

TECHNOLOGY IN L1

A Review of Empirical Research Projects in Scandinavia 1992-2014

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Abstract

In recent decades, several Scandinavian research projects have had an explicit focus on how technology intervenes in L1 (or so-called Mother Tongue Education) practices in Swedish, Norwegian and Danish educational contexts, and how this may impact on understanding of the subject. There is currently no systematic overview of the documented possibilities and challenges related to the use of technology in L1. At the same time, there is terminological confusion in use of 'technology' and related concepts in L1. Finally, there is a general lack of critical reflection on the relation between technological developments, political rhetoric, and the development of L1 teaching and learning as a social practice related to specific contexts and actors. Thus, the paper attempts to answer three interrelated research questions: 1) what do we mean when we talk about 'technology' in L1?; 2) based on a systematic review of empirical studies, what characterizes the research field?; and 3) for discussion, which broader implications does the review suggest for a rethinking of L1 in terms of practice and research? Introducing the notion of educational boundary objects, a theoretical framework is developed, which suggests four metaphors for understanding technology within L1: as a tool, as media, as socialization, and as literacy practices. These are found useful for analyzing and comparing both theoretical perspectives and empirical research on L1. A key finding of the study is that, although the included research is characterized by a large degree of diversity, the conceptualization of technology as media is a dominating approach which downplays aesthetic, critical and tool-oriented perspectives. Another finding is the large number of studies that focus on student practices within L1 and the relationship to out-of-school literacy practices. A final finding is the emphasis on teacher uncertainty regarding how and why to integrate technology within existing paradigms of the subject. This calls for further research on how technology may be justified in L1 practice, including various forms of teacher education.

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1. INTRODUCTION

Public interest in the relationship between technology and education was enhanced by a Danish newspaper article in November 2014. The article “The Green Table – version 2.0” (Jessen, 2014) describes a press release from the Danish Ministry of Education announcing that the Minister for Education wants to change the legislation so that *all* final written exams in *all* Danish secondary school subjects in Year 9 are based on digital technology and give students access to the Internet. A Danish L1 educational researcher, who is also an expert in the integration of educational technology in subjects and a consultant for the Ministry of Education, supports the development, and is quoted as saying that new forms of exams reflecting new technological developments in society are required; whereas a more critical voice, a professor of education and the head of the Danish PISA consortium, questions whether such exams would reduce the teaching and learning of basic literacy skills and make it possible to test and compare Danish students’ literacy skills internationally. The article contextualizes the announcement by stating that the proposal reflects a development which has been underway for some years in Danish upper secondary education and is now being implemented in several subjects, including Danish as an L1 subject (so-called Mother Tongue Education).

The news story reflects general developments that have been dominating educational discourse and, more specifically, discourse in the field of L1 research and practice for more than two decades in Denmark, other Scandinavian countries and elsewhere. Broadly speaking, the rapid development of communication technologies – particularly since the emergence of digital communication from the end of the 1970s and the World Wide Web in the 1990s – have led to a new focus and questions on the relationship between technology and education (Nordkvelle, 2007). However, a brief review of this development clearly shows that the rationale for engaging in technology differs when comparing political rhetoric with educational research. Even within research, both diversity and controversies are found: Is it a good thing, a bad thing, or something in-between?

From the *political* point of view, it is almost always a good thing. Great expectations have emerged regarding digital technology becoming a powerful tool for developing educational activities and gaining access to ‘the information society’ vis-à-vis ‘the knowledge society’. One contemporary example is the European Commission’s *Digital Agenda*, which suggests a “strategy to help digital technologies, including the internet, to deliver sustainable economic growth” (EC, 2010; cf. EC, 2006). The strategy clearly indicates that the rationale for focusing on technology is to become economically competitive in a globalized world. Following the same line of reasoning, the Organization for Economic Co-operation and Development (OECD) argues that the use of ICT has not developed in an educational culture, but outside schools. The OECD (2001) contends that, for this reason, there is an inher-

ent tension between teaching based on ICT on one hand, and traditional ways of judging and examining work in schools on the other. Reflecting such political impulses focusing on the (economic) potential of new technology, Scandinavian countries – Denmark, Norway and Sweden – like other European countries have invested large resources in ICT, becoming a natural and important part of school teaching. Consequently, ministries of education in the three countries have sponsored research and development projects based on the assumption that the developed use of digital media leads to educational change and hence better and more effective teaching that eventually leads to better and more effective knowledge production (SOU 1994; UFD, 2004a, 2004b; UVM 2001).

From the *researchers'* point of view, it is less of a good thing or, rather, it is regarded as a complex development interpreted in different ways. Some educational and/or media pedagogical researchers argue in a way that reflects, at least to some extent, political discourse, and wish to direct further research into the interplay between literacies, media, and education. For example, Drotner & Erstad (2014: 1) propose that “media literacies are being acknowledged as a key competence across a range of life functions and policy domains” and claim that:

Changes in the media practices of young people have revolutionized the ways content is created, modified, and shared in our societies. These developments, wherein users themselves create content by employing multiple modalities to remix existing content, challenge the very idea of educational content as being book-prescribed and teacher-taught (Drotner & Erstad, 2014: 11).

Other educational researchers focus more empirically on teaching as a social practice *at schools* and *in classrooms* amongst *teachers and students* and have shown that grandiose political expectations or ‘revolutions’ have not been ‘implemented’ (a term which is itself contested), and that claims may be highly overstated when compared with practice (e.g. Arnseth *et al.*, 2007; Erstad *et al.*, 2005; Hennessy *et al.*, 2005; Jedeskog, 2005; Balanskat *et al.*, 2007; Livingstone, 2012; Elf, 2009; Tække & Paulsen, 2013; Selwyn, 1999, 2014). As Sonia Livingstone – herself a promoter and researcher of ICT and media literacy and a consultant for European governments – puts it in the article “Critical reflections on the benefits of ICT in education”:

In both schools and homes, information and communication technologies (ICT) are widely seen as enhancing learning, this hope fuelling their rapid diffusion and adoption throughout developed societies. But they are not yet so embedded in the social practices of everyday life as to be taken for granted, with schools proving slower to change their lesson plans than they were to fit computers in the classroom (Livingstone, 2012: abstract).

In this way, some educational research(ers) raise critical empirical questions about a more complex and less one-sided deterministic relationship between technology and the development of teaching and learning (in) subjects. In this article, we want to position ourselves within this empirical and critical line of research. As a point of departure, we argue that school practices do not simply play the melody of political

rhetoric on new technology. Instead, old technologies related to how schooling and classrooms are and have been construed for more than a century (cf. Cuban, 1993) play a dominating role. Technologies used for teaching and learning practices, including those found in exams, change in slow, less controllable, and unexpected ways.

Some researchers engaged in studying 'lesson plans', to use Livingstone's term (that is, curriculum researchers and 'Didaktik', 'subject-specific' or 'disciplinary didactics' researchers as we would term them in the Northern European region, cf. Nordkvelle, 2007; Gundem, 1998), try to understand and explain the (dis)integration of technology in subjects. One suggested explanation is the epistemic structure of subjects and how it influences the use of technology. For example, Hennessy *et al.* (2005) argues that the incorporation of ICT varies among different school subjects because subjects have unique characteristic structures that are very important for how digital media can be integrated (cf. McEachron, 2003; Baggott *et al.* 2003). Olson (2000) has shown that in some school subjects digital media are regarded as a "Trojan horse" (Olson, 2000), standing in conflict with the traditionally deep-seated "subject grammar". In other words, the social practices of school subjects are embedded in deep understandings of the subject's knowledge regime, which co-shapes technologies more than technologies shape the subjects (Jewitt, 2006; Elf, 2014a-b). Further, the conception of subject cultures is closely related to teachers' and pupils' attitudes to and hence use of digital media in classroom practice (Goodson & Mangan, 1995; Sutherland *et al.*, 2004; Selwyn, 1999).

1.1 L1 review in a Nordic perspective

Focusing specifically on L1 in a Nordic perspective, Erixon (2010) deals with how school subjects' "paradigms", i.e. the established content of teaching and the way in which teaching is traditionally organized, are being influenced as digital media become increasingly common in educational contexts. The study shows that teachers in lower secondary school use so-called new media to a relatively limited extent but that they are ready to develop their use if resources are made accessible. They also believe that the content, working methods, relations and the role of the teacher are changing, usually for the better. Erixon speculates whether this development reflects a broader tendency of paradigmatic change in Nordic L1 subjects and beyond (2010; cf. Elmfeldt & Erixon, 2007).

Erixon's study is one of several studies in a Scandinavian L1 perspective that has had an explicit focus on how technology intervenes, or may intervene, in L1 practices in Swedish, Norwegian and Danish, and how this may impact on the epistemic and/or paradigmatic understanding of the subject – similar studies are found in Denmark and Sweden, as we shall see later.

Although acknowledging that change in L1 is indeed evolving, some Nordic L1 researchers question the notion of paradigm, arguing that this term is too broad for

understanding the variety and dynamics of L1 subjects, and suggest alternatives such as a change in subject “discourses”, and “culture” (Ongstad, 2012a).

The so-called *Nordfag.net* study (Elf & Kaspersen, 2012) offers an interesting comparative reflection on this question as it involves researchers from Norway, Sweden, and Denmark investigating local teachers’ practices and analyzing data across national contexts and in a Nordic perspective. The study takes as its point of departure Sawyer and van de Ven’s notion of four paradigms in mother tongue education that have emerged since the mid-19th century – the academic, the developmental, the communicative, and the utilitaristic (Sawyer & van de Ven, 2006). Based on teacher diaries and interviews, the study explores how L1 teachers in Denmark, Norway, and Sweden conceptualize L1. The main finding is that the L1 subject is indeed in transition and under pressure from several forces, including a strong emphasis on the utilitaristic paradigm, which is associated with late 20th century political emphasis on psychometric electronic tests evaluating basic literacy skills (Krogh, Penne, Ulfgard, 2012). The study also concludes that to some extent the L1 subjects in the three countries are not the same, including different emphases on technology in lesson plans and practices; on the other hand, teachers do share discourses and, more specifically, subtle dilemmas and paradoxes, which however cannot be described simply in paradigmatic terms. One of the interesting patterns of similarity in all three countries is that *literature* has lost its traditionally dominant position in the sense that teachers have trouble justifying teaching literature when confronted with students. Instead, *writing* has become a main focus of teachers’ practice and been used for developing students’ literacies and their personal development/*Bildung* in recent decades (cf. Krogh, 2012). However, the study also shows that writing as a key focus is being challenged too, not least by *technology*. The study reveals different perceptions of technology – or ‘media’ which is the term that is often used – for understanding and practicing the subject (Elf, 2012); teachers tend to choose either a ‘disintegrating strategy’ when considering teaching media, or alternatively an ‘integrating pragmatic strategy’ emphasizing some aspects of media literacy and multimodality. Borrowing a term from Kress (2010), Elf concludes that teachers call for “apt metaphors” that could help them conceptualize the knowledge domain and rethink L1 (Elf, 2012: 118).

The basic introductory point that has to be stressed here is that several L1 studies in a Scandinavian context suggest, on more or less empirical grounds, that *technology represents one of the big L1 questions in both contemporary research and practice – and in the future*. The emergence of technology and media raises fundamental questions about demarcation lines or, as we will term them theoretically, *boundaries*, on several levels: a) within the subject in relation to other subjects and in relation to schooling; b) about content and methods; c) about productive and receptive aspects of the subject; d) about the aim and purpose of the subject in terms of competencies and the role it has for personal development; e) questions about L1 as a nation-building subject or a subject whose content and methods, like mass media itself, are referring to a global world. It appears that media can no

longer be ‘contained’ in a simple sub-knowledge domain such as ‘mass communication’ taught for a few weeks during (upper) secondary school, which was the case in the 1970s and 1980s in a Danish L1 context (Lehrmann, 1996; Svendsen, 2011). Instead, a number of L1 studies in a Scandinavian context have discussed how media and technology cross boundaries and have highlighted the vital need to explore how they intervene with L1 practices in Swedish, Norwegian, and Danish and raise fundamental questions in terms of understanding the subject in theory and practice. Technology, we claim, raises questions about the basic ‘whats, hows and whys’ of the subject related to the traditions and knowledge regimes historically and geographically embedded in the three Scandinavian countries.

However, a current problem in research is that there is *no systematic overview* of the documented possibilities and challenges related to the use of technology in L1. At the same time, we will argue that there is *terminological confusion* in relation to the use of ‘technology’ and related concepts in L1 research and practice. Finally, as suggested above, there is a *general lack of critical reflection* on the relationship between technological developments, political rhetoric, and the development of L1 teaching and learning as a social practice related to specific national and cross-national contexts and actors. Those three interrelated problems – a lack of a systematic overview, terminological confusion, and a lack of critical reflection – motivate the purpose and research question of the article.

1.2 Purpose, research question, and overview of the article

The purpose of the article is to gather, systematize, and review research on technology within L1, asking ourselves those difficult questions about the emergence and meaning of technology in L1, how it can be described and explained in retrospect, and how it can be addressed in the future. Thus, the article attempts to answer three interrelated research questions:

- 1) What do we mean, in a contemporary perspective, when we talk about technology in L1?
- 2) Based on a systematic review of empirical studies, what characterizes the research field?
- 3) For discussion, which broader implications does the systematic review suggest for a rethinking of L1 in terms of practice and research?

The research questions imply both a distinction and a focus in terms of the unit of analysis. Considering the broad *field* of L1 knowledge, we distinguish between: a) theoretical studies; b) empirical studies; and c) other contributions to the field of knowledge. Theoretical studies are based on philosophical discussions of the subject without drawing on or analyzing empirical practice in any systematic way. Empirical studies are theoretically informed empirical studies of L1 practices investigated and reported in systematic ways. Other contributions relate to a rich diversity of knowledge creation, such as reports on development projects, new learning resources, broader debates on technologies in L1 etc. taking place in journals for

teachers, at national conferences for L1 teachers, etc. The foregrounded unit of analysis is *empirical studies* in the three Scandinavian countries. They will be reviewed systematically and thoroughly, while remaining in dialogue with theoretical studies and other contributions as a contextualizing background.

The article has five parts. In this first part, an introduction. In the second part, the theoretical framework and methodology is presented. Informed by the notion of *boundary objects* (Star & Griesemer, 1989), we propose a theoretical framework which identifies four metaphors that can encapsulate the discourse on technology in L1 in the three countries. In the following section, the review methodology and underlying epistemology is explained in some detail, among other things clarifying the criteria for including and excluding studies. The third part presents the findings of our review based on the studies included. First, we present findings based on *knowledge syntheses* of each national context: Denmark, Norway, and Sweden. Second, we synthesize and discuss what we consider as “supernational” (Ongstad, 2012a) findings in terms of comparisons across the three countries, highlighting broader tendencies in the research field. In the fourth part, we summarize our findings and identify knowledge gaps in the field. We draw conclusions on what seems to be the three most dominant features of Nordic research on technology in L1 and discuss their implications for future research and practice in both the Scandinavian region and internationally. Finally, in the fifth part, we offer an overview of all studies included in the review and an appendix with accounts of the included studies.

2. PART 2: THEORETICAL FRAMEWORK AND METHODOLOGY

2.1 Theoretical framing

Currently, conceptual confusion related to the field of ‘technology’ in L1 exists within both research and the broader public domain. This is not surprising, considering educational history. As Nordkvelle (2007) points out in his historical account of technology in education – from Comenius’ *Didactica Magna* (published in 1657) focusing on ‘proper technologies’ of mother tongue education to 21st century learning sciences – the term technology has no stable ontological meaning. Instead, the meaning of technology is established historically and contextually through the development of and transactions between technologies in relation to goals and means in specific contexts of time and space, including subjects taught in school in different localities (Nordkvelle, 2007; cf. Haas, 1996; and in the studies included in the review, e.g. Lehrmann, 1996; Lorentzen, 2013; Tække & Paulsen, 2013).

Such a contextualized understanding of technology is the backdrop for the attempt to answer our first research question – i.e. what do we mean when we talk about technology within L1? In what follows, we propose a terminology which will define our understanding of technology and guide the review methodology and later analyses of empirical studies. Based on Hanghøj (2013), we propose that technologies can be understood as *educational boundary objects* within the con-

text of L1, which draw on one or more of four different metaphors and their implied discourses that can be related to specific theoretical perspectives. The notion of boundary object was introduced by Star and Griesemer, who defined a boundary object as being “both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites” (Star & Griesemer, 1989: 393; also see Akkerman & Bakker, 2011). Everyday examples of boundary objects could be digital technologies such as websites or documents, which may hold different meanings across different sites and disciplinary boundaries. In this review, we will use the notion of boundary object as an *analytical lens* to identify and discuss how technology is discursively conceptualized, in research, as specific materialities in relation to four different metaphors, which are represented in the theoretical perspectives guiding research on the use of technology in L1 (cf. Hanghøj, 2013). More specifically, the use of technology within L1 can be understood as:

- 1) tools;
- 2) media;
- 3) socialization;
- 4) literacy practices.

According to this vocabulary, a particular educational activity within L1 investigated through research, such as students being asked to search for and compare specific authors' online profiles, may be understood in practice and explored by research from the four different, although potentially overlapping, metaphors of tool, media, socialization, and literacy practices. Moreover, each of the four metaphors can be related to distinct disciplinary “knowledge traditions” (Barth, 2002) such as analytical, productive, aesthetic, and/or critical approaches to working with technology, each representing different assumptions and theoretical perspectives on how technology within L1 should be conceptualized, enacted, and validated in relation to particular subject-specific aims and practices.

