

Students' voices about information and communication technology in upper secondary schools

Anders D. Olofsson and Ola J. Lindberg

Department of Education, Umeå University, Umeå, Sweden, and

Göran Fransson

Faculty of Education and Business Studies, University of Gävle, Gävle, Sweden

Abstract

Purpose – The purpose of this paper is to explore upper secondary school students' voices on how information and communication technology (ICT) could structure and support their everyday activities and time at school.

Design/methodology/approach – In all, 11 group interviews were conducted with a total of 46 students from three upper secondary schools. NVivo PRO 11 was used for a qualitative content analysis.

Findings – The results show that ICT plays a central role in the students' schooling, not in terms of "state-of-the-art" technology, but rather as "state-of-the-actual", by for example supporting the writing process and for peer support, digital documentation and storage.

Research limitations/implications – A relatively small number of students in three schools and three specific programmes make generalisations difficult.

Practical implications – Students' perspectives on the "state-of-the-actual" could influence teachers' use of ICT in education, their professional development activities and the development of an in-school ICT infrastructure.

Social implications – The study could lead to a better understanding of students' expectations and use of ICT at school and in everyday life.

Originality/value – The originality of this paper is the focus on students' voices about how the basic use and functionality of ICT could structure and support their everyday activities at school.

Keywords Teaching, Students, Upper secondary school, Use of ICT, Student voices

Paper type Research paper

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 use their own digital devices (BYOD) (Song, 2014) in learning activities during their time at school. Research reports that in many western schools students use ICT devices such as laptops and digital tablets on a regularly basis (Jahnke *et al.*, 2017; Håkansson Lindqvist, 2015) and that the digitalisation of education has meant that more outcome is expected from ICT in teaching and learning activities (Wastiau *et al.*, 2013).

Digitalisation has also resulted in a number of challenges (Olofsson *et al.*, 2017; Tondeur *et al.*, 2016). Due to digitalisation, there is an increased pressure on schools and teachers to integrate ICT in teaching and learning activities, even though this may be at odds with their own knowledge, beliefs and doubts about their potential (Howard, 2013). Other concerns are how schools respond to a situation in which students have instant access to their own ICT devices at school (Selwyn and Bulfin, 2015) and how schools deal with students using ICT



for academic and non-academic purposes at school (Salomon and Ben-David Kolikant, 2016). However, a major concern in the digitalisation of schools is how to keep abreast of the ongoing technological developments and the options that new digital tools, applications, services and communities make possible (Siddiq, 2016). This paper aims to explore the digitalisation of schools from a student perspective. More specifically, the focus is on students' voices about how ICT contributes to the structuring and support of their everyday activities and time at school.

Research on students' use of ICT at school

The increased interest in both research and practice in students' use of ICT at schools (Lindberg *et al.*, 2017) can be related to the one-to-one (1:1) movement that has taken place in western schools (Håkansson Lindqvist, 2015). Here, Harper and Milman (2016) suggest that two factors in this increased interest are related to ongoing digital developments and investments in new ICT tools for teaching and learning. Further, and as pointed out by, for example, Pettersson (2017), the digitalisation of schools and the 1:1 movement have nurtured research on the question of students' possibilities to develop their digital competence in use of various ICT tools for activities inside and outside school.

Research on digitalised schools also reports on students' different uses of specific ICT tools for different purposes. In addition to laptops, three tools that are of interest in this paper, and that are often targeted in research on 1:1 schools, are: smartphones, which are increasingly focussed on in research and questioned as a learning tool (Liu *et al.*, 2014); digital tablets, described as flexible and multimodal ICT tools for students' learning (Peluso, 2012) and the learning management system (LMS), which has played an important role in school over the last 20 years (Ros *et al.*, 2014). These three tools are accounted for below.

