive and constraining in terms of social and cultural practices—and, ultimately, the sense of self and belonging (Bhabha, 1994).

METHODS

The empirical study that we draw upon is situated in a Finnish elementary school of 240 students (grade levels one through six) and 16 teachers in the Helsinki district. Distinctive to this elementary school is the development of its pedagogical operating culture by integrating arts and educational technology in the curriculum and pedagogical practices of the school for almost a decade. Educational technology and media are pivotal artefacts in supporting creative and collaborative learning among members of the school community, which resonates with 21st-century learning requirements and supports students' engagement and agency in learning. As part of their schoolwork, the students and teachers of the elementary school participate in various cross-curricular collaborative projects every year, such as the musical project under study.

In the fall of 2010, all 240 students participated in a communal musical production: during a period of one year, they worked together with their teachers and collaboratively produced a number of poems, short movies, audiovisual effects, animations, stories, 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 in May 2011. The musical production is a good example of the creation of a local, school-based curriculum and of annual plans that are collaboratively designed by the school community. It complements and enriches the realisation of the national core curriculum by specifying the objectives and core contents of cross-curricular themes, subjects, and subject groups for basic education in Finland (www.oph.fi/english/education/basic_education/curriculum). The national core curriculum leaves room for teachers' professional expertise in creating and enacting pedagogies for the promotion of students' learning in accordance with the set goals.

This study focuses on a three-month phase in the musical project during which 21 fifth- and sixth-grade students (ages 11–12) worked in ten small teams of two to three students, with each team writing one part of the musical script. They were

allocated two one-hour sessions every week to write the script at school. To enable the students' collaborative creation of the script in and outside of school, they were provided with small, one-to-one computers (netbooks) that were set up with a 24-hour wireless Internet connection and a personalised user account. The laptops were also equipped with a collaborative writing tool: *VisciPad*, which included a chat channel. Furthermore, the students were able to download and use any software or program of their choosing during the writing project.

Data Collection and Analysis

The data for this study draw on the 21 students' *online chat discussions* during the collaborative writing of the school musical script. In addition, we draw on our analysis of the *revision history of the students' musical scripts* and on *student online questionnaire* data focusing on the students' experiences of their learning practices and their use of technological tools and media during the musical scriptwriting. First, the social constructions of the students' chat interactions and the revision history of the scripts were analysed at a micro-level to investigate how the students' activity was distributed across space and time. This included investigating the temporal organisation of collaborative activity. Second, we turned to analysing the actual discourses of the students' chat interactions. The methodology used in our analysis is based on educational linguistics, namely interactional sociolinguistics (Gee, 1996), and ethnography of communication (Gumperz, 1982), which examine language as inseparable from the contexts of its use. In our analysis, we focused on the content and organisation of evolving chat interactions. We paid specific attention to the social contexts that were evoked in the students' interactions and what they jointly accomplished through their interactions (Bloome & Clark, 2006). The social context provided an interpretative framework for analysing the students' discourses as they evolved in situ. We logged the topics and themes that emerged in the interactions and examined their connections to social practices and contexts.

The students' questionnaire data were subjected to qualitative content analysis (Chi, 1997; Krippendorff, 1980). The content analysis began with the careful reading of the students' responses to each question and then, after several readings, continued to identify explicit, dominant themes and topics from the data (Patton, 1990). The qualitative analysis was supplemented by quantifying the identified themes and topics and by visually presenting them separately as *word clouds* with each question. These visualisations were realized via *Wordle* (Feinberg, 2009).

RESULTS

Boundary Crossing of Discourses in the Students' Chat Interaction

A total of 8,657 messages were submitted during the three-month collaborative writing phase of the school musical. This number includes only messages that were

sent in VisciPad. The messages were distributed over every hour of the day, from 6 a.m. to 10 p.m., with almost 2,400 from the end of the school day at 1 p.m. and after. The results thus indicate significant use of VisciPad and its chat facility outside the two weekly one-hour 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 the chat messages (n = 8,657) fell outside the scheduled lessons. In a similar vein, 14% of all script-editing events and almost 6% of the chat messages were sent during the weekend (Kumpulainen, Mikkola, & Jaatinen, 2013). The data show that the students continued working on their writing project later in the day, in the evening, and during the weekends.

Our analyses of the students' chat interactions revealed the boundary crossing of multiple discourses that were mediated by continuous fluctuation of socio-emotional features. These discourses drew upon the students' various lifeworlds. Parallel to their collaborative writing activity of the musical script, the students talked about exams, homework, school lunch, and break time. Furthermore, the students drew on discourses in which they discussed and shared their music and movie preferences, hobbies, food, travels, mundane observations of their living environment, and recent news covered by the media. The students' socio-emotionally charged discourses included interactions via which they conveyed their social presence to others. These socio-emotional discourses also entailed interactions in which the students gave supportive feedback to each other and asked for help in creating text and in using the technology. In addition, the students' socio-emotional discourses carried information about their state of mind and mood. Typical moods included expressions of being happy and positive and, likewise, expressions of being bored, tired, and hungry. In all, these interactions illustrate an abundant exchange of socio-emotional and affective information. Here, the use of various forms of expression of emotions, including emoticons, repetitious punctuation, and conspicuous capitalisation, was also evident.

Next, we illuminate the boundary crossing of the students' discourses during their joint online writing activity. In the first extract, we can see how the discourses of the students' chat interaction functioned as an important means for their joint writing activity distributed across space and time. In addition to focusing on the actual writing task, the interaction entailed discourses in which the students negotiated their social relationships as well as their futures. The style of the students' chat interaction is informal in nature, characterised by their everyday discourses.

Extract 1

March 11

21	11:45	Iida:	huuhuuuhuuuhuuuh
22	11:45	Iida:	are you thereeeeeee
23	11:46	Sonja:	sorry I didn't notice
24	11:49	Iida:	you bet=)
25	11:49	Sonja:	.....

26	16:45	Iida:	i've done a kind of story there. revise or re-do down there if there's something to fix=)
March 12			
27	11:44	Sonja:	i wrote there that story, you can change it if you like
28	12:59	Senja:	Hi everyone! I never happen to be here at the same time than others:/
29	12:59	Senja:	Your planning looks great by the way:) (really)
March 14			
30	9:24	Iida:	thaaanksss
31	9:24	Iida:	yeeep it's pretty good I guess
March 16			
32	15:04	Iida:	hiiiii
33	16:58	Sonja:	hi
March 19			
34	10:16	Iida:	that's cool what you've written=)
35	22:00	Sonja:	what did you like that idea when that cleaning dance pauses due to the fire and then when the fire has been put out the cleaning dance continues from where it paused
March 21			
36	9:17	Iida:	yeah it's really ok, i guess????
37	9:17	Sonja:	cool
38	9:18	Iida:	hihi
39	9:18	Iida:	I wish you get a place in that school=)
40	9:23	Iida:	jeejeee
41	9:23	Sonja:	you say it, that's what i hope
42	9:24	Iida:	yeppp
43	9:24	Iida:	what if you do not get in?????
44	9:24	Sonja:	then i'll go to sotku

Extract 1 begins with Iida making her presence visible to the other girls (lines 21–22). In line 26, the girls' interaction shifts to writing when Iida starts to organise the group's joint activity by inviting the other girls to join in revising the text. The next day, Sonja responds to Iida's message, shares what she has done for their writing, and invites the other team members to revise her texts (line 27: "i wrote there that story, you can change it if you like"). A similar balance in interaction can be seen in lines 35 and 36. Here, the message Sonja sent at 10 p.m. to ask Iida's and Senja's opinions of her idea on the plot is answered by Iida the following morning. In line 39, the girls' interaction gradually switches as they begin to talk about how they all wish Sonja would get accepted by a recreation school to which she has applied and about the consequences if this does not happen (lines 40–44).

Extract 2

Extract 2 further demonstrates the dynamic interplay of various discourses in the students' joint writing activity. Here, the playfulness of the students' chat interaction is clearly visible, serving the students' socio-emotional expression and negotiation.

April 11

213	9:20	Mari:	hi
214	9:24	Mari:	sofkuuuu!!!!!!!!!!!!
215	9:25	Sonja:	hi!!!
216	9:26	Mari:	this computer is slow at times
217	9:27	Sonja:	this one too :/
218	9:28	Sonja:	should we start to make this beginning part and then the lines and then the middle part and then the end
219	9:28	Sonja:	do you get it????
220	9:28	Sonja:	?? ????
221	9:28	Sonja:	?? ????
222	9:28	Mari:	have to!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
223	9:29	Mari:	i cannot now
224	9:29	Sonja:	ok! do we need to go there at the front to tell something about this!
225	9:30	Mari:	:D
226	9:30	Mari:	:D
227	9:30	Mari:	:D
228	9:30	Mari:	.:::::::D
229	9:30	Mari:	:D
230	9:30	Mari:	:D
231	9:30	Mari:	:D
232	9:30	Mari:	:D
233	9:30	Sonja:	:D:D

The episode begins with Mari's and Sonja's reciprocal greetings through which they communicate their social presence (lines 213–215). This is followed by the girls' commenting on how slow their computers are (lines 215–216). In line 218, Sonja turns the discussion to their writing task ("should we start to make this beginning part and then the lines and then the middle part and then the end"). Then Sonja asks Mari to confirm that she has understood the suggestion (line 219) and reinforces her message with repetitious punctuation (lines 220–221). Mari knows she should but expresses her state of mind: how she feels that she is not up to writing at the time (lines 222–223). In her response, Sonja takes into account Mari's feelings and furthers the interaction towards a general reflection about their role in the musical performance (line 224). Mari responds to this posting with emoticons

(lines 225–232). In all, the extract demonstrates the students' active negotiation of their emotions and state of mind, furthering the students' collaborative creative activity (Vass & Littleton, 2010).

The Students' Personal Accounts of Their Engagement in the Learning Activity

According to the students' questionnaire data, the possibility of interacting with friends through chat was considered the most advantageous feature offered by using laptops and the writing service VisciPad (see Figure 9.1). Many students also mentioned having appreciated the possibility of working flexibly in and outside of school settings—regardless of time and place. Through ubiquitous wireless connectivity and increased mobility, the students were able to write the script at school and during their spare time, which gave them more freedom in designing their own learning places and work pace. These extended and personalized learning activities appeared to support the students' creativity, agency, and engagement in collective work. One of the major advantages of technology-mediated learning activity was found in the students' ease and flexibility in recording creative ideas as they emerged in different situations and times. The collaborative writing tool gave the students opportunities to suggest, invent, and propose ideas for collective reflection, encouraging them to analyse their writing processes and explore the past, present, and future of their creative processes, as demonstrated by this student response:

> I think VisciPad was useful since I could chat with my work partner at the same time. You could also see what each one of us had written. It was great to have laptops at home since you could immediately write down your good idea when it came to mind.

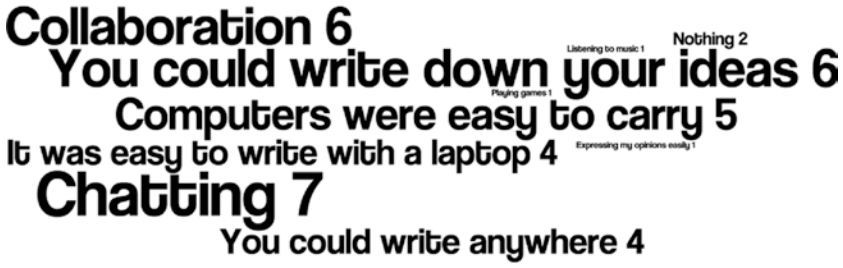

Figure 9.1. What were the advantages of using laptops and VisciPad?

When asked about the purposes for which the students used their personal laptops and VisciPad outside the classroom, the students reported having used them for a range of purposes, not the least for writing the school musical itself (see Figure 9.2). The students' technology-mediated practices at home included watching YouTube, listening to music, playing games, chatting, "Facebooking," and reading email.

Moreover, the students said they used the technical tools for reading for their school exams and collaborating with their friends in different virtual communities. These data reflect the multimodal worlds of youth. Here, schoolwork and related learning practices became a flexible and integral part of the students' ecologies of living and learning.

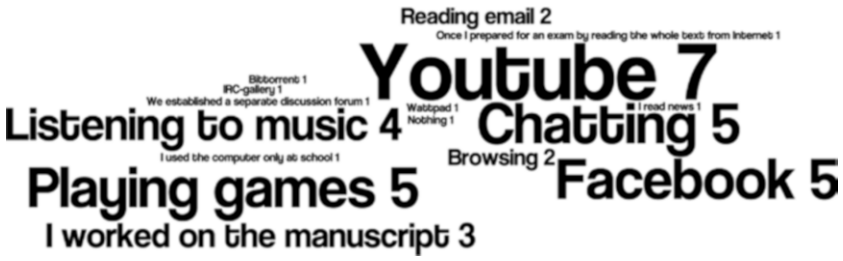

Figure 9.2. What were the purposes of using the laptops and the VisciPad outside the classroom?

Figure 9.3 further illuminates students' learning practices during their collaborative writing project. The students reported having been engaged in other parallel activities, in school and outside, while writing the musical script. Common uses that the students reported included listening to music, "Facebooking," watching YouTube, chatting, playing games, browsing and searching for information on the Internet, and reading email. Consequently, the data evidences the students having engaged in multitasking entailing the use of various artefacts embedded in the students' informal and formal lives.

Figure 9.3. What else did you do while writing the script?

When asked about the conditions and settings in which the students felt they were most creative, the majority of the students interestingly reported getting the best ideas for their musical script at home and at school (see Figure 9.4). Some students mentioned the social and collaborative nature of creative work, and some students emphasised getting the best ideas for their script when they were alone: when it was quiet, or when they were doing "something else" other than writing the musical script. Apparently, the construction of creative ideas is fostered in learning settings in which students are given enough time, flexibility, and space to work with their

ideas and in which they can go beyond what is expected of them. The following extract illuminates the collaborative nature of the students' creativity: "Some ideas I got after school at my friend's house. And then I shared them at school the next day. Also, some ideas came after someone else got an idea."

Figure 9.4. When and from where did the best ideas for the musical come?

DISCUSSION

Educational activities open to various forms of participation call for pedagogical design that cuts across boundaries while traditionally separating institutions of education, home, community, and popular culture (Ito et al., 2013; Lantz-Andersson, Vigmo, & Bowen, 2013). The challenge for education, then, is to create spaces for learning in which participants can engage in collective activities by sharing the material, sociocultural, linguistic, and cognitive resources embedded in their lifeworlds (Gutiérrez et al., 1999; Ludvigsen, Lund, Rasmussen, & Säljö, 2010; McLeod & Yates, 2006; Zittoun, 2006).

In this chapter, we have addressed present-day concerns about the mismatch between young people's learning experiences inside and outside of school. We have illustrated and examined an educational setting in which the students' learning activities were extended from the traditional time–space configurations to agency-driven engagement entailing technology-mediated joint creation of a school musical script inside and outside of school. The results from our investigation demonstrate how the students used various linguistic resources available to adopt and adapt extant discourse practices in their joint technology-mediated activity. The results illuminate the boundary crossing of discourses and the ways these crossings formed hybrid spaces in which cultural, relational, cognitive, and emotional processes dynamically intersected (Kumpulainen & Mikkola, 2014). The students' engagement at the intersection of multiple social worlds did not entail moving from diversity and multiplicity to homogeneity and unity (Akkerman & Bakker, 2011). Instead, the results demonstrate that the students' various discourses intersected, overlapped, and coexisted at different points in time and space. The students' chat interactions provided a social context within which the multidimensionality of their social worlds and identities came into play. Here, the students exercised agency in adapting their

language and social practices to address changing situations and circumstances that were constructed into being during their technology-mediated collaborative writing activity.

The students' discourses and the boundary crossing they entailed appeared to serve important functions in the students' joint activity. The hybrid interactions mediated the students' active negotiation of a common ground for joint work, including the construction of mutual inspiration for their writing activity. In addition, the students engaged in active negotiation of their sense of trust and belonging within these hybrid spaces. The results also illustrate the complex nature of engaging in hybrid interactions and how these both facilitated and challenged the students to maintain their joint focus of attention (Kumpulainen & Mikkola, 2014). At times, these tensions diverted joint focus of attention. At other times, negotiating tensions appeared to contribute to building a positive affective structure (Kreijns, Kirschner, & Jochems, 2003; Madge, Meek, Wellens, & Hooley, 2009).

In sum, our study demonstrates educational engagement that broke away from the typical tightly defined and teacher controlled learning activities of schooling. Here, the social contexts of the students' joint activity were distributed across space and time, reflecting educational engagement in which no discourse appeared to be secondary. Instead, the students' learning activity could be characterised as situated within a matrix of multiple sociocultural contexts (Lantz-Andersson et al., 2013; Ramsten & Säljö, 2012). Here, the students' discourses and educational engagement in general were simultaneously nuanced and coherent, ambivalent, and confused.

It is important to acknowledge that the hybrid learning activity identified in the study is a developmental achievement that has emerged through sustained collective efforts within the school community. Whilst creating education for hybrid learning, it is thus not just a matter of implementing and putting into use alternative pedagogical ideas and technologies, but it is also a matter of transforming simultaneously existing social practices (Kumpulainen et al., 2013). In this study, the pedagogical culture of the elementary school was transformed by longitudinal collective efforts towards extended space-time configurations of "doing school" with the support of new technologies. Important design principles for such hybrid spaces included breaking boundaries between formal and informal; valuing learner agency, authority, and accountability; and stressing the importance of learners pursuing meaningful and authentic activities with relevant resources and tools (Engle & Conant, 2002). It is the co-evolution of the social and technological infrastructures of education that can be regarded as important prerequisites for expanded and hybrid learning opportunities.