Seen from a *tool perspective*, the use of technology within L1 is primarily understood as artefacts, which can be used by teachers and students to achieve particular learning aims, e.g. when students use online search strategies and algorithms to locate the website of a particular author. From this perspective, technology is primarily conceptualized as a transparent device. Historically, the tools of L1 have been analogue, e.g. pen, paper, books, chalk, and blackboards, and more or less taken for granted. However, with the advent of digital technologies there is growing demand for conceptualizing tools within L1 through disciplinary perspectives from other research fields such as human-centered informatics and design research, e.g. in relation to the user experience, usability, information architecture, and design features of technologies for language learning. Internationally, extensive research is available on the effect of particular digital tools for supporting reading, which is often based on assumptions on learning derived from cognitive psychology and psycholinguistics (e.g. Torgerson & Elbourne, 2002). However, this field of research is rarely linked to discussions of L1 as a subject or field of research.

Thus, the tool perspective is relatively undescribed in relation to empirical research on technology within L1. As two exceptions included in this review, Bundsgaard (2005) provides an analysis of possible strategies for searching and reading online texts, which can be seen as an example of a tool perspective on technology within L1. Similarly, Tragetorn's (2005) study of how reading and writing within L1 may be supported through digital technology is also informed by a tool perspective.

Seen from a *media perspective*, the use of technology within L1 represents material means for representing meaning through different types of texts. Going back to our example with the students' assignment, the media perspective does not focus on how the actual technology is used for conducting web searches, but on how students understand particular texts, i.e. how a particular author's webpages take on different meanings in relation to specific contexts, genres, and multimodal modes of expression. In recent years, the media perspective within L1 has been strongly influenced by the social semiotic theories developed by Kress and his colleagues (e.g. Kress & van Leeuwen, 2001; Kress, 2003; Burn & Parker, 2003; Jewitt, 2006). However, it is important to emphasize that numerous other theories have been used to describe meaning-making in relation to the use of media within L1. Examples of other disciplinary perspectives include different branches of semiotic theories, the theory on media ecology, on media aesthetics, reception theory (focusing on emotional and cognitive responses to media) and medium theory (represented in the studies included in the review by, respectively, Erixon *et al.*, 2012; Tufte, 1995; Bueie & Pihl, 2011; Paulsen & Tække, 2013, among others). Historically, the media and modalities perspective has formed part of the field of L1 since the 1960s, which followed the widespread distribution of electronic mass media and expanded notions of what defines a text. This development corresponds with Sawyer & van de Ven's (2006) description of the "communicative paradigm" within L1. To give an example of the media perspective included in our review, Elf's 2012-study provides an analysis of how visual literacies may be understood and developed in a multimodal perspective within upper secondary education. Iversen & Otnes (2009) give an example of how the making of a hypertextual narrative can contribute to students' engagement in creative text production. Similarly, Lundström & Olin-Scheller's (2010) exploratory study highlights and contextualizes the changing skills needed for reading in today's media landscape, which is characterized by a convergence culture where the formats and distribution of a narrative come together and create an extensive multimodal text universe.

Seen from the third perspective, the use of technology within L1 is primarily understood as a means for *socializing* students into particular values and social worlds, which may include everything from collaborative online writing processes at the micro level of the classroom to participation in online public debate at the macro level of the global network society. Thus, the focus here is less on understanding the tool or the medium as text, but more on understanding how technology can be used to fulfill specific aims for identity formation through social participation in L1 learning activities. Returning to our example of the web search, the

socialization perspective could focus on students' critical reflection on the roles, values, and norms of authors' representation in an online literary public sphere. The disciplinary knowledge that backs the socialization perspective may be founded on a broad range of different philosophical, sociological, and cultural-historical perspectives. Historically, the socialization perspective within L1 has often been founded on the critical theory of the Frankfurt School that reflects the use of technology as part of students' philosophical *Bildung* (for the notion of *Bildung*, cf. Gudem, 1998). During the last decade, the use of critical theory has been severely criticized for advocating an "inoculation" perspective on mass media, which has reduced students to passive agents that must be protected from false ideologies (Buckingham, 2003, 2011; Elf, 2009: chapter 7). This has led to a rethinking of critical perspectives, which view the use of technology in L1 as a more pragmatic means for socialization through various agencies. To give an example of the socialization perspective in the review, Svendsen's (2011) content analysis of Danish text books on media for L1 over the last 40 years describes a shift in metaphors, and how this shift is related to different disciplinary and societal conceptions of the student. Similarly, Nielsen *et al.* (2006) explore the use of a learning platform in the light of sociocultural theory. The platform is reported to contribute to a Vygotskian "scaffolding" process and to the building of a community of practice. Moreover, Wikström & Olin Scheller (2011) contextualize the fan fiction phenomenon as part of a larger transformation of the media sphere and society in general where the role of media consumers as collaborative cultural producers is growing ever stronger.

Finally, the fourth perspective focuses on how technology is integrated into specific *literacy practices* that may be developed both within and outside formal school contexts. The practice perspective tends to focus less on specifying particular curricular aims when using technology within L1. Instead, the perspective is often informed by ethnographic fieldwork that describes how particular practices such as "literacy practices" (Barton 1994) become enacted and valued within (or across) particular school and non-school social domains. The interest in bridging students' school and out-of-school practices is often related to the use of online technologies, also referred to as "new media literacies" (New London Group, 1996; Jenkins, 2009; Mills, 2010; Gee, 2010). Going back to the example of the students' web search on authors' online profiles, a literacy practice perspective could involve a detailed understanding of the students' everyday online practices (e.g. being active on social media such as Facebook) and how their online experiences shape their understanding of different authors' online representations. The theoretical assumptions informing the practice perspective are quite varied (e.g. discourse analysis, actor-network theory, or socio-cognitive theories), although they often share a common interest in understanding how social actors and technologies constitute specific events (often referred to as literacy events) within particular educational contexts. The practice perspective is often characterized by attempts to challenge and reformulate the existing curricular aims and practices of L1. As an exam-

ple of a study included in our review which focuses on (new) literacy practices, Hanghøj *et al.* (2014) describe how teachers' educational redesign of the computer game *Minecraft* may facilitate and frame creative learning processes that allow the students to "translate" their existing knowledge of the game into the school context. Bueie & Phil (2011) find that the publication of texts on the school-based wiki motivates the students in their writing and makes them put more effort into the "content, dramaturgy, orthography and layout". Similarly, Fast (2007) shows that already in preschool children are socialized in practices rich in literacy events via their culture, traditions, language, and religion.

Together, the four metaphors (tool, media, socialization, and literacy practices) represent four different perspectives for understanding technology within L1. In this way, we argue that different technologies represent educational boundary objects within the subject. This means that specific activities within L1 such as students' web searches for authors' online profiles are always related to particular disciplinary perspectives, which imply different values, different disciplinary concepts and refer to different social worlds that may sometimes be mutually exclusive and sometimes fruitfully combined. Thus, the use of technology implies different meanings and educational consequences depending upon the chosen subject-specific perspectives and pedagogical approaches. Finally, it is important to note that L1 *research* draws on one or more understandings of technology that serve as a frame or a lens through which the use of technology in practice are investigated.

The notion of boundary objects has been developed within sociological research on scientific knowledge and is grounded in an assumption of knowledge as something that has to be *done*, which is derived from pragmatism and symbolic interactionism. In this way, our theoretical perspective advocates a *relational epistemology* which does not assume that one or more of the four perspectives presented above are purely there, or better than the others. We are instead interested in mapping how Danish, Norwegian, and Swedish research on technology within L1 represents different disciplinary perspectives. In the course of our review process, we tried to categorize all of the empirical studies included in relation to the four perspectives on tool, media, socialization, and literacy practices. By using the notion of boundary objects, we wish to emphasize how the use of technology within L1 is related to specific disciplinary discourses, which may involve many different types of boundaries and boundary crossings (Akkerman & Bakker, 2011). This involves *discursive boundaries* between different disciplinary perspectives, but also *material boundaries* in time and space, which can be crossed in different ways through, as an example, the use of online digital technologies, and, finally, *institutional boundaries* between school and non-school sites. In this way, the notion of boundary objects may help us locate what 'technology' represents, when we talk about technology in L1, i.e. by focusing on how the boundaries of particular technologies, disciplinary perspectives, and institutional sites are articulated, negotiated, maintained, and contested.

2.2 *The review's methodology and epistemology*

If establishing a robust theoretical framework is an indispensable first step for conducting a review on L1 as a subject focusing on technology, then the next essential step would be to develop a transparent and coherent methodology that further reflects the epistemology and procedures of comparative reviews. For L1 research(ers) within the broader context of curriculum research, this is particularly challenging since L1 research is evidently bound to national contexts. As Ongstad states, it is an ongoing challenge to overcome “the gravity of national perspectives and disciplinary interests which define L1 research” (Ongstad, 2012a: 21, our translation). The problem of making comparisons of L1 research becomes even more complex because the often used initials “MTE” as a unifying term for the research field Mother Tongue Education – as in International Association for the Improvement of Mother Tongue Education (cf. www.iaimte.com) – are highly contested and in some regions abandoned and/or explicitly rejected (Ongstad *et al.*, 2007: 15f; Elf, 2009: 134). Terminological alternatives such as “L1”, “standard education”, and “main language education” have been suggested, acknowledging the current trends of migration and globalization associated with increasing linguistic and cultural diversity. In the present paper, we use L1, albeit we are aware of problematic connotations, not least the point that L denotes ‘language’, which may connote and confirm the traditional assumption that the subject is solely about language and literature as a language form. This, of course, would be a highly problematic connotation considering this review’s aim, purpose, and findings.

On an epistemological level, Ongstad has offered an important comment on comparisons (2012b; also see Ongstad 2007). He argues that before comparing MTE subjects from different national contexts – and before comparing aspects within the subjects, such as technology foregrounded here – basic concepts for comparison have to be clarified and defined in order to ensure validation. Trying to navigate in such a context of almost total relativity, Ongstad offers epistemological advice on validation: When comparing, one should decide whether you are talking about *exactly the same* (in the tradition from Popper), or rather talk about *almost/nearly the same* (in the tradition from Dilthey) (see Ongstad 2012b: 315; our translation and paraphrase). He suggests the latter, and we follow him in this. Further, Ongstad suggests that the problem of comparing L1 subjects in different countries can only be overcome by framing a comparative study ‘supernationally’ [in Norwegian: ‘overnationalt’] (Ongstad, 2012a). The point is that all concepts within the subject, such as language, literature, genre, technology, text, aims, and goals, are gravitating towards locally and nationally embedded meanings, from macro policies to classroom practices. On the other hand, and this is the basic premise for meaningful comparisons and constructing a Scandinavian review on L1, these concepts are accessible for understanding, interpretation, communication, and re-contextualization in a supernational comparative perspective. This is partic-

ularly the case in regions sharing a close cultural and linguistic history, such as Scandinavian countries.

It should be noted that the problem of comparing L1 practices is an old problem, known and addressed in the 1980s by IMEN researchers, among others (Ongstad *et al.*, 2007). Echoing Stephen Ball (1984), Ongstad *et al.* (2007) argue, quite radically, that *the question* “What is MTE?” *is the answer* when attempting to compare subjects in an inter-/supernational perspective. So, what we can learn from IMEN research and other comparative research on subjects is that we have to move away from universal ontological conceptions of the subject to contextualized epistemological approaches based on communication or, more precisely, as we argue, *interdiscursive communication* (Scollon, Scollon, & Jones, 2012; also see Tainio & Winkler, 2014, and later).

Following these epistemological reflections, we wish to move on briefly to describe the more pragmatic strategies and procedures of the review methodology. Basically, our aim was to develop a methodology which draws on generally acknowledged principles for conducting reviews. As Andrews explains:

[Good reviews] are good at identifying what is available, and their explicit criteria for inclusion and exclusion make them replicable and eminently open to criticism (which they welcome). They attempt to minimize bias, and probably do so more effectively than any other form of research in that the checks and balances during the distillation process are rigorous and extensive (Andrews, 2005: 413).

It follows that we wish to make our concepts and criteria open for inspiration and criticism, and replicable in the sense that L1 researchers in other regional contexts can use the review design for similar regional and supernational comparative analyses. Contributing further to the methodology of systematic reviews, we adopted principles known from quantitative review frameworks, more specifically the so-called Campbell method (SFI, 2013). The Campbell method is used for meta-analyses of effect sizes. Almost none of the studies found in the field of L1 research in Scandinavian countries are effect studies (with the exception of Gissel, 2014), and it would not make sense to design a review analyzing effect sizes. Nonetheless, we argue that the systematic review process developed within the Campbell framework offers useful strategies for conducting qualitative reviews. Thus, the research methodology adopts and comprises the following four steps:

- 1) Establishing valid criteria for research
- 2) Searching systematically for this kind of research
- 3) Evaluating the studies found according to the criteria for inclusion
- 4) Analyzing/reviewing the studies

In the following, we explain the four steps describing the reflections and choices we made in the process of completing them.

Step 1. In the first step of the review, valid criteria for research on technology in L1 were established. Four aspects defined the criteria, related to: a) technology; b) school subject; c) publication; and d) time in history:

- a) Regarding the term *technology*, studies included should investigate the communicative practice of more than just verbal communication, that is, more than oral expression or writing on paper. Further, the boundary objects framework suggesting four categories (presented above) served as a heuristics for understanding technology.
- b) Regarding *school subject*, one or more of the three school subjects “Danish”, “Swedish”, or “Norwegian” – that is, the L1 subject as named in the three countries – should be the main or a clearly addressed focus of studies included. This implies that studies investigating the relationship between technology and learning without any consideration or integration of the subject’s unique didactic characteristics, or ‘deep grammar’ (see the introduction above), would not be included. We are aware that this criterion excludes a large number of studies on media and learning and/or media pedagogy; however, we argue that such studies have a research interest fundamentally different from studies exploring the relationship between technology and subject-specific didactics, as in the case of L1.
- c) Regarding *publication*, only studies that have been subject to peer review or studies assessed through a process similar to peer review (as in the case of PhD dissertations and studies published before the relatively recent establishment of peer-reviewed journals and books in a Nordic context) were included. Moreover, we only include empirical studies related to aspects of teaching practice, e.g. classroom studies or studies of the use of learning resources in the subject (e.g. Svendsen, 2011). We acknowledge that other contributions to the field of knowledge, such as non-peer-reviewed studies and reports, are providing important insights to the field (also see the above comments on analytical unit).
- d) Regarding *time in history*, we set a timeframe from 1992 to the start of 2014. We chose 1992 as a starting point as this marked the advent of the World Wide Web and, consequently, an explosion of digitized networked communication and communication technologies.

One more aspect should be noted regarding the definition of the criteria. The four researchers who have come together to carry out the review, have all conducted prior empirical research on technology within L1. We are quite aware that this implies a potential bias in the process of not only defining the criteria, but also in the process of searching for, evaluating, and analyzing the studies. Bryman (2004) argues that one way of minimizing such potential bias is to scrutinize and challenge our own understandings of technology and L1 by applying “validation techniques”. Such techniques are described in steps 2–4 below.

Step 2. The purpose of step 2 was to gather relevant studies. Here, we pooled all potentially relevant studies in what was named the ‘gross list’. A search strategy

was developed, and tools for making systematic searches and representing them in accounts were produced:

Search strategy. The search processes were informed by well-known principles for conducting a systematic literature search (SFI, 2006; Andrews, 2005). This implied developing a search strategy which described the search criteria (see above), keywords for searching studies, and relevant places to look for studies, including databases, homepages for research networks, reference lists from key publications, and other sources.

Account of the study and search log. If a study was considered potentially relevant, we made notes on the study's author, year, research question, methodology, theory, technologies in focus, and findings. These notes were synthesized in a so-called *account of the study* shared within the group. As a tool for the search process, we also used a *search log*. In the search log, we made notes on the search process and on any barriers or dilemmas experienced. During the search process, these logs were shared and discussed continually as one way of strengthening the validity.

Knowledge synthesis. In the search process, the accounts of studies gathered in the database and the search logs were used to construct what we named a *knowledge synthesis* of studies from each country. A knowledge synthesis is an internal working paper for the research group. It describes and reflects on individual and nationally/locally based search strategies; it evaluates the studies found considering the criteria (steps 1 and 3) and, finally, it comprises accounts of each study potentially relevant for the review.

Step 3. In step 3, we considered which studies found in step 2 should be included in the review, and which studies should be excluded.

Evaluation method. Considerations were based on the shared knowledge syntheses discussed within the group of authors, thus applying intersubjective validation across national borders. The evaluation of studies included in the gross list eventually led to a 'net list' of included studies.

Considering grey-zone studies. Some studies belonged to a 'grey zone' with respect to the defined criteria. One problem we experienced was that some studies would downplay mentioning or discussing the role of the subject in a specific publication because an international audience was being addressed. In these cases, a more thorough analysis of the study was also conducted.

Clustering. In some cases, we decided to cluster studies into one 'account' (see above). We clustered studies if they relate to the same research design, including use of the methodology, theory, and data. One example is "Bundsgaard, 2004. Related to Bundsgaard, 2005; Bundsgaard & Kjertmann, 2004" (cf. Appendix).

Result. As a result of the step 3 processes, we concluded that we had found 56 studies that met the criteria. Accounts of all included studies' are found in the Appendix.

Step 4. The purpose of step 4 is to analyze and characterize the studies. Part 3 of the paper is devoted to this step. In advance, a few remarks on our analytical strategy should be made.

Data for analysis in an appendix. Accounts of all studies included (see Appendix) comprise the corpus of data for analyses within a national context and for comparative analyses.

Strategy for national and supernational analyses. Considering the above epistemological points, namely that L1 research and practice gravitates towards the national on one hand, yet on the other can be compared supernationally, we divided the analytical part into two sections. The first section describes findings in national contexts based on a discourse and interdiscursive approach. Scollon *et al.* define a discourse approach as what “can be said or talked about or symbolized within a particular recognizable domain” (Scollon *et al.*, 2012: 8) and argue that when actors from different cultures try to communicate about their discourses, interdiscursive communication emerges constructing a new discourse. The second section describes and identifies similarities and differences in-between the three countries by applying an interdiscursive approach. Applying Scollon *et al.*'s approach, the ‘domain’ or rather ‘domains’ referred to in the present review are: L1 research in the Scandinavian countries focusing on research related to technology as a boundary object (see above).

