DIGITAL CREATIVITY: ENABLING LEARNING OF GENDER ROLES IN SOCIETY IN PRIMARY SCHOOL BY STORY DRIVEN DIGITAL PRODUCTION

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Abstract

To achieve knowledge and understanding in social science, students' ability to discuss and reflect is important. However, the goal to stimulate perspective taking and inference making upon social phenomena has proven to be difficult in general and in particular for primary school students. Thus, there is a need to develop models and concepts for learning that provide guidance that address these challenges. This study reports on how 6th grade students in a Swedish school successfully worked with gender roles in society with a story driven didactical design linked to digital competence development and creativity in a cross-border setting.

Introduction

To achieve knowledge and understanding in social science, students' ability to discuss and reflect is important. Although many subjects have this ambition, social studies is particularly connected to creating lessons that inspire and stimulate discussion and reflection (Lödén, 2012; Parham, 2014). The core of the subject area is to interpret present times and to understand the human condition in different societies (National Agency for Education 2018,).

To become a competent citizen in the increasingly digitalized society (Castells, 2010; Voogt, Erstad, Dede, & Mishra, 2013), competent use of digital technologies is highlighted in various policy documents, signaling political ambition for citizens in general as well as teachers and students in particular (Digitaliseringskommissionen, 2013; EU-Commission of the European Communities, 2008). Teachers as well as students are expected to develop their ability to use digital tools in school to learn (Hatlevik, Gudmundsdóttir & Loi, 2015; Røkenes & Krumsvik, 2014; Säljö, 2012; Selander, 2013).

Given the subject, answers are seldom unambiguous, which means that discussion and reflection are especially important in social science, and teachers need to arrange for the possibility to do so. Lund and Hauge (2011) emphasize how important it is for teachers to "design themselves in" the different activities that students must do. They emphasize the importance of being aware of when the plans for teaching and learning are in danger of tipping over to be either too rigid, which hinders students' own reflections, or become too unsupervised, leaving students adrift, preventing students from being both challenged and guided in their discussions and reflections. The goal is to stimulate perspective taking and inference making upon social phenomena, proven difficult in general and in particular for primary school

students (Peterson & Portier, 2014). Therefore, it becomes essential to study teaching activities *in-situ* as well as capturing teachers' own reflections of their own teaching activities in social science in primary school.

Aim and Research Questions

The aim of this study is to examine how primary school in-service social science teachers work with their planning and execution of teaching activities in cross-border cooperative situations with special reference to supporting student discussion and reflection abilities using digital technologies. This exploratory study is driven by the following questions: When designing a cooperative learning situation to stimulate meaningful discussion and reflection in social science, how do teachers plan for and execute their teaching activities to support student learning in cross-border cooperative practice? What type of practices becomes supportive for learning and what factors needs to be prioritized for goal achievement?

Didactic Design in Social Science - Dialogue and Digital Technology Intertwined

Teachers need to understand how digital tools play a role in learning. The choice of digital technology, and how it is used, has a bearing on the design process (Lund & Hauge, 2011). The selection of the digital tools becomes particularly important when discussion and reflection is central to the learning of social phenomena, since the digital tools play an important role in the learning situation as a mediator of symbols, signs and interpretations crucial for mutual understanding, communication and cooperation (Lund & Hauge, 2011; Selander, 2013). Consequently, digital technology is useful for learning, and the way in which technology should be used to achieve desired learning is a critical aspect for teachers to become explicitly aware of in order to support student learning.

Boundary Object and Cross - Border Digital Didactic

In situations when the teaching happens in cross-border settings, in this case cooperation between schools in Sweden, Norway and Denmark, digital technology becomes a prerequisite for the cross-border cooperation. Previous scholars have emphasized that a well-thought-out idea and a guided process for how and why to use digitals tools in general are crucial (Grönlund, Andersson, & Wiklund, 2013). To use digital tools inconsiderately could even hinder student learning (Grönlund, 2014).