In research on smartphones, the results either seem to point in different directions or to be ambiguous. For example, Philip and Garcia (2015) indicate that the use of smartphones in school has a positive impact on students' learning. Beland and Murphy (2016) show that the banning of smartphones in schools in four English cities has positively affected students' examination results at the end of nine-years of compulsory schooling. Students attending schools in which smartphones are banned experience higher academic results after the ban than before it, with the lowest achieving students improving the most. However, Ott *et al.* (2017) argue that rather than prohibiting mobile phones, pedagogical integration in support of learning should be at the heart of any discussion between teachers, students and parents.

In research it has been claimed that the use of digital tablets prepares students for life and work in the twenty-first century (Clarke *et al.*, 2013) and that tablets have positive impact on students' motivation for learning (Ciampa, 2014) and the development of oral, written and graphical communication (Bagdasarov *et al.*, 2017). On the more challenging side, students' misuse of tablets at home and at school (Blikstad-Balas and Davies, 2017) can also be mentioned. In this context, Ditzler *et al.* (2016) conclude that "How the teachers used the device was indicative of how the students would use it. For example, in one math class the teacher only used the device to upload and view homework assignments, and the students in the class did the same" (p. 185).

Ros *et al.* (2014) claim that LMS facilitates communication and collaboration, for example, between teachers and parents or between students. Similarly, Yildirim *et al.* (2014) put forth that LMS can support collaboration both inside and outside school, be customised by users and be used via smartphone apps. However, Cerezo *et al.* (2016) point out that the use of "LMS requires more effort by the student when deciding what, how, and how much to learn; how much time to invest; when to abandon and change learning strategies; when to increase effort; and so on" (p. 42). In turn, García-Peñalvo and Alier Forment (2014) argue that it is important for institutional LMS to co-exist with, be compatible with and enrich all the other ICT tools that are used by students in the learning context.

Acknowledging the research reported above, this paper attempts to answer the question formulated by Selwyn (2010): “What is the use of technology in educational settings actually like?” (p. 70). Selwyn specifically emphasises that research should be encouraged to focus more on “state-of-the-actual” rather than “state-of-the-art” technology. One example of such a focus can be found in Bulfin *et al.* (2016) and their study of the various ways in which Australian secondary school students use ICT. They highlight 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). These same scholars 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 the use of technology is facilitated by institutional infrastructures, school rules and regulations, whereas 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 also report that due to various infrastructures and regulations, only certain types of ICT are used and that information retrieval (e.g. Google) and content creation (e.g. Word) are the commonest in-school ICT activities. The latter is in line with Mangen (2016), who argues that writing is now mainly performed using digital technology, rather than a pen and paper. Clarke 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).

Purpose and research questions

The purpose of this paper is to explore upper secondary school students’ voices about ICT and how it can be used to structure and support their everyday learning activities and time at school. Based on research indicated above, the paper addresses two research questions:

RQ1. What do the students use ICT for in their daily practices?

RQ2. Which support structures regulate the students’ use of ICT?

Methodology

This study is part of a four-year research project exploring how ICT is used in upper secondary schools in Sweden. The three schools included in the study have been recognised for their advanced use of ICT. Two of the schools are campus-based (A and B), whereas the third (C) has a mixture of on-site and distance teaching. When the data was collected in November 2015, schools A and B had just introduced a new LMS system.

The data consist of semi-structured focus group interviews. A total of 11 group interviews with 46 students from the first and third year were carried out, during which a moderator used open-ended or specific questions to facilitate and deepen the conversation. In six of the groups, the students followed theoretical programmes such as the Technology Programme (TE) or the Natural Science Programme (NA), and in five of the groups the vocational Electricity and Energy Programme (EE) was followed. There were between three and six students in each group and the interviews lasted between 30 and 60 minutes. The interviews were transcribed verbatim prior to being analysed.

The content analysis using NVivo (Pro 11) included meaning condensation (Kvale, 2008) and consisted of several steps. The first step of meaning condensation resulted in 22 broad categories of the complete set of data. In the next step, these text-based categories were transferred to a Word document consisting of 242 pages. The document was read several times in order to: identify whether some of the categories were too broad or outside the scope of the study and could therefore be removed and 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. The two main themes and six sub-themes presented below were constructed from these 12 categories. In each theme, certain aspects emerged in the analysis that was qualitatively separate from other aspects. This implied that a number of students shared the same view of how ICT was used. Exactly how many students shared the same view is of less importance (Altheide and Johnson, 2011), in that views reflect qualities, rather than frequencies.