Applying the four metaphors for analysis. In the first section of Part 3 – Findings in national contexts – we present the locally grounded representation of the national knowledge field and its related discourses. We apply the boundary object approach and use the four metaphors for analysis (see above) only when characterizing what seems to be the dominating discourse on technology in the studies. In the ‘supernational section’ that follows, we make more broad inferences about the role and dominance of the four metaphors in Scandinavian research. Applying such an analytical strategy, which one might say reports from both the inside and the outside of national discourses, and respectively from more concrete to more abstract levels, we attempt to reflect the rich diversity – and indeed, complexity – found in the data.

3. PART 3: ANALYSES

3.1 Findings in national contexts

Findings in national contexts are presented below in relation to the three different countries. The presentation follows a simple alphabetical order: Denmark, Norway, and Sweden. Each presentation adheres to the format: introduction to the national field; omitted studies; findings in included studies (with references to accounts of studies in the Appendix). Each national analysis is introduced by pointing out the number of studies included and highlighting what we see as the main characteristics in a qualitative sense. It should be noted that the three national fields of re-

search differ, to some extent, due to different research traditions and research agendas throughout history. Consequently, discourses we infer from national fields differ as well.

3.1.1 Denmark

A total of 24 studies were included. Two characteristics of the Danish studies are the rich diversity in theoretical approaches informing the studies, which lead to studies that cover all four metaphors in the boundary object approach. Empirically, we find an emphasis on the role of the teacher and how (s)he uses and understands technology.

The L1 field in Denmark

The L1 field in Denmark comprises teacher education, institutionalized research and development, a national association of Danish teachers, and a broad range of publishers of learning resources, among other activities. In the 1990ies and particularly in the first decade of this century, L1 research became prioritized in university contexts, with a particular focus on Danish in upper-secondary education. Studies of 'Danskfagenes Didaktik' [Didactics of Danish subjects] became formally organized as a common research field across different educational levels with the formation in 2007 of the DaDi research network. Currently, the DaDi network includes more than 70 active researchers. There is no prior systematic overview of the role or amount of research on technology in relation to all the research relating to L1 in Denmark. Tentative overviews (Elf, 2007; Kaspersen, 2012; Krogh, 2003) suggest that research on technology represents a relatively small, although growing sub-field within the larger Danish research field of L1.

Omitted studies/delineation

Due to a lack of peer review and/or lack of empirical findings, a considerable body of Danish knowledge production on technology within L1 was omitted from this review. Examples of important peer-reviewed studies, which lack empirical findings, include Carlsen's (2005) theoretical discussions of media aesthetics in relation to L1, and Hansen's typology of the different text types within L1 that include both analogue and digital texts (Hansen, 2013). Similarly, several articles with empirical findings, but no peer-review by researchers within the field have been published, among others in the journal *Viden om læsning* [Knowledge on Literacy]; one example is Bundsgaard (2008), who argues that searching on the internet is reading, and Juul (2012), who examines whether ICT supports reading; and *Gymnasiepædagogik* [Upper secondary education pedagogy]; examples are a large quantitative and qualitative study by Zeuner et al. (2010; cf. Beck & Paulsen, 2010), which is a mixed method study on how teachers conceptualize Danish as a subject in two different

upper-secondary school forms, and Elf (2011), which explores visual practices in Danish upper-secondary education. The same can be said of reports, articles, and working papers from the Danish university colleges, which were also not peer-reviewed and often not accessible to the broader public; examples are multimodal approaches to reading and writing (Würtz, 2008), a survey on the use of technology in Danish schools (DREAM & Læremidler.dk, 2009), and the use of technology in relation to multimodal literature teaching (Hansen, 2011). Apart from the peer-reviewed journal *Cursiv*, there are currently few journals in Danish that publish studies on the use of technology within L1.

Findings in the included Danish studies

Up until the late 2000s, there are few peer-reviewed, empirical studies on the use of technology within L1. The first studies were published in the mid-1990s, and the publication rate has been growing steadily with a significant rise in the last five years. There may be several explanations for this pattern. First of all, Danish educational research has traditionally been oriented toward the German *Didaktik* tradition (Gundem, 1998; Nordkvelle, 2007), which has historically had greater emphasis on philosophical discussions of educational aims and less emphasis on empirical studies. During the last few decades, there has been a shift in Danish educational research toward Anglo-American research traditions, especially in relation to research on media education and new literacy practices. Second, reflecting the historically dominating paradigms of the subject based on language and literature (Krogh, 2003), technology has not been a predominant topic in research and practice. Third, the increasing number of publications in recent years reflects the ongoing 'academic upgrade' of Danish university colleges, which has resulted in a growing number of researchers and research projects. Finally, there has been an increase in Danish policy-based funding oriented to research and development projects with technology, some of which take place within L1.

Educational levels analyzed. Analyzing the 24 studies included and focusing first on educational levels, the Danish studies were mostly carried out within secondary (grade 7–9, age group typically 13-16) and upper secondary school (grade 10–12, in the so-called *gymnasium*, age group typically 16-19). Only five studies were conducted within primary education, and one study focused on the use of technology within L1 in higher education. No studies were found in relation to L1 within teacher education.

Methodology. In terms of methodology, 16 studies are primarily based on qualitative approaches, 2 primarily on quantitative methods, and 6 are based on mixed methods. Thus, the Danish studies are mainly qualitative with predominantly small-scale interventions that explore the use of different types of technology within classroom contexts. The qualitative studies are often inspired by ethnographical approaches combined with various forms of intervention research, such as action research or design-based research. The quantitative studies chiefly consist of an

analysis of different types of learning materials (Bundsgaard, 2013; Henningsen, 2004), and surveys on teacher attitudes to media education within L1 (Sørensen, 1994; Lehrmann, 1996; Tufte, 1995). Apart from a recent study by Gissel (2014) on the use of text-to-talk books for improving reading, there are no experimental studies that aim to test specific hypotheses through an intervention study.

Technology. The Danish studies focus on a broad variety of different resources, which are not limited to digital technologies and texts. From a boundary object approach, we find that all four metaphors are actualized in the studies, although with the predominance of the metaphors *media* and *literacy practice*. Several studies focus on a combination of various modalities across different media and various types of materials that may be analogue and/or digital (e.g. Christensen, 1997; Haugsted, 2008; Slot, 2013; Hanghøj *et al.*, 2014; Christensen *et al.*, 2014), which indicate that it is important not to reduce the meaning of technology to either fixed texts or isolated technologies for representation and communication. Instead, the use of technology is increasingly seen, and investigated, as converging resources. An example of the socialization approach is Bundsgaard (2004) who explores how students' use of a so-called Web Parliament could catalyze critical communicative competence.

Theoretically, we find a high degree of pluralism. The early studies included here are influenced by critical theory within a *Bildung* perspective in combination with reception theory (Sørensen, 1994; Tufte, 1995; Henningsen, 2004) or communication theory (Bundsgaard, 2005; also see Svendsen, 2011). In recent years, there has been more pluralism with a broader range of theoretical influences from e.g. Dewey's theory of inquiry-based learning (Elf, 2009; Hanghøj, 2011a, 2011b), sociocultural theories on learning (Slot, 2010), Kress's theory on social semiotics and multimodality (Elf, 2009, 2012; Slot, 2013), sociological theories such as Barth's anthropology of knowledge (Hanghøj, 2011a, 2011b) and combinations of Luhmann's systems theory with Latour's actor-network theory (Tække & Paulsen, 2013). A diversity of didactic theories are prominent throughout the whole period with a shifting emphasis, e.g. on media pedagogy and/or media didactic (Sørensen, 1994; Tufte, 1995, Henningsen, 2004), media education (Elf, 2009), and general didactic theory (Bundsgaard, 2006).

Findings. In terms of findings, it is possible to differentiate between results from studies which are primarily exploratory and studies mainly based on interventions. The exploratory studies focus on documenting everyday technology-assisted teaching practices within L1 (Henningsen, 2004; Lehrmann, 1996; Elf, 2012; Christensen *et al.*, 2014). Based upon surveys, observations, and interviews, these studies indicate that the use of technology beyond paper and writing represents more or less 'unfamiliar' learning resources, which tend to differ from existing learning resources and imply new or changed teaching methods and new understandings of the subject. For example, Christensen *et al.* (2014) find that a strong emphasis on verbal meaning-making is dominating L1 writing practices. Some visual and otherwise multimodal resources are found in genres like film analysis, video production,

drama, and multi-subject/disciplinary projects. However, these practices do not 'count' as much as verbal practices (for more details, see the appendix). In general, the exploratory studies find *inertia* and a relatively limited use of technology within L1. Yet this finding is relative to the context: The pattern tends to vary within different levels and types of education, e.g. some specialized branches/lines of upper secondary education tend to favor the use of technology more than other branches (Elf, 2009).

The findings from the intervention studies generally tend to emphasize how the use of technology may create new possibilities or opportunities for learning within L1 (e.g. Bundsgaard, 2005; Lorentzen, 2013; Hanghøj *et al.*, 2014; Sørensen & Levinson, 2014). More specifically, several studies show how new media and technologies may challenge the subject as a social practice and allow new forms of participation, which also challenge the conception of the content within L1 (Christensen, 1997; Hanghøj, 2012; Paulsen & Tække, 2013). The interventionist studies also document several challenges for teaching with technology within L1, e.g. the general importance and lack of sufficient meta-language amongst teachers for describing and assessing students' products and learning outcomes (Henningsen, 2004; Elf, 2009; Slot, 2010; Hanghøj, 2011a, 2011b; Bourgonjon & Hanghøj, 2011; Fougt, 2013). The interventionist studies span a broad range of different foci. Thus, some studies are primarily based on interventions that follow existing subject-specific teaching traditions within L1 (Hanghøj, 2011a; Elf, 2009; Slot, 2010; Fougt, 2013). Other interventions are more oriented to actively expanding or redeveloping the subject of L1, i.e. by importing and studying the use of informal media practices such as film making (Sørensen, 1994; Tufte, 1995) or the use of commercial computer games (Hanghøj *et al.*, 2014), which have been nurtured 'outside' the existing knowledge traditions of the subject. Another example of studies that aim to redefine the curriculum of L1 is Bundsgaard's (2005) attempt to develop and intervene in a L1 context through a competence-oriented and communicative paradigm.

Implications. The findings relate to and discuss the implications of learning outcomes amongst learners. They generally suggest, on qualitative grounds, that students working with technology develop their understanding of a broad range of different competencies related to the use of technology, e.g. "media competence" (Henningsen, 2004), "communicative competence" (Bundsgaard, 2005), "semiotic" (Elf, 2009), "text competence" (Slot, 2010), "scenario competence" (Hanghøj, 2011a), and "literacy" (Christensen *et al.*, 2014). In this way, simple notions of L1 competence are left behind. Instead, multiple (notions of) literacies emerge in theory and practice. One study by Gissel (2014) examines outcomes in terms of learning effects and points to the teacher's important role in scaffolding students' learning processes when working with technology. This relates to another prevalent theme in the included studies, namely that teacher perspectives on the use of technology within L1 are thoroughly explored, particularly within upper secondary education (Lehrmann, 1995; Elf, 2009, 2012; Slot, 2010). The studies conducted within primary and secondary education show a more balanced interest in relation

to both teacher and student perspectives. Nonetheless, the importance of reflecting on “teacher uncertainties” (Elf, 2012) due to constant technological changes seems to be an important finding pointing towards the need for new research and development.

3.1.2 Norway

Nineteen studies were included. The main characteristics are a close link between policy and explorations of new classroom practices focusing on student practices. It appears that *media* dominates as the metaphor for research on technology in L1.

The L1 field in Norway

The L1 field in Norway has developed since the 1970s, as both a reflected field of practice among and for teachers, and as a research field among researchers in dialogue with teachers, developers, and actors within research funding. Particularly from the 1990s on, several research projects have been conducted, master’s programs of Norwegian have emerged, professors of Norwegian have been appointed, and the research field has established itself (Ongstad, 2012a). A formal network of didactic research in Norwegian (NNDF) was established in 2010. In general, Norwegian research on L1 with a technological perspective is peripheral.

Omitted studies/delineation

“ICT” is the term most commonly used to describe what in this article is conceptualized as technologies drawing on the four different metaphors mentioned earlier. Typically, research projects on pedagogical use of technology are designed across the curriculum. Since the late 1990s several research programs and projects have been carried out to find the best ways to make ICT an integral part of education at all levels in the Norwegian school system. ICT is generally considered an important area for research and in many research programs funded by the Norwegian Research Council. Extended use of ICT in education has been an explicit aim. A national center for the promotion of ICT in education has been established, and reports on ICT use in Norwegian schools and classrooms are distributed annually. The revised national curriculum of 2006 stated that “digital skills” should be made part of the basic education in all school subjects along with reading, writing, arithmetic, and verbal skills. This was a watershed in policy and research. Thereafter, discussion no longer concerned whether but how ICT should be made an integral part of didactics within all school subjects.

The biggest share of research on pedagogical use of ICT in Norway is not explicitly concerned with L1 didactics, and this is the most important delineation of research in this study. Here, an important criterion for the inclusion of a study is that the Norwegian subject should be specifically mentioned or pointed out in the de-

scription of the empirical material. In a large number of studies on pedagogical media and technology use, L1 cannot be identified as part of the research question, material, or topic. In addition, studies within reading and writing research do not meet the criteria because this research does not, although with clear relevance to the knowledge base of a L1 teacher, specifically concern the use of technologies within the Norwegian subject, but contributes to knowledge about reading and writing in general. Finally, the criterion that only studies subjected to peer review should be included was also a significant point of delineation. Consequently, many reports, typically from university colleges and research institutes in Norway, are excluded, and likewise contributions from L1 teachers in the periodicals *Norsklæreren* [The Teacher of Norwegian] and *Bedre Skole* [Better School].

Findings in the included Norwegian studies

Educational level. The studies included cover a range from primary to upper secondary studies, with the clear predominance of studies on the primary and lower secondary level. Sixteen studies are qualitative; two are mixed while one is quantitative. Apart from the quantitative study, which is based on a survey (Flatøy, 2010), the studies involve 2 to around 70 participants.

Methodology. In two studies dated prior to the curriculum revision of 2006 (Dons, 2006; Krumsvik, 2004) the didactical use of technology in the Norwegian subject is researched in an action research design. The argument is made that web-based text production can enhance students' engagement, cooperation and learning outcome when integrated successfully into the subject of Norwegian. In the research contributions after the curriculum revision, the empirical findings are more typically compared to the descriptions and specifications of the curriculum. In the studies included, textual analysis is the most consistent method, typically supplemented by observations and interviews in an ethnographic or action research design (e.g. Bueie & Phil, 2011; Nielsen *et al.*, 2006). Most frequently, a small number of student texts are analyzed or examples are given of how multimodal texts can be produced on platforms like a wiki or on school-based websites (e.g. Hoem, 2009). In the studies where action research or ethnographic exploration is used to find out about the broader implications of the use of technologies, textual analysis is supplemented by classroom observations and interviews with a small number of students and teachers (e.g. Krumsvik, 2004; Nielsen *et al.*, 2006).

Technology. In all the studies 'text' and text use is the material entity, which brings together media, technologies and Norwegian didactics. This reflects that texts, how they can be read and interpreted and how they can be produced and distributed, lie at the core of the Norwegian subject and, consequently, at the core of research. Considering the boundary object approach, the findings suggest that media is a dominating metaphor in Norwegian research. This is related, we argue, to the dominant methodology and implied research interests. Seventeen of nineteen studies are dated post the national curriculum reform of 2006, which estab-

lished oral communication, written communication and language, literature and culture as the main areas of the Norwegian subject. The subject of Norwegian is upheld as a subject about text, and the skills relevant to searching, selecting, reading, writing and commenting on text are explicitly pointed out as learning goals. Apart from this general feature, the type of technologies most frequently researched is multimodal text production on wikis or school-based websites (e.g. Rogne, 2010; Schwebs, 2006; Tønnessen, 2012). Some studies investigate whether practical teaching and textbooks support and facilitate this kind of textual production (Grüter & Otnes, 2011; Rogne, 2009). Studies not concerned with multimodality relate the use of technologies to early writing education (Trageton, 2005), process-based writing (Bueie & Phil, 2011), digital folders (Bratholm, 2008), and to source use and plagiarism (Askeland & Aamotsbakken, 2013; Skaar & Hammer, 2013). In these studies, the perspective tends to be individual rather than collective. Both individual and collective digital text production are commonly related to learning goals in the national curriculum.

Theoretically, in studies concerned with textual analysis, multimodal approaches are often applied and in many studies supplemented with theories from New Literacy Studies (NLS; cf. Gee, 2010). Several contributions in the NLS field theorize the relationship between literacy, media, and technologies, and it is commonly claimed that media and technologies connect literacy in and out of school in a “positive” sense (e.g. Bjørgen, 2010). In some studies, this is connected to the Norwegian curriculum’s prescription that education in all subjects is to be adapted to the individual student’s specific needs. Thus, technologies are described as a means for levelling students’ possibilities to engage in textual work and thereby acquire literacy regardless of their different socio-cultural backgrounds (Dons, 2006). Moreover, the studies are typically underpinned by socio-cultural theory. Apart from references to Vygotsky’s sociocultural theory of learning, Lave & Wenger’s notion of communities of practice figures as a theoretical reference when cooperation through use of digital technology is researched and described.