In relation to crossing borders, previous research has enhanced the learning potential of crossing various boundaries by the resulting discontinuities in action and interaction (Akkerman & Bakker, 2011). The main argument here is that when people are involved in unfamiliar setting, then there is a learning potential involved. However, if such a potential is to be reached, the crossing of boundaries need to be handled as resources for development of intersecting identities and practices (see Kumpulainen and Mikkola (2014) for primary school setting).

One identified way to handle the crossing of borders as resources for development and learning is to identify and use a so-called boundary object. According to the theory of boundary object, what to gather around might be something tangible like a tool or something more abstract like a work process. *Boundary object* was originally defined as a "key process in developing and maintaining coherence across intersecting social worlds" (Star & Griesemer, 1989, p. 393).

The main point of the boundary object theory is that a boundary object unites people rather than separates them from each other, and creates understanding and meaning rather than confusion and pointlessness (Star & Griesemer, 1989; Star, 2010). The literature has repeatedly shown that the same type of IT systems or digital artifacts can lead to different outcomes when being used (Hasu & Engeström 2000; Rehm & Goel, 2015). In other words, it is not enough to find a system or tool to create a common shared work process but rather one that is perceived as meaningful and understandable in order to create meaning (Star, 2010).

Efforts have been made to distinguish between various types of boundary objects, to classify them in accordance to their syntactic, semantic and pragmatic features and to deal with varying information complexity (Carlile, 2004). Such theoretical classifications however, do not incorporate the more dynamic and context specific practice when intended boundary objects are used and how they are experienced (Marheineke, Velamuri, & Möslein, 2016).

The concept of boundary object has gained increased attention in educational contexts investigating how boundary objects influences adult learning (Caruso, Cattaneo, & Gurtner, 2016; Lofthouse & Wright, 2012; Schaap, Baartman, & de Bruijn, 2012) and teacher education (Nolen, Horn, Ward, & Childers, 2011). Interest has also been shown in how subject specific learning can be improved in mathematics (Kynigos & Kalogeria, 2012; Venkat & Winter, 2015), language (Elf, Hangøj, Skaar, & Erixon, 2015) and science (Rahm, 2014) by identified boundary objects.

The concept of boundary object has also been incorporated into research about institutional change in education (Banner, Donnely, & Ryder, 2012; Emand & Roth, 2009; Snoek, 2013) but is still understudied within primary school settings (Akkerman & Bakker, 2011) as well as in social science education. This is unfortunate since the concept has been shown to be fruitful in both illuminating how meaningful processes are organized, as well as in what way digital technologies might have a sense making opportunity for humans involved in cooperative work. In schools, we increasingly have such cooperative processes that span over both groups of student and institutional borders, made possible by digital technology. This article therefore suggests that the concept is suitable as an analytical lens for determining if teaching cooperative practice across borders in primary school social science is supported or hindered.

Case Study Methodology

The methodological approach in this study is a case study (Merriam, 1998; Seawright & Gerring, 2010). In particular, the case study methodology suggested by Merriam was used, focusing on rich and various data where data collection is driven by an interpretative approach. Case studies should, according to Merriam, (a) focus on a particular phenomenon, in this case social science primary school teacher teaching activities in cross-border cooperation; (b) present rich, thick description of the phenomenon under study; in this study the teaching and learning situation was the focus; and (c) facilitate the reader's understanding of phenomenon under study with the two aforementioned strategies.

The Bounded Phenomenon within the Larger Project

Within a larger action research project related to cross-border cooperation between Danish, Norwegian and Swedish schools for educational purposes supported by information and communication technologies (http://projektgnu.eu/), it was possible to define *bounded phenomenon* (Merriam 1998, p. xiii) Merriam deems essential for case studies. Bounded phenomena require clearly defined surrounding boundaries and a specific focus. The bounded phenomenon analyzed here was cross-border teaching sessions in social science that aim to stimulate discussion and reflection, essential features in social science. The session lasted from January to February. The didactical setup was planned for and executed by teachers and students in Sweden in a primary school, in cooperation with a primary school in Denmark. This article focuses specifically on the Swedish context perspective.

