STATE OF THE ART TECHNOLOGY? MAPPING STUDENTS´ TALK ABOUT INFORMATION AND COMMUNICATION TECHNOLOGY IN UPPER SECONDARY SCHOOLS

Anders D. Olofsson and J. Ola Lindberg
Umeå University

Göran Fransson
University of Gävle

Sweden

Abstract

This paper explores upper secondary school students' talk about how information and communication technology (ICT) can structure and support their everyday activities and time in school. The data consists of 11 group interviews with a total of 46 students. The results show that ICT plays a central role in the students' schooling, not in terms of "state-of-the-art" but rather as "state-of-the-actual," for instance in supporting the writing process and for peer-support, digital documentation and storage.

Introduction

Information and communication technology (ICT) is said to play a central role in several K-12 school-related activities, from school leader management and administration to teaching and learning in the classroom (Selwyn, 2011). In the ongoing digitalisation of schools, students can bring their own digital devices (BYOD) (Song, 2014) to be used in learning activities they engage in during their time at school. Research reports that students use ICT devices such as laptops and tablets on a daily basis in many schools (cf. Lindberg, Olofsson, & Fransson, 2017; Selwyn & Facer, 2014) and that the digitalisation of education has imposed great expectations for ICT in teaching and learning situations (Wastiau et al., 2013). It has also resulted in a number of challenges (Olofsson, Lindberg, & Fransson, 2017; Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2016), for instance in relation to students' in-school use of smartphones (Philip & Garcia, 2015).

According to the literature, many schools still seem to struggle with their digitalisation. Questions that have arisen include: How should schools respond to a situation in which students have instant access to their own ICT devices at school (Selwyn & Bulfin, 2015)? How should schools deal with students using ICT for academic and non-academic purposes whilst at school (Charles, 2012)? This paper aims to answer such questions from a student perspective. More specifically, the focus is on students' talk about how ICT contributes to structuring and supporting their everyday activities and time in school.

Some Additional Notes About Related Research

In their study on the various ways in which Australian secondary school students use ICT, Bulfin, Johnson, Nemorin, and Selwyn (2016) emphasise that even if schools respond optimistically to the ongoing digitalisation, they "continue to regulate student behaviour, not least in terms of what students are expected to do, and when and where they are expected to do it" (p. 240).

By encouraging research to focus more on "state-of-the-actual" rather than "state-of-the-art" technology, Selwyn (2010) asks, "What is the use of technology in educational settings actually like?" (p. 70). Bulfin et al. (2016) further distinguish between the notions of "school as a location/ setting for digital technology use" (p. 2) and "school as a purpose for digital use" (p. 2). The former refers to how technology use is facilitated by institutional infrastructures and school rules and regulations, whilst the latter refers to how ICT is used for "the logistics of managing one´s studies or using technology to engage in learning" (p. 2). Bulfin and colleagues report that the students in their study stressed the importance of their teachers' consistent use of ICT, the need for teachers to improve their digital competence and schools' provision of adequate ICT support for students. Due to the various infrastructures and regulations, it was found that only certain types of ICT were used in the investigated schools and that information retrieval (e.g., Google) and content creation (e.g., Word) were the most common in-school ICT activities. This last finding is in line with Mangen (2016), who argues that writing is now mainly performed using digital technology rather than a pen and paper. García-Peñalvo and Svanaes (2012) report that an increased use of digital writing in school can contribute to greater student motivation and that, "For those who struggle with their handwriting, which can be a problem across different disabilities, typing notes and messages is often easier and less time consuming than writing by hand" (p. 60).

Another growing body of research relating to the study at hand concerns students' in-school use of smartphones. Some results indicate that smartphones have a positive impact on students' learning (Philip & Garcia, 2015; Thomas, O'Bannon, & Bolton, 2013), whereas others point in the opposite direction. For example, Beland and Murphy (2016) show how the banning of smartphones in schools in four English cities affected students' examination results at the end of nine years of compulsory schooling. Schools that have banned smartphones experience much better academic results after the ban than before it, with the lowest-achieving students making the greatest headway. Results like these are interesting, but can also potentially create an in-school dilemma. For example, schools banning smartphones could be viewed as being against digitalisation. At the same time, they may not want their students' achievements to decrease due to a potentially non-school related use of ICT.

