Comparison of Different Subject Cultures and Pedagogical Use of ICTs in Estonian Schools

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Abstract

This paper explores the ways in which teachers have integrated ICTs in teaching humanities and science classes at the elementary and primary school levels. The research is based in Estonia, looking at five Estonian and one Russian-speaking primary and elementary schools. Data were gathered through classroom observations and two consecutive interviews with 16 teachers. Our findings indicate that technology use is strongly related to the teacher’s dominant instructional style and the specific subject culture.

Keywords: pedagogic use of ICT, subject cultures, instructional styles, Estonia
Introduction

Schools worldwide are preoccupied with integration of technology, striving to intensify the use of computers and information and communication technologies (ICT) in teaching of all subjects (Ruthven et al., 2004). In fact, effective technology integration in schools is currently one of the most important issues in the EU, and also in various national agendas, for promotion of media and digital literacy. The latter, in fact, is seen as a lifelong skill and one of the key factors for citizenship in today’s information society (European Commission, 2007). A need for digital literacy skills is one of the reasons why many countries around the world have already implemented major curriculum reforms to integrate digital competencies in initial teacher training (Rizza, 2011), as teacher competencies and practices are central to the way ICT is adopted and used in the classrooms (OECD, 2001). In teacher competencies, the understanding of digital literacies lends itself to questioning how the ICT uses differ when looked at from the angle of subject-cultures. In this article we focus on literacies as practices that can be studied and compared through subject-culture lenses, enabling us to compare humanities and sciences teaching at stage I of basic education (grades 1–3) to the teaching of these subject cultures at stages II-III of basic education (grades 4–9).

We understand digital literacies not only as an individual skillset to be improved, but rather also as an institutionally and culturally dependent set of practices all of which have an impact on ICT use. For our analysis we have chosen the “how-to” approach (Buckingham, 2009), not trying to distinguish between “good” practices (constructivists) or “bad” practices (Sjøberg, 2007) of ICT use. We maintain the perspective of media literacy as a functional, instrumental skill where technology is used as a tool for learning – as a “teaching aid” (Buckingham, 2006). The other factors (e.g. the institutional context, peer influence, and personal factors like age, experience and gender) are seen as additional influencers of which we are aware, but on which we do not focus in this study. Hence we focus on subject cultures and teaching styles as two of the notably important social and cultural aspects strongly influencing literacy and ICT use across different subjects.

Our study was conducted with the aim of understanding how technology use in basic schools and general upper secondary schools in Estonia relates to specific subject cultures and teaching styles. We set out to compare the different subject-specific styles of ICT use to see if strong influences from perceived subject cultures are also visible in practice. Respectively, the research questions are:

- How are Estonian teachers implementing ICT in different subject teaching on the level of basic education?
- How do teachers’ practices of technology use relate to their instructional styles?

We believe that Estonia serves as an interesting case study for exploring the topic because it is a country which is often recognised internationally as a success story for its rapid change from being a post-socialist country to a modern democracy (Runnel, 2009; Reinsalu, 2008). These changes are acknowledged to be connected with the “internetisation” of the society (Kalmus et al., 2008). One of the best known symbols of such “internetisation” is the Tiger Leap programme which was launched in 1997 to adjust the Estonian education system to the needs of the development of the information society by equipping schools, connecting them to the Internet and training teachers in ICT skills (Runnel et al., 2009). In a few years, around 10,900 teachers out of 17,000 took ICT skills training courses offered by the Tiger Leap programme (UNDP, 2003). Since then Estonia has striven for a general education curriculum that focuses on integration of ICT in development of active
teaching methods. The focus is being changed to the implementation of general skills and knowledge in an integrated way, in which ICT is not taught as a separate subject, but blended into all subject teaching (Mägi, 2006).

**ICT and subject cultures**

We will analyse our empirical data, first, in the light of subject cultures, sometimes also referred to as subject subcultures and, second, in relation to the dominant teaching styles. Such a focus is dependent on the findings of previous studies that suggest that ICT may fit in with some school subjects more easily than others (Goodson & Mangan, 1995) and that use of computers in the classroom has links to teaching style (Zhao, 2004).

Authors define the subject culture as a “general set of institutionalized practices and expectations which has grown up around a particular school subject, and which shapes the definition of that subject as both a distinct area of study and as a social construct” (Goodson et al., 1995: 613). Explaining further, subject cultures are described as social frameworks or social communities (Hennessy et al., 2005) where specific sets of tools and resources, approaches to teaching and learning as well as cultural values, aims and expectations of teaching are shared. In addition, the subject culture can serve as a frame for “a shared vision for technology use and definitions of ‘good’ teaching”, in addition to which the subject cultures “can initiate and support meaningful technology use, particularly at the middle and high school levels” (Ertmer & Ottenbreit-Leftwich, 2010: 266–267).