Creating educational opportunities for young people's holistic engagement in hybrid learning offers an alternative conception of being a student. In hybrid learning, being a student entails taking a transformative stance in the learning activity. In the present study, this was evidenced in the students' engagement in the co-construction of the cultural practices of what it means to make meaning, participate, and learn at school. Moreover, the students were also transforming community life outside of school via

the production and sharing of their academic work (i.e., the school musical with local communities). These are all important elements of and for transformative practice, promoting not only school learning but also the students' transformative activist stance (Stetsenko, 2008) in their learning and life in general. It can be concluded that the hybridity evidenced in this study ruptures the dominant idealisation of formal education that seeks for predictability and uniformness, as well as narrowly defined notions of what counts as 21st- century educational engagement and learning.

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10. THE CARBON FOOTPRINT AS A MEDIATING TOOL IN STUDENTS' ONLINE REASONING ABOUT CLIMATE CHANGE

INTRODUCTION

The year 2013 marked the release of the fifth Assessment Report from the Intergovernmental Panel on Climate Change. The report judged it *extremely likely* that human activity is the predominant cause of recent climate change due to an increase in anthropogenic greenhouse gases in the atmosphere (IPCC, 2013). Only a few months later, the U.S. Secretary of State, John Kerry, declared that "climate change can now be considered another weapon of mass destruction, perhaps the world's most fearsome weapon of mass destruction" (Mohney, 2014). This reflects how the issue of human-induced climate change has evolved from being a highly contestable issue to a more stable matter of concern that needs to be addressed through relevant knowledge.

To deal with such a complex global issue and to counteract further deterioration of the situation, citizens need to be involved in the process. They need adequate knowledge and awareness of the severity of the issue, since the challenge of decreasing human emission of greenhouse gases largely concerns our established habits and behaviours. The young generation has been pinpointed as a key agent of the climate change issue (Anderson, 2013), and educational contributions are seen as important to provide students with a more informed and critical view of their own lifestyles and consumption patterns.

This chapter aims to shed light on how students estimate their own environmental impact through documenting and analysing lifestyle questions. The participants used a digital tool, a carbon footprint calculator (CFC), to calculate, compare, and discuss their own impact on the environment—their carbon footprint (CF[1])—in an online forum with peers from around the world. Our research interest is to explore how such a tool may sensitise young people to these issues and support more sophisticated modes of reasoning about climate change.

In order to be able to contribute to climate change mitigation,[2] students need to gain some understanding of their own CF. They need to be aware of what activities in their lifestyles have the largest impact on the environment. Addressing climate change in education, however, presents two main challenges in terms of learning

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 179–201.

and understanding. First, climate change is a complex and multidimensional problem requiring system thinking (Sinatra, Kardash, Taasoobshirazi, & Lombardi, 2011). Sterman (1994) defines system thinking as the ability to see the world as a complex machinery in which we understand that "you can't just do one thing" but have to realise that "everything is connected to everything else" (p. 291). Second, misconceptions are common when it comes to understanding complex issues of this kind. Among students, for instance, acid rains are sometimes seen as a cause of ocean acidification, while the hole in the ozone layer (affected by the use of aerosol spray cans) is believed to cause global warming (e.g., Jeffries, Stanisstreet, & Boyes, 2001; Leiserowitz, Smith, & Marlon, 2011).

Since the complexity of climate change leads to difficulties of understanding, it is important to address climate change with a system-thinking approach. This is challenging due to the high complexity of the causality involved, as described by Sterman (1994, p. 308):

> Within a causal field, people use various cues to causality, including temporal and spatial proximity of cause and effect, temporal precedence of causes, covariation, and similarity of cause and effect. These heuristics lead to difficulty in complex systems, where cause and effect are often distant in time and space, actions have multiple effects, and the delayed and distant consequences are often different from and less salient than proximate effects-or simply unknown.

Within educational research, climate change is considered a typical socio-scientific issue (SSI); these issues are complex and lack a single straightforward solution (Sadler & Zeidler, 2005). Such issues typically are introduced in school among young citizens for science literacy purposes in order to develop their perception of what such complexity involves (Yang & Anderson, 2003). The perspectives on a given SSI will depend on personal priorities, principles, and biases and thus lead to support for different solutions (Sadler & Zeidler, 2005). An SSI often involves the evaluation of potential and unclear implications of projected actions on human sustainability. In other words, climate change presents a challenge for our society since citizens need to understand these complex scientific issues to be able to act responsibly for their own sake, for the sake of the society, and for future generations.

Support for Understanding Climate Change: The Carbon Footprint Calculator

Over time, technological innovations have provided opportunities to visualise what previously used to be invisible phenomena. Nowadays, thermometers represent the body temperature, graphs help us visualise datasets, and speedometers offer a way to control our speed. These breakthroughs give us access to reliable information that we use when understanding the world and making decisions about how to act. Recently, the emergence of digital technologies has tremendously broadened the range of concepts we can visualise and manipulate. While climate change is an abstract concept invisible to the human eye, tools such as CFCs have radically changed

the way we can access issues of climate change, visualise our own emissions, and compare them to those of others. As described by Kenny and Gray (2009, pp. 1–2):

> The calculation of individual and household CFs is a powerful tool enabling individuals to quantify their own carbon dioxide emissions and link these to activities and behaviour. Such models play an important role in educating the public in the management and reduction of carbon dioxide emissions through self-assessment and determination.

The CFC, which is easy to use, presents a series of questions concerning the user's lifestyle (e.g., transportation habits, energy consumption). By answering the questions, users both observe and report on their concrete everyday activities, which, over time, make up what we refer to as our lifestyle. The self-reported figures are combined, and the calculator provides a total carbon dioxide (CO_2) output in kilograms: the user's CF.

While CFCs are widely available online, only a few studies have looked at their impact on the users' knowledge and reported environmental behaviours. In the available literature, the CFC can be studied either as a stand-alone activity for outreach purposes, such as in the studies by Mallett, Melchiori, and Strickroth (2013) or Brook (2011), or they can be studied in the context of formal education, where they are embedded in instructional activities. Mallett and colleagues suggest that adult self-confrontation via a CFC promotes guilt and that this partially mediates willingness to support actions for existing pro-environmental groups. But Brook (2011) concludes that the use of the calculator might not always promote environmentally friendly behaviour and describes how some adults might be less likely to engage in pro-environmental action after receiving negative feedback from the calculator.

The use of CFCs has also been studied in instructional settings. Cordero, Todd, and Abellera (2008) studied the impact of an ecological footprint[3] among higher education students by giving pre- and post-tests to two groups of students, one using the ecological footprint calculator and the other one serving as control group. Their study indicated that the activity had an impact on how the students linked their lifestyles to the issue of climate change. Moreover, they suggested that the tested activity provided "a path for enhancing student understanding and possibly altering student behaviour in a manner that promotes deeper learning" (p. 871).

Ribchester, Hunt, and Alexander (2009) developed and tested a CFC for field trips. Some students participating in this project showed increased awareness of, and interest in, their energy consumption. In order to understand how students develop their environmental awareness and how they account for their actions after using a CFC, further research on these matters would be valuable in order to inform educational practices on the implications for student learning of using such tools.

The majority of previous research in relation to CFCs has emerged from a primary interest in studying the design and performance of different types of CFCs. Most research argues that CFCs are inconsistent and often contradictory

(Murray & Dey, 2008; Padget, Steinemann, Clarke, & Vandenbergh, 2008. The (more or less extended) inaccuracy of the CFCs is important to acknowledge and, as we see it, comes from three levels. First, due to the complexity of these issues and their relation to every single action we take on a daily basis, each calculator has to reduce this complexity to a finite number of behaviours to be taken into account through the questions. So the designers have to make simplifications and generalisations that reduce the accuracy (but increase the user friendliness) of the tools. Second, the equations calculating the final CF are based on parameters and data that are sometimes difficult to find and/or to verify. The diversity of greenhouse gases released directly or indirectly by different behaviours has a more or less important role to play, and this will add to the inaccuracy. Finally, the users themselves will be asked questions for which they do not know the exact answers, and they will thus estimate their activities more or less accurately. These issues of accuracy are not the focus in this study, as we are not primarily interested in the design of the tool but in the implications of the use of such a tool for pupils' environmental understanding. Nevertheless, it is worth noting that the CFC studied here follows ten out of 13 principles defined by Birnik (2013) and thus it is more valid and reliable than many other CFCs.

In this study, we scrutinise (a) the ways in which European and U.S. high school students understand their own carbon emissions, (b) how the visual display from their CF as provided by the CFC alters their ways of reasoning about CFs, and (c) their expressed willingness to address their behaviours on local and global levels.

The following research questions will be focused:

- How do students estimate their footprint, and how do they compare it to the national or world average?
- What kinds of reasoning about carbon emissions are observable through the use of the calculator?
- What impact do students consider calculating their CF has on their environmental behaviour and on their views of climate change?

These questions are addressed analytically by adopting a sociocultural perspective on learning (Säljö, 2005; Vygotsky, 1978; Wertsch, 1998) while focusing on the use of cultural tools as resources for interacting with and mastering the world. In this perspective, cultural tools such as CFCs are seen as directed towards mastering mental processes and as co-determining how we behave. The tools serve as instruments of thinking and make it possible for us to reason in sophisticated manners without necessarily understanding all the inherent processes of the tool (Vygotsky, 1997). The tools thus mediate the world for us in manners that allow us to act in specific ways that would otherwise not be possible (Säljö, 2005). In this study, we understand the CFC as a material and psychological tool which mediates the idea of CFs and their determinants in manners that make it possible to learn about climate change and about how one's own behaviours contribute to carbon emissions.

Empirical Study: Using a Carbon Footprint Calculator to Reason about Emissions

To address the research questions, the empirical study will focus on the International Student CF Challenge (ISCFC[4]), a learning activity for high school students developed within the Inquiry-to-Insight project[5] (a collaboration between the University of Gothenburg and Stanford University). The goal of the ISCFC is to help high school students around the world to understand their personal impact on climate change and to envision local and global solutions during online discussions with students around the globe. The ISCFC is organised in sessions of about two to three weeks in order to maximise the number of students interacting during that period. This learning activity is divided into different steps, which make use of different technologies:

The CFC. The students use a CFC[6] addressing their own lifestyle, including location-specific calibrations for energy sources, agricultural practices, and climatic conditions across the globe. The CFC furthermore includes the possibility to register, save, and restore one's own CF.

After creating an individual account and choosing a location, the students discover what the average CF is for their own location (country or state) and worldwide. The students are then asked to answer two introductory questions by estimating if their CF is lower, about the same, or higher than the average for their location and compared with the worldwide CF (Figure 10.1).

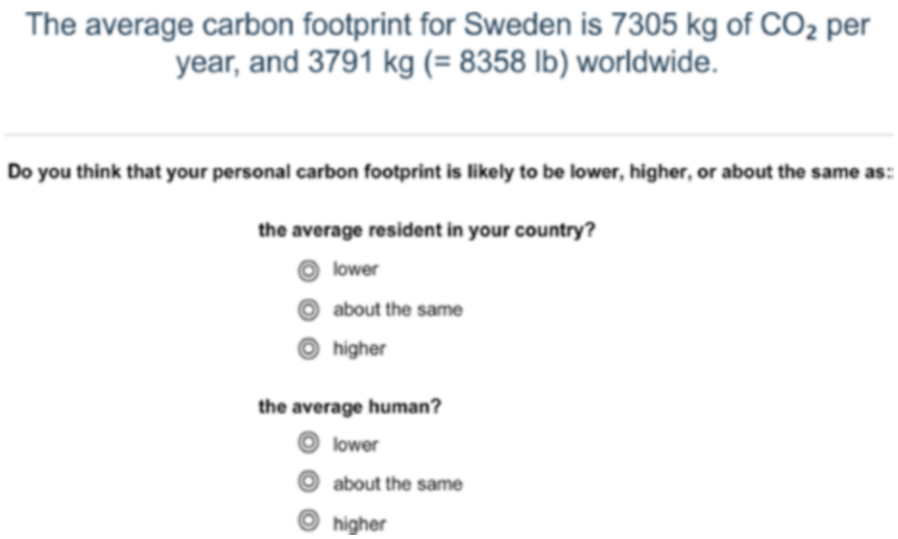

Figure 10.1. The two introductory questions for a student located in Sweden

Having answered the introductory questions, the students answer 50 questions addressing lifestyle, such as food choices (Figure 10.2). The students answer the questions by self-reporting on their own behaviour and receive direct feedback about the amount of CO_2 associated with each reported behaviour. In this way, the student is provided with information that directly displays the relation of a particular behaviour with the CF associated with it.

Figure 10.2. Example of a question addressing the consumption of organic food

At the end, the student's CF is displayed and compared to the worldwide and national average CFs (Figure 10.3). The students are then challenged to think about how to reduce their CF.

Based on your input, your total footprint is 9882 kg of CO_2 per year, compared to an average of 7305 kg for Sweden, and 3791 kg (= 8358 lb) worldwide.
By category, your totals are:

	You:	Your region:
Transportation:	564 kg	1894 kg
Home:	2647 kg	1307 kg
Food:	6068 kg	3363 kg
Purchases:	603 kg	741 kg

Figure 10.3. The comparison between the CF of the user and the average CF for the location selected

Finally, the average CF for each of the participating classes is displayed on a Google map in order to trigger discussion (Figure 10.4).

Figure 10.4. Google map showing the classes participating in the ISCFC

The online discussion. The students register on Einztein, a social learning network,[7] and join discussions related to various aspects of climate change and mitigation. In the online discussions, the students can write a post, which is a direct reply to the topic of the discussion, or post a comment that is a reply to a specific post (Figure 10.5).

The questionnaire. At the end of this activity, students are asked to fill in an online anonymous multiple-choice questionnaire in order to provide feedback and opinion concerning the ISCFC.

METHODS

The data used to answer the research questions, accordingly, are accumulated from three sources.

Data from the CFC

In October 2013, data collected from 5,970 students were retrieved from the CFC database. For each student, the data included (i) answers to the introductory questions: "Do you think that your personal CF is likely to be lower, higher, or about the same as the average resident in your country? Do you think that your personal CF is likely to be lower, higher, or about the same as the average human?" (ii) the

Figure 10.5. Structure of the online discussions including the description of the topic of the discussion, the post written as answer to the discussion description, and the comments written as answers to a specific post

average national CF (CF_{local}), and (iii) the personal CF measured by the CFC (CF_{user}). Two indexes were then calculated:

- the relative CF compared to the average CF in their country:

$$RCF_{local}\,(\%) = [(CF_{user}-CF_{local})/CF_{local}] \times 100$$

- the relative CF compared to the average CF in the world (3,791 kg CO_2):

$$RCF_{world}\,(\%) = [(CF_{user}-3{,}791)/3{,}791] \times 100$$

If the RCF was higher than 10%, the user footprint was considered above average; if the RCF was lower than -10%, the user footprint was considered lower than the average; and if the RCF was between -10% and 10%, the CF was considered average.

Since one of the aims of this study was to see how students estimate their CF in relation to the national and world average, we decided to eliminate the users who gave contradictory answers to the two introductory questions: (1) Do you think your personal CF is likely to be lower, higher, or about the same as the average resident in your country? (2) Do you think your personal CF is likely to be lower, higher, or about the same as the average human?

In Figure 10.6, which serves as an example, a Norwegian user estimates where his CF will fall in comparison to the national and world averages, the values of the national average (in this case, Norway with 7,901 kg), and the world average (3,791 kg) are provided. If users simultaneously estimate their CF to be higher than the national average (higher than 7,901 kg) and lower than the world average (lower than 3,791 kg), the users CFs were contradictory since they cannot be both higher than 7,901 kg and lower than 3,791 kg. We deleted data from 2,498 users who gave contradictory answers. Data from another additional 120 users were deleted since their CFs were unrealistically high (above 100,000 kg). The remaining database includes data from 2,499 students located in 80 countries.

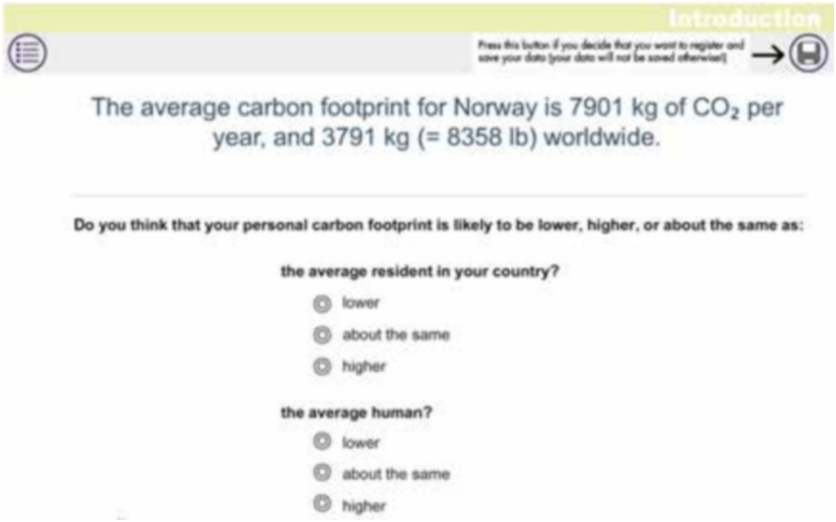

Figure 10.6. Screenshot of the introductory questions in the case of a Norwegian user

Most countries were represented by only a few users, and the material did not have enough power for a quantitative analysis. We therefore decided to focus on the users located in European countries represented by more than ten users, and in the

United States. The final database includes 1,722 users from the United States and 248 users from seven European countries (France, Germany, Greece, Italy, Sweden, Switzerland, and the United Kingdom).

Data from the Online Discussions

The data from the November 2011 session were gathered from a discussion during which students were asked, "Did you use the calculator to identify areas in your life where you can make changes in order to reduce your footprint? Are you willing to make those changes?" Since our aim was to get an understanding of how students experienced the calculation of their CF, we focused only on the post directly addressing the students' experience with the CFC. We ended up with 28 posts from students located in six different countries (United States, Croatia, Switzerland, Iceland, Bulgaria, and Greece). The content of these posts were logged and anonymised while keeping the information concerning the country of origin.

