

RESEARCH

The Relationship Between Teachers' Perceived Classroom Management Abilities and Their Professional Digital Competence

Experiences from Upper Secondary Classrooms. A Qualitative Driven Mixed Method Study

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The aim of this study was to examine teachers' professional digital competence and classroom management experiences with a qualitatively driven Mixed Method Design. The qualitative part of the study is based on interviews, focus groups, observations and quasi statistics. The first part of the study aims to examine these qualitative experiences and associations with a quantitative survey (N = 2579). The quantitative data examines the strength of the associations and the qualitative data show the nature of those associations with regard to upper secondary teachers' professional digital competence and their classroom management abilities in ICT dense classroom environments. The SMIL-study was conducted in seven counties in Norway from 2012 to 2013. The qualitative part with observational data were analyzed in relation to the other qualitative data (interviews and focus groups) and then in relation to the quantitative part of the study. This part shows how teachers, school owners, school leaders and students perceived a relationship between teachers' professional digital competence and their classroom management. The quantitative is related to the qualitative part and presents statistical regression analyses indicating that teachers' individual professional digital competence predicted their classroom management abilities. The conclusion of the paper suggests that teachers' professional digital competence and classroom management abilities are closely attached to each other in technology rich classrooms settings. The SMIL-study contributes to a broader understanding of teachers' professional digital competence in the digitized school.

Keywords: Professional digital competence; upper secondary school; teachers; classroom management; Mixed Method Research

Introduction

Despite heavy investments by national and local authorities to make the latest educational technologies available at education facilities internationally and in Norway, there has been a lack of uptake in teachers' utilization of such technologies both in Norway (Krumsvik et al. 2013) and internationally (Cuban, Kirkpatrick & Peck, 2001; Tamim et al. 2011; OECD 2015; Escueta, Quan, Nickow & Oreopoulos 2017). One of the reasons for this situation is mentioned in the PISA study, *Students, Computers and Learning*, which reveals that: "(...) we have not yet become good enough at the kind of pedagogies that make the most of technology" (OECD 2015, p. 5). At the same time research into computer literacy and educational use of Information and Communication Technology (ICT) has exploded in recent

years, but there is less documented research into how new technologies influence general classroom management. Classroom management means how teachers manage to create a good learning climate in classroom settings and facilitate both academic and social-emotional learning among the students (Evertson & Weinstein 2006). In such classrooms contexts teachers' fear of losing authority and control over their classrooms, has notably been pointed out as a challenge in ICT-related classroom management matters (Bolick & Bartels 2015, Bolick & Cooper 2006). Despite being suggested as especially prominent in ICT environments, opportunities and challenges for teachers to create and maintain fruitful learning environments have been discussed and researched for decades (Brophy 2006). Teachers' professional practice, their relations with their students and matters regarding authority are thus at the core of classroom management issues in general. This might give reason to believe that computers and other technologies not only initiate new challenges and opportunities for classroom management, but could also reawaken more general matters by challenging the traditional and culturally internalized ways in which they have

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been dealt with throughout the years. The relationship between ICT and classroom management might thus be complex and intricate, implying structural, cultural, pedagogical and social perspectives on teachers' professional practice and student learning outcomes.

Examples from classroom research suggest that some teachers have been 'frontrunners' in the use of educational technology due to their own digital competence and ability to identify and make use of its pedagogical potential beyond the ability of a normal teacher (Wasson & Hansen 2014). They seem to possess a high level of digital competence, which influences their ability and willingness to implement ICT more or less seamlessly in their own teaching and learning practices, assessment practices, administrative workflow and thus also in their classroom management practices (Wasson & Hansen 2014). However, more research is needed into the relationship between teachers' professional digital competence and their classroom management, and the SMIL-study presented in this article aims to fill some of this gap in the research field. Such research-based knowledge on whether, how and why teachers' professional digital competence is related to their classroom management practices may give us more insight into ICT classroom complexity.

The SMIL¹ study is the largest ICT study carried out in upper secondary schools in Norway. It involved 17,529 students and 2,477 teachers, as well as school owners, school leaders and representatives from student councils and the Norwegian Student Organization. This mixed-methods study was conducted from 2012 to 2013 in seven counties in Norway with a (1:1)² technology density in all classrooms. Some of the rationale for the study was to examine ICT and learning outcome both qualitatively and quantitatively, and based on the assumptions that: "At times we aim to explore and discover, and at other times we aim to test and confirm" (Hesse-Biber & Johnson 2016, p. 46). The qualitative part has a multilevel perspective and aims to examine how school leaders (macro level), teachers (meso level) and student representatives (micro level) describe the relationship between teachers' professional digital competence, student-teacher relations and their classroom management practices. This multilevel perspective aims to capture a more holistic understanding of such phenomenon addressed in this study. The quantitative part examines if the qualitative relationships holds beyond the local setting and the strength of these relationships. The main objective of this paper is therefore firstly to explore teachers' experiences with classroom management and professional digital competence in technology rich classrooms and secondly to examine (test) the relationship between teachers' classroom management and their professional digital competence. In this paper, we will focus mainly on the qualitative data followed up by quantitative data from SMIL in a QUAL-quan-design (qualitative driven sequential design, Schoonenboom & Johnson 2017).

The research questions examined are:

RQ1. How do teachers, school leaders and student representatives describe the relationship between

teachers' professional digital competence, student-teacher relations and their classroom management practices?

RQ2. Is there a statistical relationship between upper secondary teachers' professional digital competence and their classroom management?

RQ3. How can one explain the observed relationship between upper secondary teachers' professional digital competence and their classroom management practices?

Our Mixed Methods Philosophical Paradigm

We relied on *dialectical pluralism* (DP) (Johnson, 2015) in multiple places in this research study as we attempted to listen to and dialogue with multiple theories, conceptual frameworks, paradigms and participant perspectives. As a philosophical theory, DP justifies the interaction and dynamic combining of differences into new wholes. DP requires deep understanding of the different positions and search for balances and new syntheses. DP tends to use a "both-and" logic (i.e. parts of both theories might be useful) rather than an "either-or logic" (where one must only use either theory A or theory B). In a mixed-methods research study, one often interacts with different theories, ontologies, epistemologies, axiologies, methods, methodologies and so forth, and the research team must carefully consider the differences and construct thoughtful and useful syntheses (Johnson 2015). On this basis, we applied an exploratory, sequentially mixed-methods design (Creswell & Clark, 2011; Fetters, Curry and Creswell 2013). The coherence between the quantitative –and the qualitative findings in the study can be described as *expansion* where the quantitative data show the strength of associations and the qualitative findings show the nature of those associations (Fetters et al. 2013).

Conceptual Framework

Despite being suggested as the variable with the most impact on student learning outcomes (Marzano, Marzano & Pickering 2003), skills associated with classroom management are mostly studied and disseminated within specific separate curricula areas (Morine-Dersheimer 2006). Identifying and comprehensively understanding the field of classroom management is thus a complicated task (Evertson & Weinstein 2006, Wubbels 2011, Emmer & Sabornie 2015, Postholm 2013) and the ICT perspective adds new layers of complexity to matters of classroom management (Bolick & Bartels 2015). Nevertheless, teachers and school leaders worldwide are currently struggling with how to deal with the fact that students are living digital lives, constantly communicating with others, even while in class. On-line access to a world of information, knowledge, entertainment and communication may enrich and enhance student learning processes, but such access may also serve as new venues for non-academic activities, either supplementing or replacing the old ones. Sana, Weston and Cepeda (2012) found that such non-academic activities as "(...) multitasking on a laptop poses a significant distraction to both users and fellow students

and can be detrimental to comprehension of lecture content" (p. 24).

Although the field of educational computer technology has been extensively researched during the last two decades, it is difficult to find peer reviewed empirical research documenting how the introduction of technology and ICT affects classroom management directly (Bolick & Bartels 2015, Bolick & Cooper 2006), especially in upper secondary education. One can find some studies dealing with this relationship indirectly and we also find some authors who use other terms than classroom management. E.g. a commonly used term is *classroom orchestration*, which seems to highlight the complexity of teaching in today's digitized classroom. However, only a few studies from lower secondary school represent what seems to be the pervasive challenge across school levels and subjects: Classroom management in ICT environments requires (and may over time contribute to) a form of teacher resiliency that enables changes in pre-computer classroom strategies and pedagogy (Nielsen, Miller, & Hoban 2015), but teachers tend to stick to known and established teaching methods, despite being aware of the benefits of using ICT (Kretschmann 2015). Such a structure can contribute to a self-reinforcing spiral of preservation of old and familiar practices. It thus seems paradoxical that digital competence and overarching matters of ICT are often dealt with as a separate unit, not fully integrated into ongoing discussions about teachers' professional development and issues concerning classroom management in general. In this paper, we aim to explore this structure, theoretically and empirically. By illuminating mainly qualitative experiences and descriptions, but also quantitative relations, we contribute to a deeper understanding of the challenges that teachers face in managing their ICT classrooms.

