Exploring Educational Designs by Schematic Models: Visualizing Educational Value and Critical Issues of Recognition and Socio-Material Frames

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ABSTRACT

Drawing on experiences from a large-scale Nordic co-design research project, this paper explores the development of cross-border blended education with the aim to strengthen students' Nordic identity and knowledge of neighboring Nordic languages illuminating the flow of didactical designs students were offered to engage in, i.e. the knowledge content, activities, spaces and resources. The iterative, three-year educational development of designing for learning proved to provide space for shared and collaborative knowledge development involving students in rich, authentic, and goal-oriented inter-Nordic comprehension practices on multiple levels, addressing content-related as well as contextual frames in teaching situations. Schematic models of the didactical designs revealed initial dis-alignment and diverse appropriation of modes and media in parallel cooperative activities combined with collaborative cross-border face-to-face talk promoting students to take perspective, compare, and contrast. Addressing the socio-material frames of teaching gave an opportunity to discover new learning goals and design activities in new adequate arrangements of the physical classroom and the digital space. The analysis demonstrates that students developed linguistic, cultural, critical, and digital competences of varied educational value based on the teams' divergent approaches to knowledge processes to incorporate digital technologies in teaching practice. The study highlights the critical factors of recognizing digital, multimodal meaning-making and informal skills as means to promote learning and schools' remaining insufficient provision of digital infrastructure for learning activities in blended learning environments.

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INTRODUCTION

Teaching increasingly involves the use and incorporation of digital technologies changing learning being more a matter of student-active participation, collaboration, sharing and being able to interpret information from a diversity of sources and media, formulate questions for this content and solve problems (Binkley et al., 2012; EU, 2017; Godhe et al., 2020). Teachers are expected to find meaningful and stimulating ways for teaching and equip students with the skills they need to participate in this constantly changing society (Conole, 2013; Boistrup & Selander, 2022). A teacher needs to understand the relationship between digital technology and learning, and choose relevant digital technology based on the learning goals, activities, and processes on which they are designed. In this conscious choice of digital resources, teaching can be varied and expanded from merely self-correcting exercises and word processing to problem solving, creative multimodal tasks and online communication with recipients outside the classroom.

In an EU-funded *Cross-Border Nordic Education* research project, teachers, students and researchers in Denmark, Norway and Sweden collaborated to develop innovative teaching across the nations' borders in the school subjects mathematics, L1, science and social studies. This was a unique opportunity to generate realistic educational designs and bridge the formal barriers of the Nordic countries' school systems to increase the students' knowledge of the Nordic countries' culture and history and to strengthen a common Nordic identity. The cross-nordic teams planned together and co-designed collaborative tasks and joint lessons mediated by digital technology as the necessary facilitator to handle the geographical distance, communicating in their respective Nordic language.

The initial studies of the project demonstrated development of educational designs involving different technologies for students to practice content specific competencies, yet, neglecting the pedagogical dimension (Willermark et al., 2016). Analysis of progression patterns over time recognized deployment of design strategies of both repeated use of technology with gradual refinement of content and pedagogy, and explorative, new, and rich use of many different technologies, pedagogies, and designs. The purpose of the present study is to direct the analysis towards a disciplinary, subject-specific understanding: How can we understand the deployed didactical design strategies and the knowledge content, activities, spaces, and resources students were offered to engage in from the perspective of L1-subject? The goal is to illuminate the flow of design sequences in each design regarding what meaning-making activities, modes of knowledge representation, sharing and collaborative spaces students were offered to engage in and to address faced educational opportunities and challenges surrounding these practices.

CONTEMPORARY TEACHING AND LEARNING LANDSCAPE

Students and teachers are nowadays involved in meaning-making activities in schools using a wide range of physical and cultural resources (Wertsch, 1991), providing blended and/or fully online learning environments with multiple ways to represent content and instruction (Smith & Harvey, 2014). These contemporary shifts of forms, uses, and technologies in society entail also new ways to communicate, make meaning and learn (Merchant, 2008; Walsh, 2008). Digital resources and environments enable richer and more authentic learning materials of multimodal and interactive character such as moving images, films, animations, slide shows, sound recordings, digital games, etc. Computer-mediated texts and communication can be visual, written, oral, or a combination of them (i.e. multimodal), synchronous or asynchronous, providing virtual and simulating environments (Clark et al., 2016). This expansion of print towards digital, multimodal representations enables teachers to present their material in new ways and, similarly, students to learn using diverse modes and media and demonstrate their knowledge producing multimodal representations (e.g. Sofkova Hashemi, 2017; Svärdemo & Åkerfeldt, 2017; Andersen & Munksby, 2018).

In addition, the development of network technology has changed how learners interact and made it possible for students to interact with other learners located in geographically distant areas. Learners have the opportunity to engage in joint activities and tasks and to communicate, share resources, collaborate and co-construct (Jeong & Hmelo-Silver, 2016). In such a process, a group of students engage in activities towards a shared goal where we often find instances of both cooperative (e.g. division of labor, working separately with portions of the task) and collaborative (e.g. joint engagement of two or more people in activities) learning activities (Scardamalia & Bereiter, 2014). Research on computer-supported collaborative learning (CSCL) shows that technology facilitates collaboration and affords students in face-to-face settings (Lehtinen et al., 1999), that activities vary depending on the tasks and instructional goals, and that these activities need in particular promote talk (e.g. van Aalst, 2009; Peters & Slotta, 2010).

Studies on technology-mediated teaching demonstrate opportunities to provide more varied, collaborative, and individualized learning (Harper & Milman, 2016) based on real goals and recipients which makes students experience the teaching as meaningful and motivating (Warschauer, 2008). Opportunities for scaffolding also enhance as the teacher can more easily refer students to both more challenging and multimodal materials increasing the importance of a multimodal and multimedial recognition and understanding (Bezemer &

Kress, 2016; Sofkova Hashemi et al., 2020; Danielsson & Selander, 2021). Students develop digital skills, independence and participate actively and co-creatively, which are also seen as success factors for learning (Binkley et al., 2012). However, this transition towards more open, multimodal, networked and student-active teaching where students work more independently with the teacher in a different role, also requires development of new understandings, beliefs, and pedagogies (Fullan, 2007). Incorporation of digital resources and technology in education may result in already established teaching practices or substitutive forms of teaching (Cartwright & Hammond, 2007). Other studies point out that technology tends to take precedence over the subject content (Fleischer, 2011) and that structuring and organizing of learning materials dominates over more advanced and instructionally relevant application of technology in the classroom (Svensson et al., 2020). Activating students and support their work to relevant degree and level is above all a challenge of avoiding risk of leaving students without appropriate tools to solve a task (Luckin et al., 2009; Ingram, 2014).

DESIGNING FOR TECHNOLOGY-MEDIATED TEACHING AND LEARNING

The new form of educational environments in which learners engage with different tools on the Internet and through computer technologies is acknowledged as a paradigmatic change in education (Beetham & Sharpe, 2013). Teaching is recognized moving away from delivering content to students towards a creative process of *design for learning* of new practices, activities, resources, and tools that underpin particular learning objectives in a given educational context in a continuous dialogue with the learners in practice (Mor & Craft, 2012). As Sun (2017, p. 576) argues, it is a matter of concerning the learning process in an activity-centered forward-oriented design of emergent learning situations in a fundamental theoretical assumption of that "learning cannot be designed but can be designed for". This means that teachers can only design for learning tasks to facilitate students' activities as learners, not their experiences. Students have the opportunity to create their own learning paths, previously more controlled by the teacher who could provide a specific material (Lindstrand & Åkerfeldt, 2009; Selander & Kress, 2010).

