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Governance and digital transformation in schools with 1:1 tablet coverage

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There is an increasing trend of 1:1 coverage of tablets in schools in Scandinavia. Several studies have reported on pedagogical possibilities and challenges, but less is reported about how this change is perceived and practised by other stakeholders. We interviewed public school owners and leaders in Norway and found school owners used various models to support their schools, and school leaders held varied views on their roles in promoting the implementing 1:1 coverage in schools. Considering these findings, we discuss whether establishing overall national guidelines might help school owners and school leaders to effect digital transformation in schools and whether such guidelines would support or counteract school leaders' autonomy and ability to adapt the digital transformation to their local context.

KEYWORDS

1:1 coverage of tablets, school leadership, governance, digitalisation, digital maturity model

Introduction

Governments in the Nordic countries were early adaptors of digital technologies and have initiated several efforts to ensure that digital competence is included in education. Digital competencies and skills are embedded into the national curricula for compulsory education, there are national strategies and action plans for digitalisation, and the digital states of schools is monitored nationally (Erstad et al., 2021). Moreover, funding has been earmarked for monitoring the digital transformation of schools and for teacher training initiatives (Olofsson et al., 2015; Hjukse et al., 2020). In Norway, school districts own the schools that offer compulsory education. Key initiatives have provided students and teachers with individual digital devices, or 1:1 coverage (Bocconi et al., 2013). However, although 1:1 coverage in schools is increasing in Norway and beyond, it is still unclear whether or how these quite costly initiatives foster digital competency among schoolteachers and students or promote learning (Islam and Grönlund, 2016; Chauhan, 2017). Previous research suggests that the implementation of 1:1 coverage in compulsory education has led to a need for new approaches to teaching and classroom management or to overall pedagogical shifts (Blikstad-Balas, 2015; Islam and Grönlund, 2016). Other issues include ethical concerns around storing and sharing data and the use of digital resources in education (Gudmundsdottir et al., 2020; Selwyn, 2021). Moreover, teachers must themselves have digital competence to foster students' digital skills. For years, researchers have explored and documented teachers' professional digital competence (Koehler and Mishra, 2009; Ferrari and Punie, 2013; Kelentric, 2017; Aagaard

and Lund, 2019). However, fewer have addressed how teachers' digital competence is facilitated by school leaders, nor the guidelines and expectations school owners set for schools regarding these matters (Islam and Grönlund, 2016; Genlott et al., 2019; Dexter and Richardson, 2020). To our knowledge, there is limited knowledge of government guidance regarding the implementation of 1:1 coverage. Nevertheless, recent studies suggest that school leaders hold very different views on digitalisation and on how to ensure that teachers develop digital competence (Håkansson Lindqvist and Pettersson, 2019). Therefore, more structured, targeted research on the roles of school owners and leaders in the implementation of 1:1 coverage is needed. This can help ensure that available digital resources are leveraged to benefit schools and students (Pettersson, 2018; Håkansson Lindqvist and Pettersson, 2019; Dexter and Richardson, 2020). The present article aims to illuminate these issues, as we investigate school owners' and school leaders' approaches to 1:1 coverage. The article explores the following research questions: (1) How do school owners support schools' implementation of 1:1 coverage? (2) How do school owners and school leaders support the pedagogical changes in schools caused by 1:1 coverage? The first research question explores the diverse ways school owners govern their schools – here approached in terms of support – during the implementation of 1:1 coverage. The second research question further investigates school owners' and leaders' views of their own roles in the digital transformation of schools due to 1:1 coverage. Data were collected via qualitative, semi-structured interviews with public school owners and a selection of school leaders in Norway. Since Norway has been in the forefront of the digital transformation of public services, including education (OECD, 2020), the present findings offer new insights into the role of school owners and school leaders in the digital transformation of compulsory education caused by 1:1 coverage of tablets.

The digital transformation of Norwegian compulsory education

In Norway, the 2006 and 2020 national curricula include several points that directly and indirectly relate to digitalisation (Norwegian Directorate for Education and Training, 2006, 2020). Both curricula highlight the importance of students' digital competence and the need to use digital resources for pedagogical purposes. To meet these requirements, most school owners in Norway have financed 1:1 coverage in schools, providing individual tablets to school leaders, teachers, and students. While 1:1 coverage with either tablets or personal computers (PCs) has been common in grades 11 to 13 since about 2006, this trend is newer in grades one to ten. However, in 2021, most schools reported having 1:1 tablet coverage; schools reported using iPads, Chromebooks, and PCs (Gilje, 2021). This digital transformation of compulsory education calls for a new approach to teaching and classroom management and poses new challenges for school leaders and owners. In Norway, this work is very fragmented and poorly coordinated nationwide (Tømte et al., 2020). Moreover, the pedagogical benefits of the investment in 1:1 coverage are still uncertain, and this coverage is costly. To ensure that resources are used in ways that benefit schools and students, more structured and targeted incentives work is recommended on the introduction of technology.