Data from the Questionnaire

At the end of each ISCFC session, the students were required to answer a multiple-choice questionnaire online. Two questions from this questionnaire are analysed in this study:

- How serious an environmental problem did you consider climate change to be before and after participating in the ISCFC? (*not at all serious; a little serious; somewhat serious; extremely serious*).
- After participating in the ISCFC, are you more likely to take steps to reduce your CF? (*yes, much more likely; yes, a bit more likely; no change; no, less likely; no, much less likely; no concern about footprint*).

These questions were included in the questionnaires following four sessions (September 2012, November 2012, February 2013, and October 2013), and a total of 783 students answered them.

Table 10.1. Overview of the different data collected in this study

Data from	*Details*
CFC	Comparison between CF claimed by users and CF calculated by the CFC in relation to the national and global CF averages
Online discussion	Analysis of students' posts about their experience with the CFC
Post-activity questionnaire	Analysis of two multiple-choice questions answered by the students after participating in the ISCFC

RESULTS

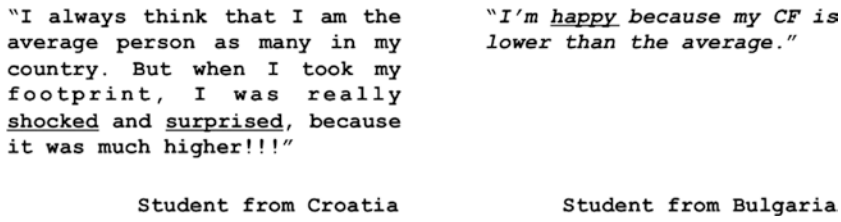

Figure 10.7. Excerpts from the online discussions

These excerpts (Figure 10.7) from the online discussion illustrate how this learning activity served as an eye-opening experience for these students, who received insight into their impact on climate change. The involvement in the activity also triggered emotionally and morally charged reactions among students. Through our results, we take a journey that begins at the point at which the student stands prior to participating at the ISCFC, and ending with the consequence of this activity on their understanding of their own CF in local and global contexts.

As a starting point, the excerpt from the Croatian student explicitly illustrates that students have some ideas, more or less accurate, concerning their CF in relation to their national, and to the global average, enabling them to make estimations in response to the two introductory questions. This, per se, is an interesting observation, and the issue of their impact on the climate seems intelligible.

The Accuracy of the Students' Estimations of Their Own CF

In the following text, we will compare the students' estimations on the introductory questions with the values derived from the self-reported CF calculated by the CFC.

European students and the national average. Table 10.2 provides a comparison between the European students' estimation of their CF and the CF calculated by the CFC both in relation to the national average (above, lower or about the same).

Table 10.2. Comparison of self-evaluation and calculated CF of European students relative to their national average (N = 248)

Lower		*CF calculated by the CFC (%)*			
		About the same	*Higher*	*TOTAL*	
Estimation (%)	Lower	48.8	18.6	23.4	*90.8*
	Average	4.4	1.2	2	7.6
	Higher	0	0	*1.6*	1.6
TOTAL		*53.2*	19.8	27	100

While about half the European students have a self-reported CF lower than their national average (53.2%), a large majority (90.8%) estimated that their CF would be lower than their national average. Very few students (1.6%) estimated that their CF would be above their national average (Table 10.2).

European students and the global average. Table 10.3 provides a comparison between the European students' estimation of their CF and the CFC calculated by the CFC, both in relation to the global average (above, lower or about the same).

Table 10.3. Comparison of self-evaluation and calculated CF of European students relative to the world average (N = 248).

Lower		*CF calculated by the CFC (%)*			
		About the same	*Higher*	*TOTAL*	
Estimation (%)	Lower	0	0	29	*29*
	Average	0.4	0	33.9	*34.3*
	Higher	0	0	36.7	36.7
TOTAL		0.4	0	*99.6*	100

Almost all of the European students (99.6%) have a self-reported CF above the global average. Nevertheless, about two-thirds (62.9%) of them estimated that their CF would be either average to (34.3%) or lower than (29%) the global average (Table 10.3).

U.S. students and their state average. Table 10.4 provides a comparison between the U.S. students' estimations of their CF and the CF calculated by the CFC, both in relation to the state average (above, lower, or about the same).

Table 10.4. Comparison of self-evaluation and calculated CF of U.S. students relative to their state average (N = 1,722).

Lower		*CF calculated by the CFC (%)*			
		About the same	*Higher*	*TOTAL*	
Estimation (%)	Lower	38.3	9.9	17.4	*65.6*
	Average	13	3.2	6.4	22.6
	Higher	6.5	2	3.3	11.8
TOTAL		*57.8*	15.1	27.1	100

About half the U.S. students (57.8%) have a self-reported CF lower than their state average, while about two-thirds (65.6%) estimated that their CF would be lower than their state average. More than 10% (11.8%) of the U.S. students estimated that their CF would be higher than the state average (Table 10.4).

U.S students and the global average. Table 10.5 provides a comparison between the U.S. students' estimations of their CF and the CF calculated by the CFC, both in relation to the global average (above, lower, or about the same).

Table 10.5. Comparison of self-evaluation and calculated CF of U.S. students relative to the world average (N = 1,722)

Lower		*CF calculated by the CFC (%)*			
		About the same	*Higher*	*TOTAL*	
Estimation (%)	Lower	0	0	14.8	*14.8*
	Average	0	0	31.5	*31.5*
	Higher	0	0	53.7	53.7
TOTAL		0	0	100	100

While all the U.S. students have a self-reported CF above the global average, about half of them estimated that that their CF would be either about the same as (31.5%) or lower than (14.8%) the global average (Table 10.4).

These results show how students come to this activity with an idea about their own environmental impact. Their understanding of their own contribution to this global problem, accordingly, can be greatly improved since many of them underestimated their CF. Noteworthy is that the U.S. students seem to have a more accurate picture of their impact, with a lower tendency to underestimate their CF. So, while the students' self-reports of their own environmental behaviour seem to be rather similar on both continents, the background knowledge varies between the United States and Europe. The European students estimate themselves as more environmentally friendly than they really are, a phenomenon less frequent among the U.S. students. More than 90% of the European students claimed that they believed their CF to be below the national average, and virtually none of them believed that they would have a CF higher than the national average. The picture is somewhat different in the United States, where a lower percentage of the students (65%) claimed to believe that their CF was lower than the state average, and more than 10% of them expected their CF to be higher than the state average (Table 10.6).

Table 10.6. Comparison between U.S and European students in terms of their estimation of their own CF and the self-reported CF calculated by the CFC

Comparison with national/state average CF			
	U.S. students	*European students*	*Conclusion*
Calculated CF	± 50% below	± 50% below	Same environmental behaviour
Estimation	± 10% expected above state CF	± 0% expected above emission	U.S. students more critical towards their CF
	± 65% expected to be below	± 90% expected to be below	U.S. students more critical towards their CF
Comparison with global average CF			
Calculated CF	All above	All above	Same environmental behaviour
Estimation	Less than half underestimated their state CF	2/3 underestimated their national CF	U.S. students more critical towards their CF

The CFC seems to give students the opportunity to realise how accurate or inaccurate their estimations were. The analysis of the online discussion gives us the opportunity to further scrutinise how students relate the CF calculated to their lifestyle. In the following section, we address such instances in our data.

The Anatomy of Online Posts

The analysis of the content of the posts revealed a pattern of frequently discussed issues that will be described in five dimensions as presented below.

Dimension 1: Making estimations from the average. The first dimension consists of students commenting on the estimation they made concerning their CF prior to using the CFC. This dimension was found in 68% of the posts scrutinised. Two excerpts illustrate this:

- When I calculated my CF, I expected it to be average for where I live, which is Texas, but higher than the average for the world. I guess I expected this because I figured that the United States had one of the largest, if not the largest, CF.

(L: 45–48, United States)

- When I calculated my CF, I expected it to be high, […]. I am from the United States, which has the largest CF in the world, so I was expecting my CF to be about the same as the average American.

(L: 59–61, United States)

Dimension 2: Comparing one's result with the average. The second dimension includes students comparing the CF obtained with the national average. This dimension was observed in 96% of the posts analysed. When making such comparisons, students often emotionally and morally charged their reactions with words such as "shocked" when the CF was higher than expected and as "happy" when the CF was lower than average.

- I'm happy because my CF is lower than the average.

(L: 206–207, Bulgaria)

- I was a bit shocked when I saw that my CF is a bit over the average for Croatia.

(L: 6–7, Croatia)

Dimension 3: Accounting for one's deviation from the average. The third dimension comprises posts in which the students account for the relation between their CF and some specific actions, for example shopping habits and ways of travelling. This dimension was found in 85% of the posts analysed.

- … probably because I took a trip to Spain by plane last year. Other than that I think it would be below average or at least equal.

(L: 7–8, Croatia)

- I think that this is mostly because of my shopping habits. I don't like shopping. Plain and simple. If I'm not in my school uniform, I'm in shorts and a t-shirt.

(L: 313–315, United States)

Dimension 4: Guiding future behaviour. The fourth dimension includes students discussing how they could (or could not) modify their everyday actions in order to decrease their CF. This type of discussion is made possible through the use of the CFC helping students to visualise and to verbalise how their actions impact their CF. This gives them the opportunity to respond to what they find by deciding to change some behaviour in order to decrease their CF. Note that students also discuss actions that they are not able or willing to change, even though the CFC helps them understand how specific activities affect their CF. This dimension shows how students can, after using the CFC, concretely understand what aspect of their everyday lives affects their CF. This dimension was observed in 68% of the posts analysed.

- Since we know other people who go to the Aggie football games, I am definitely going to get my family to try to carpool that away I can reduce my CF and won't have it higher than the average Texan's.

(L: 52–55, United States)

- So to help lower my CF, I can very easily change that habit, but all of my other travels are to see my family. They live in Puerto Rico, New Jersey, Virginia, and North Carolina. I'm sorry to say I don't think I can change that, but there are many other things I can change. My house has all incandescent light bulbs, so I can change them to CFL bulbs. One great thing about my house is that it has lots of windows, so we get a lot of natural lighting and we don't even use the lights for about three quarters of the day. We also live right by a farmers market so we have been shopping there more, and I am planning on getting reusable grocery bags for the grocery store.

(L: 65–73, United States)

Dimension 5: Considering global consequences. The fifth and last dimension includes formulations that express ways of adopting a perspective on CF as a global concern. This dimension was found in 54% of the posts analysed. Two excerpts illustrate this last dimension.

- I think that if we actually try to conserve energy and be green, our CFs will be a lot smaller. Most people don't understand that we only have one Earth and we should try to do everything we can to keep it alive and healthy.

(L: 345–347, United States)

- I know that we can't choose the place where we are born and where we live, but I think that all of us can at least take walks or ride bicycles, etc. with our loved ones and at the same time enjoy the beauty of life and make the Earth a better place to live.

(L: 388–390, Croatia)

The analysis of the variation of components in the students' postings in relation to the five dimensions illustrates how students consider the values received from the CFC and transform it to meaningful knowledge that concerns the implications of their own behaviours for the wider climate change issues.

Self-Evaluation of the Impact of the ISCFC

The data from the two multiple-choice questions in the questionnaire were analysed in order to get an understanding of how students perceive the impact that the ISCFC learning activity had on their environmental behaviour and understanding.

A majority of the students (30.01% + 56.45% = 86.46%) consider that after participating in the learning activity, they are much more likely or a bit more likely to take steps to reduce their CF (Figure 10.8).

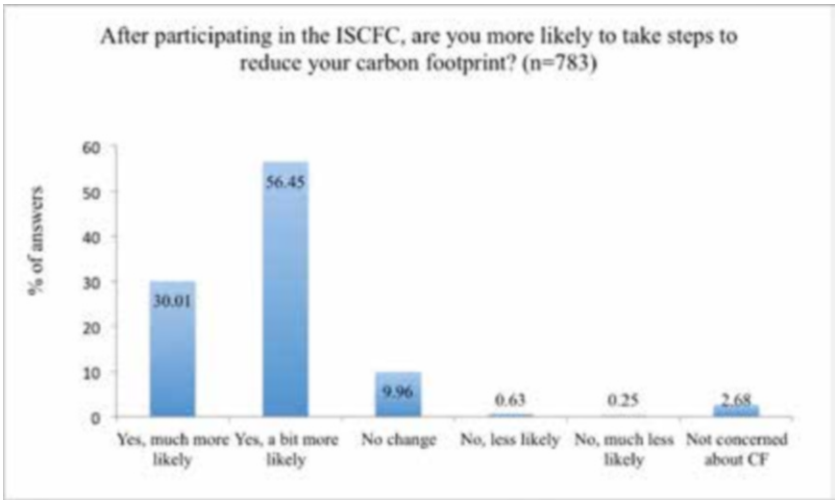

Figure 10.8. Proportion of answers to the question "After participating in the ISCFC are you more likely to take steps to reduce your CF?"

When answering the questionnaire after the ISCFC learning activity, the students reported how their view on the urgency of climate change has changed. The results show, after participating in the ISCFC, an increase in the understanding of how serious climate change is. The percentage of students considering climate change as an extremely or somewhat serious issue increased from 64.23% before participation to 91.56% after participation. The percentage of students considering climate change as not at all serious or a little serious decreased from 35.75% before participation to 8.42% after participation (Figure 10.9).

DISCUSSION

The wide range of empirical material used in this study contributes to an understanding of students' presuppositions about their own CF, how accurate their estimations are, and how the use of a CFC mediates knowledge providing an enhanced awareness of people's personal impact on the environment. By relating the answers to the questions in the questionnaire with the results from the CFC together with the online discussions, we also address the issue of how they, in relation to their new insights, discuss their own willingness to change their everyday habits.

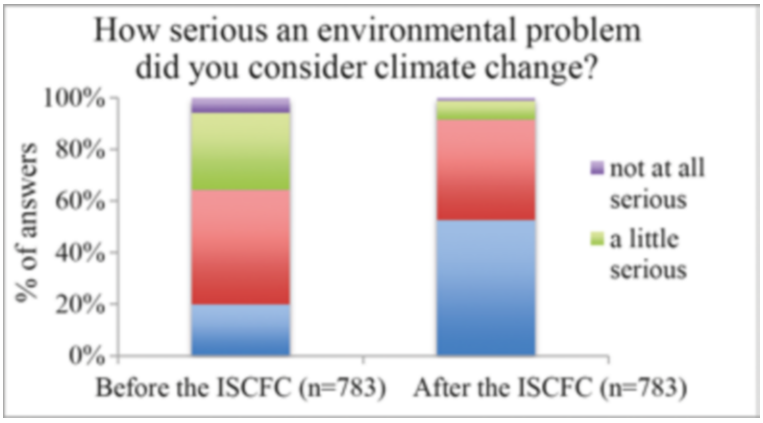

Figure 10.9. Proportion of answers to the question "How serious an environmental problem did you consider climate change?" (before and after participating in the ISCFC activity)

The students' estimations of their own CF, when compared both nationally and globally, reveal that the European students estimate themselves as more environmentally friendly than they really are, while the U.S. students' estimations are more accurate. This result indicates that the students take what they have heard previously about their own region's contribution to this global problem into their reasoning as a resource. This kind of presupposition might come from the mass media often pointing to the United States, which heavily relies on fossil fuels, as one of the greatest emitters of greenhouse gases (Lorenzoni & Pidgeon, 2006), while depicting Europe as "a moving force in the development of the international climate-change regime" (Vogler & Bretherton, 2006, p. 1). It is well known that the press strongly influences the citizens' attitudes towards science (Carvalho, 2007). This might explain why students raised in societies that point to the United States as one of the main causes of the problem possibly will be biased in their understanding of this complex issue and neglect their own responsibility. European students, assuming that Europe is "greener" than the United States, might be more inclined to believe that their own CF is low, while the U.S. students are more aware that their country is responsible for a considerable CF and might regard their own CF more pessimistically.

The online discussions give us insight into the ways students manage to understand and respond to their involvement in the climate change issue through the visualisation of their CF, enabled with the use of the CFC. In line with previous research, the results from our study show that the responses frequently were emotionally charged. We encountered two main emotional responses. The first emotion observed was the guilt expressed when the students discovered that their CF was above the national average. Previous research indicates that dissatisfaction with one's own personal behaviour triggers motivation to change (e.g., Monteith,

1993). Along the same lines, Parkinson, Fischer, and Manstead (2005) supported the idea of a link between guilt and willingness to repair the damage done. In the field of environmental issues, Ferguson and Branscombe (2000) and Mallet et al. (2013) also argue that guilt promotes the willingness to engage in mitigation behaviours. By way of contrast, Brook (2011) argues, from her study on adult behaviour, that the issue is more complex and that receiving a higher impact value than the average does not automatically imply a change in attitude and behaviour. However, our results indicate, in line with the prior studies previously mentioned, that guilt seems to be associated with a willingness to overcome the discrepancies between the average and one's own value by finding ways to decrease the CF. This suggests that a change in attitude might be easier for adolescents who have not yet acquired a strong habitual lifestyle, which in turn points to the benefits of implementing such tools as a part of regular education to promote future environmental behaviours.

The second emotion observed in this study was the pride expressed when students realised that their CF was below the national average. While pride has been much less studied than guilt in relation to pro-environmental behaviour, it has been suggested that "positive emotions like pride may be especially useful in motivating positive environmental behaviour" (Harth, Leach, & Kessler, 2013, p. 22). The online discussions in our study also display how students with a CF lower than the average express a preparedness to decrease their CF even further. Therefore, we argue that pride or guilt triggered by the use of the CFC, respectively, in students with a CF lower than average or with a CF above average, seems to promote a willingness to engage in climate change mitigation, which is observed both in the online discussion and in the answers to the questionnaire taken after completion of the ISCFC.