From the perspective of didactics, teachers relate and facilitate students access to the subject content to be taught and learned based on the three components of 'didactic triangle' linking student, teacher and content in a concrete teaching and learning situation (Künzli, 2000; Krogh et al., 2021). These fundamental parts of teaching in *what* should students learn (content), *how* should they learn it (methodology) and *why* this content and this method for these students (purpose and goal) need to be addressed together with a new knowledge

domain that entails not only *which* technology to use but also a larger context based on questions concerning interactivity in the physical and virtual spaces, *when* to teach and *where* (Lund & Hauge, 2011; Sofkova Hashemi & Spante, 2016). This entails awareness of the didactical relationships that arise between technology, student, and context. The content-technology relationship is brought to the fore as a question of *design* and which technology is to be used, such as *why* and *how*. In the student-technology relationship, the focus shifts to the use of digital resources and the didactic interaction. The primary role of the teacher is then related to the design and layout of teaching situations and learning activities (Hudson, 2011; Selander & Kress 2010; Boistrup & Selander, 2022).

Altogether, previous research highlights a vast challenge for education and for teachers to ensure that learning tasks and the use of digital technology are meaningfully integrated into the educational practice and promote students' knowledge development (Voogt et al., 2013). This complex change in education requires time, careful planning, and a gradual and systematic incorporation of what proves successful in teaching. This is where this study of a three-year, iterative, and systematic co-design work of blended, cross-border learning environments will contribute to this field of educational design research, analyzing concrete educational activities in real learning situations over time. The conducted didactical designs are explored from a subject-specific L1-directed perspective based on the following research questions:

1. How is the work organized regarding alignment between knowledge content, activities, spaces, and resources?
2. What patterns of didactical design strategies can be identified?
3. What additional developments and issues enabling or challenging the classroom practice can be discerned?

METHODS AND DATA

This qualitative co-design study explores development of cross-nordic educational designs in L1-subject part of an EU-funded research project called *Cross-Border Nordic Education*, with data collection carried out in five intervention cycles in 2011–2014. The goal was to develop innovative educational designs, where Danish, Norwegian, and Swedish students from one class in each country are taught simultaneously by a group of Nordic teachers, i.e. where teachers plan together and conduct collaborative tasks and joint lessons mediated by technology as the necessary facilitator to handle the geographical distance. Other criteria defined in the

project concerned that the digital resources would be freely available and that all participants in the project communicate in their respective Nordic language. The study follows the co-design of two cross-national teams involving six researchers, 17 teachers, and their students in 5th to 9th grade from seven schools in Denmark, Norway, and Sweden.[1]

The following describes the research design and participants including data collection, data analysis, and ethical considerations.

RESEARCH DESIGN

The co-design approach of the project combined methods of action research (Elliott, 1991, 2020; Adelman, 1993) and design-based research (Design-Based Research Collective, 2003; McKenney & Reeves, 2012/2019) involving teachers and researchers in the project in equally legitimate opportunities of systematic, iterative and reflective development (Schön, 1987) of concrete educational activities in real classroom situations (e.g. Cviko et al., 2015; Penuel et al., 2007). Action and design-based research methods have been successfully combined in the past (Majgaard et al., 2011) providing a practitioner-empoweremental and theoretical lens to examine educational designs "in a holistic, systematic, principled and sustainable way, taking into account the complexity of the contemporary learning environments" (Sun, 2017, p. 577). Action research places great emphasis on the participants' ownership of the development process. Design-based research puts more emphasis on theory development in the form of "small" theories about better teaching practice and user involvement (McKenney & Reeves, 2012/2019). Teachers and researchers in the project thus created context-sensitive knowledge of emerging local theories of teaching (McKenney & Reeves, 2012/2019) in a cyclic process of initial problem identification, contributing with new design ideas that were jointly discussed and reflected upon during workshops and team-meetings informing the development of subsequent didactical designs (i.e. redesign) then tested in the classroom settings. Didactical design (DD) refers here to the design of teaching sequences targeting a specific learning objective and subject content that includes a pre-planned sequence of lessons, with a detailed teaching plan of how to implement and conduct the task.

The initial development of DDs was practitioner-driven (*exploration phase*, McKenney & Reeves, 2012/2019, p. 83) with the L1-teams identifying assignments relevant to the project goals. Experiences from this first cycle revealed above all organizational and technical challenges such as synchronization of IT-systems in the collaborating schools, scheduling coordination to allow synchronous collaboration, and communication difficulties rooted in participants communicating in their respective Nordic language (Lundh Snis et al., 2012).

These experiences were addressed in the subsequent *construction phase* (2nd-3rd cycle) of new DDs and collaborative workshops exploring national curricula in the subject to find content of common interest to be part of the regular teaching, synchronizing schedules and exploring free digital learning resources to be used, etc. The L1-teams have through a comparative review of the content and goals of the curricula in the three countries at that time (Undervisningsministeriet, 2009; Utdanningsdirektoratet, 2013; Skolverket, 2011), identified essentially three content areas of common interest to work with: (i) language use, society and culture embracing students' identity development explicitly in connection to the neighboring Nordic languages,[2] (ii) digital texts and media, and (iii) critical and aesthetic perspective on texts and information. In the final *evaluation phase* (4th-5th cycle) the joint workshops and team-meetings were devoted not only to analyzing and reflecting upon the DDs to develop new ones, but also developing knowledge about recurrent and successful didactical design strategies, discussions that addressed the added values of technology-mediated education, as well as writing of reports and publications.

Overall, this qualitative research design yielded a rich and longitudinal data collection from multiple perspectives (Danish, Norwegian and Swedish teachers, students, researchers), a necessary framework of triangulation and "progressive focusing" of data and analysis to understand the complex practical problems in this context (Elliott, 2020, p. 114). In addition to documentation of the joint workshops and team-meetings, the implementation of the DDs in the classroom were studied through participatory observations and informal talks with two or more researchers present in each country taking fieldnotes, photographs, and/or video recordings. In addition, retrospective semi-structured interviews with teachers and focus group interviews with students were conducted using audio recordings. The data also includes collections of students work, recordings of online discussions, blog comments shared online and similar.

CROSS-NORDIC TEAMS AND DIDACTICAL DESIGNS

The overview in **Table 1** of the two cross-nordic L1-teams' DDs displays the targeted content area, grades and number of teachers and researchers involved. The initial DDs focus on the students to present themselves and their schools, sharing what everyday activities they are involved in, their hobbies, etc. (DD1; **Table 1**). The younger students in 5th grade (11 years old) of Team-A were then encouraged to get acquainted with Nordic history and culture (mythology, poems) and to express themselves in diverse text genres and modes (comics, sketches, chat). The assignments for the older students in grades 7–9 (13-15 years old) of Team-B were mainly devoted

	DIDACTICAL DESIGNS	CLASS LEVEL	NO. TEACHERS/ RESEARCHERS			SUBJECT CONTENT (GOALS)				
			DK	NO	SW	COMMUNICATE ORALLY & IN WRITING	ADAPT LANGUAGE TO PURPOSE, RECIPIENT, CONTEXT	CREATE TEXTS, USE DIFFERENT MODES	READ NORDIC TEXTS THAT ILLUSTRATE LIVING CONDITIONS & IDENTITY	SEARCH & VALUE INFORMATION OF NORDIC CONTENT
Team	**No. Researchers**		4	2	2 (4)					
Team A	1.　Everyday Life in North	5	3	1	1	x	x			
	2.　World of Comics	5	3	1	1		x	x	x	
	3.　Poems in Nordic Mythology	5	3	1	1	x	x		x	
	4.　Setting Sketches	5		1	1	x	x	x		
	5.　Language Differences	5		1	1	x	x			
Team B	1.　Presenting School	7	2		1	x	x			
	2.　News in North	7	2	1	1	x	x		x	
	3.　Nordic Youth Writers	8	2	1	1	x			x	x
	4.　Nordic Lyrics	8	2		1	x	x		x	
	5.　Telling by Movie	9	2		1	x	x	x	x	

Table 1 Overview of L1-teams' didactical designs.

to verbal (speech and writing) meaning-making reading and analyzing Nordic texts (news, fiction, poems) and a final DD addressing Nordic short films.