We will further elaborate on our understanding of the two main concepts discussed in this paper, classroom management and digital competence, and thus show how they theoretically may be mutually interwoven (and related to other variables). By doing this we also imply that skills and competences related to teachers' professional digital competence and classroom management may be partly overlapping. In the results section, we first present some key findings from the qualitative analysis, exploring the complexity that arises as matters of classroom management and matters of digital competence merge in technology-dense classroom environments in upper secondary schools. Secondly, we present statistical analyses, suggesting a quantitative relationship between upper secondary teachers' professional digital competence and their classroom management. In the integrated results section, we aim to outline some core findings on how the different stakeholders and their perspectives contribute to inform the research questions.

Classroom management: From behavioral to relational approaches

Classroom management has a broad impact on student learning outcomes and is a developing and pluralistic field of inquiry that has been influenced by the shifting traditions of general educational research throughout history

(Evertson & Weinstein 2006, Brophy 2006). When introduced in 2006, the *Handbook of Classroom Management: Research, Practice, and Contemporary Issues* extensively reviewed and mapped out research associated with classroom management and filled an existing knowledge gap (Wubbels 2011). Drawing on the work of Kounin (1970), Brophy (1988, 1989), Doyle (1986) and Watson & Ecken (2003), classroom management was defined as "*the actions teachers take to create an environment that supports and facilitates both academic and social-emotional learning*" (Evertson & Weinstein 2006). This definition marked a shift by stating that *how* a teacher achieves order is as important as *whether* a teacher achieves order, and that classroom management not only seeks to establish and sustain order for the purpose of meaningful academic learning, it also aims to enhance students' social and moral growth (Nucci 2006, Fallona & Richardson 2006). The second edition of *Handbook of Classroom Management* (Emmer & Sabornie (Ed.) 2015) further contributed to the field of classroom management by reviewing additional and new research and elaborating on the complexity of classroom management issues by identifying how strongly they are interlinked with other matters (both instructional and non-instructional) relating to teacher professional practices.

Behavioral approaches have been closely associated with classroom management throughout the history of education, but even as well-researched tools, they can be used either skillfully or clumsily (Landrum & Kauffman 2006). According to Landrum & Kauffman, skillful use of behavioral tools should thus be based on knowledge of the principles that make them work, thereby supporting autonomy instead of forming a controlling and frustrating classroom environment. Positive behavioral approaches, such as reward, could potentially enhance emotion and on-task behavior, but can also affect the long-term inner motivation of students (Reeve 2006). Awareness of the limitations regarding behavioral approaches has contributed to a paradigm shift in favor of approaches that emphasize self-regulation and trusting, caring relationships between teachers and students. Following dialectical pluralism, we believe that both of these paradigms/perspectives contain some truth value and both can help educational practice. When put into dialogue, both of the above-mentioned perspectives contribute to the understanding of educational matters as complex. For example, they pinpoint how even extensively researched approaches and methods may have unforeseen short-term and long-term consequences in new or even slightly altered contexts.

Brophy (2006) advocates that classroom management is not an end in itself, but a means for creating and maintaining any given optimal learning environment. He thus implies that understanding the contextual nature of classroom management is an important skill for a teacher, and he further emphasizes how classroom management must be perceived in close relation to student socialization in addition to disciplinary interventions. Ecological approaches to educational research are much in line with dialectical pluralism and view classrooms as tangible dynamic ecologies, without which there would be

no classroom in classroom study or classroom teaching (Doyle 2006). Wubbels et al. (2015) note that the behavior of teachers and students mutually influence each other. In a meta-analysis of more than 100 studies, Marzano et al. (2003) found that the quality of teacher-student relations is the keystone for all other aspects of classroom management. Elias & Schwab (2006) argue that social and emotional learning and effective classroom management are two sides of the same coin as students' self-control and responsibility are the ultimate goals of education. They advocate the teachers' responsibility to provide students with useful tools to enable students to build their own future. Gettinger & Kohler (2006) adds to this understanding by advocating that classroom management requires a sophisticated insight into what students need in order to understand the academic content, and that teachers must be able to connect curricula content to the experiences and backgrounds of diverse learners. Equity in society will be mirrored in schools, as morality in social relations is situation-specific and not fixed for good. Classroom management must thus be in tune with the real world and debate and dialogue related issues in the classroom (and outside) (Brantlinger & Danforth 2006). Bear (2015) proposes to integrate the ecological, behavioral and social-emotional learning perspectives of classroom management into an authoritative discipline approach. Studying classroom management in specific discourses, focusing on specific areas and curriculum, thus enriches general educational research. However, it also narrows the dissemination of such research because it tends to be published in books or forums that focus on the separate curricula area (Morine-Dershimer 2006).

Teaching and learning as cultural and social processes

Socio-cultural approaches to teaching and learning view classrooms as unique communities with their own core characteristics, where learning is related to the use of specific artifacts and tools. Such approaches entail a paradigm shift from teacher authority and control to shared control and responsibility, inspired by the thoughts of Dewey (Watson & Brattistich 2006, Schwab & Elias 2015). Given that teaching and learning are cultural processes, they must include and reflect diversity (Gay 2006) and, within the socio-cultural approach, the creation of inclusive and supportive classroom environments is a cornerstone of teachers' pedagogical repertoire (Lothan 2006). Active learning methods, such as project-based learning, regards teachers as guides and facilitators, and Mergendoller, Markham, Ravitz & Larmer (2006) explain how a successful project brings students and teachers together as partners and enhances students' metacognitive reflection. However, such perspectives make the five aspects of classroom management (engagement, curriculum, relationships, development and discipline) and the principles that follow them less clear (Hickey & Schafer 2006). Brophy (2006) elaborates on similar perspectives, noting how a shift from a (passive) teacher-centered classroom to an (active) student-centered classroom has instructional and managerial implications. He suggests that it has become increasingly important to identify intended student learn-

ing outcomes first, and to design learning activities (and reflectively acknowledge what specific activities imply about desired student roles) thereafter. The learning process benefits from stating clear expectations and helping students understand what to do and why (autonomy support). Such goal-oriented teaching and learning activities imply deliberate pedagogical reflection on the choice of educational tools, and how such tools are implemented in teaching, learning and assessment methods. However, most research on managing secondary school classrooms is conducted in the fields of special education and school psychology, which focus on disruptive and acting-out adolescents. Emmer & Gerwels (2006) thus call for more knowledge on how to manage the classroom environment in secondary schools to enhance students' academic and social learning. In summary, one can say that dynamic classroom management requires a comprehensive and profound educational reflexivity that enables teachers to flexibly facilitate student academic and social learning processes based on specific needs in specific contexts.

However, studies of teacher personal characteristics have revealed that teachers who remain in their job tend to maintain higher levels of self-efficacy and positive emotions, despite agreeing with teachers who leave their job because of the challenges of classroom management and teaching (Hong 2012, Bullough, Jr. & Richardson 2015). Such findings contribute to the understanding of a general relationship between teachers' skills and competencies and their ability to manage their classroom successfully. Other studies indicate that assumptions teachers hold about students shape their classroom management judgments and practices, and that in-service teachers generally focus on rule-setting, enforcement and "crime control" (Bullough, Jr. & Richardson 2015). Hoy & Weinstein (2006) identify contrasting views on what constitutes good classroom management: Students identify caring relationships and mutual respect as fundamental for social and academic development, whilst teachers generally believe that such relationships and respect must be earned in advance. Such contrasting views may lead to a downward spiral of mistrust (Sheets & Gay 1996). However, many traditional classroom practices are teacher-centered and favor direct instruction methods. Such practices might hold certain assumptions about the interplay between teacher authority and student behavior, which might not be sufficient nor expedient in the face of contemporary issues relating to educational use of ICT.