The School Context

The school in Sweden is a primary school for 340 students with students from age 6 to 12. The school has a vision and ambition to be open and flexible in supporting the use of digital tools for learning. It is architectonically supported with technology such as stable broadband connections and educational technologies, planned from the outset in 2001 when the school was built. It is equipped with interactive whiteboards in most classrooms; two-on-one model for surf tablets or laptops for students (two students share one device), teachers with laptops and/or surf tablets; and fast network connections. Teachers in the school are expected to be, and become, skilled users of digital tools for learning in their profession. They have access to a person at the school with a special responsibility for competence development linked to technology-enhanced learning.

Data Collection

Various types of data collection methods and work process documentation provided rich material from both of the cases examined, providing the possibility to present rich descriptions of the situation, necessary for case study methodology (Merriam, 1998). Teachers' online conversations on their wiki page and their email conversations were read through in relation to collegial didactical planning to get an increased understanding of collegial cross-border didactical planning. Classroom observations during lectures were conducted capturing activities and dialogues among teachers and students.

Student online activities in shared documents, a project blog and reflection sheets also were part of the rich empirical material, providing a rich picture of students' experiences of the processes and their learning.

The multi-faceted material was interpreted, with a focus on different pedagogical activities the teachers cooperatively planned for and executed with their students in the cross-border cooperative work. The author was, as often as possible, present in the cross-border planning process among the teachers and involved in the on-site planning with the Swedish teachers in accordance to the overall action research approach. Firsthand experience and access was also possible for the author by doing all the classroom observations, teacher and student interviews and analysis of student performances in Sweden in the social science classes reported in this case study.

The research approach in this article thus applied case study methodology on an action research project in order to analyze the bounded phenomenon, presented below, used to enhance knowledge and understanding of cross-border teaching activities in social sciences in primary school.

Case description

One cross-border teaching session was analyzed in this case study. The teachers gave their students the task of creating an alternative ending to the story of Cinderella in groups. They were to take inspiration from the class discussions about gender roles; also, they were informed that the students from the other country would do the same and that they would look at each other's suggested ending and comment upon them. Figure 1 illustrates the form of cooperation.

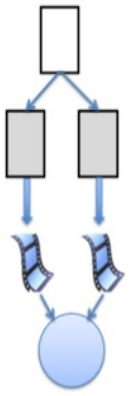
Read Cinderella and talk about gender roles in class. Work in groups at the national school creating alternative ends of the fairy tale of Cinderella. Dramatize the end, decide on requisites and place for shooting the video, make a story-board, film shooting, edit, add subtitles and music. Upload and share the video on the common blog. Look at the videos and use them to talk about gender roles in society.	

Figure 1. Cross-border didactical model, asynchronous cross-border model.

Story Driven Digital Production and Evaluation

Six groups in Denmark and six groups in Sweden made different alternative stories. Table 2 shows the different stories for the six Swedish groups, length of video, digital and dramatic video features, and teachers' evaluation of the story linked to gender roles.