DATA ANALYSIS

The study builds upon previous work from the same project that aimed at operationalizing TPACK-model to detect how balanced and complex the teams' DDs were regarding design for learning tasks that are rich in content, offer pedagogical values and apply a variety of technologies (Willermark et al., 2016). This analysis recognized different behaviors among the teams where some teams repeatedly conducted more or less the same type of DDs, whereas other teams explored many different designs and technologies over time. Thus, revealing the balance and diverse complexity of the teams' DDs there remain questions of what that insinuates from the perspective of different subjects, which this study will explore in regard to L1.

Also in this study, the activities of the concrete realization of DDs planned, argued for, and implemented in classroom settings are in focus as the unit of analysis. The data material is delimited to the work of the two L1-teams of distinct approaches to design for learning: one with repeated design and one with varied and explorative design. The analysis is based on a rich set of data comprising minutes of workshops and team-meetings, communication logs, design documents (plan manuscripts, lesson materials), field notes with logs of events of teacher and student activities and resources, transcripts from (video) observations, as well as transcripts from teacher and student retrospective interviews.

With the aim to illuminate the didactical design strategies deployed, the analysis involved examining the teams' intentions and review the design documents for the intended learning outcomes (*what*) and the teaching-learning tasks and activities students should master (*how*) (Biggs, 1996; Biggs & Tang, 2011) with the lens of the context of collaboration (*when* and *where*; local or cross-border, synchronous or asynchronous) and sharing (with *whom*), and choice of educational resources (*which* modes of representation, text genres; digital resources and platforms). The implementation of the DDs was then examined visualizing the flow of the design sequences in schematic models by creating symbols representing the meaning-making activities and modes of knowledge representations, sharing and collaborative activities displayed. Summarized in *Table 2*, the arrow symbol represents the initiation of a task (first row). The page symbol (white rectangle with horizontal lines) denotes writing activity involving the students in reading the written message and/or producing written texts, posts, or presentations. Sound symbol represents sound recording activity when students record themselves reading their texts or when they listen to an audio recording. Picture symbols represent visual and multimodal activities when using images, photos, or combining modes such as pictures, sound, animations, etc. Film strip symbol represents video recording activities. Crossed arrows correspond to sharing activities such as sending documents etc. by email or uploading material online. The filled circle represents collaborative work in cross-border constellations, for instance when planning together an assignment, or present and talk about solutions to assignments, and/or interview each other posing questions.

ACTIVITY	SYMBOL	MEANING
initiation of a task		Introducing activities in the class
writing/reading		Producing written texts/post/presentations Reading written texts
talking/reading aloud/ listening		Producing audio recordings talking/reading text Listening to audio-recorded talk/reading
writing and visually presenting		Producing multimodal representations combining writing and images
drawing/sketching/taking photographs		Producing visual and/or multimodal representations
filming/watching movie		Producing video recordings Watching films
sharing products		Sending documents etc. Uploading materials on a digital platform
discussing/asking		Synchronous face-to-face video talk Asynchronous interviews

Table 2 Overview of the symbols used in the schematic models.

ETHICAL CONSIDERATIONS

The data was collected based on the Swedish Research Council's (2017) ethical guidelines, including requirements for confidentiality, consent, information, and autonomy. In the beginning of the *Cross-Border Nordic Education* project, all the participating teachers and students were informed about the aims of the project, the purpose of data collection, and how data analysis would be conducted. Authorized letters of information were signed by the students' parents, where information was given about voluntary participation, the right to end the participation at any time, the safe-keeping of the data, and the anonymization of all participants.

FINDINGS

This section presents the findings from the analysis of the five co-designed DDs of two cross-national L1-teams illuminating the didactical design strategies deployed. For each team, first the analysis of the intended teaching-learning tasks and activities is outlined (i), followed by a list of the deployed digital resources (ii), and a visual analysis in concrete sketches of the flow of design sequences of the DDs (iii), revealing the design strategies of particular DDs (iv). The analysis is substantiated and validated with an empirical example of the teams' planning bringing to the light also subsequent developments and issues enabling or challenging the classroom practice.

COLLABORATIVE AND MULTIMODAL DESIGNS AS TOOLS FOR THINKING

The analysis of the five DDs of Team-A presented in *Table 3* illustrates teaching strategies of dynamic, varied,

and multimodal nature. Students in the 5th grade were involved in parallel tasks in each country in combination with cross-national activities, involving varieties of digital platforms and resources. In the task (row I in *Table 3*), they were encouraged right from the first DD on the topic of *Everyday life in North* to strengthen and accompany their written facts with images, photographs, music, or film in a digital presentation and also to use their voice to give feedback on the peers' work. Recording feedback as an alternative to writing a response to peers was from the teachers a strategy to expose the students to experience the neighboring languages in yet another modality. The software that supported this sound recording functionality (VoiceThread) was purposefully chosen by the team for this task. However, as the schematic analysis clearly demonstrates (row III, *Table 3*), the students preferred to produce written feedback (page symbol). Subsequently the students shared their experiences orally in a video talk in the whole class through a tool for synchronous meetings (Skype), asking clarifying questions. This was their first encounter with the collaborating Nordic peers and neighboring languages and a way to get introduced and acquainted with each other in the project.

In the upcoming DDs, the team divided the students in smaller cross-border groups (aprox. 3–4 students per country). The tasks and activities concerned students working with narrative structure in animated comics (DD2, Pixton), reading and listening to original Nordic literature, poems, and mythology (DD3, Google docs), interpreting setting descriptions in 3D-sketches (DD4, Minecraft), and writing in social media interviewing and asking peers questions surrounding differences in the Nordic languages (DD5, Twitter).
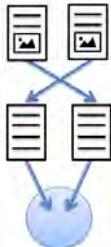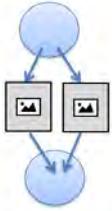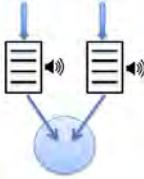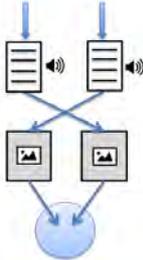
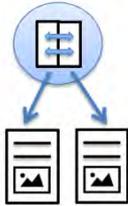| DD	1. EVERYDAY LIFE IN NORTH	2. WORLD OF COMICS	3. POEMS IN NORDIC MYTHOLOGY	4. SETTING SKETCHES	5. LANGUAGE DIFFERENCES
I.	L: Gather, document and present facts in writing, film, pictures and/or music. L: Share presentation. L: Write and/or record feedback. C: Ask questions and give feedback.	L: Read and analyze comics. C: Decide on story's plot, characters and setting. L: Create own comics – animate, write, use color. C: Give feedback.	L: Read and analyze Nordic poems; Create own poems in writing and record reading. L: Share poems. C: Read poems and give feedback.	L: Read setting descriptions; Write own description. L: Share description. L: Interpret peers' description in drawing/sketches. C: Compare drawings/ sketches with original description, talk about differences and similarities.	L: Prepare questions in writing. C: Interview in writing in social media. L: Present findings in writing.
II.	PowerPoint, VoiceThread, Skype	Pixton, Wiki, Adobe Connect	Google docs, Wiki, Adobe Connect	Google docs, Wiki, Minecraft, Adobe Connect	Twitter, Google docs
III.					
IV.	Present – Share – Response – Co-evaluate	Co-plan – Compose – Co-evaluate	Compose – Share – Co-evaluate	Compose – Share – Sketch – Co-evaluate	Co-interview – Compile

Table 3 Analysis of Team-A's Didactical Designs (DDs).