Teacher roles and competencies in the ICT environment

In recent decades, several researchers and academics have addressed issues relating to educational use of computers and other technologies. Both theoretical and empirical contributions have revolved around the influences that such tools could (or should) have on students' social, moral and academic learning outcomes. Important contributions on the concepts of computer literacy, media literacy, digital literacy and digital competence have been made since the 1990s. The teacher's role as a facilitator who must contextualize the use of ICT tools is strongly emphasized in the ICT field, which implicitly connects

digital competence to classroom management. However, there is general agreement that the effective use of technology in teaching and learning practices is aligned with the general paradigm shift towards socio-cultural constructivist behavior and student-centered methods (Säljö 1999). Teachers who fear loss of control may experience such a paradigm shift as destabilizing and threatening (Bolick & Bartels 2015, Hickey & Schafer 2006, Brophy 2006); taking the perspective of dialectical pluralism and rejecting an either-or perspective, one can be informed by both of these paradigms. In both pre-service and in-service teacher training, there seems to be a general lack of awareness of the dynamics, vitality and diversity of classroom management (Evertson & Weinstein 2006). The concept of classroom management seems to be out of fashion, and academics and researchers tend to prefer phrases that elucidate the aims of classroom management rather than its techniques (Wubbels 2011). Standardized and internalized classroom management understandings are thus often adapted to a teacher-centered practice, associated with behavior management and sets of rules. However, the introduction of ICT tools in teaching and learning activities challenges the premises on which institutionalized solutions to behavioral issues are built. Ultimately it even challenges what really constitutes concepts such as classroom environment, learning, inclusion, relationships and behavioral issues as technologies offer additional (digital) venues and thus possibilities and limitations for managing teaching and learning activities. It would be interesting to further explore what might happen when a layer of ICT complexity is added to a static "crime-control" pre-understanding of classroom management.

Several different positions and studies, dealing with digital competence and ICT in teaching and learning, share the assumption that teachers' professional digital competence is more complex than digital competence in other occupations and among average citizens. It is therefore important to be aware of the complexity of professional digital competence and its relation to teachers' self-efficacy. According to Krumsvik, "Digital competence is the individual teacher's proficiency in using ICT in school with good pedagogical judgement, and his/her awareness of its implications for learning strategies and the digital Bildung of pupils" (Krumsvik, 2012, p. 466). A recent study from Krumsvik et al. (2016) shows that demographic, personal and professional characteristics, such as a teacher's age, work experience, gender, screen time and ICT education predict teachers' levels of professional digital competence in upper secondary school to a certain degree.

Based on the national curriculum in Norway (LK06) (Kunnskapsdepartementet 2006), we can generally say that teachers need *generic digital competence* when they are mastering general skills and knowledge of educational technology in the digital learning environment; they need *subject didactic digital competence* when they apply their digital competence to subjects; and, finally, they need *professional digital competence* which includes (but is not limited to) elements that occur outside the teachers' teaching but are simultaneously within the teaching profession. A national framework for teachers' professional digital competence

(PfdK) in school was implemented in 2017 (Center for ICT in Education) and in the general plans for all kinds of Norwegian teacher education. National educational authorities also expect PfdK to influence all aspects of teachers' professional development (in-service training) in the future and is already offered as 5–10 ECTS in-service courses in many municipalities and counties by the school owners.

However, these are very general descriptions and there seems to be a gap between the arena of formulation and the arena of realization when it comes to this issue, due to stakeholders having different interpretations of digital competence. Teachers therefore often perceive ICT and educational technology differently than intended in the policy documents. In the SMIL study, we explored the arena of realization through multiple lenses (dialectical pluralism and mixed-methods research) by mapping out qualitative and quantitative relationships between teachers' professional digital competence and their classroom management. The context examined in this paper is thus Norwegian, and it is important to bear in mind that different ICT policies in different countries influence our perception of how to define teachers' professional digital competence based on its connection to curricula. Similar awareness of context also applies to the understanding of classroom management. To enable international outcomes to be compared, the OECD report *Assessing the Effects of ICT in Education* (OECD, 2009) and its framework were used as a starting point in the SMIL study so that national (and maybe international) indicators for ICT use in school could be developed.

Methodology

In this study we aimed to mainly explore and discover (qualitatively), and then test and confirm (quantitatively). The reason for this is to avoid the well known criticism against qualitative research where it is questioned if the inductive standpoint holds beyond the local setting. Therefore we also apply quantitative data to examine the qualitative relationships statistically (Hesse-Biber & Johnson 2015). In this way we examined if the quantitative data show the strength of associations and if the qualitative findings show the nature of those associations. To achieve this we decided to use an QUAL-quan (qualitative driven sequential design, Schoonenboom & Johnson 2017) which means that it is a qualitative dominant Mixed Method study. More concrete it is an exploratory, sequentially mixed-methods design for this study to be able to answer the research questions (Creswell & Clark, 2011; Fetters, Curry and Creswell 2013). This type of research design implies a linking of the different qualitative and quantitative elements in the design and in the analyses, so that they will supplement one another and provide a more holistic idea of the research area. More specifically, the *sequential design* means that the different phases build on each other and "In an exploratory sequential design, the researcher first collects and analyzes qualitative data, and these findings inform subsequent quantitative data collection" (Fetters et al. 2013, p. 2136). This implies a form of integration through methods, applying *Integration through building* which "occurs when results

from one data collection procedure informs the data collection approach of the other procedure, the latter building on the former. Items for inclusion in a survey are built upon previously collected qualitative data that generate hypotheses or identify constructs or language used by research participants" (Fetters et al. 2013, p. 7) which this study applied. Furthermore, we carried out an integration at the interpretation and reporting level, applying *narrative* where both qualitative and quantitative results are reported in the same article in different sections through the *contiguous approach* (Fetters et al. 2013). The coherence between the qualitative and quantitative findings are mainly based on *confirmation* and partly on *expansion* in this article (Fetters et al. 2013).

Participants

We selected the interview participants, focus group participants and teachers and students for classrooms observations based on *purposeful selection* (Maxwell 2005) and included 30 school owners, school leaders, county politicians, teachers and the student organization from all public upper secondary schools in the seven counties in the Eastern Norway County Network. The online survey was completed by the 2579 teachers in the Eastern Norway County Network where the quasi-statistics (Maxwell 2005) in this study is related to the qualitative part, and the regression analysis is related to the quantitative part.

Instrumentation

In this paper, the focus is on teachers' experiences with the relationship between classroom management and teachers' individual professional digital competence. To enable us to evaluate these relationships, we needed to develop a number of indicator areas of the schools' contribution (e.g. teachers' competence, learning climate, etc.) and indicator definitions, as Pelgrum (2009) implied above, and teachers' individual professional digital competence is one such indicator area and indicator definition. Following analyses of relevant policy documents and literature reviews, six indicator areas were considered significant. These were primarily based on recommendations from the framework created by Kikis, Scheuermann and Villalba (2009), which can be found in the above-mentioned OECD report. Previous research findings and suggestions from our employer, Norwegian Association of Local and Regional Authorities (KS), were also important when developing the indicator areas.

The six indicator areas of the school contribution are *implementation strategies, access to PCs, curriculum and competence improvement, infrastructure to support learning, degree of ICT use in teaching and educational ICT activities* (pupils). In the SMIL study, all six indicators areas were explored with a number of relevant groups. In this paper, however, we concentrate on teachers' experiences with classroom management and their individual digital competence. Indicator definitions were developed based on the indicator areas identified. These were rooted in well-established, distinguished theory, and the mixed-methods design that was utilized in the wider study ensured that we also maintained a broad empirical foundation. The

indicator definitions were then used when developing the instruments for collecting information. They were divided into operationalized indicator definitions, which means that they could potentially be used again when monitoring similar phenomena in the future.

In the wider SMIL study, both qualitative and quantitative data were collected and analyzed. The data were collected in sequences, and one of the important goals of the SMIL study was to place equal emphasis on both types of data and combine them in the analyses (Johnson 2015).

Qualitative Instrumentation

The qualitative part of the study is based on interviews, focus groups, observations and quasi statistics.