The CFC does not only trigger emotional reactions and promote a willingness to counteract climate change but also provides a very local vision of the problem. This helps to increase the awareness of the impact of behaviours contributing to climate change, thus providing the students with the knowledge needed to decide what behaviour to modify at a local scale. Moreover, the CFC focuses on local aspects of climate change that can be directly addressed by the students. The importance of focusing on the local and actionable aspects of climate change has been discussed by several authors (e.g., Anderson, 2013; Fauville, Lantz-Andersson, & Säljö, 2013; Mallet et al., 2013; Uzzell, 2000). For example, Uzzell (2000) reports that people feel responsible for the environment at a local level, but at a global level

> they feel least personally responsible and powerless to influence or act. (p. 314)

On the other hand, the use of CFC and the online discussions seem to enable the students not only to shift the focus of climate change issue from a more general global perceptive, where people might feel powerless, to a local perspective where they are accountable for their behaviour, but also to reflect on relationships between individual and collective activities and their impact on a global level. When the students engage in reasoning about their CF. they realise dilemmas connected to the

environmental impact of actions in various areas in society, enabling both individual and collective awareness (cf. McWilliam, Poronnik, & Taylor, 2008). Noteworthy in relation to our study is that the students, in the online discussion, keep a local focus as long as they talk about their own impact but do not forget to involve the global aspect of the issue, which indicates an awareness of the importance of also taking a general dimension. The global vision in this activity might also have been promoted by the fact that students' data are pinned on a world map and that the discussions took place between students from across the globe.

Altogether, the discussions triggered by the CFC seem to be linked to an eye-opening effect in which students declare that they had no idea they had such an impact on climate change. This eye-opening effect is also observed by Cordero et al. (2008) in their study of higher-education students' reactions by using an ecological footprint calculator (the authors used the same concept as the CFC but measuring the area of land needed to sustain the user rather than the amount of CO_2). The "I had no idea" refrain formulated by the students is a key element as it demonstrates how a CFC can transform an abstract and invisible concept into something visible and tangible that students can discuss and manipulate and respond to by changing their behaviour. It is thus evident that even if the CFCs have limitations in terms of how correctly they estimate and calculate a person's impact, they serve as "access points" (Giddens, 2002; cf. Säljö, 2010) that enable concrete discussions that would otherwise be quite abstract. Such access points provided by outcome figures of the CFC enable the students to come closer to grasping a complex concept. Measuring one's own CF without the help of the CFC is an extremely complex activity even for experts. Consequently, this tool provides shortcuts between a given behaviour and the CF associated with it through a specific mediating tool. The complex calculation happening in the CFC stays invisible to the users. This phenomenon, called *black boxing*, is defined by Latour (1999, p. 304) as "the way scientific and technical work is made invisible by its own success."

> When a machine runs efficiently, when a matter of fact is settled, one need focus only on its inputs and outputs and not on its internal complexity. Thus, paradoxically, the more science and technology succeed, the more opaque and obscure they become. (Latour, 1999, p. 304)

The use of such tools enables the users to skip the black-boxed calculation part and get direct access to the CF. The personal CF is both an essential tool for citizens in order to counteract climate change and mediates extremely advanced knowledge that would be out of citizens' reach without a device.

To sum up, this study shows how students report not only their CF calculated by the CFC, but also how they develop modes of reasoning and negotiating their own contributions to both the global and local consequences of their CF. The results of this study show that students lack the ability to estimate their own CF correctly. This finding calls for reflections on what additional actions are required to help the

young generation become more aware of their own impact on the environment, both locally and globally. This study also indicates that the students not only developed their attitudes in the discussions but also in their answers to the questionnaires completed after the ISCFC. Indicating that the students consider that the activity has changed their insight into climate change, the answers declare that they are more willing to take action and that they view climate change more seriously after participating. Consequently, the CFC may serve as a reasonably accurate and easy-to-use mediating tool that enables the students to discuss their own impact on the environment both locally and globally. It is not inconceivable that when CFCs are integrated into our daily lives, we will find it just as easy to talk about our environmental impact as we now comment on the temperature and precipitation. In the latter cases, the tools are firmly established in society, and we all use them to plan our activities and to discuss what happens with the weather. In a not too distant future, transparent and easy-to-use CFCs might mediate knowledge in similar ways. Thus, we argue that CFCs can be used for efficient instruction practice to enhance climate-change mitigation, a conclusion that has also been reached in other research (e.g., by Cordero et al. (2008) in their study on the ecological footprint. Despite how broadly available CFCs are online, and their important potential for promoting climate change mitigation, these tools are relatively little studied. In that respect, we argue that more research about the implication of the use of CFCs to inform educational practices is needed.

To conclude, this chapter explores how a CFC can scaffold students' understanding of their own impact on climate change. The results indicate that this kind of tool provides insights into the invisible concept of CF and may serve as a catalyst for triggering students' responses towards mitigation.

ACKNOWLEDGEMENTS

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NOTES

1 The CF is the amount of carbon dioxide and other greenhouse gases that is emitted by a person's lifestyle, an organisation's operation, or a product manufacture and transport.
2 Climate change mitigation comprises actions to limit the magnitude of climate change.
3 Tool close to the CFC measuring the amount of land needed to provide all of the resources and absorb all of the waste of any given population.
4 http://footprint.stanford.edu
5 http://i2i.stanford.edu
6 http://i2i.stanford.edu/NewFootprint/footprint.html
7 Einztein was shut down in February 2014 due to economic reasons.

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11. INTERACTING WITH THE WORLD

Learners Developing Identity and Agency through Boundary Crossing in Mobile Learning

INTRODUCTION

Studies of media use and mediatisation indicate radical changes occurring in young people's lived experiences and how their learning lives are pursued (Buckingham, 2003; Couldry, 2014; Ito, 2010; Livingstone, 2014; Livingstone & Haddon, 2009; Sefton-Green & Erstad, 2013). Youth culture studies in the Nordic countries also reveal such changes (Guðmundsson, 2006). A statistical review in Iceland from 2013 showed that almost 99% of those in the 16 to 24 year age group used the Internet daily or almost daily (Statistics Iceland, 2014a), and 97% used networking sites such as Facebook or Twitter (Statistics Iceland, 2014b). In a 2014 study among all learners in Grades 6 to 10 in the Eastfjords of Iceland, everyone (N = 269) had Internet access, and 90% had access in their own rooms (Thráinsdóttir, 2014).

A digital divide, on the other hand, has been forming between the home and school use of technologies. Already in 1998, there was a large gap between home and school computer use among learners in Icelandic primary and lower secondary schools (Jakobsdóttir, 1999), and learners' ICT skills were correlated to use and computer access at home but not to school-related factors. Recent studies still indicate limited use of technologies in European schools (European Schoolnet & University of Liege, 2013; Jakobsdóttir, Hjartarson, & Þórhallsdóttir, 2014).

However, improved access to the Internet, learning materials, and information have gone hand in hand with increased availability of new technologies, and this has encouraged a steady development in blended learning (Bonk & Graham, 2006; Staker, 2011): online teaching and face-to-face teaching have become interwoven (Pachler, Bachmair, & Cook, 2010). Student diversity challenges institutional practices and encourages learning across sites, the use of new tools, and changes to infrastructures and practices (Ludvigsen, Lund, Rasmussen, & Saljö, 2010). Several studies testify to the rapid developments in mobile learning with tablet computers and smart phones (Balanskat, 2013; Burden, Hopkins, Male, Martin, & Trala, 2012; State of Queensland, 2012; Stald, 2008) and 1:1 learning initiatives in schools (Balanskat, 2013). Production of content for these devices increases steadily (Statista – The Statistics Portal, 2014), and connected learning gains leverage within schools (Ito et al., 2013). Initiatives for the co-design of learning materials

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 203–223.

(Jenkins, 2012) is an open path for educators to follow in participatory learning environments in which participants collaborate on the creation of new meaning and knowledge (Kovalainen & Kumpulainen, 2007; Kumpulainen et al., 2011). In these new developing learning ecologies, the social construct *connected learning* has emerged in interaction with learners engaging in various social practices, mediated by different artefacts (Kumpulainen & Sefton-Green, 2014). According to Kumpulainen and Sefton-Green, an important characteristic of connected learning is that the learner can pursue a personal interest supported by friends, caring adults, and other expert communities and is able to link this learning, for example, to academic achievement.

It is against this backdrop we present the results of a case study of an introduction and use of tablet computers (iPads) at the lower secondary level in Nordlinga School in Reykjavík. The school is a Reykjavik public school which opened in 2005 for 300–400 students in Grades 1 to 10. The school runs a progressive educational policy, with a high degree of emphasis on inclusion. The welfare of students is a shared task of the home and school, building on mutual trust, responsibilities, and reciprocal information exchange. The school curriculum emphasises the fulfilment of individual student needs and the development of social competences, collaboration, and teamwork. The school employs multi-age instruction in open classroom settings. This invites peer learning and peer instruction. Teachers work in teams assigned to age-divided student groups, including a team for Grades 8 to 10. Timetables are structured flexibly, with slots in the beginning of each week for making goals and personal learning plans. In addition to subject related time, each week includes time for cross-curricular projects related to student interests (Sigurgeirsson, Ólason, Gunnlaugsson, Jóhannesdóttir, & Vígþórsdóttir, 2010).

The tablets were introduced to students in Grades 9 to 10 in 2012 and 2013, and the project was of three-semester duration. It was initiated by a group of teachers who wished to harness new mobile technologies in order to further personalise learning and improve the digital competences of their students. Initially, the teachers met with resistance from the City of Reykjavik's government officials, who did not consent to tablet implementation and changes that had to be made to the ICT administration. This opposition enforced the agency of teachers to re-organise their work, to introduce 1:1 pedagogy, and to employ mobile devices and appropriate software. With the firm support of the headmaster, the teachers overcame hindrances. The project enabled the teacher group to engage in school reforms, to implement The National Guide for Compulsory School (Ministry of education science and culture, 2012) and the Nordlinga School curriculum, which emphasises personalised learning, outdoor activities, and learning through the arts. The project was supported by an inter-agency coordination, a collaboration of the school and agents in the educational community, which provided expertise to the project. These comprised the Reykjavík municipality: the IT Centre/School Division, The National Centre for Educational Materials (NCEM), Apple in Iceland, and The Centre for Educational Research on ICT and Media (RANNUM) at the University of Iceland. Interim

evaluation (Jakobsdóttir, Kjartansdóttir, Þórormsdóttir, & Pálsdóttir, 2012) indicated increased student motivation and interest in learning.

In this paper, we further explore how mobile technologies enabled teachers and students in Nordlinga School to cross contexts. The main focus of the study is on identity formation and the development of students' agency while boundary crossing and interacting with the world beyond the classroom in connected learning.

BACKGROUND AND THEORETICAL FRAMEWORK

The sociocultural framework of learning is particularly relevant in relation to the study presented here. It acknowledges the importance of cultural tools and signs in the mediation of action (Saljö, 1999). Boundary objects are also taken into account as well as boundary crossings (Akkerman & Bakker, 2011; Star, 2010) involving different contexts and agencies. These are considered valuable opportunities or resources for learning, providing materials for expansive learning and opportunities for negotiations and the re-orchestration of developments (Engeström, 2009). Theories of affordances are also relevant to understanding the complementarity of people and objects or the environment (Gibson, 1979), a relationship that signals an opportunity for, or the inhibition of, action. A relationship exists between particular attributes of the receiver and object/environment (two-way perception; Lier, 2004), indicating a reciprocal relationship. Self-awareness, as it relates to world-awareness, can be a source of learning, meaning-making, and identity development.

Learning is furthermore viewed as a participatory process of collective activities in which the individual learns and contributes to peer learning (Kovalainen & Kumpulainen, 2007; Kumpulainen & Lipponen, 2010). Within the sociocultural framework, human action is the main unit of analysis (Vygotsky, 1978; Wertsch, 1995) with a focus on interaction, discourse, and participation processes, through which the sense of *agency* is constructed (Kumpulainen, Lipponen, Hilppö, & Mikola, 2013).

The notion of *identity* is central in sociocultural discourse and is inextricably linked with the concept of agency, which can be seen as "a mediating term between social-structural approaches and views of lived, interactional experience" (Lemke, 2008, p. 17).

Identity

Identity is a concept that "combines the intimate or personal world with the collective space of cultural forms and social relations" (Holland, Jr., Skinner, & Cain, 1998, p. 5) and is highly contextualised. It distinguishes us from others but also implies a relationship with a broader collective or a social group that the individual seeks identification with in terms of shared social and cultural values and interests (Buckingham, 2008). Rapid societal changes and fluidity of identity (Bauman, 2004)

make it an elusive and troublesome concept, not lending itself easily to normative approaches of analysis. Research on how youth appropriate cultural commodities and new media indicate growing capabilities and independence in application (Ito, 2010; Jenkins, 2010). New media tools provide "young people with symbolic resources for expressing their own identity" (Buckingham, 2008, p. 5), sometimes escaping and resisting adult authority and creating their own worlds of action (Gee, 2008), such as in online gaming and other youth communities. In those contexts, technology becomes the means of their empowerment. Identities are an important base from which people create new activities and ways of being. Identity is therefore always unfinished and constantly in process through social interaction. Identity can be understood as the disposition people have towards themselves, and learning is an inherent part of the identity change process (Biesta, 2008; Teaching and Learning Research Programme, 2008). It can be frail in relation to power and domination, and in its situatedness in collectively formed activities (Holland et al., 1998).

Lemke (2008) argues that identity "gives us a way to link the phenomenological domain of lived moment-by-moment experience and the semiotic domain of enduring cultural and social systems of beliefs, values and meaning-making" (p. 21). What the notion of identity "adds to basic sociological or cultural framework is the sense of agency; that we construct our own identity out of the options afforded to us by our general positionality and our particular trajectory of experiences, encounters, options for action…" (p. 21). This focus is important in education, as the agency of learners can be reduced or augmented by the options afforded to them.

Agency

In the past, agency has been associated with various terms, such as *self-hood*, *motivation*, *will*, *purposiveness*, *intentionality*, *choice*, *initiative*, *freedom*, and *creativity* (Emirbayer & Mische, 1998). Emirbayer and Mische consider agency a "… social engagement, informed by the past (in its habitual aspect), but also oriented towards the future (as a capacity to imagine alternative possibilities) and towards the present (as a capacity to contextualise past habits and future projects within the contingencies of the moment)" (p. 963). Emirbayer and Mische define it as a:

> …temporally constructed engagement by actors of different structural environments – the temporal relational contexts of action – which, through the interplay of habit, imagination, and judgement, both reproduces and transforms those structures in interactive response to the problems posed by changing historical situations. (Emirbayer & Mische, 1998, p. 963)

Emirbayer and Mische (1998) view human agency "as composed of variable and changing orientations within the flow of time" (p. 964) making it possible to understand "how the structural environments are both dynamically sustained by and also altered through human agency" (p. 964). According to Biesta and Tedder (2007) this understanding is the key to grasping the dynamic possibilities of human agency

and that, therefore, agency can be located in the "ability to shape our responsiveness to …contexts" (p. 133).

Agency has played a crucial role in education through the understanding that, in education, people develop their "rational capabilities and become capable of independent action," which "forms the basis for agentic and autonomous activity" (Biesta & Tedder, 2007, p. 133). Biesta and Tedder (2007) also point out the term's increased importance in sociological analyses of modernisation towards the turn of the 21st century (Beck, 1992), when modernisation "forces individuals to become more agentic" (Biesta & Tedder, 2007, p. 134) and to take control of their lives. Agency refers to the identity that the individual has formed in participation when they have learned to act authoritatively and accountably (Kumpulainen et al., 2011).

Formal, mainstream schools have long been criticised for being outdated and for the fact that their transmission of knowledge is no longer useful or meaningful for students (Postman & Weingartner, 1971; Tyack & Cuban, 1995). Furthermore, these schools have been censured for not acknowledging students' experiences and forms of agency that they bring to school from out-of-school contexts (Brown & Renshaw, 2006).

Evans (2002) states that many studies of youth transitions have underestimated the degree of choice or agency evident in transitional processes and indicates that empirical evidence of the individualisation and structuration are lacking. She points out that young people's experiences are not only determined by socialising and structural influences, but also involve elements of subjectivity, choice, and agency. She introduces the concept of *bounded agency* as an alternative to structured individualisation to explore and to explain the experiences of control and personal agency of young people and to describe how young people are constrained in a "social landscape" when they manifest agentic beliefs in relation to their social environment but encounter frustrations in expressing or acting upon them (Evans, 2007). Evans argues that some of these constraints are difficult to remove, but that they might be reduced through new policy initiatives or foci. These can, for instance, be brought about through changes in school curriculum/learning design and by changing the affordances students are offered.

Boundary Crossing with New Technologies

Learning involves boundaries, and when it is considered an identity development, a key question is the distinction between what is a part of the individual and what is not (Akkerman & Bakker, 2011; Evans, 2007). A boundary can be seen as a sociocultural difference leading to discontinuity in action or interaction. Boundary crossing in learning refers to the learner's transition and interaction across sites (Suchman, 1994). A *boundary object* (Star, 2010; Star & Griesemer, 1989) is an artefact that fulfils a bridging function; it contains the reality of the interacting systems, enabling interpretation when crossing boundaries between different systems and sites. For example, a tablet computer can be considered a boundary object which enables

personalised learning. *Personalised learning* is seen here as learner-driven learning, in which the learner connects learning with interests, takes responsibility for his or her learning, teaching, and learning changes (McClaskey, 2014). It involves a degree of autonomy to understand oneself as owner and to be responsible for one's own learning. Self-directed learning can be seen as an aspect of personalised learning, in which intrinsic motivation and internalised extrinsic motivation are facilitated by *social contexts* that allow satisfaction of the basic psychological needs for autonomy, competence, and relatedness (Deci & Ryan, 1996). Such contexts are characterised by the "provision of choice, optimal challenge, informational feedback, personal involvement, and acknowledgement of feelings" (Deci & Ryan, 1996, p. 165) The tablet computer can be seen to provide more choice of knowledge funds and feedback in learning, as well as more opportunities for personal involvement, expression, and social interaction.