(i) Intended teaching-learning outcomes and activities – local (L), cross-national (C); (ii) digital resources; (iii) sketch of DDs flow; (iv) design strategy.

The Team-A increasingly accommodated diverse multimedia programs and social arenas in their designs (Pixton, Minecraft, Twitter). The students, thus, had the opportunity to enhance their cross-border understanding not only in reading and writing alphabetic texts as was the case in the initial design (DD1) but also using audio software to record voice and listen to a poem being read in the source language (DD3), visualizing their interpretations of language in drawings on paper and 3D-sketches on screen (DD4), and engaging in instant conversations using social media (DD5). The team offered early in the project a collaborative digital platform on a wiki webspace for the students to share information, sound recordings, texts, and other representations of their work in the cross-border groups. Besides shared experiences of the final outcomes of the assignments the students were involved in co-planning with the Nordic peers of a comic story (DD2), drawing 3D-sketches based on peers written descriptions, translating across sign systems (DD4), and interviewing each other in synchronous social writing activities on Twitter as a basis for producing a final presentation of what they learned about each other's languages (DD5). Overall, the students were thus engaged in both *assimilative* and *productive* tasks (reading, listening, writing, creating, drawing), *information handling* (analyzing) and *communicative* assignments (peer exchange, asking questions, discussing). In the

DD4 they were also involved in *adaptive* (virtual worlds modeling) and *experiential* tasks applying knowledge transferring between modes (cf. Laurillard, 2003 media typology; Conole, 2013 task taxonomy).

The analysis of the team's design strategies (row IV, *Table 3*), revealed in the visualization of the flow of DDs in the schematic models a pattern of *Compose–Share–Co-evaluate* activities in three of the designs (DDs 1, 3, 4). Students engaged here in solving problems and finding solutions to the tasks in parallel and subsequently sharing their compositions between the Nordic peers and evaluate the outcomes in the cross-border groups in synchronous video talks. Another design strategy was to *Co-plan–Compose/Compile–(Co-evaluate)* which concerned initiating a design in a collaborative task such as the co-planning of plot, characters and setting of comics (DD2) or co-interviewing peers using instant messaging software (DD5). Here the knowledge composing/compiling was a subsequent activity after deciding upon and creating a task to each other with an option for sharing the assignments outcomes in the software (Pixton) and discuss final experiences during real-time video talks.

As an example of the conscious application of diverse modalities to enhance student's language comprehension, *Table 4* presents the Team-A's planning for DD4 of setting sketches representing the addressed knowledge goals, subject content, and criteria for

Assignment:

We will find similarities and differences in our Nordic languages by writing a setting description with a descriptive and explanatory text. The groups then exchange descriptions with each other and interpret/ translate it by building it up in MinecraftEdu. We will then be able to compare the setting descriptions with the interpretations in a conversation in Adobe Connect.

Goal – core content years 4–6 (curricula):

- Use of language in Sweden and the Nordic area. Some variants of regional differences in spoken Swedish. Some typical words and terms in Nordic languages, as well as differences and similarities between them.
- Narrative text messages, language characteristics and typical structures involving parallel action and flashbacks, descriptions of settings and persons, as well as dialogues.
- Descriptive, explanatory, instructional texts. Textual contents, structure, and typical language features.

Assessment criteria – writing (curricula):

- Students can write different kinds of text with understandable content and basically functional structures and with some variation in language. In the text students use basic rules for spelling, punctuation, and correct language with some certainty. The narrative texts students write contain simple expressive descriptions and simple plots.

Assessment criteria – language use (curricula):

- Students can give examples of national minority languages, apply simple reasoning about language variants in Swedish, and give examples of some of the main language similarities and differences between Swedish and closely related languages.

Activities and preparation in respective classroom:

- Class reads setting descriptions; groups compose mind-maps of key-elements describing the house.
- Students upload their written house description on Wiki.
- Students interpret peer group's description in 3D-sketches and upload on Wiki.

Cross-national activities:

- Conversation via Adobe Connect, approx. 20 minutes per group comparing house descriptions and 3D-sketches.

Time plan:

Week 1–2: The composition of setting descriptions.

Week 3: Work with interpreting peer group's 3D-sketches.

Week 4: Synchronous meetings comparing house sketches with original descriptions.

Technologies, tools, and teaching resources:

- Installing MinecraftEdu in the classes.
- Planning for the students sharing of descriptions in a Wiki.
- Regular meetings for proceeding on the Adobe Connect.
- Student conversations on Adobe Connect.

Table 4 Team-A's planning for Didactical Design 4. *Setting sketches.*

assessment. This didactical design was planned for a period of four weeks by the team and involved students in a composition of a written description of a setting, a house with a garden, explaining where it is located, what it is built of, how many windows and doors it has, the size and color, if it has a chimney, if there are flowers, plants or animals in the garden and so on. The students then exchanged the house descriptions between the countries with the goal to interpret the content in a digital 3D-representation in Minecraft. This involved the students in discovering differences and similarities in meanings between the neighboring language across multiple sign systems. The written description of the house setting was shared with the peers together with a corresponding audio recording with a student reading the written text. The students engaged then in meaning-making practices of reading and listening to the house setting, underlining, and translating words and phrases using word books and online translation tools (Google Translate). They were drawing sketches of their understandings on paper using pens and on screens creating digital sketches in Minecraft transforming abstract word representations to concrete visual representations. They divided labor and made decisions about what part of the house setting would be more suitable to represent on paper and what part as the digital 3D-sketch on screen. Working in groups with peers required decisions about distribution and responsibility of tasks, taking photographs and screenshots of the produced representations of the house setting to share on the wiki-platform and discuss their interpretations in real-time video talks with the Nordic peers. The students discovered meaning potentials in conscious decision of gains and losses in print and screen representations translating between linguistic, auditory, and visual systems. They divided responsibilities and applied their digital competences (also informal regarding Minecraft) through the team's design strategy of multimodal production, collaborative sharing of knowledge and real-time meetings (see Sofkova Hashemi, 2014).

CONVERSATIONAL STRATEGIES ENHANCING COLLABORATIVE ONLINE PRACTICE IN CLASSROOM

The analysis of the five DDs of Team-B presented in *Table 5* confirm the repeated design strategy applying mostly verbal representations and same digital resources over time. The team involved students at lower secondary level (7th-9th grades) to construct solutions to tasks in parallel designs, i.e. locally in the separate country classrooms, and to share and reflect on the outcomes with the Nordic peers. The schematic analysis of the flow of design sequences in each DD

(row III, **Table 5**) clearly demonstrates and visualizes this recurrent pattern to *Compose–Share–Co-evaluate* in the designs (row IV, **Table 5**).