An ICT tool that is used in the schools reported on in this study and also more generally in western European schools is the Learning Management System (LMS). Ros et al. (2014) describe the development of LMS in terms of three generations and show how the third generation of LMS allows students to personalise their use of it. Further, LMS makes other communications and

collaborations possible, for example between teacher and parent, or student and student. Yildram, Reigeluth, Kwon, Kageto, and Shao (2014) explore the use of several LMS in relation to their capacity to support what is described as a learner-centred paradigm of education. They conclude that LMS should support collaboration both inside and outside school, be able to be customised by users and be used via smartphone apps. In their study, García-Peñalvo and Alier Forment (2014) argue that it is important for institutional LMS to co-exist, interact and enrich other digital tools that students use in the learning context.

Purpose

The purpose of this paper is to explore how students at upper secondary schools talk about ICT for structuring and supporting their everyday activities and time in school. Two research questions are posed: (a) What do the students regard as the main areas and activities of ICT use? (b) How might schools improve the use of ICT to structure and support students' time in school?

Methodology

This study is part of a four-year research project on how ICT is used in upper secondary schools in Sweden. Three schools are included in the study that, in different ways, have been recognised for their advanced use of ICT. Two of the schools are campus-based (schools A and B), whereas the third (school C) has a mixture of campus and distance teaching. When the data was collected (in November 2015), a new LMS system had just been introduced at two of the schools (A and B). The data consists of semi-structured focus group interviews. A total of 11 group interviews with 46 students were carried out. In six of the groups the students followed theoretical programmes, and in five of the groups the students followed vocational programmes. The students were either in their first or third years. The number of respondents in each group varied from three to six students, and the interviews lasted between 30 and 60 minutes. The interviews were transcribed verbatim before being analysed.

The analysis was conducted using content analysis, including meaning condensation (Kvale, 2008). The data was analysed in several steps. Using NVivo (Pro 11), the first step of meaning condensation resulted in 22 broad categories of the complete set of data. In the next step, the data was transferred to a Word document consisting of 242 pages. The document was read several times in order to: (a) identify whether some of the categories were too broad or outside the scope of the study and could therefore be removed and (b) determine whether some categories were similar in focus and content and could instead be grouped together in one category. This process resulted in 17 categories in a 64-page Word document. In the fourth step, the document was repeatedly read in order to further condense the meaning of the data. This resulted in 12 categories in a 15-page Word document. Six themes were constructed from these 12 categories and are presented below.

Results

In this section the results are presented in a thematic and qualitative manner.

Theme 1. How and When Should ICT Be Used in School?
There were some variations in the students' descriptions of the frequency of use of ICT. For example one group of students, attending a theoretical programme at school C, talked about ICT as being used intensively on a daily basis: "[I] *f you don´t bring the laptop you won't be able to do anything because you won´t get tasks on paper*" (student, year 1, school C). In contrast, a group of students in a vocational programme (student, year 3, school B) estimated the time of ICT use to between three and four hours per week. However, the majority of the students in the 11 groups said that they used ICT in school at least four out of five days a week. Students talked about the use of ICT both as something that the subject teacher decided and as their own choice. Some students stressed that it must be their teachers' decision when ICT should be used "*…you actually have to trust the teacher´s judgement. I mean they were also students once*" (student, year 1, school B). Several students expressed confusion about when ICT could or could not be used at school and that they experienced the way their teachers talked about ICT as paradoxical: "*... `well I* [the teacher] *am rather old-fashioned so I want you to take notes using pen and paper'…but they* [the teachers] *anyway always tell us to bring the laptop as often as possible*" (student, year 1, school B).