Research Questions

In this study, we examine boundary crossings, as well as the contexts and activities involved, for learners with tablet computers at Nordlinga School in Iceland. We focus on the following research questions:

- Are the activities involving tablet computers affecting the development of students' identities and agency?
- What are the changes and resulting possibilities or consequences for learning and for students' personal development?

METHOD

This is a case study involving a sub-case within a larger study on the development project "Tablet Computers in Nordlinga School" from February 2012 to June 2013. Data were gathered with quantitative and qualitative methods and involved interviews, observations, and surveys.

Participants and Data Collection

Two cohorts were involved in the larger study, but the focus here is on students in the earlier cohort, who used tablets for the whole duration of the project period while in Grades 9 and 10. In that cohort, there were 20 girls and 9 boys who participated in the project during the first semester (spring 2012), and 21 girls and 9 boys participated the following school year (2012–2013). The students participated in three interviews (with participation rates of 100%, 96%, and 93%), one each semester. In interviews 1 and 3, students were interviewed in small groups; in interview 2, they were interviewed individually. During the individual interview, data on the apps were collected by photographing the tablet screens. Students also

completed two surveys at the end of the first and last semesters (with participation rates of 48% [2012] and 93% [2013]). The project team included five teachers, school managers, and support staff who were interviewed each semester. The teachers also participated in a survey after the first semester. Parents of the student cohort were surveyed at the end of both school years (with participation rates of 72% [2012] and 45% [2013]). The student, parent, and teacher surveys were adapted from similar surveys by the European Schoolnet (European Schoolnet, 2012). Observations in the school included two days in spring 2012 and one week in November of that year.

RESULTS

In this chapter, we present results related to learners' development of identity and agency. First we will focus on the school context and the affordances brought on by mobile learning. Then we will present the effects of different types of boundary crossings which were facilitated by the tablet computers and the pedagogies employed.

Affordances, Changing Identities, and Agency Development

Students' democracy is encouraged in the school with participation in learning committees. There is an annual school parliament where students can propose ideas and changes to academic content and school management. The student cohort, which participated in the tablet project, was consulted on participation and agreed to take part.

Interview data from May 2013 indicated that students valued the trust and respect that their teachers put in them, to choose their own learning materials and to design their own learning trajectories. Students felt that they could contribute and influence how school work was carried out. Two students who had transferred from other schools were particularly appreciative of the school and the project:

Student 2: The teachers say that they want us to feel good at school.
Student 1: They trust us and it gives us ambition…
Student 1: I attended a different school before and did not have this connection to my teacher.
Student 2: Yes, me too, it was just…
Student 1: It was more like: he controls everything, he is a sort of "dictator" and if you do not do what he says then you are punished. I was not studying for myself, I was studying for him. That was what was wrong and then you have no ambition to learn, if I am not studying for myself, but for him.
Student 1: I have always been rather a bad learner.
Student 2: Me too…

Student 1: Have always been like that, but because, when I was younger, my brother died and it became a sort of a family problem. I moved, went to a school, which is a horrific institution—would not recommend it to anyone to send their children there. Then I come to this school and I am just broken and did not care for learning, I did not care at all. Then, slowly, I get better, when I received the iPad then I got a chance to do things the way I preferred and it is actually acknowledged. Now I am getting pretty good grades.

Student 2: I attended another school before and I was bullied a lot. I did not feel good at that school and the teachers were really strict. If you did not turn in your tasks exactly on the day you would receive a zero grade. This ruined my self-confidence and it takes time to rebuild it. I am still doing it and I have less then a month to go (to final exams). But, you know, I have recovered well, I went from the average grade of 4.0 to 7.5.

Learning forced by others may dissuade learners and decrease their agency. Their agency becomes "bounded" to the extent that they feel constrained and in loss of control. The students quoted above experienced a supportive learning environment which seemed to reverse a downward trend in their learning outcomes and to help build a positive learner identity. A good relationship with teachers and personalised, active learning appeared to kindle their motivation and to reshape their identities for the benefit of learning.

The Tablet and Personal Development

The tablets enabled students to access websites, portals, social-media tools, and the App Store, with a plethora of learning software, games, and tools. They offered an efficient work environment, which teachers and students could tailor to their learning needs and use to extend their scope of learning. It supported students in keeping track of their learning, becoming more self-directed, and executing school projects in a personal manner while employing new technologies.

Teachers noted an increased student interest, motivation, independence, and engagement in learning. They also noticed an acceleration of learning processes and increased student efficiency through relying partly on the steady feedback that the use of a tablet computer enabled. One teacher commented on students' progress at the end of the project period:

> …I have gradually found out that I do not have a clue on how their projects were done, how they were made. They are making various presentations with different types of software, and they are mixing a lot, that is the technology. They are using their own computers, computers at home, tablets and netbooks, and make all sorts of projects, whereby they teach themselves the technology.

Some students were challenged with time control, and with constantly coping with new ways of working and mastering new technologies. Gradually, the tablet made learning tasks easier and more effective. Peer learning was also supportive. Teachers introduced a "flipped-learning" method (flipped learning network, 2012), which gave them added time to attend to the needs of each student and to encourage students' explorative learning and problem solving in class.

Table 11.1 provides an overview of reported positive effects in student, teacher, and parent surveys on different aspects of students' development in learning.

Table 11.1. Reported positive effects by using tablets on identity (or self-image), motivation, study performance, and study-related skills

Factor/item	*Student survey 2013 (n = 27 of 29) %*	*Teacher survey 2012 (n = 5 of 5) %*	*Parent survey 2013 (n = 13 of 29) %*
Identity (self-image)	51	NA	NA
Enjoyment in school	82	100	
Motivation	85	100	100
Study/school performance	88		77
Learning in subjects		NA	NA
Icelandic	82		
English	78		
Natural science	74		
Social science	56		
Danish	56		
Mathematics	44		
Reading	33		
Arts & crafts	19		
Physical education	12		
ICT skills	70	100	100
Organisation, planning	82	100	
Self-pace	82	100	100
Independence	85	100	
Influence on		NA	NA
how projects were solved/completed	89		
type of projects	82		
learning materials used	41		
Work with other students	82	80	NA
Confidence in taking tests	37	60	NA

In the final student survey, 51% of the students thought that the use of the tablets had positive effects on their identity (self-image), whereas 48% thought that there was little or no impact; none thought that there was a negative impact.

A large majority of the students (82%) thought that the schoolwork was more enjoyable with tablets, and 85% believed that it had increased their motivation to learn. About 46% of the parents said that students' interest in the tablet was very high, 54% said that it was high, and all parents thought that the tablets had positive effects on their children's motivation to learn.

In the final interviews, the students remarked on the importance of having a tablet for their personal use and that it could be adjusted to each student's learning needs. Many students found that the tablet facilitated learning and made it easier compared to earlier circumstances at school. Survey results in 2013 showed that 88% of the students thought that the tablets had a positive or very positive effect on their study performance, but only 12% thought that there were little or no effects. On the effects of using tablets, 70% agreed there were positive effects on skills and learning in ICT. In the first interviews in 2012, many students mentioned positive effects of tablets on their ability to use special apps to organise themselves. The tablets evidently supported planning and self-directed learning.

In the final interviews, students remarked upon the importance of having a choice of learning tasks and projects and to be able to influence them during the learning process. The resulting learning outcomes of projects were diverse and manifested the different identities of learners and their personal learning trajectories.

Many parents (69%), however, worried about time control—that their children would spend too much time on the tablet or be distracted by games, chats, downloading music, or social-networking sites. Interview data with students and teachers indicated that there were few or no such worries.

Boundary Crossing—School, Homes, Community

Within the school context, one could study micro-contexts and the somewhat blurred boundaries which were crossed between cohorts, locations within the school, and indoor versus outdoor spaces. Students worked not just with their own cohort but also with other students in Grades 8 to 10. This created some organisation problems for teachers, as not all students in the larger group had their own iPad. However, those who did often shared their computers with other students. The tablets were used to access online information from the school (85%), and 56% reported communicating online with the teacher on school projects. In addition, 85% used social media (such as Facebook), 37% said they communicated with family or friends during school-time using email or Skype, and 30% said that they participated in online chat. Project work could include exploration of nature in the vicinity of the school or on field trips.

During the first weeks of the project, students were not allowed to take the tablets home, but then contracts were made with parents regarding student home-use of the

tablets. Surveys showed that all students brought the device home, and it obviously helped to bridge the digital divide described in many studies between schools and homes. This continuous access allowed students to complete their projects at home and to communicate with peers about school projects, if needed, through social media. When asked about the most frequent use of the tablet at home, 41% of the students said they used the tablet to learn, 33% reported using it for social media, and 19% said they used it for play or entertainment. The majority (70%) reported they were developing skills related to their leisure interests, 63% said they searched for information about subjects/areas not taught in the school, 59% searched for information in other languages than Icelandic, 56% searched for information related to subjects at school, and 30% followed the news. Results from the parent surveys supported these findings.

Boundary Crossing—Local Collaboration and Resources

An effort was made to exploit local cultural resources and to establish partnerships, which brought different funds of knowledge within teachers' and students' reach. Textbooks and workbooks from the National Centre for Educational Materials (NCEM), which normally are distributed to schools as printed material, were made available in digital form so that students could access them on their iPads. They could also access various educational websites of choice and make a collection of gateways of knowledge.

The RANNUM Research Centre organised visits by University of Iceland graduate students for classroom observation, which gave students opportunities to talk about their learning experiences and to demonstrate school projects. The school received many visitors who wanted to view school practices and the use of tablets. According to a record the school principal kept from March to October 2012, 22 visits focusing on the tablet use were recorded: five from schools, eight from universities, and four from institutions or associations in Iceland. The school was invited to give presentations at nine different conferences or gatherings. Conferences were also held at the school, during which students shared their experiences in workshops about iPad use in education.

The school and teachers organised several opportunities for the students to tap resources at the local level. Students crossed the school boundary to interview people, such as actors, a South Pole explorer, or a parliamentarian, to gather information and data for their projects. They also visited several institutions and companies.

Apple in Iceland collaborated with the teachers and students in various ways, such as giving introductions and presenting short courses. The teachers also gave talks at other schools on Apple's behalf. Apple organised iPad workshops at the school, thus attracting visitors nationwide.

Boundary Crossing—Global Collaboration and Resources

During the project period, the school received many visitors from abroad, for instance teachers and council members from Denmark, Dutch teachers and professors from

teacher training institutions, and education leaders from Europe. Nordlinga School teachers travelled on school visits to Denmark. Apple brought foreign guests, who met with school management, teachers, and students. Apple also arranged for an education conference, featuring a foreign speaker, to be held at Nordlinga School (epli.is, 2012). During this event, students acted as hosts to guests. The visits and workshops became opportunities for teachers and education professionals to exchange experiences, and this context-crossing enabled teachers to acquire new ideas and expertise.

Students were encouraged by their teachers to search for free learning resources and apps that would benefit their learning. When students received the tablets in February 2012, they contained around ten apps, but in November 2012 the 29 students had downloaded 582 apps between them. Only two apps of 582 were of Icelandic origin. One student had as many as 132 apps on her tablet, while another had only 21 apps. Teachers introduced learning management tools, such as Nearpod, Educreations, and iTunesU, which enabled students to share learning resources and provided access to open international courses. This gave students opportunities to cross contexts and access knowledge funds previously out of reach.

The 582 apps found on students' tablets in November 2012 fell into 19 iTunes categories. Figure 11.1 shows the number of titles in each category, as well as the number of apps found on students' tablets:

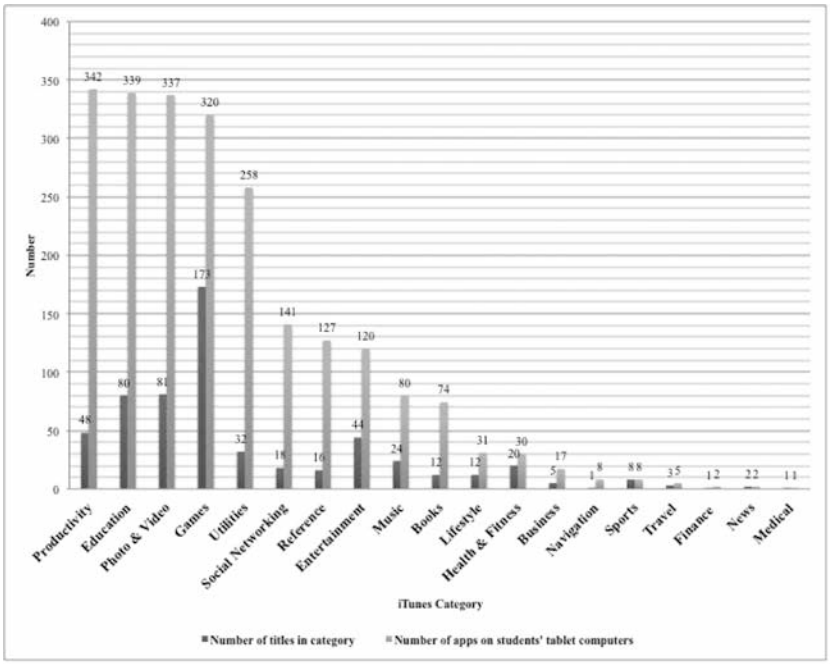

Figure 11.1. Number of titles & apps on students' tablets, according to iTunes categories

In comparison to learning materials available before the introduction of the tablets, when NCEM standard textbooks/workbooks, along with teachers' materials and recommendation of free resources were typical, the affordances of learning resources for students greatly expanded. Teachers introduced some apps, but mostly students were able to make their own choices of education apps (e.g., education, references, books, and business), as well as games and apps relating to their learning lives (e.g., health and fitness, lifestyle, music, sports, travel, navigation, finance, news, and medical) and interests.

This data clearly show that tools for organising students' own learning, tools for productive learning (i.e., productivity and utilities), and creative, multimodal meaning-making (e.g., photo and video) were sought in considerable numbers. Tools for communication, inside and outside of school (e.g., social networking) were in demand. Entertainment apps were also downloaded, sometimes not only for the student's own use but for siblings or even for parents.

Education app titles numbered 80 in total, but 288 education apps were downloaded. An analysis of the education apps indicates a much broader range of learning than that of the main curriculum for this age group, with evidence of students studying or becoming acquainted with, languages such as Spanish, German, Chinese, Japanese, and Korean. Students were preparing for studying at the upper secondary school or, in the cases of students of foreign descent, strengthening their knowledge of a second language and conversing with their relatives abroad. The analysis also indicates changes in the management of learning with apps for planning and regulating students' own studies. Many of the education apps could be identified as supporting teaching and learning in specific subjects. The results of the analysis are shown in Figure 11.2.

Seventy-four *eBooks* were found on students' tablets, mainly written in the Danish and English languages. Students downloaded books of classical literature for pleasure reading.

Students were quite pleased with the availability of *music apps and services* to acquire songs, music videos, and tools. The final student survey showed that 96% of the students reported using iPads to listen to music, both at home and at school. Some students experimented with music-mixing and music-composing. Music was used in project work, as well as for listening to, during school hours while studying:

> Student 1: …it is extremely convenient, what I love about the iPad is that you can listen to music while studying. It really matters, no one learns in the same way, or exactly the same. Personally, I feel good to listen to music while learning…it isolates me and enables me to concentrate.

The category of *games*, along with *productive and creative tools*, signals the arrival of new multimodal forms of learning in the school context. In total, students downloaded 172 game titles, and 320 game apps were found on their tablets. The game apps fell into 41 game genres, as diverse as music, cognitive skills training, dance, and social experiment, but many belonged to more traditional genres, such

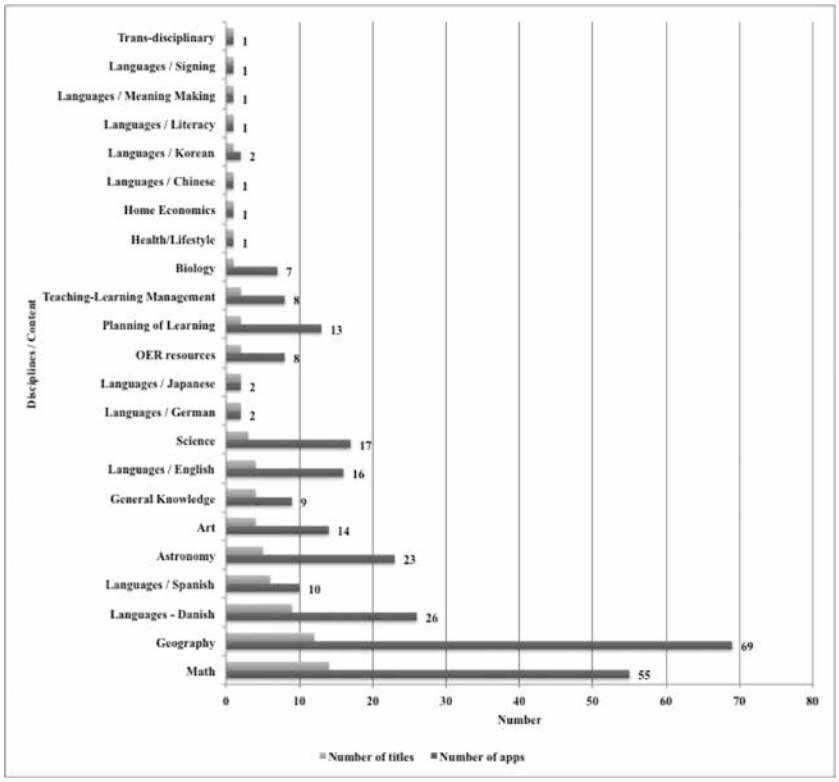

Figure 11.2. Number of titles and apps on students' tablets (education apps)

as action, puzzle, adventure, sport, and strategy games. Some of the games were not specifically educational but could support learning in different subjects (art/design, trivia, words), while others would relate to interest areas of students (building, flight simulation, running, hunting). The variety and number of games was somewhat unexpected and supports the claim that games have acquired a status, nationally and globally, as a specific cultural form (Mäyrä, 2008) which can serve a purpose for learning.