Table 2

Gender Role Videos and Teacher's Interpretation

Group	New End	Video Length	Digital Practice and Drama Features	Teacher Evaluation of Gender Role Types
1	Prince punishes stepmother and gets married to Cinderella	1:51	Video with text Props as clothing Indoor video shooting Video editing	Unequal gender roles Male dominance Female submission
2	No one gets to marry the prince	4:04	Video with text Props as clothing Indoor and outdoor video shooting Video editing Inserted sound effects and music	Unequal gender roles Female dominance
3	Both Cinderella and her step sister get to marry a prince	2:49	Video with text Props as clothing Indoor and outdoor video shooting Video editing Inserted text to clarify the story	Unequal gender roles where the females need to marry, and preferably with a prince.
4	Cinderella kills the prince after the marriage to get his money	3:16	Video with text Props as clothing Indoor video shooting Video editing Inserted slow motion effects and music	Unequal gender roles but a violent Cinderella
5	The prince marry a man	2:18	Video with text Props as clothing Indoor video shooting Video editing Inserted text to clarify the story Inserted music	Equal gender roles, and norm critical thinking
6	Cinderella becomes empowered and perhaps she will marry a man	3:55	Video with text Props as clothing Indoor and outdoor video shooting Video editing Inserted sound effects and music	Equal gender roles

The initial teacher-led discussions on gender roles brought enthusiasm and interest. Students were able to give their own examples of situations where they had experienced differences between boys and girls at school and expectations that they considered to be present for boys or girls. Furthermore, they discussed the differences between men and women. The teachers

interpreted that the students' discussion were spring boarding from their own thoughts and experiences, which they later actively used in the scripts for alternative endings to the Cinderella story, and were tightly connected to the curriculum of gender roles in society.

Student engagement for the task was striking. The students' work to dramatize the ending was also discussed so that students could divide roles that suited everyone. For example, those who did not want to be in front of the camera got roles as filmmaker and editor, and those who were good at running group work became producers. Teachers continuously went around in groups and helped with what was needed for the moment. They supported the learning situation and the students' understanding of gender roles in parallel as they supported the work process.

In this particular example, a large part of the benefits of working in cross-border settings was to be found in the collegial cooperation where the initial discussions and agreed arrangement gave added value to the teaching that occurred at each school. The teachers were particularly focused upon how to secure a common understanding of the task for the students. They used several meetings and wrote down their meeting minutes on a shared wiki page. Together, they clarified the task and reduced a lot of complexity. Task clarification was finally obtained with the very specific task of figuring out a new ending for the Cinderella story. Complexity reduction was obtained by not using real time interaction due to scheduling difficulties and also by using digital tools that they were familiar with and had easy access to in each school. The cross-border collaboration effect was obtained by the requirement for the students to upload and share their videos on a common blog and also to provide comments on each other's work. Due to the asynchronous model of communication, these requirements were possible to perform within the normal schedule at each school rather than rearrange the schedule in order to meet in real time settings.

The teachers had collaborated before during the GNU project, and the time perspective is not trivial since policy regarding implementation of technology innovations in school might happen at the expense of teachers' professional practice (Convery, 2009). Collegial cooperation needed time to develop. Time was also essential to become affected by the collegial cooperation (Leitch & Day, 2000). A social studies teacher, involved in the project over three years said: "If the project had only lasted a year, it would have felt like a failure. It took a long time before we really felt that we 'owned' the problem and could work with it accordingly."

Analysis

The teachers worked hard to come up with an approach that reduced the risks of fragmentation and confusion while keeping the ambition to create a focused, yet open task to support discussion and reflection This ambition was accomplished by the fairy tale about Cinderella where students were given completely free rein to create alternative endings, while still within the borders of their understanding of gender roles (see Table 3).

Table 3

Didactic Questions and Answers

Didactic Questions	Answers
What	Gender roles in society
When	During January and February in the spring
Where	In class and on the common blog.
How	In groups in class. Creating story and video. Uploading videos on common blog. Commenting on each other's videos in a video conference. Asynchronous model domination.
Why	To discuss gender roles in society in relation to their own video productions to support discussion and reflection to learn about gender roles in society
Didactic evaluation	Success due to common understanding of task, no scheduling problems, well-functioning technology and joy.

As presented above, the students created both varied endings and digital creations through their own written and dramatized ending that they videotaped, edited and uploaded on the mutual blog. The active choice not to make use of real-time communication promoted learning in this particular situation. The task fit the students. Teachers could actively guide students in their work when they collaborated on the creation of an alternative story. Both teachers and students used their surf tablets and software that they were already familiar with, while using some additional functions such as implementation of sound and music in their videos. The technology fitted well to the task, thus supporting the activities they would undertake, i.e., filming the dramatized ending and sharing these films on the common blog with the Danish students.