More specifically, the informants were asked demographic questions and questions from six categories based on the framework of Kikis, Scheuermann & Villalba (2009), which aimed to outline a holistic perspective of the use of ICT in the upper secondary schools in the study. These categories were 1) implementation strategies, 2) resources, 3) curricula and in-service training, 4) infrastructure for learning support, 5) teaching, and 6) learning. We focus in this paper on indicator 3, 5 and 6. These are in line with the focus in the research questions of the paper and to answer the qualitative part of the research questions, interview-guides, focus-group guides and observation-schemes were developed as well as quasi statistics applied (Maxwell 2005). This kind of methodical triangulation was applied to enhance the internal validity of the qualitative part of the study as underlined by Merriam and Tisdell (2016): "With regard to use of multiple methods of data collection, for example, what someone tells you in an interview can be checked against what you observe on site or what you read about in documents relevant to the phenomenon of interest (Merriam and Tisdell, 2016, s. 245). Below we will describe this in more detail.

Observational data

While these observational data examined the nature of teachers' experiences and associations, the quantitative data examined the eventually strengths of associations attached to the research questions. Therefore, "Observational data represent a firsthand encounter with the phenomenon of interest rather than a secondhand account of the world obtained in an interview" (Merriam & Tisdell 2016, p. 137). The observational data in this paper is based on 10 classrooms observations (120 minutes each) in the subjects Norwegian, English and Mathematics over 2 weeks among pupils in 1st grade in upper secondary school (16–17 years old). In addition we had 6 classrooms observations (180 minutes each) in the subject Natural Sciences over 8 weeks (2nd grade, 17–18 years old).

The observations were based on *Observer as participant* (Merriam & Tisdell, 2016) and also based on the framework from Kikis, Scheuermann and Villalba (2009). We applied extensive use of field notes in the observations based on the assumptions that "writing field notes is an onerous task, but field notes constitute the basis for data upon which the study is based: no field notes, no data" (Schensul & LeCompte, 2013, p. 20).

We followed Taylor and Bogdan (1984) suggestions for recalling data:

- Pay attention
- Shift from a “wide angle” to a “narrow angle” lens— that is, focusing “on a specific person, interaction, or activity, while mentally blocking out all the others” (p. 54)
- Look for key words in people's remarks that will stand out later
- Concentrate on the first and last remarks in each conversation
- Mentally play back remarks and scenes during breaks in the talking or observing

The observational data were then analysed in relation to the other qualitative data and then in relation to the quantitative part of the study.

Semi-structured interviews and focus groups

We carried out a large amount (30) of interviews in this study and a research interview can be described as “A conversation with a structure and a purpose; it involves careful questioning and listening with the purpose of obtaining thoroughly tested knowledge” (Kvale 2007, glossary). The semi-structured interview guides (Kvale & Brinkmann, 2009) we developed for these research interviews were based on the Kikis, Scheuermann and Villalba's (2009) framework and the research questions. This had seven sections, including demographic data, digital competence, approaches to digital educational resources and compliance between classroom management and digital competence. Some of the main findings relating to classroom management and digital competence are reported here as they are most relevant for the research questions and discussion in this paper. For a full description of all the results, see Krumsvik et al. (2013, 2016).

The same procedure were carried out also for the interview guides for the 3 focus groups interviews (Krueger & Casey 2009; Silverman 2009). Focus groups followed Krueger and Casey's (2009) characteristics: “People who possess certain characteristics, provide qualitative data in a focused discussion to help understand the topic of interest” (p. 6). We carried out focus group interviews with the project group for the SMIL-project (90 minutes), vocational school teachers (90 minutes) and the student council at one school (90 minutes).

We carried out semi-structured interviews (30 minutes each) with 9 school owners, 3 county politicians, 1 county education manager, 1 representative from the national school organisation (KS), 8 school leaders, 7 teachers and 1 (45 min.) with the leader of the national student organization.

We carried out 3 focus group interviews (90 minutes each) with the project group of the study (3 teachers and 2 leaders), vocational study teachers (5 teachers) and the student council at one school (5 students). The reason combining teachers both from vocational program and teachers from academic programs in our focus group interviews, is based on the fact that the total amount of teachers in the survey part of SMIL-study (N = 2579)

showed that 48% came from vocational programs and 52% from academic programs. So that was the reason for having both vocational and academic teachers in the focus group interviews.

We transcribed the interview material ourselves and Merriam and Tisdell (2016) state: “There are great benefits to transcribing the interview yourself, not least of which is increasing your familiarity with your data” (p. 132). We analyzed the interviews based on Creswell's (2013) data analysis spiral which underlines the need to “Immerse yourself in the details, trying to get a sense of the interview as a whole before breaking it into parts” (p. 183). And Merriam and Tisdell (2016) describe this in the following way: “Involves consolidating, reducing, and interpreting what people have said and what the researcher has seen and read – it is the process of making meaning” (p. 202).

We analyzed the interview data in line with Merriam & Tisdell (2016) recommendations where we applied Kvale & Brinkmann (2009) concept driven coding based on the aforementioned indicators (3 and 6) framework from Kikis, Scheuermann and Villalba (2009). We have further applied an abductive approach in the analysis which is based on “Categories are conceptual elements that “cover” or span many individual examples of the data you previously identified” (Merriam & Tisdell, 2016, p. 206) and related to theoretical lenses of the study, the quantitative part to the research questions.

This establish a good coherence between the qualitative and quantitative parts, items for inclusion in the quantitative survey were built upon these qualitative data.

Quantitative Instrumentation

The four-part survey questionnaire included digital competence, classroom management, approaches to digital educational resources and compliance between classroom management and digital competence, and demographics. Classroom management was further classified into two categories:

- 1) Student-teacher relations
- 2) Teaching control

The teachers' professional digital competence part was further divided into five categories:

- 1) Elementary ICT,
- 2) Basic ICT skills,
- 3) Didactic ICT competence,
- 4) Digital learning strategies and
- 5) Digital Bildung (Krumsvik 2016).

The survey questions relating to teachers' attitudes, opinions and views on classroom management and digital competence included 7-point rating scales. The anchors for digital competence ranged from (1) ‘no skills’ to (7) ‘very high skills’. The anchors for classroom management ranged from (1) ‘to no extent’ to (7) ‘to a very large extent’ (Krumsvik 2016).

The online questionnaire was first developed in 2012 in Bergen based on the goals of the education monitor, findings from previous research, the framework for the SMIL

project and indicator areas and definitions. This quantitative questionnaire was piloted by two researchers in four schools in the Eastern Norway County Network using 'live surveys' (Student Response System). Information was gathered from 153 teachers and 921 students in the pilot test. KS's project group and the SMIL project's scientific advisor also examined the questionnaire during the pilot phase. After the pilot phase was completed and the questionnaire adjusted, it was converted into an electronic survey³ using the SurveyExact online questionnaire system.

The questionnaire items were checked for validity and reliability based on the pilot data. Eight of the questions on how teachers perceived their digital competence had high face validity. Exploratory factor analysis (using oblimin rotation) was then used on the resulting data to identify possible higher order factors that could be used to develop a digital competence index (Russell, 2002). The factor analysis was conducted using an oblimin rotation, which allows the factors to be correlated (Russell, 2002). The factor loadings are outlined in **Table 1** below.

Question 8 and question 10 load on both factors produced from the analysis (see **Table 1**). Hence, they must be interpreted according to the other variables loading on the two factors. Factor 1, as we see it, is the (an) indicator of teachers' individual professional digital competence; factor 2 indicates a contextually related competence scale that also included teachers' understanding of their own competence and skills.

Factor 1 statistically explains 48.5% of the variation. Six out of the eight variables analysed show loadings above the guidelines for identifying significant factors (Hair et al. 1998), and these were used to create an index representing the teachers' professional digital competency. Questions 12 and 13 were not included in the index due to their low factor loadings. Compared to the other questions, questions 12 and 13 are more related to how the teacher perceived others' (pupils' and colleagues') competence rather than their own digital competence.

Technically, the index is the arithmetical mean of the answers to the six questions included. A Cronbach's alpha value of .86 indicates that the internal consistency of the digital competence index was high.

In addition to the data from the teacher survey, quasi statistics from the student survey (N = 17529) in the SMIL study are applied in the discussion part of this paper for the purpose of methodological triangulation.

Results

In this paper, we present both the qualitative and the quantitative (interview data, focus group, observations, quasi statistics and survey data) because the research questions are aimed at teachers' experiences with the relationship between classroom management and teachers' individual professional digital competence.

Qualitative results

In this qualitative results section, we aim to explore how teachers, school leaders and students perceive and explain the interaction between teachers' professional digital competence, student-teacher relations and teachers' classroom management. The SMIL-semi structured interview guides contained questions on non-academic use of ICT, the overall scope of ICT, and classroom management. They thus provided data on classroom management matters, both explicitly and implicitly. These three categories were obtained during the qualitative analysis based on the broader concept-driven categories (Brinkmann 2013), on former research and Kikis, Scheuermann & Villalbas' (2009) framework.