Theme 2. ICT – Making Storage and Text Production Easier
ICT was often talked about as supporting the ongoing documentation of students' schoolwork "*…you have all your stuff in one place, you can search for things. Everything is so easy. I especially appreciate the easiness*" (student, year 3, school B) or "[I] *can create folders* [in Google Drive]*, and know for sure where they are*" (student, year 1, school C). Some students also wanted to use their school laptop for private means by having school and non-school related aspects on one digital device "[A] *lot of people do that. Using it* [the laptop] *both as a private and work computer is common in many workplaces*" (student, year 1, school A).

The students claimed that the laptop helped them to take structured notes during lectures "[Y]*our notes aren't a mess if you are stressed. If you're stressed and take notes using pen and paper you can´t always read what you've written*" (student, year 1, school B). The laptop also enabled the students to move easily around text sections or to reformulate sentences in their documents. Moreover, the students maintained that digital written texts could be better structured, were of higher quality, and could be completed in less time than they would be with pen and paper "[I] *mean, we can write so much faster on the computer. Basically our fingers fly over the keyboard*" (student, year 1, school A) and "[I] *often change a lot in the* [text] *structure. You can´t* [using pen and paper] *move a section in the same way, which means that you need to think in a different way than you're used to. That takes a lot of time*" (student, year 3, school A). Another aspect of how ICT supported students' communicative work was "*...when giving oral presentations it's much easier to have your notes in your smartphone*" (student, year 3, school B). Some students thought that teachers should only use digital assignments, both with regard to digital editing and for physical comfort: "*...writing 27 pages makes your hand ache a lot*" (student, year 1, school C).

Theme 3. Institutional Regulations and Support
Students at all three schools had to sign a laptop user-contract. School leaders, teachers and IT technicians had the right to control students' laptops if there was any suspicion of irresponsibility. Several students talked about the contracts as reasonable "[I] *can´t say that this is wrong. It's a school laptop and should be used for that purpose and not for a lot of other things*" (student, year 1, school A). However, many students also expressed uncertainty about the regulations, if they were used in practice or were simply a rhetorical trick: "[I] *think they are pretty cool about this* [downloading]*, but yes it might prevent students from doing it if the school first issues a warning and if it happens again take the laptop away*" (student, year 1, school A). Despite this, several students stressed that they did not at all want their laptops to be impounded because it was an important tool for their schoolwork and that if it was taken away their studies would suffer.

In all the groups, the student talk included aspects of the ICT support provided by their school. Overall, the students seemed to be relatively pleased with the support they received. However, one frequently mentioned improvement concerned the limited opening times of the ICT support centres, which potentially conflicted with students' lesson times. Further, the turnaround time for a laptop handed into the local ICT support centre could range from one day to two or three weeks. At school C, the students were concerned that "*only having one IT technician at the school is vulnerable*" (student, year 1, school C). Other students at school C said that the Internet connection was not always stable and that they had experienced problems with lessons not running smoothly as a result: "*...it was on a Monday. All the students are in school that day, sitting with their laptops. It* [the connection] *didn´t work, we were too many* [connected to the Internet at the same time]" (student, year 3, school C). Students at this school were also grateful that the maths teacher made sure that the ICT infrastructure worked well for the distance-based lessons:"*...even if he has his own class* [of students] *he always pops in to make sure that everything's OK*" (student, year 3, school C).

It can also be noted that, with one or two exceptions, students at all the three schools seldom talked about more structured introductions of digital software, such as Microsoft® Office or the local LMS. However, there were a few examples. At school C, students said that in first grade they were introduced to Class Live [a synchronous ICT tool] and taught how to use Fronter [the local LMS] and LMS for online communicative purposes when studying at a distance.