The ongoing discussions about male and female gender roles and notions of gender roles in society were interwoven in a meaningful way in the activities from start to end. According to the teachers' comments when evaluating the students' work, "They really have the courage to get involved and engaged in their roles," and "Thanks to the drama driven task, they clearly can talk about things that they seldom talk about."

On the whole, this collegially developed task provided knowledge, joy and learning, although it did not work exactly as wished. The Swedish teachers and students felt disappointment by the feedback they got from the students in Denmark according to reflection talks and comments with the students. The Swedish students would have liked to hear more specific comments than "the videos were good." Likewise, they had required that Danish films made use of subtitled dialogue for them to understand the Danish films better. Danish continued to be difficult for the 11- and 12 - year old Swedish students.

Despite this criticism, the study was evaluated as a topic-focused learning situation with relevant support of technology. The arrangements of the task and the chosen digital tools created a meaningful creative situation that all

students vividly engaged in over time, thus showing features of a boundary object driven activity (Star, 2010). The students understood the task at hand and could use available technology appropriate for the task in a cooperative way becoming engaged in discussions and reflections about gender roles. Still, the creative group work was present in physical classrooms, whereas the feedback sessions were linked to cross-border actions in the mutual blog.

The boundary object was thus found in the structure and content of the task as well as in the integration of the actual use of familiar digital tools for task completion. It might be tempting to address the digital tool as the boundary object (Gajek, 2016; Prinsloo & Sasman, 2015), but that has proven not to be enough guidance (Hasu & Engeström, 2000; Rehm & Goel, 2015). Boundary objects can be both physical and abstract (Star & Griesemer, 1989). Therefore, it might be a concept that can be used as a "mental design device" when involved in complex learning situations, such as cross-border settings in social science in primary school that aim to stimulate discussion and reflection among students through social interaction across schools contexts. In order to incorporate subject specific learning goals with actual situation complexity aligned with institutional constraints, this paper suggests that *boundary object* as a concept might provide support and guidance in the complex planning of cross-border digital didactic.

Discussion and Conclusion

In social science, where discussion and reflection is a necessary part of the subject itself (Lödén, 2012; Parham, 2014), it becomes particularly important to insightfully plan for opportunities to support students to have a clear understanding of what should be done and discussed. However, there is a risk that the task becomes too rigid or too loose (Lund & Hauge, 2011) therefore not supporting discussion and reflections of the content to be dealt with, essential abilities to develop in social sciences in primary schools (National Agency for Education, 2018)

When such cross-border cooperation is a prerequisite in social science, teachers need to consult the curricula very actively to identify common ambitions that are present in the cooperative nations. They also need to spend considerable time to find time to coordinate the cross-border activities between the teachers as well as the students given the schedule constraints at each participating school, as each school has its own institutional constraints (Hauge, 2014). Support may be created through the understanding of the restrictions and possibilities linked to curricula, schedules and technological resources when finding ways how to deal with these issues, addressing the institutional requirements in their work practices. Since in-service teachers already have tight schedules, added activities to arrange for cross-border cooperation and communication becomes yet another demand to handle. Cross-border didactics in social science for primary schools can be supported by insights of the complexity that are added by cross-border cooperation. Naïve implementations of such complex practice should be avoided (Convery, 2009).

Here it is argued that such planning can be facilitated by the use of a boundary object-guided work process (Star, 2010). Adding the framework of boundary object driven design helps to improve the process by its focus on a shared understanding, common practice and sense making, making possible explicit evaluation after each activity in a cross-border setting. In such processes the choice of digital tools has an important supporting role, as the technology itself and how it is used can either divide or unite activities that drive discussion and reflection forward for both teachers and students, thus calling for teacher digital competence in learning situations (e.g., Hatlevik et al., 2015; Petterson, 2017).