After the first DD of *Presenting school* initiating the project and getting acquainted with each other in activities to gather and present information about the own school and country (DD1), the team had deepened its focus on the main goal of increasing the students' knowledge around the content area of neighboring languages. They planned for that the students would make many and different encounters of Nordic literature and prose, including non-fiction. The team agreed on the choice of literature for young people and to involve the students in active learning comparing similarities and differences between the neighboring language and working with vocabulary and translation (DD2-4). The final design concerned watching a Nordic movie in original language (DD5). As the analysis of the designs reveals, the students were recurrently involved in reading texts locally in their separate classrooms in the original, source languages (news, fiction, poems; DDs 2–4) and composing also texts of their own in the targeted genre, i.e. news articles, fiction, poems. The collaborative cross-border activities concerned sharing their outcomes of the assignments by sending or uploading their written documents on a shared space online (a wiki), created by the team, and engage in synchronous meetings in Skype or Adobe Connect in a final real-time response and co-evaluation in cross-border scenarios with the Nordic peers. Also here the students were divided in smaller cross-border groups of approximately 3–4 students per country. Consequently, the team involved students to engage in both *assimilative* and *productive* tasks (reading, listening, writing), *information handling* (analyzing) and *communicative* assignments (peer exchange, asking questions, discussing) (cf. Laurillard, 2003 media typology; Conole, 2013 task taxonomy).

What the Team-B teachers and students experienced as challenging, which is not visible in the analysis of the team's design strategies in **Table 5**, were the emergent technical disturbances as well as comprehension difficulties in the online video talks. Video conference software share features with ordinary face-to-face communication such as co-presence, visibility and audibility and offer in addition the possibility of chatting and screen sharing (Svensson et al., 2013). However, the software required sound setting adjustments each time, the sound quality suffered from lags and echoes, and sometimes no sound could be detected from one of the sites. The students' utterances during video conversations were directed towards concrete actions to solve the technical issues such as: *Have you activated the microphone?, Why did you close the camera?, Strange, try to disconnect the headset.* There were also chat responses indicating that utterances have not been fully comprehended: *We do not hear you!,* or expressions of impatience such as*: Do you hear us!! Hello!!!!!!.* Also, with all the groups conducting synchronous video talks, the sound level was high in the classroom causing comprehension difficulties, attempts to isolate the group, distraction, and impatience.
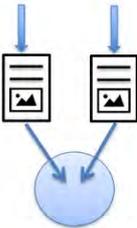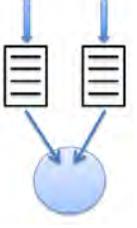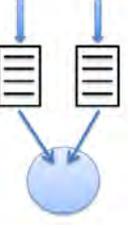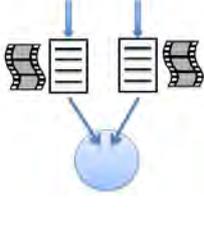
DD	1. PRESENTING SCHOOL	2. NEWS IN NORTH	3. NORDIC YOUTH WRITERS	4. NORDIC LYRICS	5. TELLING BY MOVIE
I.	L: Gather, present facts by taking photos, writing, reading aloud. L: Share presentation. C: Ask questions and give feedback.	L: Read, interpret and analyze news articles in Nordic languages; write own news articles. L: Send news articles to cross-class.	L: Read, interpret and analyze fiction from Nordic writers; write own fiction. L: Share fiction. C: Discuss fiction from Nordic perspective.	L: Read, interpret and analyze Nordic poems; write own poems. L: Share poems. C: Discuss poems from Nordic perspective.	L: View, interpret and analyze Nordic films; Write scripts; Create own films. L: Share films. C: Discuss films from Nordic perspective.
II.	Present.me, Skype	Newspapers online, Google docs, Email	Google docs, Wiki, Adobe Connect	Google docs, Wiki, Adobe Connect	Google docs, YouTube, Wiki, Adobe Connect
III.					
IV.	Present – Send – Co-response	Compose – Send	Compose – Share – Co-evaluate	Compose – Share – Co-evaluate	Compose – Share – Co-evaluate

Table 5 Analysis of Team-B's Didactical Designs (DDs).

(i) Intended teaching-learning outcomes and activities – local (L), cross-national (C); (ii) digital resources; (iii) sketch of DDs flow; (iv) design strategy.

Goal – core content years 7–9 (curricula):

We read fiction for youth by Nordic youth writers.

- Reading Nordic fiction for youth that provides an insight into the conditions under which people live, issues related to life and identity.
- Distinguish/discern language features, structure, and narrative perspective in fiction for youth (parallel action, flashbacks, descriptions of settings and persons, internal and external dialogues).
- Use of language in the Nordic area. Some distinctive words and terms, and differences and similarities between the different languages.
- Differences in the use of language depending on the context, the person, and the purpose of communication.

Assessment criteria – reading (curricula):	Assessment criteria – speaking, talking (curricula):
- How well the student can make summaries of the contents of different texts with a good connection to the theme, genre, and narrative perspective, which shows reading comprehension. - How well the student, based on own experiences, different issues concerning life and the surrounding world, can interpret and reason about the explicit and implicit messages in different works.	- How well the student can prepare and give oral accounts with adaptation to purpose, recipient and context. - How well the student can reason about the Swedish language characteristics and compare these with closely related languages and clearly describe important similarities and differences.
Activities and preparation in respective classroom:	**Cross-national activities:**
- Class chooses a writer from each country, agrees on a book and chooses an excerpt to read. - Students practice and analyze narrative perspective, typical genre features and to see theme and messages. - Students study the texts linguistically by looking for distinctive words, words that have a different meaning and they write notes. - Students plan a presentation of the work in groups. - Class talks about differences in language use depending on the context, with whom and for what purpose you communicate.	- Planning in groups how the conversation should go. A student plans an opening, another student distributes the word. - Conversation via Adobe Connect, approx. 20 minutes per group. The conversation is recorded and used in the assessment.
Time plan:	**Technologies, tools, and teaching resources:**
Week 1–2: The classes prepare. Week 3: Work with the texts in the classes. Week 4: Synchronous meetings via Adobe Connect and evaluation.	- Planning for the educators in a Wiki (alternatively Google docs). - Regular meetings for proceeding on the Adobe Connect. - Student conversations on Adobe Connect.

Table 6 Team-B's planning for Didactical Design 3. *Nordic youth writers.*

This vulnerability to disturbance and students' low experience in online face-to-face talks encouraged the Team-B to include instructional strategies to develop students' online conversational skills. This involved organizing the synchronous video discussions to prevent these technical and sound disturbances and thus provide opportunities for the students to carry on with their assignments. This led the team to expand the subsequent interventions developing DDs in the project with knowledge goals and assignments concerning successful video discussion. ***Table 6*** demonstrates the Team-B's planning for DD3 comprising reading youth fiction from popular Nordic writers representing the addressed knowledge goals and subject content, criteria for assessment, a plan for activities in the local classroom and the cross-national activities, time plan and what technologies to use. The DD was planned for a period of four weeks. The instructional strategies addressed the critical challenges concerning successful organization and maintaining of the cross-national video talks. This entailed a changed organization in the classroom with one computer continuously connected to the online video-room on a computer placed in an adjacent group-room and a time schedule with the students taking turns conducting their synchronous peer

discussions online. This not only led to minimizing the risks of sound disturbance and disruptions in internet connection but also possibility for the team's presence (both teachers and researchers) in the room, supervising students' discussions, as well as guiding and responding to students' questions.