Findings. Knowledge of how to interpret and produce multimodal texts is a specific learning goal in the curriculum, and those studies which explore how school-based websites function emphasize the multimodal aspect to text interpretation and production in the investigation of students’ use of these websites. There is only one contribution in the corpus with an explicit hypertextual focus (Iversen & Otnes, 2009). Typically, the dynamic aspect of digital text production is brought to the fore when the topic of investigation is cooperation and collaborative writing, and not in the studies based on digital text analysis or analysis of individual reading and writing of digital text. Collaborative writing and sharing of resources are typically judged to be valuable, and several studies investigate how digital text making, individually and with peers, is facilitated and supported in textbooks and school-based websites. Most of these studies focus on the positive possibilities technologies offer students with respect to literacy learning. A minor share of the studies is more critical with regard to the relationship between the use of technologies on one

hand, and students' acquisition of literacy on the other (Blikstad-Balas, 2012; Skaar, 2008; Skaar, Buckingham & Tingstad, 2010). In the studies not concerned with multimodality that focus on the individual rather than collective, the individual writer's use of media and technologies is commonly related to the learning goals in the national curriculum.

Implications. Digital texts could be characterized as multimodal, hyperlinked, and dynamic. The latter quality strongly affects how students select, read, and make texts. This appears to be under-researched in the Norwegian context compared to the two first mentioned. Moreover, studies to which the criteria apply often emphasize the positive possibilities the use of media and technologies offers with regard to reading, writing, and literacy, while the problematic or negative aspects often appear to be underplayed. In this sense, Norwegian L1 research to some extent echoes international rhetorics on technology and education, and a line of research interested in promoting the relationship between new technology/media and education (see the Introduction above). Overall, a more balanced account of the overall gains and losses from successfully making technology an intrinsic part of L1 practice has not yet been produced.

Focusing on a teacher perspective in relation to included studies, particularly from the recent decade, it becomes quite clear that the term "literacy" has gained ground in Norwegian pedagogy and didactics and thereby partly replaced *Bildung*-thinking and the idea of the curriculum as an instrument for preserving a literary canon, a tradition that has played an important role amongst L1 teachers in Norway for decades. Although still voiced in the introduction to the curriculum, the traditional *Bildung* does not form part of the descriptions of learning goals within each subject. Instead, the learning goals are adapted from an international framework to facilitate measurement and cross-national comparison on one side, and new advanced skills such as multimodal writing and digital literacy on the other side. This policy development is echoed in included studies on classroom practice and teachers' perceptions (Flatøy, 2010; cf. Elf, 2012, which includes research on Norwegian teachers). For example, Flatøy (2010) finds that many teachers felt a need for more education on use of ICT in the classroom and suggests a revision of teacher training. This development raises new questions for research and/on practice, which could focus on whether Norwegian L1 teachers have trouble identifying, understanding, and/or integrating the new L1 (super) national discourses, including discourse on technology as a complex boundary object.

3.1.3 Sweden

Thirteen studies were included. The findings suggest that Swedish studies are nourished by non-German and predominantly Anglo-Saxon theory, and highlight the benefits of incorporating digital tools that young people use in their free time in school.

The L1 field in Sweden

The L1 field in Sweden emanates from two traditions: one from teacher education, and the other from a research field developed within the disciplines of comparative literature and Nordic languages that served the subject teacher education in mother tongue (Erixon, 2012). The Swedish didactic field, SMDI, may be considered a relatively uniform research field after 2003, when the national network of 13 university institutions in Sweden was established. The main research focus within the network has so far related to the traditionally core elements in mother tongue teaching, like reading and writing. Only 10% of the research involves issues related to new media (Arfwedson, 2006; Svedner, 2006; Erixon, 2012). Currently, the core of the SMDI context is made up of 103 researchers listed on the homepage of the network in the Swedish didactic field, SMDI. To be included on this list, identification with the field and an active choice are required.

Although the numbers of reviewed and internationally published articles within the SMDI field have gone up significantly during the last decade, issues related to technology and L1 seem to have increased quite modestly during the last decade. This change is largely due to new publication patterns in the social sciences and humanities in general, at least in Sweden. Previously, articles and book chapters within the field were published for a more limited local and national audience in the Swedish language and in the form of institutions' reports and proceedings, from conferences and publications such as the *Swedish Teachers' Association Yearbook* [Svenskläraryörelingens årsskrift], i.e. from nationally published articles or monographs in Swedish, rarely or never reviewed, to articles in English in international peer-reviewed journals. Despite this fact, the rising numbers of internationally published articles may be perceived as an expression of a more mature and established SMDI research field.

Omitted studies/delineation

In the search for Swedish L1 research that complied with the criteria, all publication lists from SMDI researchers were checked and all titles that signaled technology in an L1 context were taken into consideration. Of the 15 researchers identified, ten were contacted by email to make sure that the identified articles were relevant for the purpose of this review.

A number of studies in the didactic field of Swedish relate more indirectly, and theoretically, to the school subject of Swedish and its relation to technology (Elmfeldt, 2002; Elmfeldt & Persson, 2009). For example, Elmfeldt & Persson (2009) discuss and criticize the dichotomy connected to the reception of print fiction on one hand and new media texts on the other. The authors want to transgress the dominant assumptions of transactional reception theory within literary studies when moving in the direction of what they call creative reading and media-reflexivity. In addition, Christina Olin-Scheller (2007) has mapped an area she con-

tinues to explore in a great number of articles of strong relevance for the school subject Swedish regarding youth cultures and literature as well as new ways to read and write texts using the Internet. Not all are empirical and/or peer-reviewed and thus not included in the review below. However, her findings indicate that mismatches between teachers' and students' literary repertoires are common in upper secondary school literary teaching. Using the genre of fan fiction as a point of departure, Olin-Scheller & Wikström (2010) explore the driving forces behind net communities organized around fan culture that can be regarded as an informal learning setting. Based on their results, Wikström & Olin Scheller (2011) claim that fan fiction could play an important role in the development of adolescents' literacies and identities and how their pastime works as a vehicle for personal growth. Further, Lundström & Olin-Scheller (2014) state that we have a need for play not only as a first step in our socialization to become a reader, but also as a tool for reading development throughout life.

Findings in the included Swedish studies

Educational level. Seven studies deal with secondary and upper secondary school (Elmfeldt & Erixon, 2007; Erixon, 2007; 2010; 2014; Erixon *et al.*, 2012, Holmberg, 2010; Lundström & Olin-Scheller, 2010) and five deal with preschool and primary school (Fast, 2007; Björkvall & Engblom, 2010; Hultin & Westman, 2013a; 2013b; Sofkova Hashemi, 2013). Swedish as a school subject has a firmer identity in secondary and upper secondary studies than in preschool and primary school.

Methodology. The vast majority of the studies are small and qualitatively oriented, frequently with an ethnographic touch and based on interviews and observations. One exception is Elmfeldt & Erixon (2007), which is based on a combination of a quantitative survey covering more than 1,000 students in upper secondary school and qualitative methods (interviews, observations, and text analysis).

Technology. The included studies predominantly refer to "writing" when characterizing the focus on technology; however, some studies indicate a combined focus on reading and writing, typically in interaction with digital technologies. From a boundary object approach, we would argue that the materiality of technology is predominantly tied to media, socialization, and literacy practices, which include ethnography and media literacy studies. None of the studies refer to media and information technology solely as a tool.

Theoretically, the Swedish studies are mainly nourished by the Anglo-American theoretical tradition. Unlike the discipline Education in Sweden, where a German theoretical undercurrent is still noticeable, it is absent in the Swedish didactic field. More theoretical studies are linked to media philosophers like Deleuze, Guattari, Aarseth, Benjamin, Hayles, Bolter, Ryan, and Manovich, but also to sociologists like Beck, Ziehe, and Giddens. Elmfeldt & Erixon (2007), Erixon (2007; 2010; 2014) and Erixon *et al.* (2012) relate to North American media philosophy and theories on media ecology together with educational sociology (Basil Bernstein). Other theoret-

ical standing points are social semiotic and ethnography (Björkqvall & Engblom, 2010), Systemic Functional Linguistics (Holmberg, 2010), genre theory and multimodality (Hultin & Westman, 2013 a,b; Lundström & Olin-Scheller, 2010), the latter in combination with narrative theory and visual literacy (Fast, 2007).

Findings. Theoretically-oriented studies (Elmfeldt, 2002; Elmfeldt & Persson, 2009) draw attention to the fact that new media in a school context hold educational implications that need to be pedagogically considered. These theoretical explorations inform and cast light on empirically-based studies. Almost all empirical studies deal with writing instructions, sometimes in connection with issues connected to teaching writing (Elmfeldt & Erixon, 2007). The computer in school has mainly been used as a writing tool, not a reading tool. Around these common patterns some themes are also crystallized. In the preschool and primary school studies new media are unequivocally regarded as something beneficial for teaching and learning in school (Sofkova Hashemi, 2013; Fast, 2007; Hultin & Westin 2013a, b.) Another theme, and in line with the previous one, highlights the benefits of incorporating digital tools that young people use in their free time in school, which is considered to contribute to the development of instruction in school (Sofkova Hashemi, 2013; Fast, 2007; Hultin & Westman, 2013a,b; Olin-Scheller, 2007; Olin-Scheller & Wikström, 2011). It is in this context that education must evolve with new perspectives and develop new concepts such as narrative skills (Lundström & Olin-Scheller, 2010; 2014). In secondary and upper secondary school, the identity of the school subject of Swedish is emphasized in a stronger way, while at the same time the pedagogical implications for the school subject are more highlighted; for example, how new media affect the content and the form (Erixon, 2007, Elmfeldt & Erixon, 2007; Holmberg, 2010), as well as social relations or interpersonal conditions (Erixon *et al.*, 2012; 2014; Holmberg, 2010). There is also a realization that new media are opening up for new content which is more connected to the students' own tastes and youth culture and challenging the traditional curriculum (Erixon, 2010; 2014).

Implications. The theoretical studies bring up issues on a more individual level, e.g. what happens to the ability to read texts in a new media context. This more philosophical question is followed by a number of issues that have been broken down in a series of empirical studies, which often highlight the need to integrate new media into teaching. This raises issues about the school subject itself and includes discussions about how content and form are affected when new media are integrated into the school and teaching of Swedish. The research focus that has been identified within the SMDI field has largely focused on writing instruction in a new media context. The first explanation would be that the process of using the computer and keyboard has been relatively long and therefore has become a natural tool for writing, also in school, although there is still a shortage of computers in schools. The second explanation is connected to the history of SMDI and the strong traditions at research institutions in Lund and Malmö. Already in the 1970s, and under the influence of reception theorists like Louise M. Rosenblatt, a reading di-

dactic, built on the students' own experiences, was developed (the so-called *erfarenhetspedagogik*). The majority of theses written by PhD students within the SMDI files have therefore, probably, been directed to reading instruction. There is also a third explanation associated with the affordances of digital technology. The computer, screen, and keyboard have primarily provided new opportunities for writing, not reading. The iPad is a relatively late technology, and will probably alter this ratio. A fourth explanation is connected with the school subject itself and its built-in resistance to a technology that may threaten the "sacred" in the subject, i.e. reading, which is intimately connected with a privileged text type, i.e. the book (Persson, 2005; also see Erixon, 2010).

3.2 Findings of the supernational analyses

In this section, we compare the findings in the national contexts to construct a supernational understanding of L1 research in Scandinavia with a technological perspective. The main question is: Which patterns of similarities and differences do we find when comparing research in the three national contexts?

3.2.1 A sociology of knowledge: Comparison of the research fields in the three countries

The formal organization of a research field, including networks in all three countries, is relatively new. This relates to a recent development in publication patterns in Scandinavia. Publication of empirical research in peer-reviewed publications is a relatively new phenomenon, and publishing in English, not in the mother tongue, is also new. This to some extent explains the limited number of studies we found.

However, there is also another explanation related to the status in the research field. So far, studies with a technological perspective are *peripheral*. What dominates the L1 research field in all three countries are historically well-established disciplines such as literature, reading, and writing pedagogy. On the other hand, contemporary research within these fields often addresses the importance of integrating a technological perspective (e.g. Elf & Kaspersen, 2012), and policies and research grants have tended to support a technological perspective. From a boundary object perspective, one might say that an *interdisciplinary boundary crossing* in-between technology-oriented approaches and historically well-established approaches in L1 research is emerging.

The review also documents a *difference in the number of studies found in the three countries*, with 24 found in Denmark, 19 in Norway, and only 13 in Sweden. It is interesting to note that three of the Danish studies included were published before 2000, whereas the first included Norwegian and Swedish studies were published in 2004 and 2007. The number of studies has been on the rise in the last decade in Denmark and Norway, but not in Sweden; in Sweden other aspects of L1 research dominate. We note that there are differences in terms of focus on the

educational level. In Norway and Sweden a predominance of studies focus on primary and secondary school, whereas the Danish studies are more focused on upper secondary education. This may reflect the criteria of our study, more than an interest of researchers (see also Discussion below).

3.2.2 *Epistemological and methodological patterns*

Generally, the studies show *a clear majority of qualitative research*. Most of the qualitative studies are small-scale studies based on observations of a few classes and/or teachers. However, there are also notable examples of larger interview studies, in Sweden in particular. The quantitative studies are mostly based on small-scale surveys or examinations of learning materials based on textual analysis. Almost no effect studies are found in all three countries; only one study aims to test a specific hypothesis. Almost no comparative Scandinavian studies are found. The qualitative research included involves both explorative and interventionist approaches, the latter including design-based research and action research. The Swedish studies are primarily explorative, whereas there is a more even distribution of explorative and interventionist studies in Norway and Denmark. It is interesting to note the relatively large quantity of qualitative interventionist approaches. Such studies, by nature, promote changes in L1 practice and imply a critical stance on the existing practice of the subject. However, the included intervention studies do not seem to generate any stable new practice as a result (also see below). Instead, they reveal existing discursive and institutional boundaries that define the subjects' practice, and how primary practitioners – teachers and students – conceptualize such boundaries.

As part of the comparative analysis, we coded the type of actor foregrounded in the studies: teachers, teachers and students, students, learning resources, other. 19 studies focus on teachers, 15 studies have a mixed focus on teachers and students, 12 studies focus on students, 8 studies focus on learning resources, and 2 have other foci. This means that 36 out of 56 studies, or more than 50% of the studies, place the teacher in the foreground. This suggests that *the role of the teacher* in relation to technological perspectives in L1 is considered crucial in Scandinavian research, and has been described in some detail and in different contexts through empirical research. Arguably, variances are also found in the three countries. A majority of Danish studies tend to emphasize the teacher, whereas Swedish and Norwegian studies tend to focus more on students.

These epistemological and methodological patterns may come as a surprise for an international audience of educational research(ers) because quasi-experimental quantitative approaches and a strong focus on learners' learning outcomes are dominating international research (cf. the introduction above). For a Nordic researcher, however, this finding is no surprise. Qualitative research dominates in L1 research with a technological perspective as in other educational research domains in Nordic countries. We argue that the advantage of the existing qualitative re-

search is that it offers in-depth case studies of L1 practices with a technological perspective that has the potential of being generalized to other contexts (Flyvbjerg, 2006). The limitation of such studies is that they are not representative and not measurable, and thus, as some would argue, not easily evaluated or controlled from a policy perspective.

3.2.3 *Findings and implications on L1 practices with a technological perspective*

On a superficial level, the studies document the wide variety of technologies and text types being used within L1 in Scandinavian countries. Clearly, L1 is *not* only about teaching the traditional dyad of language and literature (Elf, 2009). Instead, the dyad has developed in “centrifugal” ways (Ongstad, 2012b; also see Part 4 below) into a multitude of converging technological uses which involve both analogue and digital learning materials, e.g. pen and paper drawings, websites, computer games, and text books. Similarly, the studies document the wide variety of learning resources that are being used, or *could* be used, for teaching and learning within L1. This involves learning resources that have been specifically designed for educational purposes, and learning resources that have primarily been designed for non-educational purposes. In this way, the studies show that it is probably misleading to impose overly narrow dichotomies between digital and non-digital learning materials within L1.

The findings also document, more or less directly, that traditional analogue technologies – such as orality, the blackboard, and the book – have historically dominated and *still dominate* in L1 classrooms in Scandinavian classrooms. This becomes particularly clear when considering studies focusing on teachers (e.g. Krumsvik, 2004; Slot, 2010; Paulsen & Tække, 2013; Elf, 2009, 2012; Christensen *et al.*, 2014). Studies applying interventionist methodologies attempt to change this dominant practice practically and/or discursively, whereas explorative studies reveal the practice as the dominating pattern. For example, in an action research project Krumsvik (2004) investigates how the designed learning resource “Temaweb” could help integrate technology into the students’ textual work within the subject of Norwegian (in a cross curricular design) and finds a need for schools to embed digital technology in a didactical design aimed at making students active producers of knowledge themselves. Christensen *et al.* (2014) report from an explorative study that students write a lot outside school, particularly on digital platforms, but that such digital out-of-school practices are integrated in a very limited way into schools in general and in L1 in particular, and that students find this problematic.

In the more recent studies there is a tendency for a higher degree of variation in terms of using different digital technologies. This reflects the ever growing number of available learning resources outside and inside school. This movement towards the increasing availability and usability of technology creates a perception of freedom and/or a sense of frustration amongst teachers, often in ambiguous ways experienced by the individual L1 teacher or in teacher communities on different

levels (local school, region, nationally). This freedom-frustration practice sometimes produces a loss of control and a decrease of quality in learning outcomes, which teachers may or may not be aware of (as documented in the study by Skaar & Hammer (2013), which finds plagiarism in 25% of all students' writing practices). This suggests a more problematizing implication in the studies, one that documents real or suggests potentially negative outcomes.

On a deeper theoretical level we argued earlier that different technologies represent educational boundary objects within the subject. In order to understand what this means, more specifically, for actors in the L1 classroom in general, and L1 teachers in particular, we wish to return to the notion of boundary objects and the four metaphors for understanding technology illustrating the complexity of technology found in empirical practice.