A few instances of game overuse at school did occur during the research period, which challenged teachers, but they were tackled by limiting tablet access to individuals periodically and by providing instruction on responsible app use during school hours. There was a concern that only one app provided access to books in Icelandic, but the teachers compensated for this by creating their own books in iBook Author in different subjects. Apps were of various origin and quality, and choosing and testing them were challenges for teachers, as well as for students. As the school had not allocated specific funds for buying apps, most of the apps

downloaded by students were limited-version apps (lite) or free apps. There is a concern that some apps contained advertisements and commercial references. This suggests an evaluation challenge for students and that the school should consider informing about the origin and quality of apps to guide students' evaluations.

Each student created his or her own *online learning environment*, with storage of apps, project work, photos and videos, and essays (Dropbox, iCloud, and YouTube). Context-crossing from formal classroom learning into online learning environments developed gradually, and some students reported in the 2013 interviews that they had accessed open university courses through iTunesU. This allowed students to jump school levels in learning and to attend international courses offering subjects that were out-of-curricula/school context.

Social media comprised an important vehicle of communication from the very start of the project. Facebook was used for communication about learning activities and school events between teachers, students, and parents. Also noted were several other social-networking tools (17 in total) that students used for emailing, chatting, blogging, messaging, video/audio-conferencing, file-sharing, photo- and video-sharing, collaborating, and working online. Social software of this kind supports different kinds of interaction, such as one-to-one, one-to-many, and many-to-many, with various opportunities for context-crossing (Dron & Anderson, 2014). A teacher remarked on the importance of social media for learning, maintaining that they provided students with additional opportunities for collaboration and extended their time and space for learning.

SUMMARY AND DISCUSSION

In this chapter, we present a case of an Icelandic school implementing mobile learning with a focus on the development of identity and agency through boundary crossing. The Nordlinga school initiative to introduce tablet computers and 1:1 pedagogy can be seen as an attempt to create a learning ecology in which both teachers and students are learning to tackle new tools for learning, and in which experimental and explorative ways of organisation, learning strategies, methods, and content are forming for the benefit of education. A strong vision and willingness to collaborate enabled the teachers and the headmaster to build a framework for supporting progressive school development, as well as participatory and collaborative learning scenarios for students and teachers.

During the tablet project at Nordlinga School, teachers restructured their learning designs by implementing pedagogies that were adaptive to students' learning lives, employing mobile devices and flipped learning. This minimised teacher-centred activities and allowed for an increase in personalised learning. A greater availability of learning resources, specifically through the personal access of every student to the Internet, fundamentally changed the affordances of both students and teachers. Simultaneously, it spurred challenges, such as time control, overuse of games, or entertainment and software evaluation issues.

Trust and respect, as well as the support and encouragement of teachers, provided preconditions for increased motivation and interest in learning, and indicated positive effects on the identities of students. This result is in line with research demonstrating that experiences of successful learning can have a positive impact on students' self-confidence, which in turn can lead to increased agency at school and in different aspects of their lives (Teaching and Learning Research Programme, 2008). The school culture, interest studies, student committees, and opportunities for democratic participation in school management also contributed to the sense of having scope for agentic actions.

Results from the student survey at the end of the project indicated benefits for learners' identity development. The majority reported positive effects of the tablet project on motivation (85%), enjoyment in school (82%), and working with other students (82%). Furthermore, 88% reported positive effects on study performance in general, and 70% on ICT skills. Half the students (51%) reported positive effects on self-image, and the other half indicated few or no effects. The student survey also indicated positive effects on agency in many respects. The majority of students felt this was true regarding the self-pace of learning (82%), independence (85%), and study organisation and planning (82%). Also, 89% felt that they had increased influence on how projects were completed or on the type of projects they did (82%). Surprisingly, however, only 41% thought that they had increased influence on the learning materials used. This could be due to the predetermined use of specific textbooks and workbooks from the NCEM.

There were indications of various positive effects associated with learners' activities of boundary crossing within the school, and between schools, homes, and the local community. Social media played a key role in maintaining communication between teachers, students, and parents, encouraging peer learning and expanding the learning space to the home, nature, and community. Evidence of experiential and informal learning points to developing student identities and increased agency.

The school benefitted from partnering with companies and institutions, which provided expertise and opportunities for developing new ideas and approaches in education. Exploitation of different cultural resources in the local community brought students first-hand opportunities for extending and deepening their knowledge of society and of vocational options. Such exposure offers orientation and preparation for further studies at the upper secondary school level.

The study presented in this paper furthermore shows an effective use of tablets as a boundary object that enables boundary crossings across contexts at the global level. Options for students' personal learning increased with global learning content and opportunities to embark on international courses via global learning-management systems. Our results suggest that it had positive effects for personalised, self-directed learning and identity development, and provided access to resources that promoted agency for students. This development manifested itself in students' learning outcomes through the innovative application of tools, creative

meaning-making, and considerable variation in project work; it was also demonstrated in the acquisition of technical competences and increased media awareness. Students' broad choices of software for learning, productive tools, and games indicated new sources for learning that hitherto had been out of reach. This impacted schoolwork in an unprecedented way and warrants further research, particularly with regard to multimodal literacy and creative aspects of learning.

A follow-up study to the Nordlinga School evaluation study (Ásgeirsson, 2014) was conducted in the spring of 2014. Eleven (38%) of the students from the cohort involved in the tablet project were tracked during their upper secondary school year (2013–2014) and were interviewed at the end of the school year. They strongly missed Nordlinga School and felt that they had experienced a regressive development of their learning, both in terms of teaching methods and in the use of technology for learning. At the same time, they appeared to have a high level of confidence in themselves and seemed to be doing quite well in the "traditional schools." A recent study of students' transitions from the context of lower secondary to upper secondary schools in Iceland revealed a regressive break in their education (Óskarsdóttir, 2012). Students had, for example, to re-learn content when entering the upper secondary school and experienced fewer opportunities to influence their projects and the progression of their learning. As a result, students have fewer options to take initiatives and control of their studies—consequently; their opportunities to exercise their agency are reduced.

In a 2010 Nordic study, 27% of Icelandic students at the upper secondary level reported being bored in their academic endeavours, and 7% said that they often or always found their studies pointless (Guðmundsdóttir, Sigfússon, Kristjánsson, Pálsdóttir, & Sigfúsdóttir, 2010). Upper secondary education in Iceland is suffering from severe drop-out, with only 45% of a student cohort graduating from upper secondary school at the end of the usual four-year duration of study (Birgisdóttir, 2013). This disengagement of students is a major challenge. An effort is needed to work with students' unique interests and experiences, and with the form of agency the learners bring to school from out-of-school contexts (Hubbard, Mehan, & Stein, 2006) in order to reverse this trend. In a world of diversity and constant change, it is important to understand and support students in their connected-learning efforts to encourage an active participation of all at school and in society.

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12. PEDAGOGY OF CONNECTION

Teachers' Experiences of Promoting Students' Digital Literacy

INTRODUCTION

One of the much discussed topics in educational research is the use of information and communication technologies (ICT) by subject teachers. One of the reasons for this is the popular opinion among policymakers and educational researchers that digital and ICT competences should no longer be taught within specialised subjects, such as informatics or computer science but should become an integral part of every school subject curriculum (Haydn, 2010; Tondeur, van Braak, & Valcke, 2007; Voogt & Pelgrum, 2005). Teachers of different subjects are to help students to develop transversal computer skills and information literacy (European Commission, 2014), collaboration, problem-solving skills, creativity, communication, and information-handling skills (Voogt & Pelgrum, 2005). This chapter aims to shed some light on how different subject teachers in Latvia integrate the promotion of digital literacy into their teaching practices.

Many countries, including Latvia, recently have followed the example of Norway, where, in 2006, digital competence in national curricula was defined as one of the five basic core competencies (Krumsvik, 2008), addressing the educational challenges of 21st century and the development of the information society (Aesaert, Vanderlinde, Tondeur, & van Braak, 2013). This adds a compulsory dimension to technology use in education (Aesaert et al., 2013). As in majority of East European schools (Dagiene & Jevsikova, 2012), however, the system of teaching digital competences in Latvia has not changed since the second half of 1980, when a separate subject of informatics was introduced for developing students' digital literacy and ICT skills (Kango & Kangro, 2004).

In general, the concept of digital literacy has many, and sometimes conflicting, definitions (Bawden, 2008). Some of the frameworks emphasise technical skills, but some propose it to be a "specific kind of mindset" (Aesaert et al., 2013). Gilster (1997) compares digital literacy to the idea of traditional literacy, but in the digital age. He states that "digital literacy is about mastering concepts, not keystrokes" (1997, p. 30). In his view, digital literacy is "the ability to read, write and otherwise deal with information using the technologies and formats of the time" (Bawden, 2008, p. 18). On the EU, level digital competence is acknowledged to be "a transversal key competence which enables acquiring other key competences

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 225–240.

(e.g., language, mathematics, learning to learn, cultural awareness" (Ferrari, 2012, p. 1). Gilster proposes a generic view on digital literacy without any exhaustive skills' list. As Aesaert et al. (2013) note, digital competence should be understood more broadly than as just a list of specific skills; rather, it should be understood as a functional, integrated use of knowledge, skills, and attitudes. For the purposes of this chapter, the term *digital literacy* is defined as the umbrella term for addressing the set of knowledge, confidence, attitudes, and technical skills that are related to the deployment of rapidly developing technology, as proposed by Janssen et al. (2013).

However, when it comes to national curricula, digital literacy is often conceptualised as a set of specific ICT-related skills (Aesaert et al., 2013). The transversality aspect of digital competences is often missing in national curricula (e.g., application to other areas or connection with broader societal issues; Dagiene & Jevsikova, 2012). It is also the case in Latvia: among five curriculum aims, digital literacy is defined as the improvement of modern information and communication technology usage skills (Latvian Ministry of Education and Science, 2013). Except for some exceptions in the curriculum of informatics, an emphasis on technical skills for information retrieval, processing, and presentation dominates in specific subject curricula. The national curriculum does not provide guidelines as to how teachers could promote digital skills in their teaching, a situation similar to that of national curricula in other countries (Aesaert et al., 2013). This approach is consistent with the decentralised educational system that Latvia has been developing since regaining independence in 1991 (Bethell & Kaufmane, 2005), which values teachers' professionalism and freedom to choose teaching tools and methods according to the particular topic, available infrastructure, students' knowledge level, etc.

As argued by Loveless (2003), teachers tend to think about ICT as a "specialist subject" (p. 320) with its own specific content and pedagogic realms; therefore, the integration of digital competence into subject teaching remains problematic. Despite the optimistic views about the promotion of digital literacy in every subject taught, some voices (Lin, 2008) also warn about the risks related to this idea. Undoubtedly, teachers play the major role in interpreting the curriculum, shaping pedagogy and deciding about assessment activities. Therefore, Lin's (2008) main argument is that it is unreasonable to expect that subject teachers of various disciplines are ready to adequately teach ICT knowledge and skills to promote them in a holistic and coherent way. Therefore, the need for informatics as a separate subject should not be downplayed.

In this situation, the absence of required pedagogies (Vesisenaho & Dillon, 2013) makes the Latvian teachers' experiences an interesting case for examining the existing practices of how teachers promote digital literacy along with subject-knowledge promotion. Keeping in mind that school systems worldwide still rely on subject- or discipline-based learning (Dillon, 2006), embedding digital skills in subject curricula can be seen also as boundary crossing activity that establishes connections between disciplines (Voogt & Pelgrum, 2005). The concept of *pedagogy*

of connection proposed by Dillon (2006) provides a useful framework for addressing these issues.

Drawing on Dillon's (2006, 2008) framework, this chapter aims to examine teachers' experiences of connecting elements of two subject curricula, namely their experiences in embedding the promotion of digital competences in subject teaching. This study contributes to the body of research that focuses on the interdisciplinary aspects of teaching with the emphasis on teaching *about*, and not *with*, technology (Mikser, Reiska, & Rohtla, 2008). This small-scale study draws on semi-structured interviews with two upper secondary school teachers of biology and English as a foreign language (EFL), who have many years of professional experience and rich repertoires of ICT usage. I picked these two individuals from a sample of 16 teachers because both of them had what Dillon (2006) calls *specialist knowledge* in teaching about technology.

The research questions of the study are:

- What are the digital competences that subject teachers try to promote in their teaching?
- How do teachers integrate digital competences in their subject curricula, and what are the perceived affordances of subject boundary crossing and digital competence promotion in subject teaching?
- What subject-culture-related aspects appear in teachers' reasoning when they speak about the integration of digital competences' promotion in their teaching?

This chapter continues with a brief introduction to the concept of *pedagogy of connection* and the notion of school subject cultures, short insight in the national frameworks for digital literacy, and ICT skills, followed by an analysis and discussion of the empirical data. I conclude by discussing some implications for teacher training and support based on my findings.

PEDAGOGY OF CONNECTION AND SUBJECT CULTURES

Pedagogy of connection is based on the argument that crossing boundaries of specific subjects and making connections between disciplines open spaces for creating something new. Dillon argues that pedagogy of connection:

> brings together epistemological and methodological elements from the contributing disciplines. These may combine and re-form, or they may coexist in a state of tension, or they may contradict each other. These relationships may be explored by (...) associated knowledge claims of the new content. (2006, p. 71)

All knowledge is context-dependent (Dillon, 2006); therefore, for understanding the relationships between elements of the contributing disciplines, the *activity context* and *associated knowledge claims* of the new content should be examined

(Dillon, 2006), as well as the creative potential of the boundary transactions, which is enabled by specific teaching and learning strategies (Dillon, 2007). Dillon situates his arguments within the theoretical perspective of sociocultural theory and activity theory. An important aspect of the latter is the claim that human action is mediated by tools (Sutherland et al., 2004), and teachers' practices can be conceptualised as a representation of tools in forms of specific teaching approaches that enable the connection between different subjects and facilitate the movement of concepts and constructs (Dillon, 2007). Dillon (2006, 2007) takes Shulman's (1987) concepts of specialist knowledge and pedagogic content knowledge as the point of departure for building his argument. Dillon (2006) argues that

> just as discipline-based teaching depends on having pedagogical content knowledge associated with discipline-specific knowledge, then so too should there be a pedagogy that is integral to integrative work in the curriculum. (p. 70)

His concern is that for connecting several different disciplines, a teacher needs the specialist knowledge in all these disciplines and also an understanding of how to teach within the particular discipline. Most of the teacher training programmes prepare teachers for working within one specific discipline.

The pedagogy of connection always contains some degree of flexibility, as Dillon (2008) notes, referring to Moran (2002), who argues that interdisciplinarity comprises a variety of forms of dialogue between two or more disciplines, but that is expected to be transformative while producing new forms of knowledge. Here one can draw on the idea of vertical and horizontal expertise that teachers develop along with ICT integration in subject teaching. Y. Engeström, R. Engeström, and Kärkkäinen (1995) argue that the vertical image of expertise assumes a uniform and singular model of what counts as "an expert" in the field. In subject teaching in the digital-age context, the other model, horizontal expertise, becomes increasingly relevant to transforming the realities of teaching in which multiple parallel contexts "demand and afford different, complementary but also conflicting cognitive tools, rules, and patterns of social interaction" (p. 319). This can lead to hybrid solutions in the subject teaching.

The boundaries of specific school subjects, therefore, should not be addressed as barriers but rather as resources and spaces for learning (Engeström et al., 1995). Encountering the subject boundaries provides opportunity to reconsider the existing assumptions and go beyond what is known and familiar (Akkerman & Bakker, 2011). For the teachers, it means considering how the particular strategies of using ICT tools can potentially support the learning objectives, respectively: how and whether the outcomes of opening the boundaries of the subject teaching will justify the efforts and be sustained as a new practice (Harris, 2002).

However, as the previous research reveals, the integration of digital competences into subject teaching is challenged by school-subject cultures (Goodson & Mangan, 1995). Although the subject communities by no means should be treated as

something very homogeneous and stable (Jephcote & Davies, 2007), they carry and re-produce particular assumptions about what could be considered "worthwhile knowledge," "effective teaching," "the good student," and "appropriate assessment" within a particular discipline. Ellis (2007) argues that subject knowledge is a form of collective knowledge. Teachers collectively are the authoritative source of the subject knowledge and understanding where the subject boundaries lay (Ellis, 2007).

The previous research (Cox & Marshall, 2007; Ertmer, 2005; Hammond, Reynolds, & Ingram, 2011; John, 2005; Karaseva, Pruulmann-Vengerfeldt, & Siibak, 2013; Ruthven, Hennessy, & Brindley, 2004) indicates that subject cultures have a strong influence on teachers' decisions about what type of ICT will be used and on opinions as to how ICT can contribute to students' learning. The previous studies revealed that teachers often refer to "subject boundaries" when they are explaining the choice of technology used in their lessons (Hammond et al., 2011). John and Baggott La Velle (2004) argue that science and mathematics teachers are more willing to integrate ICT into their teaching; these subjects are perceived as having a stronger link to technology. Language teachers, in contrast, are more anxious about "losing the core features and values" of their subject—classroom discussion and the use of printed text (Hennessy, Ruthven, & Brindley, 2005).

Regarding the digital competence, Loveless (2003) suggests that teachers tend to think about ICT as a "specialist subject" (p. 320) in which specific knowledge, skills, and understanding is needed for teachers if they are to embed teaching about ICT-related aspects in other subject curricula. This way of thinking may bring confusion into teachers' reasoning surrounding ICT use in subject teaching (see also Howard, 2013). A recent international study (European Commission, 2014) reveals that situation is changing, and subject teachers now give emphasis, at least to some extent, to the development of their students' computer capabilities. Results vary between countries, but teachers claim to teach students how to access information efficiently, how to evaluate the credibility of digital information, etc. A common practice is to prepare students for using computer software to produce digital content. This study indicates that teachers' computer self-efficacy seems to be the strongest predictor of teacher emphasis on developing students' digital competences.