This is especially important in the context where some of the teachers have also been referring to “subject boundaries” when explaining the choice of particular ICT tool (Hammond et al., 2011). For instance, John and Baggott la Velle (2004) reveal that science and mathematics teachers are more willing to integrate ICT in their teaching, because these subjects are perceived as more linked to technology. On the contrary, history teachers, when asked to explain the very limited use of ICT, refer to the “essential humanism at the core of the subject” (John & Baggott la Velle, 2004). English teachers, however, have been reported to show anxiety about “losing the core features and values” of their subject – classroom discussion and use of printed books (Hennessy et al., 2005). Other authors (John, 2005) have also indicated that teachers have expressed their concerns about technology “becoming the message”: by using ICT the core idea of obtaining knowledge in a particular subject is replaced by simply playing with technological means. It should be remembered, however, that these different approaches evolve not only in the context of each particular subject, but also in the institutional context of a particular country or school.

**ICT use and teaching style**

There is a notable body of research revealing the different approaches to and motives for ICT usage in pedagogic practice, in which scholars have sought to reveal the most influential ones affecting the integration of ICT at primary and secondary educational levels. In addition to the three groups of factors which influence the teaching process and technology use in classrooms – availability of infrastructure, contextual factors and personal factors – various studies (Buckingham, 2006; DeVries & Zan, 2003) report that the dominant teaching style and the perceived role of the teacher in the classroom can also be directly linked to the use of ICT in schools. We see these factors in interaction with each other and as formulating a set of literacies for the teachers.
In fact, research indicates that use of ICT often depends upon the established pedagogical practice (Baggott la Velle et al., 2003). Technology in this context is an important part of altering the teacher–learner relationship, thus redefining the role of the teacher and his/her teaching style (Grasha & Yangarber-Hicks, 2000). Although some authors argue that the technology integration alone does not ensure a shift to more student-centred instructional styles (Palak & Walls, 2009), others suggest that the instructional style may alter, according to the learning goal (de Kock et al., 2004) or the age of the students (Zhao, 2004). For instance, when working with younger students, teachers are found to prefer having more control over what the student does with the technology and in deciding what tools and resources must be used, including giving specific websites to visit and specific guidelines to follow (Zhao, 2004).

For our empirical data analysis, we were looking for existing frameworks or classifications of instructional styles. We relied on the framework provided by Zhao (2004), whose continuum of technology use in the classroom consists of four dominant instructional models:

- in the teacher-centred model, mainly PowerPoint presentations are used, actually just substituting for printed textbooks;
- in the teacher/technology-guide model, teachers use WebQuests, simulations and games, giving a little more space for individual student work;
- in the student–teacher negotiated method, students are given much more independence in using the technology to complete project-type tasks where they can demonstrate in-depth comprehension. In this model, the role of the teacher is to guide student work by giving the assignment, defining research topics and introducing useful web resources;
- in the student-centred model, students become the active information explorers and presenters. Teachers have the role of facilitators of the process and guides for advising the useful resources and tools to accomplish the planned work. Numerous combinations of technology can be used.

Our empirical section will look at the emergence of these models in different classroom situations with an attempt at comparison if these also correspond to the level of teaching (stage I or stages II-III at the level of basic education) and the subject being taught (humanities or sciences).

Methods and data

Setting and Participants

Data collection for this paper comes from three stages: (a) in-class observations, (b) short semi-structured interviews with teachers immediately after class, (c) longer semi-structured interviews with teachers 6–8 months later.

Our sample consists of 16 teachers from five different schools around Estonia, who all teach different subject areas at the level of basic education, either in Estonian or Russian-speaking schools (see Table 1). All the teachers in our sample had passed ICT-related training courses offered by the Tiger Leap Foundation and appreciated practical training programmes that had provided them with ICT related skills and concrete suggestions for incorporating the technologies into everyday teaching. Nevertheless, our aim was to capture as wide a variety of different classroom practices related to ICTs as possible. The list of schools participating in the various training programs and activities organised by the Tiger Leap Foundation was taken as the basis for forming the sample for
this study. Hence, in addition to differentiating between schools in bigger cities and schools in rural areas, we also differentiated between schools which had been quite active in taking part in various ICT related initiatives organised by the Tiger Leap Foundation, schools that had taken part in some of those activities and schools whose teachers had no connection to ICT related training courses and activities.