Starting with the *tool perspective*, it is clear from our review that hardly any of the mentioned studies adopt this perspective on the use of technology within L1. Thus, we could only locate three studies (Bundsgaard, 2005; Trageton, 2005; Gissel, 2014) that examine in detail how particular technologies are used as tools within L1. More specifically, the three studies all describe how digital technologies can be used to support reading and writing processes. This lack of studies that focus on technologies as tools is quite striking given that comprehensive research exists on reading and writing in relation to L1 within Norway, Denmark, and Sweden. Similarly, research exists on the use of technology in relation to reading and writing electronic online texts in all three countries, including PISA and ICILS monitoring programs (OECD, 2009, 2011; Mejdning, 2011; Fraillon *et al.*, 2014). However, these studies do not address L1 as a practice nor as a field of research, and are consequently not included here. In this way, there is a clear knowledge gap, and a lack of communication within research, on how or to what extent particular technologies are able to support students' reading abilities in relation to the aims and practices of L1. Arguably, this gap also reflects how L1 as a research field is mostly populated by researchers shaped by humanistic research traditions, which tend to downplay the more technical and skills- and information-oriented aspects of using technology within L1.

Second, it is clear that the *media perspective* – especially in relation to theories on multimodality and social semiotics – has become an integrated part of the vocabulary within L1 when it comes to understanding the analysis, design, and interpretation of technologically-mediated texts (e.g. Elf, 2009, 2012; Slot, 2010; Hultin & Westman, 2013a; Lundström & Olin-Scheller, 2010; Rogne, 2009, 2010; Schwebs, 2006; Grüters & Otnes, 2011). Following this and other media perspectives such as the theory on media ecology, several studies point to the ongoing need to develop a “meta language” (New London Group, 1996) or new “apt metaphors” (coined by Kress, 2010 and used in Elf, 2012), which may help teachers and students identify new curricular aims and new assessment criteria when using unfamiliar technologies within L1. Studies show how teachers' and students' adoption of unknown technologies is clearly not just an instrumental matter of learning how the technol-

ogy 'works', but also a matter of understanding how particular technologies influence didactic (some would say curricular; cf. Nordkvelle, 2007) aims and knowledge production processes in relation to particular texts and genres. The findings back the claim that technologies cannot be reduced to transparent carriers of 'content'. Students' ability to read electronic online texts should not, as argued by psychometric tests, simply be a matter of testing their reading literacy in a narrow verbal sense; the notion of reading and writing has expanded and become multisemiotic.

This may sound like the advent of a new and better future. However, the findings from the included studies also point to a recurring *gains and losses paradox* within L1. On one hand, the studies document how digital technology such as computers, iPads, mobile phones, and wireless networks are more available than ever before, and that they enable a number of gains in terms of teaching and learning. On the other hand, the potential availability of countless new digital technologies also illustrates the huge task and choices that teachers face when trying to 'keep up' with new genres and new types of learning resources, which involve both resources designed and not designed for educational purposes. Often, teachers and researchers alike acknowledge that something may also be lost in the subject. In this way, the many possibilities for using new technologies may easily make it even more difficult for teachers to select and use specific learning resources in relation to particular curricular aims. In a critical interpretation, teachers are caught in crossfire, trying to navigate in, or seeking cover from, a multitude of technological and/or didactic demands and expectations from actors within a number of domains: the *policy domain* on international and national levels; the *local school domain* with boards, head of schools etc.; the *private domain*, including parents with high expectations; the *market domain* supplying 'edutainment' and 'learning tools', however driven by a basic interest in making money (cf. Skaar, Buckingham & Tingstad, 2010); and also, to some extent, the *research and development domain* pushed forward by researchers, in particular those who are applying an interventionist methodology, which is often funded by actors within the policy and/or market domain! In a more optimistic interpretation, one could argue that more technological reflection amongst L1 teachers is required in the future, and that teacher education could provide this. In a future teacher education perspective, the implication would be that *reflection on technological choice is becoming a crucial L1 teacher competence*.

Third, in relation to the *socialization perspective*, the critical theories, which were so clearly present in early work within the field, are less visible within more recent studies (for exceptions, cf. Svendsen, 2011; Bundsgaard, 2013; Erixon, 2007). This may partly be explained by the fact that a large share of the research published in relation to technology use in L1 in the last ten years has been policy-driven and conducted on the basis of Research and Development projects that have clearly delineated aims and scopes. In this way, the focus has turned away from *Bildung* perspectives in a critical socializing perspective and more toward understanding how technologies can be used to develop specific competencies, in-

cluding the competence to write collaboratively in larger groups or organizations. Thus, several studies describe how students may use technologies to develop competencies in relation to particular “communities of practice” (e.g. Nielsen *et al.*, 2006). As some researchers within this perspective point out, there is a lack of studies focusing on or revitalizing the “aesthetic Bildung” and the socialization of aesthetic learning processes when working with technologies in L1 (Lehrmann, 1995; Christensen, 1997; Elf, 2009; Elmfeldt & Erixon, 2011). The aesthetic dimension forms a key part of L1 in relation to research on teaching literature and other types of fictional texts. This was once also the case in L1 research and development focusing on media production (e.g. Tufte, 1995). In a broader contemporary perspective, a large field of research within education is emerging on media aesthetics and creative media production (e.g. Jenkins, 2009). However, empirical studies on how to teach and assess technology-supported media aesthetics as a part of L1 practice have decreased.

Finally, several studies included in the review indicate a strong interest in the *literacy practice* object. These studies tend to be less interested in the individual competencies of teachers and students in relation to particular curricular aims. Instead, the focus is on describing the meaning of technologically mediated literacy practices across school and out-of-school domains (Olin-Scheller, 2012). *Identity* and *agency* are important topics in studies focusing on literacy practices. For example, Christa Lykke Christensen (1997) argues that perceptual and sociocultural processes of meaning-making are related to students’ identity and experiences outside school; however, Christensen demonstrates, these aspects are clearly not addressed when teaching visual literacies in Danish. In a similar critical perspective, Skaar (2008) explores students’ work on the design of a website and finds that for *one* category of students the commercial website stimulated the building of an identity in accordance with the social demands from the school community, and also stimulated the development of skillful digital design; for a *second* category of students, the commercial website was used to build an identity which is socially unacceptable at school, while simultaneously the students’ digital design was brought to a higher level of perfection; for a *third* category of students the commercial site was used to establish an identity at odds with the school-based norms, and at the same time contributed very little to the development of skilled digital design. Such findings raise questions about the ambiguous relationship between in- and out-of-school practices and, more specifically, the relationship between productive digital practices, literacy development, and identity.

Some studies also aim to introduce new theoretical frameworks for describing relational aspects of technology use within the context of L1, which consider technology as a social actor alongside teachers and students (Tække & Paulsen, 2013; Hanghøj, 2013). This mirrors a ‘relational turn’ toward sociological and anthropological perspectives on the use of technology within L1, which relate the meaning of specific technologies to broader aspects of the educational context. This development follows an international tendency within New Literacy Studies and ‘media

ecological' studies with a rising number of studies that challenge how technologies used within L1 tend to become "black boxed" (Latour, 1999), that is, taken for granted or made invisible by their own success. Thus, there is a need for more studies that focus on boundary *crossings*.

Summarizing the analyses in Part 3, we find that the analyses of L1 in a national context and a comparison of these analyses in an supernational perspective illuminate a number of similarities and differences related to different contexts and levels of analysis, including the research field, theories informing research, methodology, and findings based on the diversity of research designs. One striking feature of the research field, which we will elaborate more on in the Conclusion and discussion Part 4 is that studies from each of the three countries indicate a pluralism of different theoretical approaches. This diversity must, of course, lead to diversity in the research field, making a review such as the one conducted here a challenging and complex quest.

4. PART 4 CONCLUSION AND DISCUSSION

In this fourth part of the paper, we wish to summarize our conclusions based on the above analyses. In addition, we offer some answers to the third research question, i.e. which broader implications does the systematic review suggest for a re-thinking of L1 in terms of research and practice?

4.1 Conclusions

First of all, we claimed that terminological confusion characterized the knowledge field and asked what we mean when we talk about technology. As an answer, we suggested a new theoretical framework which revolves around four metaphors: tool, media, socialization, and literacy practices, arguing that this terminology could encapsulate, or at least be used to better understand, existing research. Whilst acknowledging the locally situated knowledge fields in the three countries, we also tried to analyze the included studies applying this framework. Although we recognize that the framework represents a high degree of abstract thinking, we do believe it has proven useful for understanding disciplinary boundaries within the field, making it more clear what characterizes the practices and discourses surrounding the use of technology in L1.

Considering our second research question, asking what characterizes research we developed a review methodology and conducted a systematic analysis of studies that complied with criteria made explicit. Through a two-fold analysis of findings in studies in a national and a supernational perspective, we will argue that three main findings have emerged.

The first key finding revolves around the dominating metaphors of technology. Taken together, it seems impossible to maintain *one* understanding of technology in the reviewed studies, or to make claims of the hegemony of one metaphor in the

interwoven domains of research and practice. Nonetheless, we conclude that *the conceptualization of technology as media is a dominating approach*. Further, we conclude that, although such an approach does not necessarily downplay the aesthetic aspects of technology, we find that this is the case. We also find that critical and tool-oriented perspectives have been downplayed. Finally, we find that there is fundamental epistemological instability related to technology. What is construed as ‘technology’ in empirical L1 practice, as seen through research, is very much dependent on a contextualized understanding of technology as a boundary object based on the discursive, material, and institutional sites within which technology is used for teaching and learning L1. Danish, Norwegian, and Swedish taught as subjects with a technological perspective are, by no means, stable entities or ‘exactly the same’, as pointed out by Ongstad (2012b; see above), nor are they within a national context or when comparing them as L1 subjects.

The second key finding relates to the amount and characteristics of studies which focus on student practices within L1 and the relationship to out-of-school literacy practices. Ethnographic studies, which play a dominant role in existing research, have revealed how students develop a broad range of competencies, or ‘multiple literacies’, out of school which are difficult to integrate into contemporary L1 practice. In school, under special conditions such as interventions informed by research, Scandinavian L1 practice does manage to create a space for such competencies to be used in meaningful and even creative ways. This potentially holds many implications. For example, a few studies highlight how this may affect the *essay genre*, which is a finding with a potentially great impact considering that the essay is probably the most dominant writing practice in all L1 subjects in Scandinavia and beyond. It should also be noted that some studies suggest, critically, that research tends to romanticize students’ competencies and downplay potential pitfalls of allowing students to use digital competencies in school. Other studies suggest an alternative critical implication developed from the point of view of students, arguing that L1 could be stripped of its legitimacy amongst students if it is not able to integrate out-of-school practices in a better way. This point may, very well, have implications for policy thinking.

The third and final key finding is the emphasis on teacher uncertainty on how and why to integrate technology within the subject. L1 teachers in general seem to consider the emergence of new technologies on the school level and within the subject as a significant challenge interpreted in both analytical and emotional ways. Emotionally speaking, what is found in teacher discourse is often an ambiguous sense of both freedom and frustration, of experimentation and conservation, of vulnerability and empowerment – or, more generally, of *crossfire* produced by multiple actors from different domains: *policy- and meaning-makers* focusing on the public interest in national and international contexts, representatives of *work domains* pointing towards a new work order of the local and global economy, *the market*, including producers of technological equipment offering services and pedagogical ideas more or, indeed, less cost-free to schools, the *home* with parents,

some of whom express high hopes and expectations for their children going through the education system, children and adolescents themselves being part of a *youth culture* saturated with technology use and, finally, *research* which, in some cases, at least also has an agenda of change, and puts pressure on practice. In this crossfire situation, findings suggest that teachers inhabit different positions and apply different strategies: one position disintegrates new technology explicitly, and calls for an acknowledgement of the well-known ways of legitimizing L1 teaching; another position embraces the many opportunities and wishes to alter, or even revolutionize, the subject; and a third position attempts to reshuffle and integrate old cultures and paradigms with new approaches. Regardless of the teacher position and strategy, there is a general call for new concepts and understandings amongst teachers that could help justify the more advanced integration of technology as a core aspect of the subject.

4.2 *Implications and discussions*

The three key findings clearly document that technology is playing an increasing role in the communication about and reflection on L1 as a subject in a Scandinavian context. In general, we argue that the review has demonstrated an impressively rich and diverse L1 practice, which in many ways reflects how technology has become a crucial force for change in education and, more specifically, in one of the most important subjects in school, L1.

These key findings suggest that a reconfiguration of the L1 subject is indeed taking place in terms of alterations in communicative forms and utterances. We follow Ongstad (2012b; cf. Ongstad, 2006) when he argues that what constitutes a subject is the dynamic interplay between the subject's communicative forms and its utterances related to content, form, and activities/use, which again, on a more abstract level of contextualization, are related to disciplinary discourse on and paradigmatic understandings of the subject locally, supernationally and globally. The findings suggest that the communicative forms and utterances are becoming *less stable* and more *amorphous* due to technology, and that technology is clearly not a simple matter of value-free 'tools' made accessible by schools and offering information to students with the teacher as neutral mediator. Instead, technology is embedded in historical, political, cultural, economic, and philosophical developments in society, which are co-shaping the use and understanding of technology in L1 in practice and research. Through the review of empirical research, we demonstrated that technology represents what Ongstad terms (more speculatively, with Bakhtin) "centrifugal forces" (Ongstad, 2012b), altering the content, form, and actions within the subject. This makes it highly interesting, and highly necessary, to keep further track of and discuss new developments in practice – and to consider new research. The purpose of this review was indeed to contribute to a theoretically informed and empirically based discussion of the subject's present and future.

The review points towards obvious discussion points as well as knowledge gaps and lacunas in research, which may inform future research and practice. We will highlight a few aspects.

Initially, let us offer a critical note on the burden on the L1 subject in general, and L1 teachers in particular, in terms of what they are expected to do with technology. Simply put, the burden is enormous, if not schizophrenic. On one hand, policy-makers suggest that new technologies could be used for more 'effective' teaching and learning, measured and controlled through evaluative tests, focusing on literacy in a narrow sense. On the other hand, L1 research(ers) tend to suggest, not least in the studies included in our review, that technology represents a diverse and hyper complex diversity of potentials and barriers, that new technologies are catalyzing new understandings of literacy, and that the use of technology in an organizational perspective is relatively uncontrollable and follows dynamics related to teachers' and students' identification processes along with subject-related practices and cultures developed over time. The rationales of the two approaches seem opposite, even incompatible. In many cases, there is a huge discrepancy between policy and research approaches to technology in education, including L1. Where does that leave research and practice?

We would also like to make a critical note on publication patterns, an issue we have raised several times throughout the review. One of the findings of the supernational comparison was a difference in the number of studies found in the three countries. However, considering the way publication patterns have changed in recent decades, we need to be both cautious and critical about drawing too strong conclusions on quantitative differences and how they reflect knowledge production in the broader field of L1. As the L1 subject at the primary and upper secondary levels varies extensively in terms of goals, purposes and patterns for knowledge distribution, this makes supernational comparisons more complex and calls for contextualization when comparing findings. For example, as indicated in analysis of Danish studies, during recent decades several Danish L1 researchers published in the journal *Viden om læsning* [Knowledge on Literacy], which has been acknowledged in both research and practice. However, this journal is not peer-reviewed and articles from the journal are therefore not included here due to strictly defined criteria. If we had had resources for making a review of the larger field of L1, we would have included insights from these studies. This raises interesting questions both regarding the limitations of the present review and the emerging regime of 'scientific' publications in peer-reviewed journals. Harsh critics would characterize the emerging publication pattern a "feudal academic knowledge exchange system" and suggest that this system is replaced by a "democratic knowledge system" integrated with new digital distribution technologies (Whitworth & Friedman, 2009: no paging).

Returning to the teacher perspective, the analyses demonstrated that teachers face major challenges in understanding and conceptualizing technology in practice in a way that still offers them authority in the classroom. New research may con-

sider, as a point of departure, what characterizes a Scandinavian or Nordic understanding of teachers and teaching (Hopman, Riquarts & Westbury, 2000). Inspired by the German Didaktik tradition, the role of the teacher in this context has historically been dominated by an *autonomous* understanding of the teacher. Some recent studies suggest that this is changing due to international trends, particularly the pressure from the Anglo-Saxon curriculum tradition and the influence of international consortiums in educational research, such as PISA (Kaspersen & Elf, 2012; Sjøstedt, 2013; Hansson, 2014). For example, Sjøstedt (2013) argues that L1 in Sweden and Denmark is embedded in an age of “economism”; economism is the rationale that controls all aspects of L1 development, including the integration of technology. Similarly, Norwegian curriculum researcher Kaare Skagen (2014) argues that the policy-driven implementation of technology during the last two decades has led to a catastrophic decrease in didactic reflections amongst teachers – they are simply controlled by external technological developments in their daily practices, and this means the fall of the *Bildung* and Didaktik tradition in Nordic countries. If such claims are true – and we insist on calling them claims, which need to be investigated empirically – then we could speculate hypothetically on future negative developments. One scenario could be to see the tool perspective on technology being implemented in L1 teaching for instrumental reasons, say, as a means for counting the number of logins, uses, and for measuring literacy in a narrow sense through computer-mediated multiple choice tests. Is this going to be the case, empirically speaking, research could ask. In our view, such a future horror scenario is unlikely, among other reasons because the review finds that the media perspective on technology is relatively well-integrated into existing L1 practice, and because school subjects’ practices are not easily and quickly changed. However, this scenario could and probably should be explored critically.