FRAMEWORKS OF DIGITAL LITERACY AND DIGITAL SKILLS

Regarding the digital literacy and skills in informatics' subject curricula, researchers note that a common international agreement or accepted IT-framework could be useful (Dagiene & Jevsikova, 2012), as it is, for example, regarding languages for which the Common European Framework of Reference for Languages exists (Micheuz, 2008). It is problematic because of a lack of consensus about the concepts of digital competence and digital literacy, which sometimes provide conflicting visions (Bawden, 2008). Achieving a common understanding of the IT field is complicated, due mainly to the dynamics of the field (Dagiene & Jevsikova, 2012).

Dagiene and Jevsikova (2012) argue that the national frameworks of informatics often draw on three axes: (1) teaching students general concepts, definitions, and terminology related to ICT; (2) developing students' capabilities to use new technology for learning and problem solving; and (3) training students in the use of technical skills required to work with technology. The European Commission (2014) recently has proposed the construct of computer and information literacy (CIL), which is conceptualised in two strands. The first strand focuses on the technical knowledge of computers, information access and online evaluation, and information management and organisation. The second strand focuses on using computers as productive tools and individuals' abilities to transform, present, and share information with the help of ICT, as well as be able to use information safely and securely. It includes the abilities to evaluate the reliability and usefulness of information based on its content and source, skills to present information according to the needs of the audience, etc.

As was mentioned in the introductory part of the chapter, the Latvian national curriculum reflects the narrow notion of digital competence, which emphasises the improvement of digital skills to prepare students to work with modern information and communication technology. Better ICT skills for school students are defined as one of five national curriculum aims (Latvian Ministry of Education and Science, 2013). Except for the curriculum of informatics subjects, the emphasis on digital skills prevails further in curricula of specific subjects. Students are generally expected to use technology to acquire, process, store, and present information linked to subject disciplines.

The Latvian standard for the informatics curriculum (Latvian Ministry of Education and Science, 2013), at the upper secondary level, builds on three interrelated components: (1) the basic concepts of ICT; (2) practical skills for learning and research; and (3) ethics and the legal aspects of digital environments. After completing the curriculum, students must be able to apply the acquired digital skills and knowledge to learning and research in different subjects and disciplines.

The first component of the Latvian informatics' standard requires students to learn the basic concepts and terminology related to ICT, as well as to understand how information processing and data transfer networks work. *The second component* involves learning how to handle computers and other popular hardware, create files and folders, create, format, and edit texts, tables, pictures, spreadsheets, and presentations, and work with data bases. Students also must learn how to search information online, send and receive emails, to be aware of the affordances and risks of information publishing online, as well as they are expected to know how to create simple web pages. *The third component* in the Latvian informatics curricula is about online ethics, security, and the legal aspects related to the use of ICT and the Internet, as well as the risks of becoming computer-addicted.

Regarding technical skills and abilities, the Latvian informatics curriculum has many similarities with the framework of CIL (European Commission, 2014).

The higher-level elements are missing from the Latvian curriculum (e.g., skills to evaluate the quality of the online information and the reliability of sources, to focus on the audience needs when presenting information, etc.

PROCEDURE

This study draws on semi-structured interviews with teachers of two different subjects: biology and English as a foreign language (EFL). I selected these two cases from a sample of 16 teachers because both of them had specialist knowledge (Dillon, 2006) about teaching digital competences. Interviews were conducted in spring 2013 as a part of a larger doctoral study (the whole sample consisted of 16 teachers). All teachers come from one average-size (~ 500 students) regional school. Interviews lasted for about one hour each and focused on various topics related to the use of ICT: the teachers' perceived levels of ICT competence, their perceptions of opportunities and constraints related to ICT usage, the professional training they have had regarding the use of ICT, their ICT usage practices in the class, and the ICT-related assignments they give to the students.

First, the audio-taped interviews were transcribed; I then applied the hierarchical coding method (Straus & Corbin, 1998), since the interviews covered a broad range of topics, and I aimed to analyse only the parts that were related to the digital skills inclusion in subject teaching. I did the initial open coding to split the interview material into smaller units of analysis. I then continued with focused coding and close reading of the interview material, specifically looking for and selecting themes and patterns in teachers' speech related to the following: (1) what are the digital competences of students that teachers try to enhance? (2) teaching approaches that influence the ways in which teachers integrate promotion of digital competence in their practice; (3) teachers' reasoning about their motivation to integrate digital competences' teaching in their practice, namely what, according to them, are the perceived affordances of including the promotion of digital competence in subject teaching? and (4) representations of subject cultures in teachers' speech about the promotion of digital skills.

In the empirical data analysis, I focused on the second (practical skills) and the third component (ethics and legal aspects) of the Latvian informatics curriculum for understanding teachers' practices of digital competence promotion. This was due to the limitations of the study: the interview material did not provide explicit answers as to whether the interviewed teachers helped students to learn new terminology and definitions related to technology, which is the first component of the Latvian informatics curriculum. For understanding whether and how teachers teach ICT terminology and concepts, other data collection methods should be employed (e.g., observations, or recording the classroom process during the lessons).

In further data analysis, only these selected parts of the interviews were included, and the axial coding was carried out to look for relationships between these four

categories. As Straus and Corbin (2008) suggest, during data analysis, attention must be paid to axial coding to look for linkages between the categories to present the causal, contextual, and intervening conditions.

PARTICIPANTS IN THE STUDY

The biology teacher had 26 years of teaching experience. In 2005, she joined the team of teachers who created the online educational resource www.dzm.lv (in Latvian) for science and mathematics teachers in secondary schools. In her opinion, technologies help subject teachers to try new teaching approaches and to bring some fun to the learning process. About 15 years ago, she taught informatics for a short period of time and was therefore familiar with the subject curriculum.

She claimed to structure her teaching around real-life problems, and her assignments were project-based and required much active participation on the part of the students, as well as individual and group work in class and at home. The tasks that she gave to her students required the application of different hardware and software for research, information collection, analysis, collaboration, discussion, and presentation. She admitted that students being used to a more traditional and teaching-centred instructional style often have insufficient skills for working with the assignments in her class; therefore, she saw the promotion of digital competence as a natural and integrative part of her teaching.

The EFL teacher had been working at the school for 30 years. Besides teaching school students, because of her interest in different kinds of technology and its application in education, she had become a teacher-trainer, mentoring English teachers in Latvia about ICT usage for professional purposes. For her, technology was, first, a time-saving tool and, second, a gateway to online resources (Baggott La Velle, McFarlane, John, & Brawn, 2004); it was closely related to her belief that language teaching in high school means a lot of drill and repetition to prepare students for the final exam. Grammar and vocabulary skills are essential to pass it with a good grade, she told me during the interview.

Admitting that students often lack skills to search and evaluate information online, she felt it was her responsibility to guide students to the *right* online resources. She had created and was maintaining a collection of digital learning materials which her students could access for practicing and drilling. It allowed her to assign different tasks to students with better knowledge and remedy materials to less performing students. Interview data indicate that her approach corresponds to what Cox and Marshall (2007), Hennessy et al. (2005), and Palak and Walls (2009) describe as a teacher-controlled learning environment in which the teacher has the main role in the overall classroom process, for example, in selecting and providing learning materials, setting rules for technology use, and actively directing the learning process towards the planned goal.

RESULTS AND DISCUSSION

Digital Skills That Teachers Promote in Their Teaching

Regarding the competences for research and learning (the second component of the informatics curriculum), both teachers emphasised students' insufficient skills for *information searching* online, especially the ability to evaluate the quality and reliability of the material found. According to the Latvian informatics curriculum, students learn how to search online by applying keywords and how to store and save the information that has been found, but further evaluation of the quality or reliability of the retrieved information is not required. The EFL teacher argued that students often develop styles of digital information online searching that are far from "systematic" (Wikan & Molster, 2011); therefore, she saw her role here to teach how the Internet can be used for *serious* work and information retrieval. Both teachers claimed to teach their students how to select appropriate keywords for performing more effective searches and for speeding up the process of searching. Both of them helped their students to improve skills for working with different search engines to look for information on data bases. The biology teacher also claimed to help students how to "read" the web, for example, how to handle hypertext and deal with the multimodal character (Kuiper, Volman, & Terwel, 2008) of online information when the necessary information can be found not only in text but also as pictures, animation, video, etc. She paid attention, also, to developing skills for web evaluation (Kuiper et al., 2008), teaching her students how to notice contradictive information about different topics, and also how to assess the authority and reliability of the online information sources. Regarding information retrieval, both teachers clearly promoted elements of a higher-level digital literacy than required in the Latvian informatics curriculum.

The biology teacher was also teaching her students how to work with *specific software*, namely Microsoft Publisher, with which they were not familiar**.** Her assignments included taking and editing pictures, and creating texts and data tables. As a part of the research projects in biology, groups of students created *blogs* for uploading their originally produced content and shared it with peers. A part of the practice can be seen as similar to what students learn in informatics lessons (e.g., word processing and visual editing), but some of it again ensured that students learn skills that are not taught during informatics lessons. By teaching students how to create and maintain blog diaries, she helped students to use computers as productive tools (European Commission, 2014) for creative expression and communication.

Computers as productive tools, in a slightly different way, were used also by the EFL teacher, who promoted her students' skills of collaboration in a digital environment: groups of students in her lessons were writing short stories in Google documents. Previous research indicates that during language lessons, students mainly study individually. However, the use of collaborative environments for

language studies boosts their writing motivation and increases group interactions (Li, Chu, Ki, & Woo, 2012). The EFL teacher agreed with this finding and claimed that students enjoyed writing together with their peers and engaged in the task enthusiastically. At the same time, she told me that it was also an opportunity for her to facilitate the writing process, check the progress, and evaluate the contribution of each participant by reviewing the history of the document. It is worth emphasising that use of technology for promoting student collaborative activities is not mentioned in any of the frameworks discussed previously in this chapter, which indicates that both teachers promoted digital literacy skills that students would not gain by simply attending informatics lessons.

Regarding the third component of the Latvian informatics curriculum—ethics and legal aspects—the biology teacher mentioned that, for her, it is important to improve students' awareness of the online *information overload* and of the ways in which individuals can cope with it. Since her students were producing and uploading content in their blog entries, she had also discussed the issue of copyrights and plagiarism online. These topics are a part of the national curriculum.

Summarising the discussion presented in the previous text, attention must be paid to the fact that both teachers supported the learning of skills that are included in the Latvian informatics curricula; what is more important, however, is that they promoted a number of aspects of digital literacy which are not addressed in the curriculum: the critical evaluation of quality and the reliability of online information; the use of computers as productive tools for creative expression and communication; and the use of collaborative spaces for learning. Lin (2008) argues that it is unreasonable to expect that subject teachers of various disciplines will be ready to adequately teach ICT knowledge and skills. My findings indicate that teachers with specialist knowledge (Dillon, 2006) in ICT help students to develop higher-level aspects of digital literacy which are not included in the informatics curricula because of its focus on technical information retrieval and storage skills rather than the abilities to read the Internet and to evaluate the quality of the content (Kuiper et al., 2008). The next section explains the reasons why teachers view it necessary to promote higher levels of digital literacy.

Teachers' Motivation for Promoting Students' Digital Literacy

The biology teacher told me that she tries to improve students' digital abilities, first, to make the classroom activities more diverse and dynamic, and second, to teach students how to produce and to share original content instead of copying other people's work. Another motivating factor for her was the opportunity to open space for authentic learning with the help of technology. For her, it was very important to involve students in the learning process, and to promote their agency and active participation. She argued that "it is very strange to think that students come to schools to be taught. They are here to learn something by themselves." She emphasised that the teacher's role is "to be there ready to guide [students] if necessary and help

them when it is needed." She also wanted to help students to realise the ways in which biology is linked to other disciplines. Her approach corresponds very much to the constructivist idea in education which describes the teacher as the guide and facilitator of the learning process and who advises the students regarding those online resources which are useful; at the same time, the teacher values student autonomy in doing information searches and evaluation of the information retrieved (Zhao, 2004).

My second respondent, the EFL teacher, was very concerned about her students' performance on the final exams. Her practices of including elements of digital literacy were linked to this concern. With her collection of learning materials, she wanted to ensure that students could do the drilling tasks independently. She argued that the usage of online materials had other affordances, as well—it removed some of the workload from the teacher. "Before computers, all of it [the tasks and exercises] would be on paper, and then I had to do checking and correcting answers. Now the system does it all, and I save time for doing something else," she said during the interview. The use of collaborative documents, in her opinion, helped students to learn the language better, because they were more motivated to write without mistakes in front of their peers.

These findings indicate some interesting points. Teachers' motivation is one of the crucial aspects that influence the use of technology in the classroom. These two cases show that teachers' motivation for using technology can be rather diverse. As a result, teachers can promote different sets of skills which are derived from their choices of technology and teaching methods. One can only speculate what would be the teaching methods for making the biology classes more diverse and attractive if the biology teacher were a less confident ICT user. The same applies in the case of the EFL teacher. Both practices indicate that the teachers' motivation determines why a particular tool or method, and how it is linked to the dominant instructional style (Zhao, 2004), as well as to the goals that the teacher strives to achieve.

Representation of Subject Cultures in Teachers' Practices

In technology-supported pedagogy practices, technology can function as a replacement for the existing instructional means, as an amplification tool that helps to accomplish tasks more efficiently and effectively while not changing the task. Or technology can serve as a tool for transformation, which changes the cognitive processes of students and the instructional practices of teachers (Hughes, 2005). For the EFL teacher, very active ICT use during lessons was combined with a strong belief about what *counts as knowledge* in English at the upper secondary level. The interview data indicate that the EFL teacher is much more concerned about maintaining the language subject boundaries than the biology teacher, who is more flexible and tries to integrate the subject teaching into the larger context and to link the knowledge of biology science to other disciplines. During the interview, the biology teacher emphasised that an active employment of ICT allows teachers *to go beyond accepted norms and rules*. Most probably, her experience of teaching

informatics years ago, which meant being familiar with the curriculum of this subject and having already developed practices of teaching it, helped her to be more flexible and creative in integrating elements of ICT teaching into her practice. According to Hughes (2005), the technology in her classroom helped to transform the learning process and to bring changes that would not be otherwise possible.

The EFL teacher's motivation for digital skills inclusion in her teaching was related to the need to learn the curriculum in a more effective way, to speed up the learning process, and to prepare students for examination. Technology, in her practice, played the role of amplification (Hughes, 2005). It is important to note that foreign languages are among the four school subjects in which students in Latvia are to take centralised exams in Grade 12. This, combined with the teachers' strong feeling of responsibility for her students' success with exams, seemed to be a significant obstacle for more diverse approaches to technology deployment in her classes. As a teacher-mentor on technology usage for language-learning, the EFL teacher was very familiar with the pedagogic affordances of a diverse range of ICT tools. But, as she emphasised during the interview, involvement in many creative tasks during the lessons and allowing the students to learn at their own pace would slow down the study process and put the curriculum at risk. Her answers indicated that she felt very responsible for the language abilities of her students, which will help them to become successful in their further studies and in their careers. This echoes the idea of Munn and Lloyd (2005), who argued that "schools cannot help but be highly conscious of their public accountability for pupils' attainment" (p. 209). The EFL teacher's practice also illustrated the idea of Lim and Chai (2008), who draw on the work of Gibson (1979) and note that teachers may "perceive a particular affordance of the computer tool, but their pedagogical beliefs, competences or sociocultural contexts, and objectives of the lesson may prevent that affordance from being attended to or taken up" (p. 809). Previous studies (Sutherland et al., 2004) have found similar tensions and confusion about the integration of ICT among science teachers who have worked in the context of doing science "in a practical way" (p. 416), which is based on learning activities that are very practical by their nature and include the use of experimental equipment.

CONCLUSION

This chapter aimed to shed some light on how subject teachers integrate the promotion of digital literacy into their teaching. The inclusion of particular aspects of digital literacy were identified and discussed, as well as the motivation of teachers to include promotion of digital literacy in their practices. Subject cultures were applied as a useful framework to explain the apparent differences in the practices of a biology teacher and an EFL teacher. To summarise my findings in a more coherent way, I refer to the concept of pedagogy of connection.

First of all, pedagogy of connection implies that crossing boundaries of specific subjects and making connections between disciplines open spaces for creating

something new (Dillon, 2006). In both cases, the integration of aspects from the Latvian informatics curriculum led to something new. For the biology teacher, it was an opportunity to promote her students' creative, collaboration, problem-solving, research, and communication skills. It clearly overarched the framework of digital literacy that is defined in the Latvian informatics curriculum. Her practice seemed to support the development of higher-order thinking and reasoning skills, which is not emphasised in the curriculum. The teacher promoted task based authentic learning with the active use of different technology for research and practical projects in which students were involved. The English teacher supported her students' abilities to structure information and to learn to use digital resources for systematic and self-organised learning. She wanted her students to understand the educational value of online resources and to develop their skills as future independent learners. Her practice extended the idea of digital literacy beyond the framework that is defined in the Latvian informatics curricula. Another element of crossing the boundaries of the particular subject for the EFL teacher meant also acquiring a new role as a teacher: becoming a digital curator/aggregator, or the maintainer of a digital learning material collection.

Dillon (2007) also emphasises the importance of teaching strategies that trigger boundary transactions. As the two cases illustrate, boundary transactions might not be dependent on the dominant teaching style. The biology teacher's approach was much more student-centred then that of the EFL teacher, which was somewhat close to the traditional teacher-centred instructional style. What opened up the boundaries of the subjects was their deliberate choice to include promotion of students' digital skills in their teaching, which was clearly stated during the interviews. According to Harris (2002), teachers had evaluated the potential risks and opportunities to cross the boundaries. In both cases, the teachers had prior specialist knowledge in teaching about ICT, which might be one of the reasons why they had arrived at hybrid solutions (Engeström et al., 1995) in their teaching.