Theme 4. In-School Use of Smartphones
In many of the groups the students talked about not being allowed to use their smartphones during class: "[T]*he teachers think that you use it* [the smartphone] *for checking out social media…you should show* [the teacher] *what you are searching for*" (student, year 3, school A). Teachers were also thought to have difficulties judging whether smartphones were used for learning purposes or not: "[I]*t is easier for them* [the teachers] *to check whether the laptop is being used than the smartphone*" (student, year 3, school B). Several of the students talked about the use of smartphones in the

classroom as a potential distraction and a disturbing element. In some of the groups the students talked about responsibility "[I] *feel that if you pick up the smartphone you'll risk missing the lecture, but that's your own fault. It's your problem. You have to take more responsibility*" (student, year 1, school B). One group posted the rhetorical question: "*...perhaps they* [the smartphones] *could be part of the teaching, so you can focus on the right things*?" (Student, year 1, school C).

Despite the talk about smartphones as a distraction and students seldom being asked by their teachers to actively use their smartphones for learning purposes, there were some exceptions: "[Name of the teacher] *lets us use it* [the smartphone] *as a dictionary, for listening to music, for checking out things we want to know more about or understanding in order to make learning easier*" (student, year 1, school A). Some students also described the advantages of using smartphones in class: "[M]*aybe you have a test that day or something needs to be handed in. If you have taken a photo and by accident display it* [the photo] *on the smartphone, you just think `now I remember`* [we have a test today]" (student, year 1, school B). Other advantages were that smartphones could be used as calculators and for speed googling to avoid starting up the laptop. Students also said how much easier a smartphone was to carry than a laptop. Another argument for in-school use of the smartphone was: "[I]*f I want to check something here and now it's very convenient. It's great for retrieving information*" (student, year 3, school C).

When talking about the usability of technologies like the laptop, tablet and smartphone, students seemed to prefer laptops to tablets and smartphones: "[P]*ersonally I think that the laptop is far better than the smartphone. It has a much more powerful hardware which makes things so much faster and it's also easier to write on it* [the laptop]. *The space for writing is very small on a smartphone*" (student, year 1, school A).

Theme 5. LMS

The talk about LMS concerned the teachers' and the students' own use of the system. Many students said that most of their teachers used the local LMS to some extent. It also become apparent that a mobile app for the LMS would probably result in more active use on the part of the teachers. The teachers' use of LMS was described as being for activities such as distributing and collecting assignments, posting student grades and disseminating information and learning materials.

Students described many teachers as dissatisfied with the design and functionality of LMS: "[I] *haven´t met a single teacher who actually likes it* [the local LMS]" (student, year 1, school B). The limited use of LMS by the teachers was related to the age of the individual, their own interest in using LMS or their low levels of digital competence: "[T]*oo often you hear phrases like `I´m not confident in using ICT, I can´t use it`. They* [the teachers] *have to learn; that´s the reason why it's like it is when it comes to the present use of XXX* [LMS at school B]. *There are lots of possible functions in the system, but we only use one of them because that's the only specific function they* [the teachers] *know how to use*" (student, year 3, school B).

Students in many of the groups also talked about being dependent on the teachers for using LMS in a consistent way. If they did not do this they could miss school assignments and as a result fall behind in their schoolwork. This seemed to be the case for students at school C: "*...if we're out on a training camp we're not physically able to go and see the teacher*" (student, year 1, school C). Teachers' consistency of use also seemed to reflect how frequently the students logged into LMS: "*...if you know that work is to be done or has been uploaded* [to the LMS] *you log in. You don´t log in just to check for new information*" (student, year 1, school A). Many of the students talked about inconsistent use as being related to the implementation of a new LMS system: "[I]*t* [XXX, the former LMS] *was easier to use than YYY* [the current LMS] *and above all our teachers knew that system really well. Now the teachers hardly know how to use YYY, it has become more difficult to access the things you need. In my experience, since we switched learning platform things have got worse*" (student, year 3, school B).