For primary school teachers in social science it becomes essential to have competence in how to design and execute cross-border teaching sessions. Science is strongly connected to the general societal development of increasing digitalization as well as cross-border cooperation due to increased globalization, which are core issues in social science as a subject. However, such a design process is far from straightforward and simple, as exemplified by the cross-border setting presented and discussed above. To enhance such competence, it is suggested that boundary object driven design might be a helpful approach in digital design processes.

References

Akkerman, S., & Bakker, A. (2011). Boundary crossing and boundary objects. *Review of Educational Research*, *81*(2), 132-169.

Banner, I., Donnely, J., & Ryder, J. (2012). Policy network and boundary objects: Enacting curriculum reform in the absence of consensus. *Journal of Curriculum Studies*, *44*(5), 577-598.

Carlile, P. R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science*, *15*(5), 555–568.

Caruso, V., Cattaneo, A., & Gurtner, J.-L. (2016). Learning documentations in VET systems: An analysis of current Swiss practice. *Vocation and Learning, 9*(2), 227-256.

Castells, M. (2010). Globalisation, networking, urbanisation: Reflections on the spatial dynamics of the information age. *Urban Studies*, *47*(13), 2737–2745.

Convery, A. (2009). The pedagogy of the impressed: How teachers become victims of technological vision. *Teachers and Teaching*, *15*(1), 25-41.

Digitaliseringskomissionen 2013. Retrieved from https://digitaliseringskommissionen.se/wpcontent/uploads/2013/11/Textunderlag_skola-och-undervisning_webbversion.pdf

Elf, N., Hangøj, T., Skaar, H., & Erixon, P.-O. (2015). A review of empirical research projects in Scandinavia 1992-2014. *Educational Studies in Language and Literature* (Special issue), *15*, 1-88.

Emand, G., & Roth, W-M. (2009). Policy as boundary object: A new way to look at educational policy design and implementation. *Vocations and Learning*, *2*(1), 19-35.

EU-Commission of the European Communities. (2008). *The use of ICT to support innovation and lifelong learning for all - A report on progress*. Brussels, 09/10/2008 SEC (2008) 2629 final.

Gajek, E. (2016. Mobile technologies and boundary objects in the hands of student teacher of languages inside and outside the university. *Journal of Mobile and Blended Learning*, *8*(2) 85-92.

Grönlund, Å, Andersson, A., & Wiklund, M. (2013). *Årsrapport Unos Uno*. Örebro, Sweden: Örebro Universitet.

Grönlund, Å. (2014). *Att förändra skolan med teknik: Bortom "en dator per elev."* Örebro, Sweden: Örebro Universitet.

Hasu, M., & Engeström, Y. (2000). Measurement in action: An activity-theoretical perspective on producer–user interaction. *International journal of Human-Computer studies*, *53*(1), 61-89.

Hatlevik, O. E., Gudmundsdóttir, G. B., & Loi, M. (2015). Examining factor predicting students' digital competence. *Journal of Information Technology Education*, *14*(1) 123-137.

Kumpulainen, K., & Mikkola, A. (2014). Boundary crossing of discourses in pupils' chat interaction during computer-mediated collaboration. *Learning, Culture and Social Interaction*, *3*(1), 43–53.

Kynigos, C., & Kalogeria, E. (2012). Boundary crossing through in-service online mathematics teacher education: The case of scenarios and half-baked microworlds. *ZDM-International Journal on Mathemacis Education*, *44*(6), 733-745.

Leitch, R., & Day, C. (2000). Action research and reflective practice: Towards a holistic view. *Educational Action Research*, 8(1), 179-193.

Lofthouse, R., & Wright, D. (2012). Teacher education lesson observation as boundary crossing. *International Journal of Mentoring and Coaching in Education*, *1*(2), 89-103.