Teachers ended with promoting rather different sets of digital competences, because the contexts (Dillon, 2006) in which they operated were different. The EFL teacher's choices of technology use were based on the need to speed up the learning process to prepare students for exams and to reduce some of her workload. The biology teacher's reasoning for promoting digital competences and for making her ICT choices was based on the argument that students need to understand biological concepts through authentic learning.

My study points to the need to continue discussions on the idea that digital and ICT competences should not be taught within specialised subjects, such as informatics or computer science; rather, they should become an integral part of every school subject curriculum (Haydn, 2010; Tondeur et al., 2007; Voogt & Pelgrum, 2005). As the two teachers' practices indicated, ICT-confident teachers can promote sets of digital skills which stretch far beyond the traditional curriculum of informatics, where the main emphasis is on providing technical abilities. My study shows that teachers can help students to develop aspects of digital literacy related to critical thinking,

independent studies, collaboration, creative expression and communication, problem solving, and other skills which are needed to tackle the challenges of the present information society (Aesaert et al., 2013). Without a doubt, schools still have to play a key role in providing digital competences to the "digital natives" (European Commission, 2014). Inclusion of digital-skills promotion still seems more welcomed than required in subject teaching due to the lack of clear guidelines in the national curricula on how these skills should be promoted (Aesaert et al., 2013). Lin (2008) asks whether the subject teachers can be held solely responsible for the promotion of digital competences of their students. Therefore, drawing on my findings, I would suggest that subject teachers *not* be viewed as the main providers of digital competences; rather, their task could be to demonstrate how the skills that students acquire during informatics lessons can be transferred to other disciplines and used as the starting point to amplify the transformation of learning in different disciplines (Hughes, 2005). This calls for the adaptation of approaches in teacher training that encourage them to try hybrid solutions (Engeström et al., 1995), leading to practices that are aimed at subject boundary crossing and interdisciplinary teaching. In-service teachers, as the principal sources of authority over subject knowledge and subject boundaries (Ellis, 2007) in schools, should be given enough support and opportunities to learn from each other to face the challenges that technology introduces to their teaching and to widen their repertoires of ICT usage in ways that enhance their students' digital literacy.

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COMMENTARY

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13. CAN STUDYING LEARNING ACROSS CONTEXTS CHANGE EDUCATIONAL RESEARCH OR WILL IT LEAD TO THE PEDAGOCIZATION OF EVERYDAY LIFE?

At first glance there appears to be something both backward and forward looking in this collection. The ambition to study learning across contexts harks back to the early progressive ambitions of sociocultural theory to conceptualise learning in ways that emphasise its rootedness in cultural practices rather than privileging forms of education shaped and privileged by academic schooling in contemporary societies (Scribner & Cole, 1973). At the same time the collection is highly contemporary, looking forward to an interconnected social life where school is only one site for learning amongst many and where the value of learning has permeated many different social contexts (Edwards, Biesta, & Thorpe, 2009). The fact that the authors of this collection, and the project, which initiated it, are Scandinavian is no accident and bears heavily on this dual perspective. Whereas lifelong learning has attracted criticism for its colonisation of everyday life and the imposition of responsibility for continuing education onto the individual (Field, 2006), Scandinavian societies, as represented by the analyses in this collection, still hold onto state supported educational initiatives as a guarantee of social mobility and persist with an enlightened, non-surveillant conception of the distribution of learning experiences across social life in general – significantly motivated by humanistic beliefs in the growth of the person (*bildung)* (Biesta, 2011).

There is also an immediate and current policy focus to this work in that as it directs the readers' attention across a wide range of contexts, this collection is also making the argument that it is premature to limit any understanding of education to schools-based outcomes: and this is not a popular position in the UK or the United States at this time. This is mainly a question of understanding learning more broadly than as simply measured by standardised testing and again the collection's Nordic origin reveals a broader concern with personal well-being and a wider understanding of the benefits and purposes of education in general (Sahlgren, 2015). Although a number of the essays here are set within school and concerned with progress within formal academic disciplines, nevertheless the thrust of the discussion has been to open up ways that learners travel across contexts and how contemporary epistemology is best understood in terms of distributed and plural knowledge(s) rather than a set of easily digestible facts.

O. Erstad et al. (Eds.), Learning across Contexts in the Knowledge Society, 243–251.

The introduction to this volume drew attention to the potentially transformative role of digital technology in both disrupting existing contexts for learning and creating and linking to other and new ones; yet it remains a paradox that despite such innovations and such faith in them, the main response of public education systems around the world has been to retrench and concentrate on standardised and tested outcomes in the face of ever-increasing possibilities for alternative ways of arranging and measuring learning. In general, it should also be added, the authors in this collection have actually drawn on the stimulus any attention to the digital has created, as a way of looking at anew at social relationships as they are constituted within and across formal and informal learning environments. It is not so much that the digital has opened up startling new learning contexts more that it has focused attention on the challenges of building learner agency and the way that the credentialing power of authority in schools has been both unsettled and reasserted.

For the rest of this essay I too want to draw from the boundary of the new and the old, the established and the innovative, the backward and forward in order to explore two challenges thrown up by this collection. The first of these derives from the fact that digital research methods now mean that it is possible to find out much more about the ways that learners themselves move between/across/within learning contexts and that the long-standing interest in learning across contexts can be investigated by following or tracing learners themselves. Secondly I want to take up the challenge posed in the introduction that there has been an intensification of interest in learning to the point where it is now plausible to talk about a pedagocization of everyday life – a term or concept which carries with it, fraught values and polarized debate.

FROM LEARNING ACROSS CONTEXTS TO FOLLOWING LEARNERS ACROSS CONTEXTS

The scholars in this collection are particularly interested in the question of how knowledge and learning *travel* across different kinds of contexts and are then applied and reapplied with and to different forms of understanding. We tend to use terms like 'travel', 'transfer' and crossover' to describe the processual (Drotner, 2013) nature of identifying and theorizing phenomena for analysis but this language, and these metaphors actually frame some limits when applied to 'following' learning across contexts.

In trying to open up the vexed challenge of theorizing learning transfer to make sense of how we learn across social contexts, and what learning might mean in more informal domestic circumstances, Reed Stevens and his colleagues offered a series of detailed studies of gaming in the home (Stevens, Satwicz, & McCarthy, 2008). They argue that we need to look at the 'dispositions and purposes' that people bring with them to experiences and then 'what people *make* of experiences in other times and places in their lives' (p. 63/64 original italics). Learning, they suggest is the processes of interpretation as people reach back and forth across experiences (and the meanings that have been attributed to them). Rather than focusing on the learning

experience in isolation we need to pay attention to how learners conceptualize, contextualize and reflect on experiences and what resources they use and draw on to do this. They suggest that only by developing methods that allow us to study people across and within a range of settings can we see how people actively juxtapose, reject, select, contrast or build on experiences. This suggests the need for a research focus that captures both an intra-personal historical dimension, as individuals frame their experiences over time, as well as a way of describing the types of understanding – the language and values that circulate within it (for an example, see Livingstone & Sefton-Green, 2016).

Scholars who have taken up this challenge of following or tracking young people across settings and over time have not always made the idea of learning an explicit focus of their work. Some of the most absorbing and narrative rich multisite ethnographies are place-centered, but as in the tradtion of Paul Willis' work (Willis, 1978) concerned with political questions of social reproduction and the relationship between the formation of subjectivity and class identity. Lois Weiss similarly followed cohorts of young people into adulthood, parenthood and work (or un and under employment), (Weis, 2004). These studies implicitly develop theories of learning as part of the way they account for how the young people in these studies change over time. Additionally, and possibly as a consequence of this attention to people over time, these studies are explicitly concerned with the role of formal schooling from both institutional and experiential perspectives. The authors balance a focus on critical moments with an attention to the effects of slow change where the attritional nature of difficult living conditions inevitably frame and reframe aspirations as the characters in these books build lives for themselves. Inevitably this means defining what constitutes learning – what might be the phenomenon we can observe and study – as complicated and politically contentious. At an in-principle and theoretical level who defines what learning is, and when it is learning, is also part of this problem (Green & Luke, 2006; Ladwig, 2010).

Here also the concept of a transition (another vector–based term) as both describing a movement across institutional boundaries and an intra-personal process of change and growth has been important: (see Ecclestone, Biesta, & Hughes, 2009). The longitudinal studies in this tradition do follow individuals in considerable detail across important institutional boundaries: from home to independent living; across educational institutions such as school or university; into relationships and taking on of family responsibilities and so forth. The processes of understanding and conceptualising transition, of mediating and coping with significant change at the same time as observing continuities in the self and in the everyday are well captured and theorised in these longitudinal studies and yet rarely enter into the micro- and temporally focused studies of children and young people's learning across contexts.

Similarly, the attention in this literature and that of the wider lifelong learning tradition (see for example, Edwards, 1997), on the place and meaning of schooling within the subject's 'life' and therefore how conceptions of schooling determine understanding about the meaning and purpose of learning, is also an influence in

this field. Different conceptualisations of the instrumental or the intrinsic value of learning, the value of rote learning or of exposure to new experiences and how such ideas relate to different cultural expectations helps us disentangle generational debates within the family about the purposes of learning. Making sense of learning over time thus almost always depends on how we interpret the reflexivity of those that we study. Reflecting on transitions, situating the meaning of choosing a particular subject of this or that high school in relationship to an understanding of the family narratives about learning – even talking about learning in non-academic domains – all rest on how subjects make sense of and interpret these experiences. Rachel Thomson draws attention to how we can make sense of 'the meaning of reflective performances in relation to particular social fields' (Thomson, 2009: 172). She suggests that studying 'learning lives' (Erstad & Sefton-Green, 2013b), involves the relationship between identity, subjectivity and possibility; that is, the kind of person young people want to be, their sense of themselves and the social possibilities open to them (172). Her work and that of others (for example, McLeod & Thomson, 2009), alerts us to the need for a wide range of processual methodologies drawing on memory work, oral history, generation and revisiting as well as exploring time and emotions in research practice.

All of these kinds of longitudinal study are of course the traditional way to understand change over time but, as the authors collected here have argued, sociocultural attention to the interplay of identity, context and forms of knowledge also makes visible the reinforcement and disconnection we all of us build for ourselves as we construct theories of learning to make sense of the social practices we encounter in our everyday lives. Traces of these kinds of interactions are now more permanent and visible as they frequently occur in digital media and one key challenge for research in the future that begins from these questions will be the impact of big data and the host of micro-transactions that we can now collect around social interactions-in context. The burgeoning field of learning analytics (see: http://learning-analytics.info) suggests that intra-institutional learning across contexts can now be gathered at scale. The kinds of scholarship recounted above is labour intensive and frequently centred around individuals or small groups in order to build up the weight of historical evidence, yet it may soon be possible to begin applying the same kind of perspective using forms of digital ethnography.

Whilst learning analytics so far is more concerned with understanding the meaning of measurable and observable outcomes it will be interesting to see whether the kind of tracking across institutional spaces and within social networks (see for example, Silverman, 2015, or Schneier, 2015) can be harnessed to complement the intellectual tradition we have grown up with in order to challenge what it might mean to study learning across contexts. This will also mean a shift from individual or small case studies which of course populate this book and which we know have little status in larger policy debates about education. Given much study of learning across contexts is at this micro-interactional level, these new opportunities to broaden out a hitherto limited range of methods to capture what are extremely difficult and complex social

phenomena many offer the sociocultural tradition a much more dynamic future at the centre of debates about education.

OR TOWARDS THE PEDAGOCIZATION OF EVERYDAY LIFE

However, in a post-Snowdon age it is impossible to see the application of big data and the capacity to trace social interactions across contexts even the tradition of longitudinal ethnography entirely innocently (Schneier, 2015). Whilst the section above argued that studying learning across contexts may help disrupt the emphasis on standardised and measurable outcomes and thus frame study of what it might mean to be educated (Levinson, Foley, & Holland, 1996) within the sociocultural tradition – a move I have emphasised several times, with significant political implications and one which sits far more easily within the more liberal social democratic societies of the Nordic countries – it is not without its consequences. Key to this more dystopian interpretation of the interest in studying learning across contexts is the fact that whereas education used to be understood as a public good, now the burden to be involved in leaning can be seen as part of the management of risk in an individualized society (Chisholm, 2008).

From this perspective an interest in learning across contexts can be seen as a larger project to pedagocize everyday life where in a remorseless, exhaustive, 24:7 regime, all forms of social and leisure activity can be 'curricularised' (Buckingham & Scanlon, 2000, and see also Kenway & Bullen, 2001) and turned to educational ends. In particular, the learning lives of parents and children outside of school are subject to increasing scrutiny and attention (Nixon, 2013), and there is intense pressure on family life to ensure that growing up is spent purposefully with a particular emphasis on engaging in educationally 'worthwhile' activities (Lareau, 2003). Many commentators explain this intensity of attention to what was hitherto the more private and un-circumscribed leisure time of young people as a consequence of increasing competition in an accelerating global war for talent in the current economic climate (Brown, Lauder, & Ashton, 2011; Ito et al., 2013; Mason, 2015). These scholars suggest that an increased anxiety about employment, in the context of a globalised economy, has led to an increase in private, family-centred learning driven by the commercial interests of the 'edutainment' leisure industry (see for example, Buckingham & Scanlon, 2002; Ball, 2008).

Key ideas in this regime are the ideas of 'informal' and 'non-formal' learning, the utilisation of after-school and community activities and, intermixed with all of these, the role of digital technologies as both medium and resource for this expansion (Sefton-Green, 2004; Sefton-Green, 2013; Erstad & Sefton-Green, 2013a). Of course, the idea that we are living through a period of intensification, that time previously given over to 'childhood' or the leisure activities of youth are now being monitored and controlled in different ways, begs three important questions. The first of these is historical. Whilst it makes for a compelling critique that growing up in the digital age means that private and leisure time activities are now being

colonised by the pressures of neoliberal forms of subjectivity, the empirical evidence about the nature of childhood and leisure or changing attitudes to learning is more difficult to find and to interpret (Buckingham, 2000). The second challenge is more conceptual. Research into forms of learning in non-school contexts has frequently been provocative – especially the attempts to recuperate what are commonly seen as 'non-educational' pursuits like computer games (Gee, 2004) – and have helped to develop theories of learning beyond the school. These theories characterise an ever-increasing range of social engagement as learning and as pedagogy, thus subsuming our interest in learning across contexts into a more surveillant gaze (Rose, 1999).

Thirdly, schooling is frequently given prominence as a kind of meta-level organisational metaphor for all kinds of teaching and learning. The question then becomes whether pedagogy is a kind of master metaphor extrapolated from the wider pedagogicization of modern social life and has traction because of its place within that paradigm or whether at a technical level it offers us something new as a way of explaining how we become who we are. Pedagogy can be used as a theory to explain older and other kinds of force as an example of power (as in Bourdieu and Passeron's (1990) formulation of 'symbolic violence for example). It seems a particularly effective way of theorising structuration in that it appears to offer a way of making sense of agency (the activity, the motivation and drive of the learner) as well as the determining influence of structure (the 'curriculum' however, or wherever that is defined, (Buckingham & Sefton-Green, 2004)).

The spread of schooled forms of discipline into wider social life is thus described as the pedagogicization of everyday life, but strangely enough this is not a widely explored or theorised concept. This may be because the word itself, 'pedagogicization', is so terrible. At a macro level, the idea has been useful and is often glibly used, especially in the Foucauldian tradition, and it also seems to be widely used in the Germanic intellectual traditions to explain structuring processes (Depaepe, Herman, Surmont, Gorp, & Simon, 2008). The sociologist Basil Bernstein used the term to describe how the discourses and practices of schooling 're-contextualise' knowledge and understanding in an excluding and exclusive fashion (Bernstein, 1990). His work describes a conflict between casual everyday knowledge and disciplined controlled and arcane expressions of 'formal knowledge'. He emphasised how school 're-contextualises' knowledge seeking to impose disciplinarity and exclusivity on new and emerging domains especially with regard to the use of specialised academic language (Moore, Arnot, Beck, & Daniels, 2009; Tyler, 2004). His later work argued we are living through a wider pedagogicization of society involving the spread of school-like forms of organisation and subjectivity beyond the boundaries of traditional learning institutions, describing this as the 'totally pedagogicized society' (Bernstein, 2001), situating it, in line with the arguments in the introduction to this volume, as part of the reclassification of traditional knowledge boundaries coming about as a result of the knowledge society and the economic imperatives to engage in lifelong learning. From this point of view, learning across contexts speeds up and connects previously disparate educational experiences incorporating them in the

pedagogic gaze. One implication then is that researchers such as those collected in this volume who clearly start with an enlightened and idealistic interest in making sense of learner agency and in empowering learners to reflect on and make sense of a wide range of experiences, are actually playing their part in the expansion and incorporation of the pedagogicized society.

CONCLUSION: KNOWING TOO MUCH, NOT KNOWING ENOUGH OR NOT-KNOWING

Studying learning across contexts is an ambitious intellectual challenge. It requires significant resources for research, especially time and complex multiple methods. It is difficult to do at scale yet crucial not only to understand the different kinds of learning that are embedded in diverse forms of social participation but in raising important challenges to the dominance of a simplified uniform notion of schooling enjoying so much political popularity across the societies of the global North. This volume contributes to that debate even if one of the messages from this collection is that we don't know enough about how to study learners learning across contexts or indeed how to study their learning within more than one context at a time.

However, the possibly strange pedagocized, surveillant world where every trace we make can lead to data maps and large-scale patterns of social behaviour and interaction (Lima, 2011), and where lifelong learning becomes a burden for the individual negotiating their way through late modernity might also mean that our interest in learning across contexts paradoxically can lead to the diminution of the kind of educational values we set out to espouse. Here knowing too much maybe a cause for introspection and a reflection on the politics of research.

It seems impossible for any intellectual agenda not to be able to draw on the new social sciences that shed insight onto connections, disconnections, networks and social relationships. This may be a project whose consequences we cannot yet foresee but the careful and conscientious work of the young scholars collected in this volume suggest that the ambition to truly know what it might mean to learn across contexts is going to engage with these assumptions and these desires head-on.

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