Students at all the three schools mostly used LMS for submitting assignments and downloading new tasks. However, many also talked about LMS as an important hub for supporting and structuring their time in school: "*...we have a room in XXX* [the local LMS]*, you just enter that room and the log out if you don't have anything to submit to the teacher*" (student, year 3, school B), or "[I]*t´s so much easier. You don´t need to keep track of a lot of paper...you can access* [to the LMS] *at home. For example, if you are ill you can still do your* [school] *work*" (student, year 1, school A).

A new LMS system had recently been introduced at two of the schools. Some of the students talked positively about the change of LMS system, although the majority seem to be of a different opinion. On the positive side, the students regarded some of the teachers as supportive and able to demonstrate the basics of the new system, such as how to report sick leave and absence from school. However, several students talked about texting a classmate as the easiest way of reporting this and asking him or her to tell the teacher. On the less positive side, many of the students regarded the new LMS as user-unfriendly and that it contained unnecessary levels: "*...just to submit work to the teacher you have like click ten times. It would've been so much easier to choose from a dropdown list or search* [in the LMS]*...it takes like ten minutes* [to send a message in the LMS]" (student, year 1, school B) or was outdated: "[T] *he LMS is not up-to-date enough. It* [the LMS] *expects that we log into the system using our laptops. It would've been much smarter to use an app*" (student, year 1, school A).

Theme 6. Peer Support Through ICT

Several groups talked about ICT as a functional tool for peer support in school-related activities and in particular mentioned Dropbox, Facetime, Google Drive, Snapchat and Facebook – but not the local LMS. Peer support ranged from sharing information about subject-related assignments to providing each other with peer-review comments on writing assignments. The tools used were mostly said to be other than those provided by their schools. It can be noted that when talking about parallel ICT tools, the students also referred to power, in the sense that they, not the teachers, could decide who

should have access and which information should be posted "[I]*f we invite the teachers so they can see and read, it often only includes the presentation. First you write down everything* [in Google Drive] *so that your classmates can take part in a discussion, and after that we do the presentation*" (student, year 3, school A).

In one of the groups the students talked about a page on Facebook that was reserved for members of the class. This page was used to share information to support their school work "*...when you are ill and at home there is always the possibility to post a question* [on Facebook] *about for example whether we have received any homework or whether I've forgotten something to do with school. That's really great!*" (Student, year 1, school B). Examples of other peer support activities were students sending text messages to support a classmate who was ill at home or in the same classroom but did not know how to solve an assignment. Another example of smartphone support use was mentioned by a student at school C, who received support from her father geographically located elsewhere in Sweden "[I] *text a mathematical problem for him to solve. He then texts the solution to me together and calls me to explain what he did* [how he solved the problem] *and how he got that answer*" (student, year 1, school C).

Discussion

The students' talk about how and when to use ICT in school includes many of the aspects referred to in former research (cf. Lindberg et al., 2017; Selwyn & Facer, 2014; Song, 2014). Although there are minor differences, according to the students ICT is used more or less on a daily basis. Students in all the schools are expected to bring their laptops to class, even though some of the teachers never actually make use of them in their teaching. Ambivalent signals like these could help to generate opportunities for a more structured and efficient use of ICT in school. It could also be argued that if students always brought their laptops to class teachers would have with richer opportunities to use them to re-plan, improvise or capture teachable moments. This aspect would, of course, need to be researched empirically.

ICT is said to be used for ongoing digital documentation. Students describe how they see both Google Drive and the laptop hard drive as easily accessible containers for both storage and rapid searches for material to solve a school assignment (cf. Bulfin et al., 2016). Furthermore, ICT is talked about as a tool that supports oral presentations and the taking of structured notes during lectures. Another advantage in relation to digital text production is that text processing programs such as Word do in fact provide students with rich possibilities to edit, structure and re-structure their texts. This is said to result in written assignments of a higher quality that are completed in less time than they would be using pen and paper (cf. Clarke & Svanaes, 2012; Mangen, 2016).