Lund, A., & Hauge, T. E. (2011). Designs for teaching and learning in technology-rich learning environments. *Nordic Journal of Digital Literacy.* Retrieved from https://www.idunn.no/dk/2011/04/art04

Lödén, H. (Ed.). (2012). *Forskning av och för lärare: 14 ämnesdidaktiska studier i historia och samhällskunskap*. Karlstad, Sweden: Karlstad Universitet.

Marheineke, M., Velamuri, V. K., & Möslein, K.M., (2016). On the importance of boundary objects for virtual collaboration: A review of the literature. *Technology Analysis & Strategic Management, 28*(9), 1108-1122.

Merriam, S. B. (1998). *Qualitative research and case study application in education*. San Francisco, CA: Jossey-Bass.

National Agency for Education. (2018). Social Studies Syllabus. Retrieved from https://www.skolverket.se/laroplaner-amnen-och-kurser/grundskoleutbildning/grundskola/samhallskunskap#anchor1

Nolen, S. B., Horn, I. S., Ward, C. J., & Childers, S. A. (2011). Novice teacher learning and motivation across contexts: Assessment tools as boundary objects. *Cognition and Instruction, 29*(1), 88-122.

Peterson, S. S., & Portier, C. (2014). Grades five and six students' representation of meaning in collaborative Wiki writing. *Reading Horizons, 53*(3), 1-25.

Prinsloo, M., & Sasman, F. (2015). Literacy and language teaching with interactive whiteboards in early schooling. *TESOL Quarterly*, *49*(3), 533-554.

Rahm, J. (2014). Reframing research in informal teaching and learning in science: Comments and commentary at the heart of a new vision for the field. *Journal of Research in Science Teaching*, *51*(3), 395-406.

Rehm, S. -V., & Goel, L. (2015). The emergence of boundary clusters in inter-organizational innovation. *Information and Organization*, *25*(1), 27–51.

Røkenes, F., & Krumsvik, R. (2014). Development of student teachers' digital competence in teacher education – A literature review. *Nordic Journal of Digital Competence*, *4*(9), 250-280.

Schaap, H., Baartman, L., & de Bruijn, E. (2012). Students' learning processes during school-based learning and work place learning in vocational education: A review. *Vocations and Learning*, *5*(2), 99-117.

Seawright J., & Gerring, J. (2010). Case selection techniques in case study research. A menu of qualitative and quantitative options. *Political Research Quarterly*, *61*(2), 294-308.

Selander, S. (2013). Transformation and sign-making: The principles of sketching in designs for learning. In M. Böck & N. Pachler (Eds.), Multimodality *and social semiosis: Communication, meaning-making, and learning in the work of Gunther Kress* (pp.121-129). London United Kingdom: Routledge.

Snoek, M. (2013). From splendid isolation to crossed boundaries? The future of teacher education in the light of activity theory. *Teacher Development*, *17*(3), 307-321.

Star, S., & Griesemer, J. (1989). Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907-39. *Social Studies of Science*, *19*(3), 387–420.

Star, S. L. (2010). This is not a boundary object: Reflections on the origin of a concept. *Science, Technology & Human Values*, *35*(5), 601-617.

Säljö, R. (2012). Literacy, digital literacy and epistemic practices: The co-evolution of hybrid minds and external memory systems. *Nordic Journal of Digital Literacy*, *12*(1), 5-20.

Pettersson, F. (2017). On the issues of digital competence in educational contexts – A review of literature. *Education and Information Technologies*. doi: 10.1007/s10639-017-9649-3

Venkat, H., & Winter, M. (2015). Boundary object and boundary crossing for numeracy teaching. *ZDM- International Journal of Mathematics Education*, *47*(4), 575-586.

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2013). Challenges to learning in schooling in the digital networked world of the 21st century. *Journal of Computer Assisted Learning*, *29*(5), 403-413.

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