Non-academic use of ICT

It seems that relatively many informant teachers believe that students are responsible for using the computers as intended. When asked about non-academic use of ICT, most informants preferred not to estimate exactly how much time they think students spend on non-academic computer content, but most of them agree to a certain

Table 1: Factor Loadings (Oblique Rotated) from the Principal Axis Factor Analysis (N = 2477).

Questions	Factor 1	Factor 2	Communalities
'How would you rate your <i>basic skills</i> when using digital tools in school?'	.86	.01	.76
'Based on the previous questions, how would you estimate your overall digital competence in relation to teaching?'	.84	.51	.78
'How would you rate your <i>elementary skills</i> when using digital tools in your leisure time?'	.81	-.02	.72
'How would you rate your skills within didactic ICT use?'	.77	.38	.63
'How would you estimate your competence to guide students' digital judgement related to their digital lifestyle within and outside of school?'	.66	.56	.58
'How would you rate your skills in guiding students in the use of digital learning strategies?'	.62	.57	.55
'Based on the previous questions, how would you estimate the students' overall digital competence within school subjects?'	.27	.75	.57
'To what extent do you believe the teachers at your school are good role models for the students' curricular ICT use in education?'	.13	.74	.56
Eigenvalue:	3.9	1.3	

degree that students using ICT for other things than they are supposed to is a challenge:

"More than half of my students are abusing the trust. It is a bit (...) I may be a bit naive (...) but more than half of the students use the laptops for other than intended purposes" (LF32)

"I do not have an overview all the time (...) it is a bit hard to say when they are working on their assignments (tasks), so they may be doing other things in addition to the school-related work. They probably do. Say 20–25%." (LF61)

A third teacher (LF51) remarked that non-academic use of ICT varies between subjects. The teacher reported relatively extensive non-academic use when students are supposed to be using their computers to take notes during natural science class. While for another subject (geography), the teacher believes that students almost exclusively use their computers for academic purposes. This teacher pointed to student age and entertainment addiction as reasons for non-academic use of computers. The teacher further explained:

"(...) You have this group of students who spend most of their time on Facebook and so on, and when I told them NOT to do that, they had to take it out somewhere else, and then they take it out through chats (...) so they kind of make themselves addicted to the non-academic aspect in class as well".

This quote is interpreted as though the teacher views students' use of social media and entertainment content as a direct reason for not being attentive in class.

The school leaders mainly confirmed that teachers (without specifying whether they were many, some or few) complain about students having access to mobile phones and their computers, and several of the teachers and school leaders stated Facebook as a distraction. However, it is worth noting that not all informants agreed that non-academic use of ICT is a specific challenge or that Facebook is a distraction. One school leader (SLF11) and one teacher (LF41) provided a contrasting perspective on social media, pointing out that Facebook can be useful for teaching, learning, information and communication purposes. The teacher said:

"(...) If someone is wondering about something, rather than just asking the teacher, they may ask other students in class or other people with knowledge of the specific area" (LF41).

The extent to which teachers recognize computers as artefacts of learning may be seen in relation to teaching and learning practices in general, and whether the individual teacher's practice aligns with and is related to the use of ICT. One school owner (SEF3B) pointed out that a teacher who only ever lectures to a small degree will benefit from the use of ICT.

The student organization representative (EO) also pointed to teachers' classroom practices as a main reason

for non-academic use of computers. The EO said that the organization has not explicitly worked on measures aimed at reducing non-academic activity, but suggested that the organization implicitly stretches towards reducing non-academic use of ICT tools by efforts aimed to enhance pedagogical use of ICT:

"There is a public debate, which probably also takes place in many teacher staffrooms, about whether or not to shut down Facebook access, which boundaries to establish for that, and I think this is something of a sidetrack to what it's all about. We need teachers to establish boundaries for how and when to use ICT, because today it is more likely that teachers get annoyed when students use Facebook."

The EO wants the teachers to communicate guidelines for when and how ICT should be used rather than getting irritated and confrontational when they experience that the students are using it incorrectly.

The overall scope of ICT use in teaching and learning practices: Goal or means?

When asked about the scope of the use of ICT in teaching and learning, most informants agreed that this varies among teachers, schools and subject areas. School owners and school leaders tended to describe variation using arguments and explanations relating to teachers' professional digital competence and the paradigm shift towards student-centered methods. One school leader (SLF71) said:

"I miss a greater curiosity, in a way, from the teachers. And it's not only teachers in their 60s who lack competency. People in their 40s also exhibit too little curiosity and their ICT competency might be very inadequate. (...) We are constantly considering whether to be stricter or to regularly offer new voluntary courses and so on, but such curiosity would, in a way, make them more self-driven and they would simply spend more time (on ICT). If you never use your PC for other things than simple searches and so on, you never improve your skills and knowledge. This is a bit of a struggle".

Another school leader said that it is important to focus on the learning aspect, not ICT use in itself:

"We are clear in our expectations towards teachers using ICT, and that students should benefit from their computers and that positive aspects of student and classroom computers should be adopted" (SLF51).

The leader further explained how he/she considers himself/herself to be a "computer freak", yet still spoke about how he/she sees the computer as the one educational tool school could do without and still achieve similar learning outcomes. This is an interesting paradox. The leader added:

"It seems like quite a few politicians and other key people are more focused on ICT use than the actual learning".

Although the two leaders asserted different arguments, they pointed to similar underlying issues: Use of computers in itself is not the ultimate goal. It should be a means to support learning processes. One school owner expressed similar views and said:

"The public debate about ICT is on the wrong track if you think that computers in themselves lead to more and better learning. It would be very valuable to make the connection to (teachers) beliefs about learning and students, and what characterizes the successful teacher and what characterizes the teacher who fails" (SEF3B).

Two school owners differed in their answers on teachers' use of ICT: One school owner (SEF4) said he/she is afraid that demanding a good "analogue" teacher to use ICT might transform a good teacher into a bad one. Whereas the other school owner (SEF3B) claimed that bad teaching with ICT simply uncovers a teacher's poor pedagogic practice, and that the use of ICT just makes poor practice more visible. This school owner said that good teachers will manage to adapt to changes and continually adjust their practices.

The informant teachers themselves described varying experiences related to practices and scope of use. One teacher said:

"It (the computer) becomes a distraction during the lecture and you often lose eye contact with the students. They sit and ... it is not the same anymore. There is so much more going on with the computer than what happens in front of the classroom and on the blackboard. This makes many (teachers) prefer that the computer stays in the backpack and that students take notes like we did when we were in school" (LF71).

This teacher misses his/her relationship with the students and finds technology a distraction. It also indicates that the teacher identifies with a teacher-centered traditional (pre-computer) practice. This teacher's experience contrasts with the teacher (LF41) who described the students' use of social media as an integral part of the learning process. To metaphorically rephrase: While the first teacher (LF71) described students' ICT use as "students disappearing out of reach into a black hole", the other teacher (LF41) acknowledges and encourages what is going on in "the black hole" as a desired part of the learning process. The gap between the two explanations helps highlight an important aspect of the relationship between classroom management and digital competence, namely teachers' ability and willingness to facilitate digital learning communication. In a dialectical pluralism perspective, the two different views on students' ICT use is not necessarily a question about who is more right in their assumptions.

Classroom management

The informants agreed across groups that classroom management is important when ICT is used, but viewpoints, perspectives and arguments varied. The teacher informants mostly agreed when asked explicitly if they believe there is a relationship between low classroom management ability and a high degree of non-academic use of ICT. Two teachers explained their viewpoints:

"(...) If the teacher doesn't care what students do, they will do whatever they want" (LF32)

"Only in the sense that if you don't have rules for how the computer should be used it will slip (...), and if you don't have a good connection, and students paying attention in class, (...) then it certainly will be non-academic use. I believe that classroom management is essential to keep students away from non-academic use" (LF21).