Many of the students seem to have a rather relaxed attitude towards (cf. Bulfin et al., 2016) the signing of a laptop user-contract. The contract seems to reflect a kind of silent agreement that school leaders and teachers trust students to use their laptops in a responsible way and that in practice the contracts play a very

minor role. A related issue that students talk about concerns the possibility of receiving ICT support when their laptops crash. Overall, the students in the three schools seem to be satisfied with the turnaround time. However, given the important role the laptop appears to play in the students' everyday lives in school, a turnaround time of up to three weeks, indicated by some students, is likely to create problems when it comes to managing school work. LMS is often described as being of inferior standard and under used by teachers. Notably, at two of the schools the LMS system had recently been replaced, which could explain why students regarded it as under used by many of the teachers. However, at the same time LMS is referred to as a highly important hub for supporting and structuring students' schooling (cf. Yildram et al., 2014). Students download and upload their assignments and collect information via LMS (e.g., to find out whether a lesson has been cancelled for some reason). In many of the groups the students talk about the importance of teachers using LMS consistently. For example, students want to be sure that the information they need for an assignment is always accessible in LMS. For instance, if students are unable to attend school, they can still access their assignments and thereby reduce the risk of falling behind in their schoolwork (cf. García-Peñalvo & Alier Forment, 2014).

Another issue that is talked about in the interviews is the in-school use of smartphones. In several of the groups, students say that they are not allowed to use smartphones in class, sometimes for obscure reasons The teachers are also described as being unsure about whether or not smartphones should be used for learning purposes, and that the easiest solution is to ban their use in class. Students talk about the smartphone as a potential source of distraction, but also that if it is used responsibly it could be a good learning tool. Students also talk about the smartphone as a digital tool that is always available, as a support to remember assignment deadlines, or as a calculator. Furthermore, they think that smartphones are functional tools for peer support, both inside school during class and outside for school-related issues. In research, the question of students' use of smartphones has been reported as both negative (Beland & Murphy, 2016) and positive (Philip & Garcia, 2015; Thomas et al., 2013). The findings in this study also indicate positive and negative aspects.

In many of the groups, different tools for peer support and the sharing of information are regarded as central, such as Dropbox, Google Drive and Facebook (Bulfin et al., 2016). Interestingly, ICT tools and resources are not always provided by the schools, but are instead selected and used by the students. Of importance here is that it is the students and not their teachers who decide how the tools are used and who has access to the peer support communities that are established.

Methodological limitations

Three schools were included in the study. Two of the schools were campus-based (schools A and B), while the third (school C) had a mix of campus and distance teaching. Additional schools, as well as more groups of students interviewed, could have provided both richer and more nuanced results. The results could also have gained from being complemented with

ethnographically inspired observations by means of the researchers documenting the students' everyday ICT supported activities in school.

Conclusions and Future Research

The main conclusion is that schools can increase the use of ICT to structure and support students' everyday activities and time at upper secondary school, such as using ICT for writing, documentation, storage and peer support. Further, consistency in the use of ICT by the teachers is important, especially concerning LMS and clarity about when the laptop can be used in class. Other conclusions are students' appreciation of prompt ICT support and that there are different opinions about the in-school use of smartphones. Finally, it can be concluded that the overall result from the study in this paper seems to show a somewhat different picture compared to a significant body of research in K-12 school that focus on the use of advanced technology in teaching and learning. Following the students, in order to learn more about "school as a purpose for digital use" (Bulfin et al., 2016), research on the use of ICT in K-12 school would instead benefit from an increased focus on "state-of-the-actual" rather than "state-of-the-art" technology (Selwyn, 2010). Considering that, future research could for example continue to investigate several issues. For instance, (a) how, and with what purposes, students' use of ICT provided by the schools can be in comparison to ICT use chosen by themselves. Another issue is (b) how different kind of school regulations have impact on students' use of ICT such as smartphones. Further, (c) teachers' understanding of the role of ICT for students' everyday activities in school. Finally, (d) teachers' understanding of students' perspective on the use of ICT for everyday activities in school.