Results

In this section the results are presented in a thematic and qualitative manner. The students' quotes are marked to show to which school they belong (A, B or C) and the year of study (1 or 3). For instance (B1) means a student from school B in year 1.

Theme 1: how and when should ICT be used at school?

This first main theme is concerned with how the students' address aspects of their use of ICT related to time, space and specific ICT tools in their learning activities. Four sub-themes are part of theme 1.

Sub-theme 1: variations in the students' use of ICT. There were some variations in the students' voices about the frequency of use of ICT. For example, one group of students attending a theoretical programme at school C, described 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" (C1). In contrast, a group of students in a vocational programme (B3) 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 at school at least four out of five days a week. According to the students, the use of ICT was either decided on by the subject teacher or themselves. However, some students stressed that their teachers ought to decide when to use ICT: "[...] you actually have to trust the teacher's judgement. I mean they were also students once" (B1). Several students were confused about when ICT could or could not be used at school and 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" (B1).

Sub-theme 2: ICT – making storage and text production easier. The students at all three schools said that ICT supported the ongoing documentation of their school work: "[...] you have all your stuff in one place, you can search for things. Everything is so easy. I especially appreciate the easiness" (B3), or "[I] can create folders [in Google Drive] and know for sure where they are" (C1). The students also said that the laptop helped them to take structured notes: "[Y]our notes aren't a mess even if you are stressed. If you're stressed and take notes using pen and paper you can't always read what you've written" (B1). Some students pointed out that the laptop enabled them to move text sections around easily and reformulate sentences in their documents and that digital written texts were of a 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" (A1) 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" (A3). 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" (B3). Some students said that teachers

should only use digital assignments, both with regard to digital editing and for physical comfort: “[...] writing 27 pages make your hand ache a lot” (C1).

Sub-theme 3: peer support through ICT. Several of the groups revealed an understanding of 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 those provided by their schools. It can be noted that regarding parallel ICT tools, the students 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” (A3).

One of the groups described a Facebook page that was reserved for members of their 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!” (B1). Another peer support activity was students sending text messages to support a classmate who was either ill at home or in the same classroom, but who did not know how to solve an assignment. Another example was mentioned by a student at school C, who by using the smartphone 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 and calls me to explain what he did [how he solved the problem] and how he got that answer” (C1).

Sub-theme 4: in-school use of smartphones. In many of the groups, the discussions during the interviews revolved around not being allowed to use smartphones in 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” (A3). According to the students, the teachers found it difficult to judge whether smartphones should be 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” (B3). Several of the students saw the use of smartphones in the classroom as a potential distraction and a disturbing element. The importance of student responsibility was expressed in several of the groups: “[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” (B1). One group posed the rhetorical question: “[...] perhaps they [the smartphones] could be part of the teaching, so you can focus on the right things?” (C1).

Despite voices about smartphones being regarded as a distraction and students seldom being asked by their teachers to actively use them 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” (A1). 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]” (B1). Other advantages were that smartphones could be used as calculators and for speed Googling to avoid starting up the laptop. The smartphone was also easier 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” (C3).

Regarding the usability of technologies like the laptop, tablet and smartphone, the students seemed to prefer laptops to smartphones and tablets: “[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" (A1). In fact, tablets were only mentioned in passing in two of the groups and then in terms of them being used in the students' homes for leisure.

Theme 2: regulatory aspects in the students' use of ICT

The second main theme concerns students' talk about how the support structures in school make some activities possible but hinder others. From a student point of view, the regulatory aspects both enable and challenge in their everyday life at school. Two sub-themes are part of theme 2.