The answers (besides LF21 pointing at rules) provided little information on *how* the teachers think classroom management can prevent non-academic use of ICT. The lack of suggested strategies and "how-tos" might mean that the teachers find such strategies to be self-explanatory. It seems that teachers are not fully able to reflect upon and verbalize the "how-tos" of managing the use of ICT, even if they view it as generally important. If so, one might further wonder whether teachers experience or feel (consciously or unconsciously) that they are being given a responsibility which they are not capable of handling. However, the quasi statistics showed that most informant teachers (5/7) only believed, to some degree, that there is a relationship between teachers' classroom management and their digital competence. Only one teacher graded the relationship between digital competence and classroom management as true to a large extent. Bearing in mind the description of non-academic use of ICT as a challenge, the agreement upon the necessity of classroom management and the quantitative relationship between digital competence and classroom management, this finding might be seen as somewhat surprising. One of the teachers elaborated on his/her answer:

"To some degree, I would say. Because ... I mean, it has to do with being where the students are, and they are digitally competent and if we are left behind we kind of lose grip on them. So, to some degree I would say that there is a relationship." (LF61).

This quote is interesting because it points directly to the core of student-teacher relation issues, also raised by the EO. By using the phrase "being where the students are", this teacher seems to emphasize the importance of understanding the relationship between student learning and their use of ICT. But what do the students say about this issue? In the student survey (N = 17529) of the SMIL study 55.7% of the students claim that the teachers' classroom management influences student learning outcomes with ICT to a high degree (Krumsvik et al. 2013).

When asked about beliefs regarding the relationship between teachers' professional digital competence and rule-based ICT practices, one informant teacher (LF21) said:

"I cannot see that less digitally competent teachers have less rules for how to use the computer in the classroom".

The teacher added that a digital competent teacher might, to a greater extent, make use of technical support systems for classroom management. Another teacher (LF61) provided a somewhat different perspective:

"In order to make sensible rules, we must know what it is all about".

The teacher added:

"Given that ICT is part of the job, as it is, it is also a part of our job to be updated. Then it becomes easier to have reasonable and clearly defined framework too".

The viewpoints of the two teachers emphasize the importance of rules and/or frameworks for use. However, their explanations on how and why digital competence matters for rule-setting are partly contradictory. The first teacher believes that teachers who are less digitally competent also have rules, and perceives a high level of digital competence more as a precondition to make use of technical support systems for management. The other teacher regards high levels of digital competence as necessary for establishing rules that are sensible and up-to-date. This implies that rules may be less sensible and outdated.

However, teachers are not alone in developing and practicing their classroom management understanding. Even if school leaders and school owners acknowledged that non-academic use of ICT is a challenge for teachers, most of them seemed to expect that teachers should be able to handle such challenges. Nevertheless, they had partly different solutions. Some of the leaders and school owners mentioned strict rules as a solution, whilst others would rather avoid such measures and believed that teachers should use more relation-based strategies to reduce non-academic use of ICT. School leaders used two partly overlapping phrases to communicate their expectations of teachers' classroom management: teachers are expected to *control* students' use of ICT and teachers are expected to *lead* students' use of ICT. The use of the two words may mean the same thing, but, bearing in mind that these informants are leaders and administrators by profession, it is also possible to interpret the words as consciously chosen and indicating contrasting attitudes toward the nature of classroom management (crime control vs. relational). As previously mentioned, many of the school leaders and school owners tended to explain teachers' diverse and contrasting ICT practices using arguments related to pedagogical understanding and digital competence. However, as with the teachers themselves, school

leaders and school owners also tended to be very general in their descriptions of how they expect teachers to practice classroom management and facilitate learning in an ICT environment.

The student organization representative (EO) suggested three main reasons for the extensive non-academic use of ICT: 1) poor student-teacher communication about how to use ICT, 2) deficient pedagogical use, and 3) teachers are not good at communicating their expectations to students. The participant described teachers' classroom management in a broader way than the other informants, emphasizing student-teacher relations. The participant suggested that teachers should maintain an ongoing dialogue with their students educational use of ICT, saying that dialogues could revolve around teaching and learning activities, involving students in planning, implementation and evaluation of learning processes including the use of ICT. The EO was sceptical about focusing exclusively on discipline and rule-based classroom management, and said:

"(...) I find the public debate on classroom management rather weird (...) because it revolves around (...) well, one speaks about how there should be more discipline in school as a kind of slogan for good classroom management and I think that is a bit hollow and conveys associations to a teacher role which I don't find positive for student learning".

The EO added:

"(...) If you're a teacher who is able to see and hear the students, who is clear and at the same time has a good dialogue with the students all the way, then I think you're a good classroom manager".

Descriptive statistics (quasi statistics)

In line with Maxwell (2005, 2010) and Becker (1970) we apply quasi statistics as part of the qualitative data in this study for to a certain degree validate the claims above in verbal form since the items in the survey are generated from the qualitative data. Becker states that it is important to make explicit the quasi-statistical basis of their conclusions in qualitative research. Therefore, we present some simple descriptive statistics below attached to the qualitative parts of the research questions.

The results for the teachers' self-reported data relating to the seven elements of classroom management, on an adjectival Likert scale with seven response options from 'to no extent' (1) to 'to a very high extent' (7) is presented in the following **Figure 1**.

The results for the teachers' self-reported data relating to the five elements of the digital competence model, on an adjectival Likert scale with seven response options from 'no skills' (1) to 'very good skills' (7) is presented in the following **Figure 2**.

Even if this quasi statistics is based on numbers and not text, it adds a layer to the methodical triangulation of semi-structured interviews, focus groups, and observations in the qualitative result part.

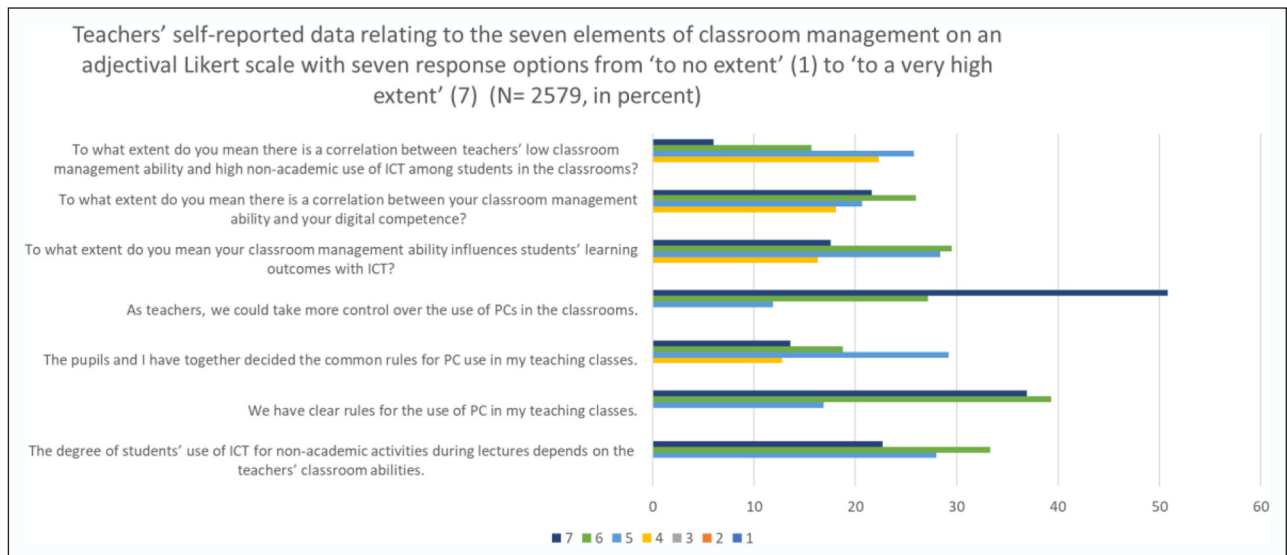


Figure 1: Teachers' self-reported data relating to the seven elements of classroom management (N = 2579).