DISCUSSION

The subject-specific L1-directed analysis exploring the design strategies of two Nordic teams' cross-border teaching in blended learning environments demonstrates an initial development from whole-class interaction in real-time talks with the neighboring class towards work in small collaborative cross-border groups with access to shared spaces online. The schematic models, visualizing the flow of design sequences of the addressed knowledge content, activities, spaces, and resources, revealed design strategies of parallel time-independent activities locally in the class combined with collaborative cross-border real-time activities sharing and reflecting on gained knowledge with peers representing authentic speakers of the neighboring languages. Teaching activities were designed towards a shared goal with

instances of cooperative learning activities working in parallel with parts of the assignments and collaborative tasks in joint participation in the cross-border activities (Scardamalia & Bereiter, 2014). Students and teachers thus engaged and participated in local as well as cross-border face-to-face, social practices (van Aalst, 2009) to analyze, co-construct, share, communicate and interact with learners and practitioners located in geographically distant areas (Jeong & Hmelo-Silver, 2016; Lehtinen et al., 1999). Stimulating collaborative learning designs in small groups promoted reflective face-to-face talk among students, highlighted as imperative for students to experience the collaboration meaningful and to learn to take perspective, compare and contrast (e.g. Jeong & Hmelo-Silver, 2016; Fleischer, 2011).

In this, both teams relied strongly on the added value of linguistic and socio-cultural authenticity in the development of the DDs. Knowledge content and activities captivated students to read and immerse in original Nordic literature and media from a historical perspective (e.g. Nordic mythology) as well as working with contemporary texts and youth writers. Students shared these original materials and their co-created outcomes (story plots, poems, drawings) on collaborative spaces online engaging in reflective activities asking questions and discussing with peers of the same age, writing, and speaking in their native tongues. Other attempts of engagement and participation (Binkley et al., 2012) rendering authenticity and approaching recipients outside the classroom (Jeong & Hmelo-Silver, 2016) concerned recording voice and opportunities to listen to peers reading or talking in the Nordic languages. Knowledge content and activities combined assimilative and productive tasks (reading, writing, listening) with information handling and communicative assignments (Conole, 2013) devoting time and attention to the pre-understanding work of the neighboring languages in teaching. Students engaged in analytical learning activities to compare and translate works in the source language towards co-constructive activities of sharing, asking, contrasting, and reflecting in real-time discussions.

Team-A's dynamic designs in a variety of activities, modalities and digital resources gave in several designs space to promote student autonomy in knowledge-transmediating processes modelling and transforming knowledge content in new modes and contexts of representation (Bezemer & Kress, 2016). Design strategies involved students in active learning to co-plan, pose questions and to apply acquired knowledge in problem solving activities (Harper & Milman, 2016). Students discovered meanings in a blend of digital and multimodal meaning-making practices to read, write, create, present, watch, listen, audio record, draw, sketch, and in reflective activities in the collaborative cross-border constellations to decide, ask, interview, compare and give feedback. Initial dis-alignment in intended knowledge outcomes,

for instance in the team's ambition to strengthen the experience of neighboring languages by voice-feedback, was developed in new ways of organizing teaching by the team in subsequent DDs. The Team-A's strategy of expanding print-based practices of writing and reading exploring multiple modes and media to represent knowledge content resulted in a recognition of multimodal meaning-making (Bezemer & Kress, 2016; Sofkova Hashemi et al., 2020) and also making room for students' informal social media and digital skills in the teaching practice (Beetham & Sharpe, 2013; Walsh, 2008).

Team-B's repetitive and print-oriented approach engaged the students in recurring learning activities to discover meanings and gain knowledge of the neighboring languages mainly through knowledge-accumulating approaches and verbal, linguistic modes of representation. Students engaged in productive and analytical tasks in reading, writing, interpreting, and comparing activities combined with communicative assignments of peer exchange asking questions, discussing in the collaborative constellations. The team's re-application of same instructional activities, modes of representation and digital resources made space and re-directed the focus of attention to the faced contextual challenges in the frames of the physical classroom (e.g. Bielaczyc, 2006), not visible in the schematic models. This led to identifying local design strategies (McKenney & Reeves, 2012/2019) in reflective evaluation and discussions on action in the team of how to successfully organize online video talks in the situated conditions of the classroom. The DDs altered over time, gradually refining the learning goals to strengthen the students' online communication, re-designing and developing ways to ensure good synchronous meeting techniques and to inhibit sound and internet disturbances (cf. Svensson et al., 2013).

CONCLUSION

This educational change and development of practical and theoretical insights (McKenney & Reeves, 2012/2019) co-designing for cross-border Nordic education with the aim to strengthen the students' Nordic identity and knowledge of neighboring Nordic languages demonstrates development on multiple levels. The interventions comprised several iterations that were studied in several settings across a range of classrooms developing local theories that have implications for this domain-specific instructional practice (McKenney & Reeves, 2012/2019).

From the subject-specific L1-perspective, the teams' design strategies proved to provide space for shared and collaborative knowledge development involving students in rich, authentic, and goal-oriented inter-Nordic comprehension practices speaking in the neighboring languages. The rigorous and reflective inquiry addressing

complex problems in real, cross-border teaching situations resulted in developing tools for planning, analysis, and evaluation of didactical designs. The schematic models proved to be a useful tool for meta-thinking and constructive alignment of design sequences revealing and shedding light on the teams' diverse appropriation of digital multimedia technologies in teaching practice. The study in particular demonstrates that students developed linguistic, cultural, critical, and digital competences of varied educational value based on the teams' divergent approaches to knowledge processes, meaning-making, and faced challenges of schools' provision of digital infrastructure. The developed didactical designs promoted students to discover meaning potentials applying knowledge-transmediating processes in a blend of digital and multimodal meaning-making practices in the lower ages and knowledge-accumulating approaches in verbal, linguistic modes of representation in the upper-level classes. Furthermore, the school's unpreparedness for the complexity of collaborative online learning situations in the socio-materiality of a classroom challenged the teams and gave an opportunity to discover new learning goals and activities in new adequate arrangements in the physical classroom and cyberspace.

To conclude, the study highlights the critical factors of recognizing digital, multimodal meaning-making and informal skills as means to promote students' communication and learning of any manifestations in teaching practice (Bezemer & Kress, 2016; Sofkova Hashemi et al., 2020) as well as schools' remaining challenges of digital infrastructure amenable to learning activities in blended learning environments (Merchant, 2008; Bielaczyc, 2006).

NOTES

1. The project in overall enrolled about 100 researchers and school personnel (teachers, principals, IT-staff) and more than 600 students from 18 classes in 13 schools from seven different municipalities in Denmark, Norway, and Sweden. *projektgnu. wordpress.com.*

2. Neighboring languages are part of the curricula since the 1850s building on the tradition of Scandinavian intercomprehension, or receptive multilingualism (Delsing, 2007). Danes, Swedes, and Norwegians can understand each other in their own language with relatively little effort.

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COMPETING INTERESTS

The author has no competing interests to declare.