In terms of research interests, we would suggest that future studies focus not only on L1 practices, but also on the broader technological culture of local schools, and discourses on technology in education on a broader meso school and macro policy level. We acknowledge, as one limitation of this review, that we have not included several contextual aspects of L1 practice, including the relationship between L1 research, research in other subjects, research focusing on notions of learning (such as literacy, literacies etc.) within L1 and across the curriculum, and/or organizational aspects at the school level. Perhaps most importantly, setting up our criteria, we excluded what some term the literacy throughout the curriculum perspective and the Council of Europe terms ‘Language Across the Curriculum’ (Vollmer, 2006). The upside of this choice is that it helped us search for and include research on the relation between technology and literacy practices within L1 as a discipline. The downside is that the review risks overlooking an important development in research and practice that is reflected, for example, in the Danish curricula (the “Common Goals”, which focus on literacy development) and in growingly widespread practices of interdisciplinary and multi-subject activities and projects in upper secondary school. One of the included studies (Christensen, Elf & Krogh,

2014) does, in fact, touch upon this link between literacy within L1 and across the curriculum. It is a study on the “culture of writing” in compulsory school (grade 9), which shows that literacy from top policy level down to classroom practice does have an impact in defining goals and practices of L1 education not only for L1 teachers, but *also* for L1 teachers – and, consequently, for the use of technology in L1. In this sense, development in L1 (literacy) practices cannot be understood without drawing on research in other subjects and on research on school and policy level. L1 does not exist in splendid isolation. Some studies included do suggest a link between organizational aspects and the practice of L1 (cf. e.g. Paulsen & Tække, 2013; Zeuner *et al.*, 2010, Erixon, 2010), and it would be interesting to pursue such links in more systematic detail.

Another interesting research question would be how technology relates to contemporary developments in teacher education, and the role and profession of the teacher in classroom practice. Interventionist and explorative approaches suggest there is a knowledge gap between the way practitioners conceptualize technology within L1 and the way researchers describe and understand technology in relation to L1 as a research field. Along these lines, there is a need for more research on how educational practitioners might benefit from research. In contrast, research could learn more from practice about how teachers conceptualize and use technology (particularly in Sweden and Norway, where this perspective is less prevalent in research). The Danish research project *Technucation* (cf. <http://technucation.dk/en/>), which focuses on how teachers conceptualize technology in educational professions, might be a useful point of departure for such a L1 study. In the review, we identified a general lack of research on L1 with a technological perspective in relation to teacher education, and thus call for more research in this context. One way of approaching such research would be to focus on the relationship between teacher education and primary, secondary and upper secondary classroom *practices*; or, as indicated above, such research could focus on discursive boundaries analyzing *curricula* in teacher education and school. It is our impression that L1 teacher education on the tertiary level has reproduced itself for decades, insisting on the old demarcation lines between language and literature, and between receptive and productive knowledge domains, and thus seems quite detached from current demands and requirements in secondary and upper secondary lesson plans, which construe technology as a complex boundary object, which is again reflected in practice.

Following the boundary object approach to technologies in L1, we found that the media perspective is prevalent in all three countries. We therefore suggest a more nuanced approach that considers critical, aesthetic, and tool-oriented aspects. For example, a critical perspective could include, as suggested by Skaar, Buckingham & Tingstad (2010), more emphasis on the relationship between the market, the curriculum, textbooks and teachers’ approaches to advertising and marketing. They find that teachers generally fail to include the new marketing strategies that are now targeting children on the Internet, and thus in texts. Should

this be part of the competencies and/or literacies focused on in L1 teaching? And how can we further investigate this question? By asking questions in this way, we are in fact drawing on and trying to integrate all four metaphors developed in the theoretical framework: socialization, media, literacy practices, and a tool.

Another aspect open for discussion is methodology. It is quite clear that the nature of applied methodologies is quite homogeneous; that is, it is one-sidedly qualitative. In terms of knowledge production, this means that Scandinavian studies are useful for generalizations to a lesser or greater extent depending on the nature of the case studies (Flyvbjerg, 2006), but they are not useful for making claims of representativity. Perhaps it has to be like that, given the complex and situated nature of teaching and learning seen from the point of view of technology and learning as 'an emerging area' (Gee, 2010), and perhaps not. The applied methodologies do not reflect evidence-based hopes and expectations based on the predominantly quantitative methodology found in the policy domain and in some research disciplines within L1, such as research on reading. This raises critical questions at both the policy level and for research: Should the policy level rethink its approach by acknowledging its situated and complex nature? Or is research overlooking potential quantitative methodologies that could produce new interesting knowledge? Future research on L1 from a technological perspective will shed new light on this in the future.

Looking beyond the Scandinavian context, we note that one of the interesting outcomes of comparing research from the three national contexts has been to become aware of blind spots in both research and practice. As outlined in Part 3, research questions related to educational level, methodology, theory, and conception of technology which may be highlighted and explored thoroughly in *one* country are (almost) non-existent in the *two other* countries, although the same topics seem relevant there too. This includes, among other topics, focuses on teacher and student perceptions and practices. Perhaps, reading this review as a researcher located in another region has led to a similar recognition.

Considering international research on L1, we invite other researchers from other regions in the world to try and carry out reviews similar to the one developed here. We believe that the methodological toolkit, which we have attempted to describe and illustrate as transparently as possible, could be adapted by our colleagues. Of course, this requires that L1 research with a technological perspective has already been made, and that practice encourages or calls for research. If this is not the case, then perhaps this article has served as an inspiration for a change in practice. The relationship between education and technology does indeed seem to be on the agenda globally, and has great impact on the L1 subject, albeit in quite complex and differentiating ways, not least within a Scandinavian context.

5. STUDIES INCLUDED IN THE REVIEW

5.1 *From Denmark*

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| Bourgonjon & Hanghøj, 2011 | Haugsted, 2008. |
| Bundsgaard, 2005. | Hanghøj, Hautopp, Jessen & Denning, 2014. |
| Bundsgaard, 2013. | Henningsen, 2004. |
| Christensen, 1997. | Lehrmann, 1996. |
| Christensen, Elf & Krogh, 2014. | Lorentzen, 2013 |
| Elf, 2009. | Paulsen & Tække, 2013. |
| Elf, 2012. | Slot, 2010. |
| Fougt, 2013. | Slot, 2013. |
| Gissel, 2014. | Svendsen, 2011. |
| Hanghøj, 2011a. | Sørensen, 1994. |
| Hanghøj, 2011b. | Sørensen & Levinsen, 2014. |
| Hanghøj, 2012. | Tufte, 1995. |

5.2 *From Norway*

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| Askeland & Aamotsbakken, 2013. | Iversen & Otnes, 2009. |
| Bjørngen, 2010. | Krumsvik, 2004. |
| Blikstad-Balas, 2012. | Nielsen, Sandvik, Østerud & Schwebs, 2006. |
| Bratholm, 2008. | Rogne, 2010. |
| Bueie & Pihl, 2011. | Rogne, 2009. |
| Dons, 2006. | Schwebs, 2006. |
| Flatøy, 2010. | Skaar, 2008. |
| Grüters & Otnes, 2011. | Skaar, Buckingham & Tingstad, 2010. |
| Hoem, 2009. | Skaar & Hammer, 2013. |
| | Trageton, 2005. |

5.3 *From Sweden*

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| Björkvall & Engblom, 2010. | Erixon et al., 2012. |
| Elmfeldt & Erixon, 2007. | Fast, 2007. |
| Elmfeldt & Erixon, 2011. | Holmberg, 2010. |
| Erixon, 2007. | Hultin & Westman, 2013a. |
| Erixon, 2010. | Hultin & Westman 2013b. |
| Erixon, 2014. | Lundström & Olin-Scheller, 2010. |
| | Sofkova Hashemi, 2013. |

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APPENDIX: ACCOUNTS OF THE STUDIES INCLUDED IN THE REVIEW

Table entries ordered alphabetically related to 1: Country: Denmark (DK), Norway (NO), Sweden (SW), and 2: Author. See references in the article for bibliographical information.

Author	Country	Level	Research type	Methods and data	Participants' use of technology	Theories (predominant)	Key findings and implications
Bourgonjon & Hanghøj, 2011	DK	Secondary	Qualitative	Case study based upon interviews with two "game literate" teachers	Computer game	Intermediality (Kress and van Leeuwen, Gee); game literacy (Burn, Squire); teaching as a professional practice (Schön)	The two case studies analyze how teachers translate video gaming into educational practice. The two cases are understood within a broader framework of intermediality/ multimodality and related to debates about (video game) literacy and the position of the teacher in education. The question of what it means to be a game-literate teacher is explored in relation to science education and MTE. The preliminary findings raise important issues about the role of expert video game knowledge for teachers involved in game-based learning, the description of game-based learning as an interplay between distinct but intermingling knowledge aspects, and the need for teachers to be able to understand games rather than to be gamers.
Bundsgaard,	DK	Secondary	Qualitative	Action research projects	Reading and com-	Sociology (Castells, Gid-	Primarily theoretically grounded de-

2005. Related to Bundsgaard, 2004; Bundsgaard & Kjertmann, 2004.				at one school during 2002-2003.	municating through the use of ICT	dens, Wellman); linguistic theory (Bang & Døør); multimodality (Kress); scaffolding (Vygotsky, Bruner); didactic theory (Klafki, Schnack)	velopment of the concept of communicative competence with particular emphasis on the use of ICT within the context of MTE. Empirical examples include 1) information competence when searching on the web, 2) ICT-based collaboration, 3) the use of interactive assistants, and 4) online production of students' written texts in relation to authentic communicative situations.
Bundsgaard, 2013	DK	Secondary & upper secondary	Mixed	A review and text analysis of 82 examples of Danish textbooks and teaching materials on mass media, mass communication, commercials, and communication critique from the 1960s until present.	Mostly textbooks that focus both on teaching with analogue and digital media texts	Critical theory (Bundsgaard)	The study investigates if and how communication critique has been taught and approached in the period. The historical study is followed by a close analytical examination of four characteristic works from the period in order to show how communication critique has (and has not) been in focus in different ways through time. The historical and analytical studies function as the point of departure for a suggestion to revitalize the focus on communication critique in Danish language teaching and learning.
Christensen, 1997	DK	Upper secondary	Qualitative	An empirical study described as an 'experiment' in the subject Danish in a Danish upper secondary education	Adverts and verbal writing on paper	Cognitive and sociocultural understandings of visual literacy (Messaris; Höier)	Findings do not back the popular claim that children brought up in 'the age of visual culture' are more visually proficient than people from other ages. Students construct the same

				classroom setting. Students are asked to write an essay analyzing an advert from a magazine.			patterns in their approach to visual analysis in essays on adverts. Students master formal analysis, such as composition and use of color, although in a fragmented and decontextualized way. They also demonstrate a sense of critical media literacy, contesting values of the advert. On the other hand, perceptual and sociocultural processes of meaning-making related to students' identity and experiences outside school are not found in the data material. The study interprets the finding as a consequence of an 'operationalization' and 'institutionalization' of visual literacy within the school subject. Specific literacies related to constrained and constraining disciplined semiotic and socializing takes on media are dominating. The study calls for a broader understanding of teaching and learning visual literacy in school, i.e. in Danish.
Christensen, Elf & Krogh, 2014	DK	Secondary	Qualitative	An exploratory, ethnographic study at three schools throughout a school year (2009-2010). Data comprise interviews with teachers and students, field notes from	Technologies and media (digital and non-digital) for teaching and student writing, including paper, notebooks, com-	Sociocultural and socio-semiotic theory (Bakhtin, Vygotsky); New literacy studies (Street, Gee, Ivanič, Barton, Kress); Didactic theory (Ongstad)	A strong emphasis on verbal meaning-making is found. Some visual and otherwise multimodal resources are found in writing practices in Danish (and other subjects) in genres like film analysis, video production, drama, and projects; however, these practic-

				participant observation, field comments (<i>aide de mémoire</i>), student texts and other documents from teaching practice, and a survey of all grade 9 students at the three schools.	puters, blackboards (digital and non-digital), posters, websites, and other material.		es do not 'count' as much as verbal practices. The quantitative study shows that students write a lot outside school, particularly on digital platforms. Such out-of-school practices are integrated in a very limited way into school. Schools in general and the mother tongue subject in particular are confronted with a challenging relation between well-established genres of writing and semiotic activities driven forward by student culture related to commercialized and popular for that fascinate and offer important spaces for identification and learning.
Elf, 2009. Also see Elf, 2007a, 2007b.	DK	Upper secondary education	Qualitative	Design Based Research (DBR). A model is developed and applied quasi-experimentally in a longitudinal multi-case study in collaboration with four teachers and students in four classes at four different schools during a year. Data are field notes, teacher and student documents, interviews, and other data.	A variety of multi-modal media, including digital archives, analogue and digital reading aloud versions of fairytales, illustrated versions, animated fairytales, analogue and digital writing, orality	Media pedagogy (Buckingham, Drotner, Erstad, Meyrowitz); sociocultural and pragmatic theory on teaching and learning (Dewey, Gee) and theory on the 'Didaktik' of teaching mother tongue education (Ongstad; Sawyer & van de Ven); social semiotics and multimodality (Kress; Kress & Hodge)	The study develops a model for developing students' 'semioicy' (expanded literacy) within the subject. The four experiments focusing on the teaching of modes and media of Hans Christian Andersen result in a variety of outcomes in terms of multimodal media production and reflections on the relevance of the experiments for rethinking the subject. Among students and teachers, a strong perception of complexity and divergence from 'normal' Danish teaching was found. Theoretically informed com-

							parative analysis demonstrates a clash with dominant paradigms found in the subject, particularly the academic paradigm related to monomodal regimes of production, reception, genre, and knowledge production. On the other hand, the findings also substantiate the possibility of teaching the subject based on a technosemiotic rationale adapted to local national school contexts.
Elf, 2012	DK	Upper secondary education	Qualitative	A discourse analysis of 26 Danish, Swedish, and Norwegian teachers' diaries and reflections in interviews	A variety of multimodal media and digital and non-digital technologies	Media literacy studies (Buckingham); social semiotic theory, including multimodality (Kress; van Leeuwen); discourse studies (Gee); theory on the 'Didaktik' of teaching mother tongue education/L1 (Sawyer & van de Ven; Krogh; Ongstad)	The study finds that the discourse of media as tool, or teaching 'with' media, dominates, whereas media as a knowledge domain taught 'about' is less salient. Teachers tend to choose either a disintegrating strategy when considering teaching media, or alternatively an integrating pragmatic strategy emphasizing some aspects of media literacy and multimodality. However, incongruity is also found in the sense that teachers have different perceptions of the implications for the subject. Some find that a fundamental change of the subject is necessitated, while others argue that the change occurred in the 1970s with 'the communicative turn'. The study points towards the need to rethink mother

							tongue education in light of new media and technology suggesting that a new meta-language is required.
Fougt, 2013	DK	Secondary	Qualitative	Case study based upon intervention	Presentation software (Prezi)	Theories on classroom dialogue (Dysthe, Hetmar, Mercer, Wegerif); didactics (Bundsgaard); teachers' subject-specific foci in terms of directed autonomy (Jensen) and primary traits (Berge)	This article describes two major challenges faced by teachers when transforming complex theories of "good teaching" into practice. The first challenge concerns the predominance of IRF structures (Initiation, Response, Feedback) and the teachers' view of the subject matter. The second challenge concerns the inherent risk of insufficient subject learning. Preliminary findings suggest that "situation-based teaching" increases the frequency of exploratory discussions and reduces the traditional IRF-pattern. Moreover, problems of insufficient subject learning are alleviated through application of directed autonomy and primary traits. Finally, the article invites further debate regarding "meaningful situations", whether "real-world" or "school only".
Gissel, 2014	DK	Primary	Quantitative	Small-scale intervention based upon screen recordings of 17 students using the TTS software	Text-to-talk software	Connectionist theory of reading (Adams, Seidenberg, Coltheart); self-teaching hypothesis (Cunningham)	Danish grade 1 students used a talking book with TTS (text-to-speech) with emphasis on decoding and reading for meaning in written text. The students all read the same unfamiliar text, which was considered being at their

							frustration level. Only five students out of 17 used the software in ways that could promote self-teaching. Five other students very quickly refrained from trying to decode, instead clicking the full page TTS. Another five students did not at any point try to decode words independently. These results suggest that by using TTS and talking books in reading instruction without measures to fine tune the scaffolding, it is very doubtful whether any students benefit from the TTS at all.
Hanghøj, 2011a	DK	Upper secondary education	Qualitative	Through a theoretical and empirical analysis of educational gaming, this dissertation contributes with practice-oriented knowledge on game design, game pedagogy and game competencies. Specifically, it is a design intervention in a multi-subject coursework of Danish and Social Science in upper secondary education.	Digitally mediated learning resources; websites of political parties; oral presentations and debate	Pragmatism (Dewey); anthropology of knowledge (Barth); dialogical pedagogy (Bakhtin); interactionism (Goffman)	The main finding is that educational use of games is a tension-filled meeting of two knowledge traditions. Teachers and students both regarded the adaptation of The Power Game (designed by the researcher), which could be described as a staged and focused form of problem-based project work with verbal presentations, as a valuable form of teaching. On the other hand, the students' game-based knowledge was given an ambivalent status as their game competencies were difficult to integrate with the existing validation criteria within the curricular and pedagogical context.