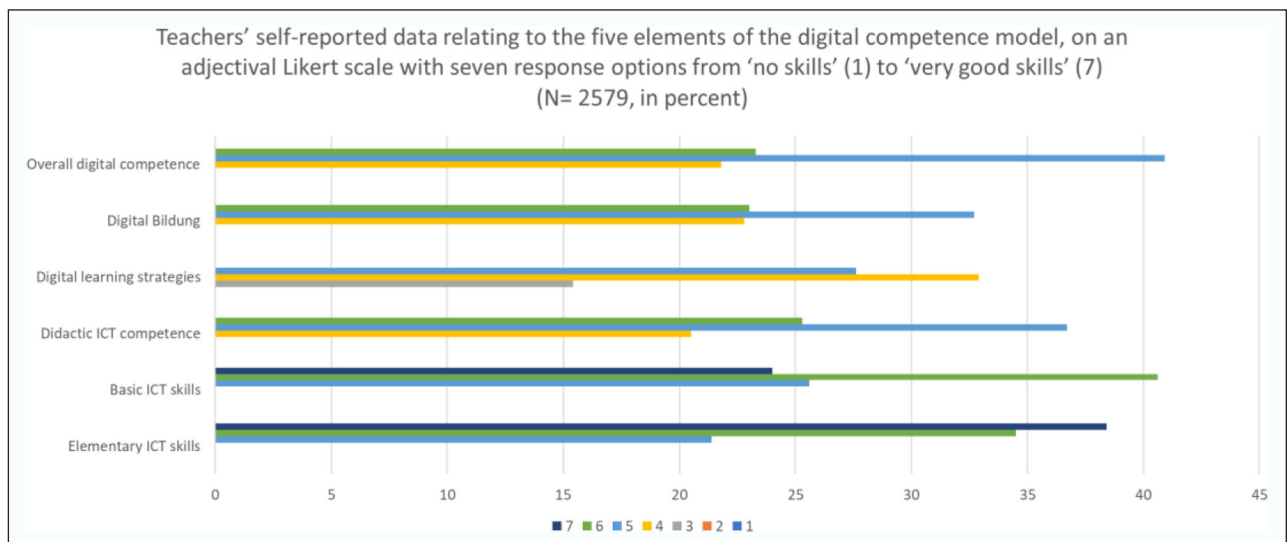


Figure 2: Teachers' self-reported data relating to the five elements of the digital competence model (N = 2579).

Quantitative results

So far, we have seen from the qualitative part of the study that both teachers, school leaders, students representatives and others perceives that there is some kind of relationship between teachers' professional digital competence and their classroom management abilities. However, the qualitative analysis only explores the nature of these associations in relatively a small sample of participants. The qualitative analyses alone therefore provide limited evidence as to how and why digital competence predicts classroom management ability in larger populations. The next part will examine this issue.

Regression analysis

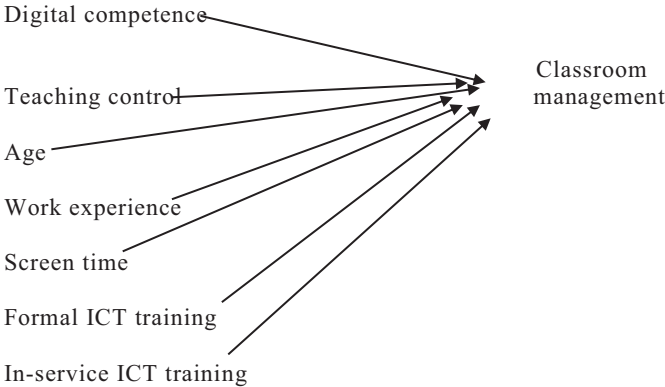
Because the sample size was large (2579 teachers), we used a more conservative significance level of .001 for the quantitative analyses.

A digital index covering six questions was developed. This was statistically analyzed and compared to a number

of factors in order to explore whether there was a relationship between demographic, personal and professional characteristics and teachers' professional digital competence (see Krumsvik et al. 2016).

Ordinary least square regression was used in estimation of the regression coefficients. In the first regression analysis (Table 2), teachers' classroom management (dependent variable) was regressed on the following independent or predictor variables: teachers' professional digital competence, their teaching control, work experience in years, age, daily screen time activity and whether they have ICT qualifications (both formal and in-service). Four independent variables that were statistically significant predictors were digital competence, screen time, work experience and teaching control. The strongest predictor of classroom management was teachers' self-reported professional digital competence (beta = 0.34). The other three statistically significant predictors had smaller relationships with classroom management: the beta for screen time was 0.10, the

Table 2: Regression analysis results of teachers' reported ability for classroom management (dependent variable) predicted by professional digital competence, teaching control, age, work experience, screen time and ICT qualifications (formal and in-service).



Predictor Variables	Classroom management	
	B	Beta
Digital competence	0.43*	0.34
Screen time	0.08*	0.10
Work experience	-0.07*	-0.07
Teaching control	0.05*	0.10
Age	0.02	0.03
Formal ICT training	0.01	0.01
In-service ICT training	0.04	0.02
R ² (adj.)	0.175	

Note: * $p < .001$.

beta for teaching control was also 0.10, and the smallest significant predictor beta was -0.07 . The full set of predictor variables accounted for 17.5 percent of the variance in classroom management.

Student-teacher relations was the dependent variable in the second analysis (Table 3). It included the same independent variables as in the previous analysis. The following independent variables were statistically significant predictors: digital competence, teaching control, and age. The strongest predictor of student-teacher relations was teachers' professional digital competence (beta = 0.39); the second strongest predictor was teaching control (beta = 0.31); and the third strongest predictor was teachers' age (beta = 0.16). None of the other independent variables contributed significantly to the student-teacher relation prediction. The full set of independent variables accounted for 31.2 percent of the variance in student-teacher relations.

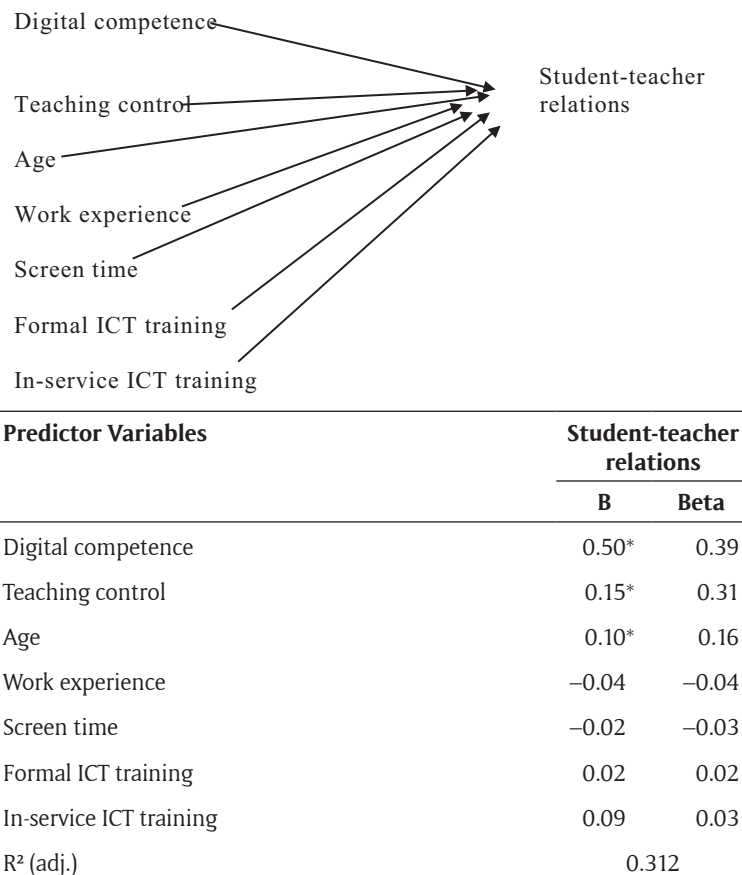
Integrated Results

The first research question was:

How do teachers, school leaders and student representatives describe the relationship between teachers' professional digital competence, student-teacher relations and their classroom management practices?

The qualitative analysis indicated that teachers generally believed that classroom management is important when ICT is used. However, views regarding the importance of digital competence seemed to vary. This was expressed through statements about classroom management explicitly, and through statements relating to more general questions on educational use of ICT and non-academic use of ICT. Teachers seemed to experience and interpret ICT usage differently, even if the situations and examples they described from their classroom experiences seemed to have common traits. They described different expectations for their students' use of computers and they described somewhat contrasting views about facilitating, modelling and regulating students' use. Statements by school owners and school leaders also seemed to support the fact that teachers experience and interpret ICT usage differently. However, these participant groups emphasized that teachers' professional digital competence explains the variation, and most of them said that teachers should develop their practices and skills to enable them to cope with ICT challenges in the classroom. Statements by the student organization representative seemed to support the fact that teachers' expectations and practices vary. On the one hand, the participant provided examples of teachers who succeed in using ICT in teaching and learning activities. On the other hand, the

Table 3: Regression analysis results of student-teacher relations (dependent variable) predicted by digital competence, teaching control, age, work experience, screen time and ICT qualifications (formal and in-service).