Table 1. Overview of the sample

<table>
<thead>
<tr>
<th>Subject</th>
<th>Total</th>
<th>Of them in schools with a strong connection to Tiger Leap Foundation</th>
<th>Of them in schools with a mild connection to the Tiger Leap Foundation</th>
<th>Of them in schools with no connection to Tiger Leap Foundation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class teacher (all subjects for 1–3 graders)</td>
<td>5</td>
<td>2*</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Sciences teacher (math, physics, chemistry, biology, geography)</td>
<td>5</td>
<td>2*</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Humanities teacher (history, foreign languages)</td>
<td>6</td>
<td>3*</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

*One of the schools was a Russian language school.

In September 2011, we sent an e-mail to the schools asking them to participate in the study. The schools which responded positively to our request were asked to suggest one teacher of humanities, one of sciences, and one class teacher from their school who were accustomed to using ICTs in everyday teaching, and would be willing to participate in the study. Therefore, our final sample consisted of teachers who might be more experienced and active in using ICTs in their everyday teaching, compared to the others in their school. Furthermore, our sample was heterogeneous also in terms of the teaching experience: all of the teachers in the sample had been working in school for at least three years; however, some of them also had more than 20 years of teaching experience. The teachers in our sample also had different opportunities in terms of ICTs they could use for teaching. All teachers had access to computer labs, and could also use data projectors, Smart Boards and in some cases tablets. However, none of the teachers in our sample had simultaneous access to all three additional technologies.

Data Collection

In the first phase of the study, in autumn 2011, in-class observations by two observers were conducted for two lessons per teacher (see Table 2). During the observations we aimed to find out what kind of ICTs are used during the class, by whom and for which activities. Furthermore, we aimed to observe how the instructional style of the teacher varies in respect to the assignments given and the materials used.

In the second phase of the study, short semi-structured interviews were carried out with each teacher directly after the observations. Exceptions were class teachers, as they usually gave two consecutive
lessons and were interviewed after the second lesson. During these short interviews, the teachers were asked to reflect upon the lesson that had just finished – if everything had gone according to the plan; if the teacher was satisfied with the way the lesson had turned out; etc.

Table 2. Overview of the lessons for in-class observations

<table>
<thead>
<tr>
<th>Subject</th>
<th>Stage I of basic education (grades 1–3)</th>
<th>Stage II of basic education (grades 4–6)</th>
<th>Stage III of basic education (grades 7–9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humanities</td>
<td>Mother tongue 4</td>
<td>Mother tongue* 3; English 3; History 2</td>
<td>German 2; History 2</td>
</tr>
<tr>
<td>Sciences</td>
<td>Mathematics 2; Biology 2</td>
<td>Mathematics 2; Biology 1</td>
<td>Physics 2; Geography 1</td>
</tr>
<tr>
<td>Classes attended for observation</td>
<td>8</td>
<td>11</td>
<td>7</td>
</tr>
</tbody>
</table>

*In two cases the mother tongue was Russian.

In spring 2012, in the third phase of the study, hour-long interviews with all of the teachers were carried out. The interviews focused upon various topics – the teachers’ self-assessments of their computer knowledge and skills; their perceptions about various opportunities and risks related to using ICTs; their own in-class ICT usage practices and ICT-related assignments they usually gave to the students. In the article at hand we will concentrate on the two latter aspects.

All the interviews were conducted in the mother-tongue of the respondents – 13 in Estonian and three in Russian. All the interviews were audio-taped and transcribed. Extracts from the interviews were translated by the authors to illustrate the analysis.

Data Analysis

Researchers’ field notes from the observations were compared and open coded, and later conceptually similar phenomena were grouped to form categories and subcategories.

In coding the interview data we considered only those utterances that concerned ICT use in the classroom, home assignments and instructional styles. In looking for the comparable differences in subject culture, we analysed separately both the interviews as well as the observation field notes for science (e.g. math, physics, chemistry) and humanities teachers (e.g. languages, history, civics) and the class teachers who teach all subjects for grades 1–3.

Results and discussion

While our sample is not particularly big, the differences in the data still allow us some comparison between different groups of teachers. Hence we present our results based on the subject areas, looking at science and humanities teachers separately from the class teachers.
The use of ICT in science classes

The analysis of our data suggests that the teacher-centred model and teacher/technology-guide model (Zhao, 2004) are most dominant instructional styles when incorporating ICTs in the science classes.