Sub-theme 1: user-contracts and technical support. A student laptop user-contract had to be signed at all three schools. According to the students, the school leaders, teachers and IT technicians had the right to control the students' laptops if there was any suspicion of irresponsible behaviour. Several students regarded 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" (A1). However, many students also expressed uncertainty about the regulations in terms of whether 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" (A1). Despite this, it was apparent that the students did not want their laptops to be impounded, mainly because they were important for their school work and confiscation would adversely affect their studies. It can further be noted that some students also wanted to use their school laptops for private means, so that both school and non-school-related material was on one single digital device: "[A] lot of people do that. Using it [the laptop] both as a private and work computer is common in many workplaces" (A1).

Different voices about the in-school ICT support were present in all the groups. Overall, the students seemed to be relatively pleased with the support they received. However, one frequently mentioned aspect was the limited opening hours of the ICT support centres, which potentially conflicted with students' lesson times. Further, the turnaround time for the repair of a laptop by 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" (C1). 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, there were too many of us [connected to the internet at the same time]" (C3). 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 though he has his own class [of students], he always pops in to make sure that everything's OK" (C3).

It can also be noted that the students at all three schools seldom talked about support in terms of more structured introductions of digital software, such as Microsoft[®] Office or the local LMS, although there were some exceptions. At school C, students said that in year 1 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".

Sub-theme 2: the LMS – the good and the bad. Students' voices about the local LMS were concerned with both possibilities and hindrances in relation to the teachers' and their own use of the system. Many students said that most teachers used the local LMS to some extent and that a mobile app for the LMS would probably result in more active use. The teachers' use of LMS was mainly related to activities such as distributing and collecting assignments, posting student grades and disseminating information and learning materials.

According to the students, many teachers were dissatisfied with the design and functionality of LMS: "[I] haven't met a single teacher who actually likes it [the local LMS]" (B1). 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 expressions 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” (B3).

In many of the groups the students seemed to be dependent on their teachers’ consistent use of the LMS. If this was not consistent, the students could miss school assignments and as a result fall behind in their school work. For example, a student in school C said that: “[...] if we’re out on a training camp, we’re not physically able to go and see the teacher” (C1). The teachers’ use of LMS 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 on the off chance to check for new information” (A1). Many of the students related an inconsistent use 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” (B3).

The students at all three schools mainly used LMS to submit assignments and download new tasks. However, the LMS was also regarded as an important hub for supporting and structuring their school work: “[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. If you are ill you can still do your [school] work” (A1).

A new LMS system had recently been introduced at two of the schools and there were different voices among the students about this. 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, according to several students, texting a classmate and asking her or him to tell the teacher was the easiest way of reporting. Many students regarded the new LMS as user-unfriendly, 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]” (B1), 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” (A1).

Discussion

When it comes to what the students use ICT for in their daily practices (*RQ1*), it would seem that ICT is used more or less on a daily basis and that students are expected to bring their laptops with them 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 at school. It could also be argued that if students always brought their laptops to class, teachers would have richer opportunities to use them to re-plan, improvise or capture teachable moments.

Students indicate that ICT is used for ongoing digital documentation and regard both Google Drive and the laptop hard drive as easily accessible containers for storage and for searching for material in order to solve a school assignment (cf. Bulfin *et al.*, 2016). Furthermore, ICT is mentioned 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 seem to provide students with rich possibilities to edit, structure and re-structure their texts. In general, written assignments are of a higher quality and completed in less time than they would have been using pen and paper (cf. Clarke and Svanaes, 2012; Mangen, 2016). Furthermore, 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 the students, rather than their teachers, decide how the tools are used and who has access to the peer support communities that are established.

Regarding specific ICT tools, it can be noted that besides laptops, students often talk about the in-school use of smartphones and the local LMS. Digital tablets are only briefly touched upon. With regard to smartphones, in several of the groups the students say that they are not allowed to use smartphones in class, sometimes for reasons that are not clear. Teachers are also described as being unsure about whether or not smartphones can be used for learning purposes, and that the easiest solution is to ban their use in class. The smartphone is also talked about as a distraction, but if used responsibly as a tool for learning. According to the students, the smartphone is instantly available, can help them to remember assignment deadlines and be used as a calculator. Furthermore, smartphones can be functional tools for peer support, both at school in class and outside for school-related issues. In research, the question of students' use of smartphones has been reported as both negative (Beland and Murphy, 2016) and positive (Philip and Garcia, 2015). The findings in this study also indicate positive and negative aspects.