							This reflects how educational gaming facilitates contingent knowledge, which can be difficult to legitimize even though gaming is able to add new perspectives and unfold scenario-based hypotheses within the dialogical space of teaching.
Hanghøj, 2011b	DK	Secondary	Qualitative	Design-based research project based upon video observations of ten game sessions	Playing and reflecting upon an educational computer game	Genre theory (Kress); anthropology of knowledge (Barth)	The study describes how different groups of students respond to the same game, when being positioned as journalists writing journalistic feature articles based upon their game experiences. Some students (especially the boys) were “put off” by the game, which did not live up to their expectations, whereas other students benefited from exploring and reading the relatively large amounts of text found in the game. In conclusion, the author argues that teachers need to be able to clearly frame and communicate the aims and expectations of games, when using them for educational purposes within MTE.
Hanghøj, 2012	DK	Higher education	Qualitative	Design-based research (DBR) of game-based teaching and learning in Danish in higher education. Based on a general model of game-based	Digitally mediated learning resources; orality	Pragmatism (Dewey); anthropology of knowledge (Barth)	A game format called The Debate is developed and used in the course in which students are enabled to play roles and argue for positions related to a specific aspect of the subject. The analysis suggests that the model is a

				teaching suggesting four interrelated domains (pedagogical, curricular, everyday, and scenario based), the study explores what happens when this model is applied to the teacher's own teaching in higher education, including a course on the 'Didaktik' of Danish, which is partly based on online and distant teaching and learning. Data are video recordings and other data from 2010-12.			useful heuristics for designing course work on the subject. On the other hand, data also suggest that a redesign of the game, which establishes closer relations between the four domains (pedagogy, curriculum, everyday life and debate scenarios) may be needed. One of the implications of the findings is that game-based teaching is not a simple tool for transmitting subject-related 'content'. It is instead a mediated context for making and reflecting on meaningful, yet to some extent contingent choices in relation to aspects of a knowledge field. 'Playing a knowledge domain' is in this sense an open-ended practice.
Hanghøj, Hautopp, Jessen & Denning, 2014	DK	Primary	Qualitative	Design-based intervention with a Minecraft game scenario in five classes located at two different primary schools. Data analysis based upon ethnographically inspired approach to discourse analysis	Computer game	Theories on scenario-based education (Hanghøj); inquiry-based learning (Dewey); teaching as a professional practice (Schön); frame theory (Goffman)	The preliminary findings of this study show how the meaningful use of <i>Minecraft</i> within MTE depends upon teachers' (re-)design of specific educational game scenarios. Thus, teachers need a basic understanding of the game and to be able to design educational scenarios that ensure relevant integration with curricular aims, activities, and existing genres within MTE. Moreover, the findings show how the educational use of <i>Minecraft</i> involves mixed interpretive framings across

							different domains, which may both create “frame clashes” and allow students to explore, argue, and “re-frame” the meaning of their design choices within the game world.
Haugsted, 2008. Related to Haugsted, 2004a, 2004b	DK	Secondary	Qualitative	Two research and development projects, IMTF 465: “Chat og mundtlighed” and ITMF 479: “Mus og muser”, which are described in Haugsted (2004a, 2004b)	Chat, online narration and oracy	Rhetorics, didactic theory	The article shows how spoken language (and its genres) – mostly transient and random as a subject in class – becomes visible and concrete; working with rhetoric understanding and training as well as with pupils’ understanding and consciousness of use of the spoken language may profit by utilizing this possibility. The two projects also indicate how computers may contribute to spoken language becoming not only a tool in teaching, but the subject of teaching. In this way, the studies combine several different approaches (tool, media, literacy) to working with ICT and oracy within MTE.
Henningsen, 2004	DK	Secondary	Mixed	1) Quantitative analysis of the number and type of media texts present in teaching Danish in 9th grade based upon reading and examination requirements for the oral test in Danish at the leav-	Digital film making	Media theories (Thompson, Drother), didactic theory (Erstad), learning theory (Illeris), media literacy (Potter, Baacke, Vollbrecht)	The findings show how the number of media texts on the syllabus is considerably lower than the number of book-based literary texts. The genre representation of media texts is quite narrow – i.e. mainly newspaper articles, advertisements, and films with little emphasis on digital texts. More-

				<p>ing certificate examination in the year 2000. 2) Qualitative ethnographic study of media teaching in practice as an integrated part of teaching Danish in two different 7th grade classes with special emphasis on the relationship between media texts, classroom organization, and students' learning processes.</p>			<p>over, the study shows how teaching in media texts, which alternates between analytical and practical-productive activities, provides the opportunity for pupils to obtain a critical-theoretical insight into the influence of the media and at the same time to acquire expressive culture techniques. Finally, the study shows how the students' motivation is largely dependent upon the teachers' and students' control of their learning processes; gender preferences in relation to different aspects of film making; the possibilities and challenges of developing a meta-language for understanding media texts.</p>
Lehrmann, 1996	DK	Upper secondary education	Mixed	<p>Historical and quantitative analysis. The historical study spans from the first introduction of the domain of 'mass communication' in the 1971 reform of Danish via later reforms and debates until 1995. In a contemporary and local perspective, the study explores how current steering documents are understood by teach-</p>	<p>Representations of the domain 'mass communication' as found in steering documents on the macro national level and on local school level among teachers</p>	<p>Mass communication and media theory (Bondebjerg)</p>	<p>The historical analysis finds that although some interest has been shown towards media among teachers and reformists, the impact on practice is characterized by 'inertia'. The empirical study finds that mass communication is disintegrated from two other dominating domains, language and literature; it functions as 'a precipitation of a foreign object'. The study 'non-finds' a historical dimension in the teaching of media. Emphasis is on analysis of non-literary prose</p>

				ers, based on 50 Danish teachers' accounts of what they taught during the period.			(news), semiotic/psycho-analysis of ads, and narrative analysis of drama (faction in TV). The study calls for emphasis on genre-oriented media education, asking questions like: what are the implications of new technologies for teacher-student interaction and for the understanding of the book as a medium; and are new types of knowledge required (e.g. about pop culture)?
Lorentzen, 2013	DK	Primary and secondary	Qualitative	Case studies based upon interventions	IPads; web design and digital cameras; online portal with learning materials	Theories on multimodality (Kress); the educational use of ICT (Mishra & Koehler); sociology (Giddens, Castells)	This article argues that teachers of Danish must adjust their teaching to accommodate the demands of a digitized modern communication society. Empirical examples are presented from three case studies. The preliminary findings suggest that the use of ICT may be able to support more innovative teaching within MTE if teachers are able to address subject-specific aspects, organize their teaching with relevant activities and structures, and understand the multimodal learning possibilities of particular digital learning resources. The article concludes by pointing to the demand for more knowledge on innovative teaching with ICT, especially in relation to how teachers formulate new

							objectives for the Danish subject.
Paulsen & Tække, 2013	DK	Upper secondary education	Mixed	The study reports findings from the ongoing Socio Media Education project (SME). SME is an action oriented, 'practical-philosophical' empirical study focusing on the potential and actual use of social media in a Danish upper secondary education class. The project initiates two experiments, one focusing on Twitter and the other on Wiki use in all subjects in one class during a year.	Writing in Twitter and wiki writing	Sociological and context-based theories, more precisely medium theory (McLuhan, Meyrowitz), Actor Network Theory (Latour) and system theory (Luhmann), inform the research design.	The impact of the experiments is limited, if at all observable. In Danish, the Twitter experiment leads to limited use; the wiki experiment leads to no use. The researchers argue, in collaboration with the participating teacher and through the analysis of Twitter log files and other data, that the participating students do indeed deploy Twitter in fruitful and many-layered ways. The 'effects', in a qualitative sense, are that 1) more students become active, through writing, in the reflection about media, 2) students become more aware about the quality of media content, 3) students contribute to cooperative and collaborative knowledge building, and 4) students who are normally silent, get better access to participation and development of voice. The results suggest potential changes to the subject.
Slot, 2010	DK	Upper secondary education	Qualitative	Design-based research (DBR). Slot explores, in qualitative ways, an intervention in the use of different types of learning resources in Danish in	Learning resources covered a teaching book, a film, a digital resource, and the Internet.	Sociocultural (Dewey) and socio-semiotic theory (Kress)	Analyses of ethnographic data reveal that two types of agency play the lead roles in practice. First, the teacher is the central gatekeeper when it comes to the 'didacticization', i.e. the reflection, communication and use of the

				upper secondary education (age 16-18). Among other things, it explores whether students are allowed to draw on the semiotic and cultural resources and practices they bring to classrooms from home and other contexts. Data are field notes and interviews, among others.			didactic design in practice. Second, the didactic design, including the use of semiotic resources and tools for producing text competence, co-shapes the didactisization. Teachers have a much harder time didactisizing digital learning resources than books. Consequently, what started as an intervention taking student practices related to media as a point of departure ended with a finding suggesting that the semiotics of the book conveyed by the teacher is the dominating practice.
Slot, 2013	DK	Secondary	Qualitative	Textual analysis of learning materials	Analogue and digital learning materials	Theories on task design (Skjelbred, Slot); sociocultural theory (Vygotsky, Hauge); multimodality (Jewitt)	The article provides a didactic model and design principles that can be considered when designing learning activities in the subject of Danish in order to help students develop subject-specific skills. It is argued that there is a need to develop scaffolding principles that help pupils to understand the concept development of their own learning. Based upon an analysis of tasks taken from Danish and British learning materials, including both analogue and digital examples, three design principles are presented that relate to scaffolding. Tasks have to include: 1) a basic cog-

							<p>nitive level that supports the task content, 2) a multimodal approach to problem solving, and 3) involvement and influence on subject matters in order to stimulate the autonomy of the work.</p>
<p>Svendsen, 2011. See also Svendsen, 2012.</p>	DK	Upper secondary education	Qualitative	<p>Discourse (historical) analysis of pedagogical texts covering a historical period from the 1970s to the first decade of the 21st century; also analysis of steering documents and public debates about the subject.</p>	<p>Pedagogical texts used for teaching about media in Danish in upper secondary education</p>	<p>Discourse analysis (Foucault, Fairclough) and curriculum theory (Bernstein).</p>	<p>Media has been taught in Danish classrooms for the last 40 years, although with quite different purposes and justifications. Three metaphors have dominated the discourse. 1) In the 1970s, the main purpose was to take students on a 'journey' from the superficial world of mass media to the world of critical and enlightened thinking about self and society. In the 1980s and 1990s, teaching media became a 'ford' ['vadedsted']; cultural studies suggested the teaching of how students engaged in media and cultures. In the new millennium, the metaphor 'place of being' [værested] dominates; students' creative uses of media are foregrounded. To some extent, this is justified as part and parcel of the development of competencies that enable students to contribute to the knowledge society in a globalized world. Svendsen discusses whether this instrumental focus on</p>

							media creativity excludes important understandings of media.
Sørensen, 1994	DK	Pre-school, primary and secondary	Mixed	1) Media-didactic study of development projects on media teaching (1988-1992); 2) A reception study of young children's viewing of a TV programme (1991); and 3) A study of a video production process at second-grade level (1992)	TV programmes and students' video productions	Communication theory (Jakobsen), semiotics (Peirce), and reception theory (Pahuus, Hohn, Kristeva)	This dissertation explores experiential and productive approaches to media pedagogy. The curriculum for the subject Danish is criticized for reducing media production to a teaching method, which does not acknowledge the relevance for children's holistic <i>Bildung</i> . The empirical findings indicate gender differences between boys' and girls' approaches to media education. A media didactic model is developed, which includes 1) choice of topic, 2) topic-related media experiences, 3) student production, 4) analysis of student productions, and 5) final assessment.
Sørensen & Levinsen, 2014	DK	Primary	Qualitative	Intervention-based approach to developing learning designs at two schools in collaboration with teachers	Primarily Notebooks (tablets)	Digital literacy (Martin), didactic design theory (Dale, Schön, Sørensen, Levinsen)	The study presents three case studies, which show how students act as "didactic designers" in relation to their own productions. The findings indicate how students can benefit from specific ICT tools within MTE (e.g. copy paste, spellchecking, common storage space, text to speech software, multimodal expressions), especially in relation to differentiation, feedback and inclusion.
Tufte, 1995	DK	Secondary	Mixed	1) Media-pedagogical	Analogue film mak-	Critical theory and mass	The findings demonstrate how media

				developmental project (1983-1987). 2) Evaluation of 35 media-pedagogical developmental projects in the Danish Folk School (from 1987-1991). 3) A survey of 99 media teachers' attitudes to media teaching (1999).	ing	communication theory (Habermas, Negt & Kluge)	pedagogy should take students' genre preferences (TV and films) into account. Moreover, media pedagogy can benefit from shifting between the modes of production and analysis in order to develop students' sense of self-awareness ("Bildung") and socialize them in relation to aesthetic, psychological, and critical approaches.
Askeland & Aamotsbakken, 2013	NO	Upper secondary	Qualitative	Analysis of two upper secondary students' work with a writing assignment within the Norwegian subject	Writing with Internet-based sources	Socio-cultural theory, New Literacy Studies, Bakhtin, Vygotsky, Lankshear & McClaren	When students in upper secondary school make reference lists, which their teachers have told them to do, they tend to list digital, Internet-based resources only and forget to list books and articles which are paper-based. One of the two proficient writers described in the paper confirms this general trend, but the other also adds paper-based sources to her list of references. Both writers show their proficiency in that they are positioning themselves critically vis-à-vis the sources they use.
Bjørger, 2010	NO	Primary	Qualitative	Three examples of digital storytelling among 5-7 th graders in three school classes. The study is based on video observations and semi-structured interviews.	Digital text production	Socio-cultural theory, New Literacy Studies (Säljö, Wertsch, Scribner & Cole, Lankshear & Knobel)	Digital storytelling has the potential to contribute to learning, learning identity and agency provided it is based on a more fully developed pedagogical strategy of carefully linking school and leisure time.

Blikstad-Balas, 2012	NO	Upper secondary	Qualitative	Video recordings and interviews with four students in secondary school class	Laptop use in the classroom	New Literacy Studies (Barton, Street, Lankshear & Knobel)	Although banning Internet activity will not contribute to developing students' literacy skills, what might need more explicit attention is that neither will allow unlimited Internet access without any guidance or clear educational purpose.
Bratholm, 2008	NO	Primary and lower secondary	Qualitative	Exploration of students' work with digital portfolios. Observations and informal interviews formed part of an ethnographic approach. The dataset includes documents, informal interviews and field notes.	Writing in digital portfolios	Socio-cultural theory, Fostering Communities of Learners (FCL). (Brown, Engle & Conant)	Bratholm asks how productive academic engagement through use of digital portfolios can be fostered by suitable learning conditions. She points out teachers' cooperation, didactical competence and interest in use of ICT as important success criteria. Along students' motivation and activity level she finds these factors key to successful interplay between teacher and pupils when working with digital portfolios. Bratholm suggests the study indicate that skillful use of ICT must become a priority within teacher education.
Bueie & Pihl, 2011	NO	Primary	Qualitative	Action research, a collection of 15 student texts about literature and the response on the texts from teachers and peers	Writing fictional texts on a wiki	New Literacy Studies, response theory (Street)	The chapter explores the literacies students acquire when they publish their own fictional texts on a wiki and get response from teachers and peers. In the analysis of the 15 texts written and published on the wiki, the authors find that publication of texts on the school-based wiki motivates

							the students in their writing and makes them put more effort into the “content, dramaturgy, orthography and layout”. A survey (N=51) confirms that the majority of students finds that use of wiki motivates their writing. The study indicates that a combination of literature based education and digital publishing stimulates the students’ inner motivation to read and write. The authors conclude that publishing text on the wiki is meaningful to students and can foster digital and critical literacy.
Dons, 2006	NO	Primary and lower secondary	Qualitative	Presentation of a narrative from action research. Based on theory and practice from research and development activities in school, the article points out some perspectives on the technology culture of children that may hold importance for the professional training of student teachers.	Digital text production	Cultural studies, multimodal theory and theories of literacy as a social practice (Freire, Cope & Kalantzis, Kress)	To develop students’ digital competence in schools, we must include their experiences from media convergence, focusing on their multimodal texts and multiliteracies.
Flatøy, 2010	NO	Lower secondary	Quantitative	Reports a survey involving around 1,000 teachers in 172 different Norwegian schools	ICT use	Bildung theory (Klafki)	The survey included more than 200 Norwegian subject teachers. Generally these teachers reported the integration of ICT to strengthen the sub-

							ject of Norwegian. However, reservations as to the benefits of ICT use were also expressed. Many teachers felt a need for more education in use of ICT in the classroom. Therefore, the report suggests that a revision of teacher training, e.g. by exposing teachers to ICT-supported, flexible and collaborative constructivist learning, may change teachers' attitude and willingness to change their own practice.
Grüters & Ottes, 2011	NO	Lower secondary	Qualitative	Analysis of two textbooks designed for use in the Norwegian subject at lower secondary levels to find out the extent to which the websites reflected the Curriculum guidelines in Norwegian for digital texts.	Textbook analysis	Text theory and multimodal theory (Kress, Kress & van Leeuwen)	With reference to Rogne (2009), the authors conclude that their findings are "very identical" to his. The books analyzed relate to the digital requirements in the curriculum in a weak and unsatisfying way, which represents a threat to the quality of mother tongue education.
Hoem, 2009	NO	Secondary and upper secondary school	Qualitative	Memoz is a digital learning environment developed for educational use. In this study, use of Memoz in four school classes is explored by observations and analysis of students' production of digital texts.	Digital text production	Hypertextual and multimodal theory (Vannevar Bush, Jörn Barger; Lave & Wenger)	The project focused on how students used their out-of-school digital practices while engaging in multimodal text production on Memoz in school. The author concludes that digital learning environments developed for educational use should incorporate spatial representation, not only the sequential ordering of articles.