When incorporating a teacher-centred instructional style (Zhao, 2004), the science teachers in our sample used Smart Boards or PowerPoint slides to substitute for printed textbooks or exercise books. Our in-class observations indicate that only a few students per lesson (if any) are asked to do an exercise on the Smart Board directly. Rather we observed that while the Smart Board was used to demonstrate new knowledge, exercises that followed were done either with pen and paper or on the traditional blackboard next to it.

All the science teachers in our sample used various interactive online tests and spreadsheets to help the students revise or prepare for tests. When incorporating the teacher/technology-guide model (Zhao, 2004), students were given more time for individual work with the ICTs. Our interviews with science teachers reveal that the most frequent ICT-related assignments that teachers set had to do either with searching for or accessing information on the Internet, and making (PowerPoint) presentations, whereas taking tests in an online environment or using e-mail to send in a home assignment were mentioned less often.

The most usual [student assignments involving ICTs] are searching for information, compiling a literature review and these kind of things, especially in physics. (Physics/Maths teacher)

We were both told in the interviews and were able to observe in the classrooms that the use of topic-specific software gave the students the opportunity to witness or carry out real life experiments. Physics and chemistry teachers, for example, made use of LabQuest technology and software which enables the collection and sharing of data from various experiments; while mathematics teachers found GeoGebra and T-algebra software with its interactive graphics and algebra applications useful. In addition to the specific educational software, YouTube resources were used to demonstrate experiments that cannot be carried out in ordinary classroom settings. For instance, one of the physics teachers showed a YouTube video in class to illustrate how lenses operate, while a maths teacher introduced the topic of triangles by showing the students a documentary about the Bermuda Triangle. The last example demonstrates the attempts to bridge traditional subject cultures, which in Estonia would largely focus on repetition of theorems or definitions and repeated practice solving of maths problems.

The science teachers in our sample also claimed to use different platforms (e.g. Viko, Moodle, E-kool) for record keeping, student assessment and data storage as well as for preparation, management and administrative purposes. These online environments are also used in order to communicate with students about their home assignments or other distribution of study materials. Some of these platforms are used mainly in accordance with the general school rules, and teachers have been forced to adopt record-keeping or student assessment-related ICT use based not on their own interests, but rather as part of the general institutional culture.

Although all the interviewed teachers claimed that usage of ICTs has a positive impact especially in terms of engaging students with the topic, they also declared that in their teaching they would not want to rely only on ICTs. In fact, all of the interviewed science teachers referred to the fact that
they would rather use the ICTs once in a while and combine them with various other elements, e.g. doing assignments on paper or on a blackboard.

Well, my dream would of course be that you need not go to the computer lab [to use the computers] but have them [the computers] on my own classroom tables. /---/ That if the computers were on my own classroom table then there would also be enough room to do [assignments] with a textbook and notebook, and then for a while with the computer … that would be a much better option, compared to planning the whole computer-based lesson.

(Maths teacher)

Due to the fact that in the majority of Estonian schools the students do not have their own in-class laptops or tablets, the science teachers usually need a computer lab to carry out lessons involving interactive assignments. Some of the science teachers in our sample however also referred to the problem of “de-contextualization” (John, 2005) of the subject, which is the result of the need to work in a computer lab instead of the usual study environment where the subject is taught. Furthermore, the teachers admitted that due to the specific layout of the computer labs, they often found it difficult to mix interactive programmes with other, more traditional teaching equipment. In the observations, we could also witness the reluctance of the students to use pen and paper to do some of the maths before entering the correct answer in the teaching software. Rather, they chose to engage a fast-paced trial and error game, appropriating the learning software in a very different way from its intended use.

The use of ICTs in humanities classes

Our interviews and in-class observations indicate that in case of humanities classes, the technologies are used for mixed purposes: (a) to complete written work, edit, check the results, find necessary information online, etc.; (b) to improve the instruction process – diversify the methods of tutoring, and (c) to give the students the possibility to collaborate with peers, develop critical thinking, etc.

Language teachers in particular used interactive white boards as well as online and offline whole-class games (e.g. Jeopardy, Alias) to help students memorise previously taught vocabulary, as well as to raise the engagement level and interest of students. Furthermore, ICTs were also used to give students the possibility to complete and format texts, or fill in various grammar exercises. In-class observations also show that language teachers are more likely to invite students to fill in such exercises in on the interactive boards.