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REFERENCES

Adelman, C. (1993). Kurt Lewin and the Origins of Action Research. *Educational Action Research, 1*(1), 7–24. DOI: *https://doi.org/10.1080/0965079930010102*

Andersen, M. F., & **Munksby, N.** (2018). Didactical Design Principles to Apply When Introducing Student-generated Digital Multimodal Representations in the Science Classroom. *Designs for Learning, 10*(1), 112–122. DOI: *https://doi.org/10.16993/dfl.100*

Beetham, H., & **Sharpe, R.** (2013). *Rethinking pedagogy for a digital age: Designing for 21st century learning.* London: Routledge. DOI: *https://doi.org/10.4324/9780203078952*

Bezemer, J., & **Kress, G.** (2016). *Multimodality, learning and communication: A social semiotic frame.* London: Routledge. DOI: *https://doi.org/10.4324/9781315687537*

Bielaczyc, K. (2006). Designing Social Infrastructure: Critical Issues in Creating Learning Environments With Technology. *The Journal of the Learning Sciences, 15*(3), 301–329. DOI: *https://doi.org/10.1207/s15327809jls1503_1*

Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education, 32(3)*, 347–364. DOI: *https://doi.org/10.1007/BF00138871*

Biggs, J., & **Tang, C.** (2011). *Teaching for Quality Learning at University*, 4th edn. New York, NY: Open University Press.

Binkley, M., Erstad, O., Herman, J., Ripley, M., Miller-Ricci, M., & **Rumble, M.** (2012). Defining twenty-first century skills. In E. Care, P. Griffin, & B. McGaw (Eds.), *Assessment and teaching of 21st Century Skills* (pp. 17–66), Dordrecht: Springer Netherlands. DOI: *https://doi.org/10.1007/978-94-007-2324-5_2*

Boistrup, L. B., & **Selander, S.** (2022). *Designs for Research, Teaching and Learning: A Framework for Future Education.* New York: Routledge. DOI: *https://doi.org/10.4324/9781003096498*

Cartwright, V., & **Hammond, M.** (2007). 'Fitting it in': a study exploring ICT use in a UK primary school. *Australasian Journal of Educational Technology* (Online Edition), *23*(3), 390–407. DOI: *https://doi.org/10.14742/ajet.1259*

Clark, D. B., Tanner-Smith, E. E., & **Killingsworth, S. S.** (2016). Digital games, design, and learning: A systematic review and meta-analysis. *Review of Educational Research, 86*(1), 79–122. DOI: *https://doi.org/10.3102/0034654315582065*

Conole, G. (2013). Describing learning activities: Tools and resources to guide practice. In H. Beetham & R. Sharpe (Eds.), *Rethinking pedagogy for a digital age: Designing for 21st century learning* (pp. 81–91), London: Routledge.

Cviko, A., McKenney, S., & Voogt, J. (2015). Teachers as co-designers of technology-rich learning activities for early literacy. *Technology, Pedagogy and Education, 24*(4), 443–459. DOI: *https://doi.org/10.1080/1475939X.2014.953197*

Danielsson, K., & Selander, S. (2021). Working with Multimodal Texts in Education. In *Multimodal Texts in Disciplinary Education*, (pp. 25–43), Cham: Springer. DOI: *https://doi.org/10.1007/978-3-030-63960-0_4*

Delsing, L.-O. (2007). Scandinavian intercomprehension today. In ten Thije, J. D. & Zeevaert, L. (Eds.), *Receptive Multilingualism: Linguistic analyses, language policies and didactic concepts* (pp. 231–246), Amsterdam: John Benjamins Publishing Company. DOI: *https://doi.org/10.1075/hsm.6.15del*

Design-Based Research Collective. (2003). Design-Based Research: An Emerging Paradigm for Educational Inquiry. *Educational Researcher, 32*(1), 5–8. DOI: *https://doi.org/10.3102/0013189X032001005*

Elliott, J. (1991). *Action research for educational change*. New York: Open University Press.

Elliott, J. (2020). Principles and Methods for the conduct of Case Studies in School-based Educational Action Research. In Anderberg, E. (Ed.), *Skolnära forskningsmetoder* (pp. 111–141), Lund: Studentlitteratur.

EU. (2017). *Digital Competence Framework for Citizens (DigComp 2.1)*. Publications Office of the European Union. Retrieved from *https://publications.jrc.ec.europa.eu/repository/handle/JRC106281*

Fleischer, H. (2011). What is our current understanding of one-to-one computer projects: A systematic narrative research review. *Educational Research Review, 7*(2), 107–122. DOI: *https://doi.org/10.1016/j.edurev.2011.11.004*

Fullan, M. (2007). *The new meaning of educational change*. New York: Teachers College Press.

Godhe, A.-L., Magnusson, P., & Sofkova Hashemi, S. (2020). Adequate Digital Competence: Exploring changes in the Swedish national curriculum. *Educare, 2020(2)*, 74–91. DOI: *https://doi.org/10.24834/educare.2020.2.4*

Harper, B., & Milman, N. (2016). One-to-One Technology in K-12 Classrooms: A Review of the Literature From 2004 Through 2014. *Journal of Research on Technology in Education, 48*(2), 129–142. DOI: *https://doi.org/10.1080/15391523.2016.1146564*

Hudson, B. (2011). Didactical Design for Technology Enhanced Learning. In Hudson, B. & Meyer, M. (Eds.), *Beyond fragmentation: Didactics, learning and teaching in Europe* (pp. 223–238), Leverkusen Opladen: Barbara Budrich. DOI: *https://doi.org/10.2307/j.ctvhktksh.16*

Jeong, H., & Hmelo-Silver, C. E. (2016). Seven Affordances of Computer-Supported Collaborative Learning: How to Support Collaborative Learning? How Can Technologies Help? *Educational Psychologist, 51*(2), 247–265. DOI: *https://doi.org/10.1080/00461520.2016.1158654*

Ingram, N. R. (2014). Time past: impacts of ICT on the pedagogic discourse in the Interactive project. *Technology, Pedagogy and Education, 25*(1), 1–18. DOI: *https://doi.org/10.1080/1475939X.2014.972440*

Krogh, E., Qvortrup, A., & Ting Graf, S. (Eds) (2021). *Didaktik and Curriculum in Ongoing Dialogue*. New York: Routledge. DOI: *https://doi.org/10.4324/9781003099390*

Künzli, R. (2000). German Didaktik: Models of re-presentation, of intercourse, and of experience. In I. Westbury, S. Hopmann & K. Riquarts (Eds.), *Teaching as a reflective practice: The German Didaktik tradition,* (pp. 41–54), Mahwah: Lawrence Erlbaum.

Laurillard, D. (2003). *Rethinking University Teaching: A framework for the effective use of educational technology*, 2nd edn, London: Routledge. DOI: *https://doi.org/10.4324/9780203304846*

Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M., & Muukkonen, H. (1999). Computer supported collaborative learning: A review. *The JHGI Giesbers reports on education, 10*, 1999.

Lindstrand, F., & Åkerfeldt, A. (2009). En förändring av lärandets kontext – aspekter på lärande i gestaltningsarbete med digitala resurser. I J. Linderoth (Ed.), *Individ, teknik och lärande* (pp. 200–217), Stockholm: Carlssons.