References

Beland, L-P., & Murphy, R. (2016). Ill communication: Technology, distraction & student performance. *Labour Economics, 41*, 61-76.

Bulfin, S., Johnson, N., Nemorin, S., & Selwyn, N. (2016). Nagging, noobs and new tricks – Students´ perceptions of school as a context for digital technology use. *Educational Studies, 42*(3), 239-251.

Charles, A. S. (2012). Cell phones: Rule-setting, rule-breaking, and relationships in classroom. *American Secondary Education, 40*(3), 4-16.

Clarke, B., & Svanaes, S. (2012). *One-to-one tablets in secondary schools: An evaluation study. Stage 1: 2011- 2012.* London, United Kingdom: Family, Kids & Youth.

García-Peñalvo, F. J., & Alier Forment, M. (2014). Learning management system: Evolving from silos to structures. *Interactive Learning Environments, 22*(2), 143-145.

Kvale, S. (2008). *Doing interviews*. London, United Kingdom: SAGE Publications.

Lindberg, J. O., Olofsson, A. D., & Fransson, G. (2017). Same but different? An examination of Swedish upper secondary school teachers' and students' views and use of ICT in education. *International Journal of Information and Learning Technology. 34*(2), 122-132.

Mangen, A. (2016). What hands may tell us about reading and writing. *Educational Theory, 66*(4), 457-477.

Olofsson, A. D., Lindberg, J. O., & Fransson, G. (2017, March). What do upper secondary school teachers want to know from research on the use of ICT and how does this inform a research design? *Education and Information Technologies*. doi: 10.1007/s10639-017-9590-5

Philip, T. M., & Garcia, A. (2015). Schooling mobile phones: Assumptions about proximal benefits, the challenges of shifting meanings, and the politics of teaching. *Educational Policy, 29*(4), 676-707.

Ros, S., Hernández, R., Caminero, A., Robles, A., Barbero, I., Maciá, A., & Holgado, F. P. (2014). On the use of extended TAM to assess students' acceptance and intent to use third-generation learning management systems. *British Journal of Educational Technology, 46*(6), 1250-1271.

Selwyn, N. (2010). Looking beyond learning: Notes towards the critical study of educational technology. *Journal of Computer Assisted Learning, 26*(1), 65-73.

Selwyn, N. (2011). `It's all about standardisation' – Exploring the digital (re) configuration of school management and administration. *Cambridge Journal of Education, 41*(4), 473-488.

Selwyn, N., & Bulfin, S. (2015). Exploring school regulation of students' technology use – rules that are made to be broken? *Educational Review, 68*(3), 274-290.

Selwyn, N., & Facer, K. (2014). The sociology of education and digital technology: past, present and future. *Oxford Review of Education, 40*(4), 482-496.

Song, Y. (2014). "Bring your own device (BYOD)" for seamless science inquiry in a primary school. *Computers & Education, 74*, 50-60.

Thomas, K. M., O'Bannon, B. W., & Bolton, N. (2013). Cell phones in the classroom: Teachers' perspectives of inclusion, benefits, and barriers. *Computer in the Schools, 30*(4), 295-308.

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2016). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Education Technology Research and Development*. doi:10.1007/s11423-016-9481-2

Wastiau, P., Blamire, R., Kearney, C., Quittre, V., Van de Gaer, E., & Monseur, C. (2013). The use of ICT in education: A survey of schools in Europe. *European Journal of Education, 48*(1), 11-27.

Yildirim, Z., Reigeluth, C. M., Kwon, S., Kageto, Y., & Shao, Z. (2014). A comparison of learning management systems in a school district: Searching for the ideal personalized integrated educational system. *Interactive Learning Environments, 22*(6), 721-736.

Author details

Anders D. Olofsson
anders.d.olofsson@umu.se
J. Ola Lindberg
ola.j.lindberg@umu.se
Göran Fransson
goran.fransson@hig.se