At the same time, interviews with the humanities teachers indicate that they still prefer to use ICTs as a reward after completing certain tasks, rather than on an everyday basis, making ICT use a privilege rather than seamlessly integrating it into classroom activities.

When I say that we have a lesson in the computer lab today, then this is for them [the students] very like oohh, they are all so happy, like “oh yes, now I can use the computer”, that I would like this to stay like … like a reward for them, or like, they are happy to go there … (English teacher)

In addition to incorporating the teacher/technology-guide model of instruction, humanities teachers also made use of both the student-teacher negotiated model of teaching and the student-centred model (Zhao, 2004). In the former case, students were given various project-like creative assignments. For instance, the German language teacher had asked her students to make a video about German fairy tales, whereas the history teacher had led her students to make a photo story of the buildings they considered to be most important in their hometown with the aim of introducing
them to a certain period in Estonian history. Furthermore, all the humanities teachers in our sample had also asked the students to make either individual or in-group a PowerPoint presentation, which serves as another example of the approach supporting the social aspects of learning.

In the student-centred teaching projects, however, the students were given a chance to become active information seekers and presenters. For example, an English teacher had asked the students to search for useful grammar exercises from the net; whereas in the civics classes, one of the teachers made use of an online learning environment where the students could upload their home assignments and were advised to comment upon the works of others.

History teachers, however, were active in making use of online resources both for information seeking as well as to organise students’ individual work. The history and civics teacher in our sample, for instance, had used online sources and additional educational software to get her students actively engaged in a specific topic. For example, she had asked the students to draw a (three-dimensional) timeline of a specific historical area; to draw a mind map and a concept map related to historical events; and to make use of a photo story programme to compile a photo presentation on a topic.

I tell [them] to make a cartoon about a specific century, so that one needs to investigate and to create and to think it through: what is it about that period that they want to highlight; or to draw a timeline about Estonian history from the thirteenth century to the present day; and they do it; what we would otherwise be doing an a blackboard, now on a computer, right. (History/Civics teacher)

The humanities teachers interviewed were also well aware of the various international teacher resources and platforms, e.g. OnestopEnglish, which they could use both for inspiration and materials; and also made use of different online environments (Moodle, Viko, Google sites) to upload their own teaching materials.

The use of ICTs by class teachers

Our findings indicate that class teachers matched their instructional styles to the particular subject they were to teach. A similar observation can often be made in their instructional use. For instance, in the case of maths lessons, exercises and repetition were emphasised, whereas in the case of mother tongue or language lessons, more creative uses were employed, as class teachers in our sample also stressed the importance of games and playfulness in the class.

They [students] are given some kind of an assignment which they need to solve in a group, or there is some game that they can either play with a partner or in a group; these kind of assignments are very common already from the first grade onward. (Class teacher)

Our findings indicate that class teachers also actively combine different technologies. For example, voice recorders were used during a reading assignment so that the students were able to listen to their pronunciation afterwards. In addition, new applications and the possibility of using tablet computers have opened up the range of educational resources available for teachers, all of which are increasingly incorporated in elementary school instruction.

Class teachers also favour ICTs as a way to incorporate other voices than their own in the class. For instance, they show films or videos to demonstrate diversity of voices, both from the perspective of different opinions, as well as to demonstrate the beauty of the language or voices from nature.
When it comes to home assignments and online learning environments, class teachers are usually careful to note that not all students have equal access and hence home-use is carefully regulated. Only one teacher from the countryside mentioned that she uses home assignments that require ICT use, but that she encourages students to work together so that those who have limited access to the Internet can get help from classmates.

Discussion

Our in-class observations and interviews with Estonian teachers indicate that in comparison to the science teachers, whose existing instructional style and technology integration by itself does not seem to ensure the shift to more student-centred instructional styles (Palak & Walls, 2009), the humanities teachers in our sample combined a wider variety of instructional models. In fact, our data indicate that the instructional style of the language, history, and civics teachers in our sample covered the whole continuum of technology use in the classroom as proposed by Zhao (2004).

In comparison to the humanities teachers, who were more open in using the technologies to conduct student-centred learning approaches, both when conducting pre-set project based tasks and also when managing student-led exploration-type assignments, the science teachers in our sample mainly relied on a teacher-centred instructional style (Zhao, 2004). In other words, they were accustomed to using Smart Boards or PowerPoint slides to substitute for printed textbooks or exercise books. Hence, as demonstrated by Crisan, Lerman & Winbourne (2007: 35), who explored secondary school mathematics teachers’ classroom practices in the UK, science teachers in our sample also tended to use the ICTs predominantly so as to “realise their established form of practice”. In a way, this contradicts common assumptions that science teachers would feel more comfortable in engaging students with technology, as when choosing assignments humanities teachers in our sample were somewhat less concerned about the technology skills of the students.