Luckin, R., Clark, W., Graber, R., Logan, K., Mee, A., & Oliver, M. (2009). Do Web 2.0 tools really open the door to learning? Practices, perceptions and profiles of 11–16-year-old students. *Learning, Media and Technology, 34*(2), 87–104. DOI: *https://doi.org/10.1080/17439880902921949*

Lund, A., & Hauge, T. E. (2011). *Designs* for teaching and learning in technology-rich learning environments. *Nordic Journal of Digital Literacy, 6*(4), 258–271. DOI: *https://doi.org/10.18261/ISSN1891-943X-2011-04-05*

Lundh Snis, U., Nilsson, L., Nilsson, A., Pareto, L., Petersen, A.-L., Sofkova Hashemi, S., Spante, M., & Wicke, K. (2012). Nordic Innovation Networks in Education: Dealing with Educational Challenges with Cross Boarder Collaboration and User Driven Design. In Bernhard, I. (Ed.) *Uddevalla Symposium 2012: Entrepreneurship and Innovation Networks,* 14–16 June, 2012, Faro, Portugal, 553–571.

Majgaard, G., Misfeldt, M., & Nielsen, J. (2011). How design-based research and action research contribute to the development of a new design for learning. *Designs for learning, 4*(2), 8–27. DOI: *https://doi.org/10.16993/dfl.38*

McKenney, S. E., & Reeves, T. C. (2012/2019). *Conducting educational design research*, London: Routledge. DOI: *https://doi.org/10.4324/9780203818183*

Merchant, G. (2008). Digital writing in the early years. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu (Eds.), *Handbook of research on new literacies*, (pp. 751–774), New York: Lawrence Erlbaum Associates.

Mor, Y., & Craft, B. (2012). Learning design: reflections upon the current landscape. *Research in Learning Technology, 20*. DOI: *https://doi.org/10.3402/rlt.v20i0.19196*

Penuel, W. R., Roschelle, J., & Shechtman, N. (2007). Designing formative assessment software with teachers: An analysis of the co-design process. *Research and Practice in Technology Enhanced Learning, 2*(1), 51–74. DOI: *https://doi.org/10.1142/S1793206807000300*

Peters, V., & **Slotta, J. D.** (2010). Scaffolding knowledge communities in the classroom: New opportunities in the web 2.0 era. In M. J. Jacobson & P. Reinmann (Eds.), *Designs for learning environments of the future: International perspectives from the learning sciences* (pp. 205–232), New York: Springer. DOI: *https://doi. org/10.1007/978-0-387-88279-6_8*

Scardamalia, M., & **Bereiter, C.** (2014). Knowledge building and knowledge creation: Theory, pedagogy, and technology. In L. Sawyer (Ed.), *Cambridge handbook of the learning sciences* (pp. 397–417). Cambridge, UK: Cambridge University Press. DOI: *https://doi.org/10.1017/ CBO9781139519526.025*

Schön, D. A. (1987). *Educating the reflective practitioner: toward a new design for teaching and learning in the professions* (Vol. 1.). San Francisco: Jossey-Bass.

Selander, S., & **Kress, G.** (2010). *Design för lärande. Ett multimodalt perspektiv.* Stockholm: Norstedts.

Skolverket. (2011). *Läroplan för grundskolan, förskoleklassen och fritidshemmet 2011.* Stockholm: Fritzes.

Smith, S. J., & **Harvey, E. E.** (2014). K-12 online lesson alignment to the principles of Universal Design for Learning: the Khan Academy, Open Learning: *The Journal of Open, Distance and e-Learning, 29*(3), 222–242. DOI: *https://doi.org/10.1080/02680513.2014.992402*

Sofkova Hashemi, S. (2014). Meaning-making and Communication in Virtual Nordic Classrooms: transmediation in cross-border understanding. In *EDULEARN14: 6th International Conference on Education and New Learning Technologies,* Barcelona 7–9 July 2014, 1820–1830.

Sofkova Hashemi, S. (2017). Socio-semiotic patterns in digital meaning-making: semiotic choice as indicator of communicative experience. *Language & Education, 31(5),* 432–448. DOI: *https://doi.org/10.1080/09500782.2017.13 05396*

Sofkova Hashemi, S., & **Spante, M.** (2016). Den didaktiska designens betydelse: IT-didaktiska modeller och ramvillkor. I *Kollaborativ undervisning i digital skolmiljö* (pp. 125–135). Malmö: Gleerups.

Sofkova Hashemi, S., Wennås Brante, E., Cederlund, K., Godhe, A.-L., Magnusson, P., Stenliden, L., Svärdemo Åberg, E., & **Åkerfeldt, A.** (2020). Digitala textkompetenser och undervisning: Texter, information och multimodalitet i skolan. *Svenska med didaktisk inriktning* (SmDI 13): *Bildning, utbildning, fortbildning,* 22–23 november 2018, Linköpings universitet, 271–287.

Sun, Y. H. (2017). Design for CALL – possible synergies between CALL and design for learning. *Computer Assisted Language Learning, 30*(6), 575–599. DOI: *https://doi.org/10.1080/095 88221.2017.1329216*

Svensson, A., Rustand, K. A., Sofkova Hashemi, S., & **Steffensen, T.** (2013). Students' Use of Semiotic Structures in Synchronous Computer-Mediated Communication – An Inter-Scandinavian Study. In *The European Conference on Technology in the Classroom (ECTC),* July 11–14 2013, Brighton, UK, 150–163. *http://iafor.org/archives/ proceedings/ECTC/ECTC2013_proceedings.pdf*

Svensson, E., Pendrill, A.-M., & **Pelger, S.** (2020). Teaching with Google Classroom. *Educare, 2020*(4), 158–191. DOI: *https://doi.org/10.24834/educare.2020.4.7*

Svärdemo Åberg, E., & **Åkerfeldt, A.** (2017). Design and recognition of multimodal texts – selection of digital tools and modes in the basis of social and material premises? *Journal of Computers in Education, 4,* 283–306. DOI: *https://doi.org/10.1007/s40692-017-0088-3*

Swedish Research Council. (2017). *Good research practice* (codex for research).*www.vr.se*.

Undervisningsministeriet. (2009). *Fælles Mål 2009 – Dansk.* Retrieved from *http://www.uvm.dk/Service/Publikationer/ Publikationer/Folkeskolen/2009/Faelles-Maal-2009-Dansk/*

Utdanningsdirektoratet. (2013). *Læreplan i norsk.* Retrieved from *http://www.udir.no/kl06/NOR1-05/*

van Aalst, J. (2009). Distinguishing knowledge-sharing, knowledge-construction, and knowledge-creation discourses. *International Journal of Computer-Supported Collaborative Learning, 4,* 259–287. DOI: *https://doi. org/10.1007/s11412-009-9069-5*

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & **van Braak, J.** (2013). Technological pedagogical content knowledge–a review of the literature. *Journal of Computer Assisted Learning, 29*(2), 109–121. DOI: *https://doi.org/10.1111/ j.1365-2729.2012.00487.x*

Walsh, M. (2008). Worlds have collided and modes have merged: classroom evidence of changed literacy practices. *Literacy, 42*(2), 101–108. DOI: *https://doi.org/10.1111/ j.1741-4369.2008.00495.x*

Warschauer, M. (2008). Laptops and literacy: A multi-site case study. *Pedagogies, 3*(1), 52–67. DOI: *https://doi. org/10.1080/15544800701771614*

Wertsch, J. V. (1991). *Voices of the mind: A sociocultural approach to mediated action.* Cambridge, MA: Harvard University Press.

Willermark, S., Pareto, L., & **Sofkova Hashemi, S.** (2016). Didactical designs in use – exploring technological, pedagogical and content knowledge. *Designs for learning, 2016,* 17–20 May, Copenhagen, Denmark, 253–268.

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