Turning to which support structures regulate the students' use of ICT (*RQ2*), two identified issues are technical support and structural support via the schools LMS. Overall, the students in the three schools seem to be satisfied with the support and accept the need to sign a student laptop user-contract. However, given the important role that laptops appear to play in the students' everyday lives at school, a turnaround time of up to three weeks for support if the laptop crashes, as indicated by some students, is likely to hinder their school work.

The local LMS is used by the schools as a tool to facilitate the organisation, administration and structuring of the students' learning, but is also described by the students as being of inferior standard and sparsely used by some of the teachers. Notably, at two of the schools the LMS system had recently been replaced, which could explain why the students regarded it as under-used. However, at the same time, LMS is referred to as a highly important hub for supporting and structuring students' schooling (cf. Yildirim *et al.*, 2014). Students download and upload their assignments and collect information via the LMS, e.g. to find out whether a lesson has been cancelled. In many of the groups, the students talk about the importance of teachers using LMS consistently. For example, if students are unable to attend school, they can still access their assignments and thereby reduce the risk of falling behind in their school work (cf. Garcia-Peñalvo and Alier Forment, 2014).

Limitations

One limitation is that only students from three schools and three study programmes were involved. Another limitation is that schools A and B had only just introduced a new LMS, which could mean that the focus on LMS issues was over-emphasised by the students from these schools. Further, the fact that two of the schools were campus-based (A and B) and the third (C) had a mix of campus and distance teaching may have led to biased data.

Conclusions and future research

According to the students, the schools need to be more precise and effective in the use of ICT to structure and support their everyday activities and time at upper secondary school, e.g. by using ICT for writing, documentation, storage and peer support. One conclusion is the importance of consistency in the teachers' use of ICT, especially the LMS and clarity about when laptops can be used in class. A further conclusion is students' appreciation of prompt ICT support and a responsible in-school use of smartphones. Another conclusion is that 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 schools could 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: students' use of school-based ICT and ICT that they themselves choose, students' perceptions of how ICT helps them to work better, smarter and get better grades, how different kinds of school regulations impact students' use of smartphones, teachers' understanding of students' perspectives on the use of ICT for everyday activities in school.