Furthermore, similar to the findings of Passey (2006) our results suggest that even when there is a chance to make use of an interactive whiteboard, the science teachers in our sample seldom allow students to touch the screen and work with the board directly. At the same time, the students were given their chance to try and fail through another approach – similar to the secondary school science teachers in Norway (Wikan and Molster, 2011), the science teachers in our sample were eager to make use of ICT based simulation modules.

Learning through fun and games, however, was a frequent strategy used both by the humanities teachers as well as class teachers in our sample. According to Zhao (2004), playing in-class games can, on the one hand, be seen as a method of relaxation, while on the other hand it also serves as means of obtaining knowledge in an informal way. Hence, in comparison to the previous studies (e.g. Zhao, 2004) which suggest that the teacher’s instructional style is more controlling when working with younger students, class teachers who teach all subjects for grades 1–3 appeared to be significantly more open to student-centred projects. In fact, our in-class observations and interviews indicate that, in a similar way to reflections from Dutch primary schools (Smeets, 2005) the use of ICT tools by class teachers in our sample contributed significantly to the creation of an authentic (reflecting the potential use of acquired knowledge, with links to the world outside the school) and powerful (involving active knowledge construction, differentiation according to students’ individual needs rather than transmission of facts) learning environment for students.
The instructional styles incorporated by the humanities teachers in our sample, however, emphasised the importance of social learning, i.e. similarly to the findings of Lin, Wang & Lin (2012), the teachers aimed to enhance students’ learning through their social relationships and interactions with the outside environment. In fact, our findings suggest that the humanities teachers made use of cognitive active learning (ibid.) techniques so as to engage the students actively in the learning process and get them cognitively engaged with the study materials.

Hence, contrary to a Finnish study (Ilomäki, 2008), which revealed that despite having a good command of ICT, Finnish teachers still lack vision about meaningful ways to use technology in pedagogic practice, the teachers in our sample demonstrated rather creative and playful ideas when incorporating ICTs in their classes. Indeed, as our sample was recruited through the Tiger Leap research project, knowledge of ICTs was a prerequisite to participate in the study. Nevertheless, even the ICT usage practices of those teachers who had had less contact with ICTs and whose school had not taken part in any of the training programmes or activities offered by the Tiger Leap Foundation, made considerable effort to applying ICTs in meaningful ways to complement their personal teaching styles.

Furthermore, previous studies have reported that the integration of ICT into the teaching of different subjects is very time- and effort-consuming (Baggott la Velle et al., 2003). Although similar complaints were also made by the teachers in our sample, the participating teachers were generally quite well aware of the various international teacher resources and platforms and some of them were also eager to upload their own teaching materials online.

All in all, our analysis demonstrates a strong linkage of the existing disciplinary culture and instructional styles to ICTs, meaning that it would be very hard to contradict existing modes of instruction in the effort to enhance literacies and widen the repertoires of ICT use in classrooms. As mentioned in our sample description, our teachers appreciated practical training programmes that had provided them with ICT-related skills and concrete suggestions for incorporating the technologies into everyday teaching. We can assume that the training provided for them linked nicely to their existing teaching styles, and as the training programmes often focus only on ICT use rather than broadening repertoires of instruction, teachers adopt those practices that are already familiar to them. Our study enables us to ask whether, in order to enhance the teachers’ digital literacies, helping them to overcome “subject boundaries” (Hammond et al., 2011) might be the key. Providing teachers with possibilities of diversifying their teaching style and supporting changes in subject culture might be beneficial in broadening the horizons and in the long run supporting teachers’ digital literacies. Digital literacy as a practice can be enhanced by broadening the repertoires of ICT use and better incorporating the understanding of literacies in the social and institutional context of the teachers.

While the focus of this article has been on teaching styles and subject cultures as key influencers of digital literacy, we still feel that it is crucial not to forget other aspects. We hope that in future studies more of those different aspects can be brought together and in-depth analysis will enable us not only to assess the relative importance of each of those factors, but also to map the diversity. Only when understanding the complex nature of digital literacy can we adequately support members of an ICT-saturated society in their acquisition of these practices.
Acknowledgements

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References