Note: * p < .001.

participant pointed to poor student-teacher communications about expectations and lack of pedagogical use of ICT as the main reasons for non-academic activity. The EO therefore emphasized the importance of trusting student-teacher relations and suggested that both teachers and students would benefit from discussing ICT in a teaching and learning context.

The second research question was:

Is there a statistical relationship between upper secondary teachers' professional digital competence and their classroom management?

The statistical analysis indicates that secondary teachers' professional digital competence predicted their perceived classroom management abilities and student-teacher relations. However, the analysis provided limited information on how and why digital competence, classroom management and student-teacher relations seemed to be somehow interwoven.

The third research question was:

How can one explain the observed relationship between upper secondary teachers' professional digital competence and their classroom management practices?

The integration of the quantitative and the qualitative analysis indicates a complex and mutual relationship between teachers' professional digital competence, their relations with their students and their classroom management abilities. The qualitative descriptions demonstrated that various teachers integrate digital competence in their overall professional understanding and classroom practices in quite different ways. The gap between perceived experiences pinpoints how a teacher's understanding of ICT and its place in teaching and learning activities can help explain the relationship between digital competence and classroom management. It is also valuable to question whether different teachers might describe similar use of computers differently. If so, it might also be hard for students to distinguish between what is desired use and not, hence, what they are expected and supposed to use their computers for. Whilst some teachers aimed to integrate the computer into pre-computer practices, other teachers emphasized the need to think differently and develop new teaching and learning practices. Professional digital competence seemed to predict teachers' overall willingness and ability to facilitate learning processes with ICT. We thus suggest that variations in professional digital competence can help explain the variations in what teachers perceive pedagogical use of ICT to be, teachers' conceptual understanding of classroom management in general

and how they practice their understanding in ICT-dense learning environments.

Discussion

Awareness of the importance of pedagogical use and contextualization of ICT and computers seems to be key to the mutual interplay between professional digital competence and classroom management. If one compares information from school owners, school leaders, teachers, the student organization representative and students, it seems that teachers who are willing and able to deliberately integrate and model the use of ICT in learning processes (teachers who are digitally competent) are better equipped to communicate educational purposes and clear expectations about ICT use in different contexts (classroom management). This enables the digitally competent teacher to be flexible in his/her management of the classroom environment, evaluating and adjusting on-going use. Teachers who are either not willing or not able (or both) to deliberately implement ICT into teaching and learning activities will probably have problems communicating educational purposes and expectations, and would therefore have to depend more on strict rules and "crime-control" when ICT is used. However, crime-control practice might be particularly challenging for teachers who, in a pre-computer classroom, emphasized and practiced relational classroom management. Teachers, school owners and school leaders who stress the crime-control aspect of classroom management might thus unintentionally undermine the pedagogical reflection needed to flexibly facilitate learning with ICT. Using a both-and logic, we suggest that both these practices can be moderately combined in practice.

Data from the interviews suggest that some teachers (and school leaders) label general classroom management issues as more or less infrastructural ICT issues rather than pedagogical issues. One teacher viewed students' addictiveness to social media and entertainment content as the main reason for classroom chatter. Some teachers commented that unstructured students do not seem to tackle access to technology (implying that they should not have access to computers), and often use their computers for non-academic purposes. However, the underlying assumption for both these views is that there was no (or less) chatter or inattentive students before computers were introduced into classrooms and daily school life.

Smartphones and computers provide access to a world of entertainment and communication, and students need to experience and learn the importance of using these tools in ways that facilitate their academic, social and moral learning. However, if teachers disagree amongst themselves on how students should use their laptops and what they should use them for, and are unable to clearly communicate their expectations, how can they expect the students to know what they are supposed to use their laptops for? Modelling and explaining the correct way to use ICT are thus important management skills in ICT-dense classroom environments. However, what happens in practice seems to vary. Teachers who expect their students to use computers as simple typing machines or notebooks in

a teacher-centered learning environment tended to identify, experience or/and expect non-academic use of ICT amongst students as an explicit challenge. Data from the study also suggest that teachers worry that students know more about ICT than they do. Some teachers fear their authority is being threatened, which might be especially relevant for teachers who are unable to advocate their ICT policies. Such and similar findings indicate that ICT and computers are not actively integrated into the specific teachers' professional role and their pedagogical design.

These different and partly contrasting views on classroom management and the scope and use of ICT in the classroom seem to revolve around the core question: Who is responsible for the use of ICT in the classroom, the teachers or the students? The general pattern of the qualitative results appears to be that school owners, school leaders and the student representative consider the teachers as responsible for facilitating learning processes with ICT. However, teachers seem to be variously equipped for such a task. Although teachers apparently accept this responsibility, something seems to be moving beneath the surface: Quite a few of the teachers seemed to blame the students for not using the computers correctly for academic purposes. Teachers who blame their students seem to be experiencing a feeling of powerlessness and stress related to the use of ICT in their classrooms. Findings indicate that some teachers do not know how to connect with the students when ICT is used, and that they perceive computers as disturbing elements that have somewhat alienated them from their professional role. Static, stress and fear-driven focus on managing an ICT classroom may end up as a self-reinforced spiral of mistrust if students and teachers continually and mutually suspect each other's judgements. Findings from the study also suggest that such spirals exist. Some teachers seem to assume that non-academic use often takes place despite them admitting not to have a good understanding of what students are using their laptops for.

The qualitative data also revealed that the EO and some teachers, school leaders and school owners emphasize a need to think differently about teaching and learning in the ICT environment. They outline how teachers should model and support proper use of ICT through student-teacher communication and pedagogical facilitation, and they seem to doubt that strict rules and crime control is a suitable measure for reducing non-academic use of ICT.

Individual informants (across groups) who described digital competence as important use phrases like "the teachers must be able to understand what it is all about". This wording indicates that the specific informants believe that they have understood something they experience that many others do not understand. One example is the teacher who advocated sensible rules rather than strict rules. Another example is the teacher who emphasized the importance of "being where the students are". Such statements are consistent with the theoretical perspective of the relationship between ICT usage and classroom management, which introduce digital competence as a mind-set beyond technical skills. Overall, findings from

the study point to what appears to be a challenging paradox: A teacher must have a certain level of digital competence to understand how and why digital competence influences classroom management and teachers' ability to facilitate learning processes when ICT is used. This paradox may seem quite insignificant in a micro context, if one focuses on the individual teacher. However, the qualitative analyses indicate that different levels of digital competence among teachers has led to different professional understandings and classroom practices. In a broader context and over time, this might contribute to structural uncertainty and thus widen the gap between practices. This gap between the "frontrunners" (Wasson & Hansen 2014) and the "laggers" (Rogers 2003) can give some input to our understanding of why there has been a lack of uptake in teachers' utilization of digital technologies both in Norway (Krumsvik et al. 2013) and internationally (Cuban, Kirkpatrick & Peck, 2001; Tamim et al. 2011; OECD 2015; Escueta, Quan, Nickow & Oreopoulos 2017).

Suggestions for future research

Together, the quantitative and qualitative findings from the SMIL study suggest that classroom management in upper secondary schools should entail pedagogical knowledge on how to create and maintain diverse learning environments to facilitate students' learning processes, especially when ICT is used. The qualitative descriptions indicate that some teachers do not include technology and digital communication platforms in their understanding of the learning environment and the learning processes they are supposed to facilitate, whilst others do. The seemingly unanimous common understanding that classroom management is important when ICT is used can thus prove to cover up different perceptions of what it really means to manage an ICT environment.

Ultimately, further research is needed into how digitally competent classroom managers facilitate learning processes, and to present a framework proposal for integrating digital competence and classroom management. We also suggest further research into how pre-service and in-service teacher training could successfully integrate professional digital competence in classroom management skills and professional development.

And the implications for practice from this study is to bridge the gap between the "frontrunners" and "laggers" by systematic focus towards professional digital competence and class management in teacher education as well as in in-service teacher training. In this way teachers might become gradually good enough with the kind of pedagogies that make the most of technology (OECD 2015).

Methodological imitations

The digital competence index and the elements of classroom management in this study are based on teachers' self-ratings, which might be a limitation of the study.

Notes

¹ Sammenhengen Mellom IKT-bruk og Læringsutbytte (the relationship between ICT use and learning outcomes).

² Students in all Norwegian upper secondary schools are provided with one laptop each.

³ Available from the first author upon request.

Ethics and Consent

This research project has been approved by the Norwegian Centre for Research Data (NSD) and all the counties and schools participating in the SMIL-study.

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Competing Interests

The authors have no competing interests to declare.

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