References

- Altheide, D.L. and Johnson, J.M. (2011), "Reflections on interpretive adequacy in qualitative research", in Denzin, N.K. and Lincoln, Y.S. (Eds), *The SAGE Handbook of Qualitative Research*, SAGE, Thousand Oaks, CA, pp. 1-19.
- Bagdasarov, Z., Yupeng, L. and Wuet, W. (2017), "The influence of tablet-based technology on the development of communication and critical thinking skills: an interdisciplinary study", *Journal of Research on Technology in Education*, Vol. 49 Nos 1-2, pp. 55-72, doi: 10.1080/15391523.2017.1293576.
- Beland, L.-P. and Murphy, R. (2016), "Ill communication: technology, distraction & student performance", *Labour Economics*, Vol. 41, pp. 61-76, doi: 10.1016/j.labeco.2016.04.004.
- Blikstad-Balas, M. and Davies, C. (2017), "Assessing the educational value of one-to-one devices: have we been asking the right questions?", *Oxford Review of Education*, Vol. 43 No. 3, pp. 311-331, doi: 10.1080/03054985.2017.1305045.
- Bulfin, S., Johnson, N., Nemorin, S. and Selwyn, N. (2016), "Nagging, noobs and new tricks – students' perceptions of school as a context for digital technology use", *Educational Studies*, Vol. 42 No. 3, pp. 239-251, doi: 10.1080/03055698.2016.1160824.
- Cerezo, R., Sanchez-Santill, M., Puerto Paule-Ruiz, M. and Núñez, J.C. (2016), "Students' LMS interaction patterns and their relationship with achievement: a case study in higher education", *Computers & Education*, Vol. 96, pp. 42-54, doi: 10.1016/j.compedu.2016.02.006.
- Ciampa, K. (2014), "Learning in a mobile age: an investigation of student motivation", *Journal of Computer Assisted Learning*, Vol. 30 No. 1, pp. 82-96, doi: 10.1111/jcal.12036.
- Clarke, B. and Svanaes, S. (2012), "One-to-one tablets in secondary schools: an evaluation study, stage 1: 2011-2012", available at: www.kidsandyouth.com/pdf/FK%26Y%20T4S%20Stage%201%202011-12%20Report.pdf (accessed 25 August 2017).
- Clarke, B., Svanaes, S. and Zimmermann, S. (2013), "One-to-one tablets in secondary schools: an evaluation study. tablets for schools", available at: www.kidsandyouth.com/pdf/FK%26Y%20T4S%20Stage%203%20Tablets%20for%20Schools%20Report.pdf (accessed 22 October 2017).
- Ditzler, C., Hong, E. and Strudler, N. (2016), "How tablets are utilized in the classroom", *Journal of Research on Technology in Education*, Vol. 48 No. 3, pp. 181-193, doi: 10.1080/15391523.2016.1172444.
- García-Peñalvo, F.J. and Alier Forment, M. (2014), "Learning management systems: evolving from silos to structures", *Interactive Learning Environments*, Vol. 22 No. 2, pp. 143-145, doi: 10.1080/10494820.2014.884790.
- Håkansson Lindqvist, M.J.P. (2015), "Gaining and sustaining TEL in a 1:1 laptop initiative: possibilities and challenges for teachers and students", *Computers in the Schools*, Vol. 32 No. 1, pp. 35-62, doi: 10.1080/07380569.2015.1004274.
- Harper, B. and Milman, N.B. (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*, Vol. 48 No. 2, pp. 129-142, doi: 10.1080/15391523.2016.1146564.
- Howard, S.K. (2013), "Risk-aversion: understanding teachers' resistance to technology integration", *Technology, Pedagogy and Education*, Vol. 22 No. 3, pp. 357-372, doi: 10.1080/1475939X.2013.802995.
- Jahnke, I., Bergström, P., Mårell-Olsson, E., Hall, L. and Swapna, K. (2017), "Digital didactical designs as research framework – iPad integration in Nordic schools", *Computers & Education*, Vol. 113, pp. 1-15, available at: <http://dx.doi.org/10.1016/j.compedu.2017.05.006>
- Kvale, S. (2008), *Doing Interviews*, SAGE Publications, London.