Iversen & Otnes, 2009	NO	Lower and upper secondary	Qualitative	The authors summarize a number of projects for making hypertextual narratives in classrooms. The approach was explorative or an action research design. Data comprise observations, textual analysis, and interviews. The chapter provides the reader with examples of how the making of a hyper textual narrative can contribute to students' engagement in creative text production.	Hypertextual narrative	Theories of text and hypertext (Berge, Kress & van Leeuwen, Landow)	The text culture students relate to is made more dynamic through hypertextuality. This challenges traditional text norms. Students' proper production of hypertexts is a preferable path towards appropriation of the digital text competence prescribed in the curriculum, and a way of making them literate in contemporary society. Therefore, students should be educated to read and write hypertexts in mother tongue education.
Krumsvik, 2004	NO	Lower secondary	Qualitative	Action research. Students' use of web-based learning resources in their individual text making. The web-based learning resources used were developed locally.	Digital text production	Socio-cultural theory (Lave & Wenger, Vygotsky)	"Temaweb", in this case did contribute to integrate technology in the students' textual work within the subject of Norwegian (in a cross curricular design). Krumsvik emphasizes the need for schools to embed digital technology in a didactical design aimed at making students active producers of knowledge themselves.
Nielsen, Sandvik, Østerud & Schwebs, 2006	NO	Primary and lower secondary	Qualitative	Action research, exploration of how eLogg functions	Digital text production	Multimodal and socio-cultural theory (Lave & Wenger, Kress, Vygotsky)	eLogg may function as a Vygotskian «scaffolding» process and as a community of practice, which contributes to bridging the gap between formal

							and informal learning processes.
Rogne, 2010	NO	Upper secondary	Qualitative	Analysis of five websites designed for use in the Norwegian subject at upper secondary levels to find out to what extent the websites reflected the Curriculum guidelines in Norwegian for digital texts	Website analysis	Text theory and multi-modal theory (Cope & Kalantzis, Drotner, Jenkins)	Wikipedia now seems accepted as a knowledge base in these settings. Text production and reflection about digital texts, on the other hand, have less priority and this is not in accordance with the requirements of the Norwegian Curriculum.
Rogne, 2009	NO	Upper secondary	Qualitative	Analysis of four textbooks designed for use in the Norwegian subject at upper secondary levels to find out to the extent to which the websites reflected the Curriculum guidelines in Norwegian for digital texts.	Textbook analysis	Text theory and multi-modal theory (Kress, Slot, Smidt)	The books relate to the digital requirements in the curriculum in a weak and unsatisfying way. This might make the quality of mother tongue education too dependent on the individual teacher's knowledge and skills.
Schwebs, 2006	NO	Primary and lower secondary	Qualitative	eLogg is a learning environment based on the principles of weblogs and wikis. In this study, eLogg use is explored in two school classes. The data include observations, informal interviews and students' digital texts.	Digital text production	Hypertextual and multi-modal theory (Erstad, Kress & van Leeuwen, Scribner & Cole, Tyner)	Most students demonstrated extended digital literacy proficiency, producing collaborative, hypertextual and multimodal writings. The texts were compared to texts written within a traditional learning management system. Although eLogg did not prove to result in better, more frequent or more prolific writing among the users, the LMS does not encourage open and collaborative texts, while eLogg

							made the texts more «visible» by letting the students write for a real audience.
Skaar, 2008	NO	Primary	Qualitative	In an ethnographic study of a class of 6th graders, Skaar compared the students' literacy on a school-based and a commercial website.	Digital text production	New Literacy Studies (Dyson, Heath , Hull & Nelson, Jewitt & Kress)	For one category of students, the commercial website stimulated the building of an identity in accordance with the social demands of the school community, and also stimulated development of skillful digital design. For a second category of students, the commercial website was used to build an identity which is socially unacceptable at school, while simultaneously the students' digital design was brought to a higher level of perfection. For a third category of students, the commercial site was used to establish an identity at odds with the school-based norms, and at the same time contributed very little to the development of skilled digital design. In their interaction on Internet pages the pupils were not only heavily exposed to marketing, they also became promoters, marketers, and advertisers themselves. This is the trait which most clearly distinguishes the students' out-of-school literacy from school-based literacy.
Skaar, Bucking-	NO	Primary	Qualitative	The study explores how	Digital literacy	New Literacy Studies	The study shows that the curriculum,

ham & Tingstad, 2010				Norwegian teachers understood and dealt with the relationship between educational and commercial aspects of young people's cultural and social lives online. In addition to the analysis of key documents, the study draws upon the results from a survey (n=376), focus group interviews and individual interviews with teachers.		Buckingham, Castells, Jenkins	textbooks and teachers' approaches to advertising and marketing generally fail to include the new marketing strategies that are now targeting children on the Internet. All the teachers believed that education, rather than regulation, is the best way to protect and empower children with regard to online marketing. When prompted, they were able to suggest some concrete approaches to addressing Internet-based marketing in the classroom, although these approaches were not yet part of their classroom practice, and the teachers did not know whether they would be able to try them out either. The emergence of this new media landscape outside the classroom prompts a consideration of how much it is actually reasonable to expect in terms of teachers' and students' critical assessment of advertising and marketing.
Skaar & Hammer, 2013	NO	Upper secondary	Mixed	In a two-part mixed methods study, Internet-based plagiarism amongst Norwegian upper secondary students was	Writing with Internet-based sources	Cognitive and socio-cultural understandings of plagiarism (Bazerman, Anderson, Carrol, Howard)	The quantitative part of the study showed that 75% of the 67 students in the study plagiarized from the online sources and that plagiarism accounted for 25% of the total

				measured and related to their performance level and knowledge of source use. Subsequently, interviews were conducted to explore the students' views on Internet access and plagiarism while essay writing.			amount of text. Students with a higher grade in written Norwegian plagiarized less than those with a lower grade. Further, students more familiar with the correct use of sources did not plagiarize as much as students with less awareness. In the qualitative part of the study, individual interviews with 29 of the students indicated that the students wanted to spend as little time and effort as possible on the task, and a great majority of the students wanted Internet access whether they judged this an obstacle to their learning or not.
Trageton, 2005	NO	Primary	Mixed	Action research was carried out in 14 classes in Norway and 3 other countries in 1999-2002. The collected material encompassed 7,500 mul-	Creative writing on computers	Socio-cultural theory (Vygotsky, Lave & Wenger)	Writing tests showed significantly higher quality in computer classes than handwriting classes and handwriting tests showed significantly higher quality in computer classes in spite of delayed handwriting. Because

				timodal texts, 60 edited videos, writing tests, teacher reports, and questionnaires.			handwriting is difficult for 5 to 7-years-olds writing on the computer should come first and teaching of formal handwriting should be delayed until grade 3 (8-year-olds).
Björkqvall & Engblom, 2010	SWE	Primary	Qualitative	Social semiotic ethnography. 10 pupils in two schools, video recordings and photos, texts, interviews with teachers and parents, ongoing dialogues with children, and field notes.	Computer interaction	New Literacy Studies, Multimodality and Social semiotics (Barton, Gee, Jewitt, Kress)	The article describes and discusses the learning potential of unofficial techno-literacy activities in the classroom with regard to Swedish 7 to 8-year-olds' exploration of semiotic resources when interacting with computers. In classroom contexts where every child works with their own computer, such activities tend to take up a substantial amount of time. The children have access to a wide range of sites and programs and show an interest in discovering these resources. The article thus explores a previously often neglected site for learning, located in the official classroom context but involving self-chosen activities with contemporary technology. In terms of theory and methodology, social semiotic ethnography is introduced into the field of young children's techno-literacies. It is illustrated how a social semiotic approach allows for a more detailed analysis of the semiotic resources,

							whereas ethnographic data are necessary for an understanding of how such resources are put to use.
Elmfeldt & Erixon, 2007	SWE	Secondary	Mixed	113 essays, 70 interviews (teachers and students), survey, observations	Essay writing	Theory and research in the teaching of literature, pedagogy of writing and media studies as have been developed in Scandinavia under the influence of international research on reader response criticism, cultural studies, media studies, and genre theories, including Systemic Functional Linguistics (Berge), Critical Discourse Analysis (Fairclough), and studies of multiliteracies (Cope & Kalantzis)	Elmfeldt & Erixon (2007) explore how pupils' media skills are of great importance for their essay writing in school. They discuss how the writing competencies pupils develop as cultural practices and values change when the media ecology changes. It is posed that, when writing essays at school, pupils use experiences and strategies from a range of media, i.e. that the pupils' experiences of images, video games, movies etc. are also very important when they write ordinary stories. In so doing, Elmfeldt & Erixon suggest abandoning the old dominant and Romantic conception based on a distinction between fact and fiction in favor of the experience from everything being mediated, i.e. a transformed epistemology as a result of media reflexivity.
Elmfeldt & Erixon, 2011	SWE	Upper Secondary	Qualitative	Text analysis of one essay	Essay writing	The study is theoretically based on functional writing theory (Berge), Critical Discourse Analysis (Fairclough), multiliteracy (Cope & Kalantzis).	Elmfeldt & Erixon (2011) is based on an analysis of one of the student's essays collected in Elmfeldt & Erixon (2007). At first sight, the student seems to lack the will or ability to write a traditional narrative since he

							seeks to establish strong connections between essay, films, and role play. But in the analysis it is suggested that the text might be regarded as a two-dimensional multimodal text that is in written form and based on the student's ambitions. The text consists of different types of text, image, and sound modalities positioned alongside one another and constituting a whole. This "transduction" process is regarded as an aestheticising text act, which implies that text production is a matter of design (Cope & Kalantzis, eds. 2000/2002).
Erixon, 2007	SWE	Upper secondary	Qualitative	Three teachers interviewed	Writing	Media ecology (Mackey); sociology (Habermas and Ziehe)	Erixon (2007) considers the impact on the teaching of writing and the curriculum, of changes in culture associated with mass media and new means of communication such as the Internet. It specifically focuses on the implications these changes might have for the ways in which writing is taught and practiced in schooling today. According to the three teachers in the study, the curriculum faces challenges from students' access to and use of mass media culture and computer-mediated communications. For example, the teachers reported that stu-

							<p>dents are currently less interested in grammar and spelling, and more interested in images and layout. Students also use what teachers consider to be plagiarism in their methods of communication. The article draws on media ecology to understand these reported changes in the sense that students are seen to develop new media practices involving several media-specific competencies (Mackey, 2002) which gives them access to new ways of meaning-making in their acts of reading or writing. It is tentatively claimed that students may thus develop alternative notions of authors as well as texts, which affect their own view of text production in school.</p>
Erixon, 2010	SWE	Secondary	Qualitative	Interviews of 10 teachers	Reading and writing	Media ecology (McLuhan) and Basil Bernstein's concepts of 'recontextualisation', 'framing', 'classification', and 'the sacred and the profane'	<p>This article deals with how school subjects' paradigms, i.e. the established content of the teaching and the way in which the teaching is traditionally organized, are influenced when digital media are becoming increasingly common in educational contexts. The study shows that the teachers in the lower secondary school where the investigation was conducted use so-called new media to</p>

							a relatively limited extent, but that they are ready to develop their use if resources are made available. They also think that the content, working methods, relations and the role of the teacher are changing, usually for the better.
Erixon, 2014	SWE	Secondary	Qualitative	Ethnographic approach with interviews and observations	Reading and writing	Pedagogical theory (Bernstein); media ecology (McLuhan, Strate, and Bolter & Grusin)	Erixon (2014) discusses what is identified as a remediation and consecutive relativisation that are taking place in the school subject of Swedish on three levels. For example, relativisation occurs via all of the perspectives that are brought into the pedagogical discourse through e.g. the influx from the Internet. The textbook is associated with limited perspectives and restricted and partially obsolete contents while the Internet represents something more transient and vague. In this way, the boundaries between values, knowledge and perspectives are challenged. On the second level and in the concrete teaching, a transduction is taking place, i.e. a transition from 'telling' to 'showing' or from telling and expositions to images and models. The image offers other affordances than the text and hence also different contents. The third level

							concerns the relations in the class. With the teacher's function changing from teacher to friend, the traditional hierarchical structures are being challenged. Thus, it is not only the text-book that is questioned but also the teacher, with both being tools for the pedagogical discourse and its recontextualisation apparatus.
Erixon et al., 2012	SWE	Secondary	Qualitative	Ethnographic, interviews and observations of 10 schools, interviews (50 pupils and 50 teachers), observations	Reading and writing	Basil Bernstein's concepts of 'recontextualisation' and media ecology (McLuhan; Strate)	The point of departure in Erixon et al. (2012) is the three school subjects of Art, Music and the Mother tongue (Swedish) which, like other school subjects, are feeling the pressure of a digital media and screen culture to an ever-increasing degree. The study examines how teachers and pupils in these three school subjects conceive of and relate to the shifts that take place in the subjects when digital media are being increasingly integrated into the teaching. An emerging pattern shows both similarities and differences concerning the three school subjects' relationships to digital technology; teachers in all three subjects want to use digital media to a greater extent than is currently the case, but also that the older analogue technology is often regarded as more

							authentic and, hence, attributed a higher value. Further, the incorporation of new digital technology in the teaching context varies and has reached different stages in the three school subjects, which was an important point of departure for the study. The breakthrough of new technology has evidently reached furthest in the subject of Music.
Fast, 2007	SWE	Preschool	Qualitative	Ethnography, interviews, observations of seven children	Reading and writing	Literacy and visual literacy (Barton, Gee, Kress, Kress & van Leeuwen, New London Group)	The study aims at investigating the transition between home, preschool, preschool class and primary school in order to determine to what extent and in what ways the children are allowed to use their previous experience with and knowledge of literacy. Fast (2007) shows that, already in preschool, children's practices involve reading and writing in a number of contexts that occur before they are exposed to formal education. The children were socialized in literacy events via their culture, traditions, language, and religion. Regardless of their cultural, language or socioeconomic background, the children shared experiences and knowledge relating to popular culture and the media and had in common an under-

							standing of texts in the form of words, names, images, and icons. Some children were allowed to bring their experience into the classroom. For them, there was continuity between literacy practices at home and at school. Others were forced to leave their experience outside the classroom. However, the children's knowledge about literacy related to popular culture and the media generally had a low cultural value in instructional preschool settings.
Holmberg, 2010	SWE	Upper secondary	Qualitative	Video recording and text analysis of 22 students	Writing	Systematic functional linguistics; (Berge; Halliday)	Holmberg (2010) investigates how the use of computers with Internet access transforms the conditions of writing in the school context. The case study focuses on a class in Swedish Upper secondary school (16 years old) writing argumentative texts that the students may send to a local newspaper for digital publishing. The analysis uncovers how during the writing process the students interpersonally orient themselves towards different readers, sometimes writing just for their teacher, but sometimes for the readers of the Internet paper. The analysis shows how the student's writing task quickly gets unexpectedly

							complex. As a consequence of the controversial proposal that the students want to publish, they need for strategic reasons to not “express their own opinion” as they are supposed to do according to the curriculum. They are also pushed by the situational context of public debate to not choose for the text they are writing the thesis argument outline recommended by their teacher. Instead, they elaborate a pattern that makes their thesis a solution for a problem formulated in the introductory part.
Hultin & Westman, 2013a	SWE	Primary	Qualitative	interviews with eight teachers, observations and material collected from 12 children	Writing	New Literacy Studies and multimodality (Street; Kress; Barton); genre theory (Swales)	Hultin & Westman (2013a) analyze how digitalization affects early literacy practices in primary school in terms of literacy teaching (methods, materials, routinized activities, etc.) and the use of literacy genres in digitalized writing. The results show that the studied literacy practices have changed, both in terms of literacy teaching (methods, material, routinized literacy activities) and in terms of text production and genre. The study suggests that when children use digital writing tools their texts become longer and they also use a wider range of literacy genres, specifically more factual gen-

							res.
Hultin & Westman 2013b	SWE	Primary	Qualitative	Ethnographic, observations and interviews with teachers and pupils and computer written texts from 12 pupils	Text productions	Critical literacy (Janks) and genre theories (Swales; Schleppegrell)	The study explores the use and production of text genres as a power-embedded practice in digitalized literacy practice. The article's main purpose is to contribute to an understanding of the use and production of text genres as a power-embedded practice. In doing so, first-grade children's texts are analyzed in terms of genres and sub-genres. Further, the subject positions that are constituted in the children's texts are analyzed. Genres are understood as related to power since they both open and/or close ways of saying or stating things in and about the world. "Where there is power there is resistance" (Foucault, 1976). Specific interest is directed to children's ways of offering resistance in their texts, namely resistance to prescribed dominant genres. The resistance is seen as a creative way for children to use their power and agency by creating hybrid genres.
Lundström & Olin-Scheller, 2010	SWE	Secondary	Qualitative	Exploratory study	Narrative competence	Narrative theories, multimodal theory (Gee; Jenkins; Kress)	Lundström & Olin-Scheller (2010) raise and contextualize the changing skills needed for reading in today's media landscape, which is character-

							ized by a convergence culture, where the formats and the distribution of a narrative come together and create an extensive multimodal text universe. At the same time, the traditional division between producer and consumer is challenged. With examples from fan fiction and role-playing games, the article discusses the notion of narrative competence as a possible way of understanding and describing the participation in a multimodal text universe. Some things that characterize narrative competence are social interplay in a collective intelligence, to be able to discern plots and make creative imitations and to develop a meta reflective ability to be able to meet, try and understand one's own reactions. One conclusion in the article is that, if school education wishes to be experienced as relevant among students, it should include narrative competence. At the same time, it will also increase the possibilities of achieving democratic goals.
Sofkova Hashemi, 2013	SWE	Primary	Qualitative	4 classes randomly selected among wiki projects on the Internet	Writing	Literacy as a social practice (Barton, Merchant); multimodality and new com-	Hashemi (2013) claims that when bringing social media arenas, such as wikis, into the classroom this will

					<p>municative practices (Kress); writing process (Flower & Hayes); theories of feedback (Ellis)</p>	<p>invite teaching approaches that engage students in authentic, participatory and creative writing processes. This case study examines the online text production of primary school students in a wiki environment and how the key functionalities for commentary, discussion, logging skills of text, and multimodal expression are utilized in practice to develop writing. Exploring the design of assignments and analyzing the nature of final texts, writing strategies and feedback reveals an iterative process of writing dominated by strategies of expanding texts with new information and occasional surface editing. The students composed individual narratives on selected themes augmented by drawings, images, speaking avatars, and video clips. Feedback was mainly provided by the teachers in the form of encouraging comments and corrective revisions directly in the students' texts. Peer response was rare, in one project taking the form of discussion posts. Revising indicating increased language awareness was observed among second language learners. Overall, the study demonstrates a</p>
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							tension between instructional design, the affordances of the writing arena and the space for creativity when engaging students in advanced, participatory and reflective composing and revising of texts.
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