- Lindberg, J.O., Olofsson, A.D. and Fransson, G. (2017), "Same but different? An examination of Swedish upper secondary school teachers' and students' views and use of ICT in education", *The International Journal of Information and Learning Technology*, Vol. 34 No. 2, pp. 122-132, doi: 10.1108/IJILT-09-2016-0043.
- Liu, M., Scordino, R., Geurtz, R., Navarrete, C., Ko, Y. and Lim, M. (2014), "A look at research on mobile learning in K-12 education from 2007 to the present", *Journal of Research on Technology in Education*, Vol. 46 No. 4, pp. 325-372, doi: 10.1080/15391523.2014.925681.
- Mangen, A. (2016), "What hands may tell us about reading and writing", *Educational Theory*, Vol. 66 No. 4, pp. 457-477, doi: 10.1111/edth.12183.
- Olofsson, A.D., Lindberg, J.O. and Fransson, G. (2017), "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*, Vol. 22 No. 6, pp. 2897-2914, doi: 10.1007/s10639-017-9590-5.
- Ott, T., Grigic Magnusson, A., Weilenmann, A. and Hård af Segerstad, Y. (2017), "It must not disturb, it's as simple as that: students' voices on mobile phones in the infrastructure for learning in Swedish upper secondary school", *Education and Information Technologies*, available at: <https://link.springer.com/journal/10639/onlineFirst/page/1>
- Peluso, D. (2012), "The fast-paced iPad revolution: can educators stay up to date and relevant about these ubiquitous devices?", *British Journal of Educational Technology*, Vol. 43 No. 4, pp. E125-E127, doi: 10.1111/j.1467-8535.2012.01310.x.
- Pettersson, F. (2017), "On the issues of digital competence in educational contexts – a review of literature", *Education and Information Technologies*, available at: <https://link.springer.com/journal/10639/onlineFirst/page/1>
- Philip, T.M. and Garcia, A. (2015), "Schooling mobile phones: assumptions about proximal benefits, the challenges of shifting meanings, and the politics of teaching", *Educational Policy*, Vol. 29 No. 4, pp. 676-707, doi: 10.1177/0895904813518105.
- Ros, S., Hernández, R., Caminero, A., Robles, A., Barbero, I., Maciá, A. and 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*, Vol. 46 No. 6, pp. 1250-1271, doi: 10.1111/bjet.12199.
- Salomon, A. and Ben-David Kolikant, Y. (2016), "High-school students' perceptions of the effects of non-academic usage of ICT on their academic achievements", *Computers in Human Behavior*, Vol. 64, pp. 143-151, doi: 10.1016/j.chb.2016.06.024.
- Selwyn, N. (2010), "Looking beyond learning: notes towards the critical study of educational technology", *Journal of Computer Assisted Learning*, Vol. 26 No. 1, pp. 65-73, doi: 10.1111/j.1365-2729.2009.00338.x.
- Selwyn, N. (2011), "It's all about standardisation' – exploring the digital (re) configuration of school management and administration", *Cambridge Journal of Education*, Vol. 41 No. 4, pp. 473-488, doi: 10.1080/0305764X.2011.625003.
- Selwyn, N. and Bulfin, S. (2015), "Exploring school regulation of students' technology use – rules that are made to be broken?", *Educational Review*, Vol. 68 No. 3, pp. 274-290, doi: 10.1080/00131911.2015.1090401.
- Siddiq, F. (2016), "Assessment of ICT Literacy: a comprehensive inquiry of the educational readiness for the digital era", doctoral dissertation, Department of Teacher Education and School Research, Faculty of Educational Sciences, Oslo, available at: www.duo.uio.no/handle/10852/53359 (accessed 2 November 2017).
- Song, Y. (2014), "Bring your own device (BYOD)' for seamless science inquiry in a primary school", *Computers & Education*, Vol. 74, pp. 50-60, doi: 10.1016/j.compedu.2014.01.005.
- Tondeur, J., van Braek, J., Ertmer, P.A. and 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 Development*, Vol. 65 No. 3, pp. 555-575, doi: 10.1007/s11423-016-9481-2.

Wastiau, P., Blamire, R., Kearney, C., Quittre, V., Van de Gaer, E. and Monseur, C. (2013), "The use of ICT in education: a survey of schools in Europe", *European Journal of Education*, Vol. 48 No. 1, pp. 11-27, doi: 10.1111/ejed.12020.

Yildirim, Z., Reigeluth, C.M., Kwon, S., Kageto, Y. and Shao, Z. (2014), "A comparison of learning management systems in a school district: searching for the ideal personalized integrated educational system", *Interactive Learning Environments*, Vol. 22 No. 6, pp. 721-736, doi: 10.1080/10494820.2012.745423.

Further reading

Adhikari, J., Scogings, C., Mathrani, A. and Sofat, I. (2017), "Evolving digital divides in information literacy and learning outcomes: a BYOD journey in a secondary school", *The International Journal of Information and Learning Technology*, Vol. 34 No. 4, pp. 290-306, doi: 10.1108/IJILT-04-2017-0022.

Corresponding author

Anders D. Olofsson can be contacted at: anders.d.olofsson@umu.se