Digital transformation and digital maturity frameworks

Our study draws on the concepts of digital transformation and the digital maturity framework. These concepts are interconnected. For example, digitally mature organisations may take a systematic approach towards digital transformation. Redjep et al. (2021) demonstrate that digital transformation goes beyond the issues related to digital technology, suggesting that digital transformation also includes managerial aspects that describe what organisations have done and plan to do to digitally transform their products, processes, and services. While the concept of digital transformation has often been associated with business, and although much of the growing body of research literature on this topic focuses on value creation (Vial, 2019), it can also address questions of institutional change and legitimacy. For example, digital transformation may help clarify how new institutional arrangements emerge from digitalisation and how these arrangements gain (or do not gain) legitimacy in the views of various actors (Hinings et al., 2018). For schools, implementing 1:1 coverage involves, not only technological issues such as broadband and charging capacity, but also a pedagogical shift that impacts several stakeholders. School owners, school leaders, and teachers play central roles in these processes (Islam and Grönlund, 2016).

A digital maturity framework may help us understand how schools can prepare themselves to meet or respond to the changes caused by digitalisation (Irfan et al., 2018; Ifenthaler and Egloffstein, 2020). For example, digital maturity frameworks may serve as diagnostic tools that provide schools insights on how to transform their processes, services, and products caused by digitalisation, such as digital teaching and learning. Here, concepts like e-readiness might be used to measure whether schools are prepared to adopt digital technologies.

Digital maturity frameworks thus can be used both to identify areas important to an organisation's digital transformation and to measure stages of maturity in these areas (Ifenthaler and Egloffstein, 2020; Redjep et al., 2021). Since digital maturity frameworks adopt a holistic approach, their application to educational institutions can be useful as they demonstrate the multifaceted ways that digital technologies interfere with, impact, and transform practices, products, and services in schools. Moreover, while digital technology is rapidly changing, digital maturity frameworks offer some flexibility in responses to these technological changes.

When reviewing the existing research literature on digital maturity frameworks, one observation would be that most studies are anchored in disciplines such as business and administration, information systems, or management studies (Proença and Borbinha, 2018; Corredor and Olarte, 2019; Redjep et al., 2021). Only a limited number address the education sector, but the DigCompOrg framework, initiated and outlined by representatives of the EU Member States stands out to be well known across Europe (Kampylis et al., 2015). The DigCompOrg were designed for educational organisations for self-reflection on their progress towards comprehensive implementation of digital learning technologies. Its' focus was on teaching, learning and assessment. Administrative and managerial perspectives were less present in the framework (Kampylis et al., 2015, 2016). Researchers have adapted and further aligned the DigCompOrg to study national education systems (see for example Luić et al., 2020; Redjep et al., 2021; Fernández-Miravete and

Prendes-Espinosa, 2022). To our knowledge, there are no studies that adopt digital maturity frameworks to analyse the implementation of 1:1 coverage in the Nordic countries. Since these countries are among the early adopters of digital technologies in education (Bocconi et al., 2013), we thus believe that our study may contribute with empirical evidence on governance perspectives as regards the digital transformation in schools with 1:1 coverage.

If we look to the studies conducted in Croatia, for example, Redjep et al. (2021) identified five areas that comprised the development of a digital maturity framework for compulsory education. The first, "planning, management and leadership," included vision statements, plans, strategic documents, curricula, and managing data on school management and student achievements. The second was "ICT in learning and teaching," which included the systematic introduction of ICT to teaching and learning. The third were framed as "development of digital competencies," which addressed the need to develop the systematic competence of all school staff, including educational and administrative staff. The fourth included "ICT culture," or the proper use of digital resources, including ethically and juridically (e.g., netiquette and privacy), whereas the fifth pointed at "ICT infrastructure," and which highlighted the importance of adequate digital infrastructure. The ability of school owners and leaders to handle these diverse areas may impact schools' success (Solar et al., 2013; Kampylis et al., 2015; Sotiriou et al., 2016). In the following sections, we will briefly elaborate on how the five areas can be played out, particularly considering the expansion of 1:1 tablet coverage.

Planning, management, and leadership

The area of management and planning includes plans for purchasing and implementing digital technology. Here the relationships among schools, school owners, and the government play a role in the integration of digital technology (Đurek et al., 2018). In our case, this impacts how school owners and schools respond to national strategies for digitalising education and to the national curricula. Governmental plans or guidelines that schools must follow may be accompanied by additional instructions from the school owner. Schools may benefit from understanding how to link the school's ICT strategy to the municipality's main digitalisation goals and framework, if there is one, or they may look to national guidelines, steering documents, and curricula (Dexter and Richardson, 2020). This area also includes budgets, personnel management, and the allocation of resources for skill development. Moreover, high expectations from society and various external stakeholders can lead school leaders to perceive their digitalisation work as challenging and difficult (Olofsson et al., 2015; Dexter and Richardson, 2020).

ICT in teaching and learning

Schools can systematically introduce the use of digital technology for teaching and learning. The potential of ICT for teaching and learning and the ways digital technologies can transform pedagogy (Aagaard and Lund, 2019). For example, ICT can help students to understand content by adopting multimedia approaches, it can facilitate the communication with peers and teachers, and open the classroom to the world by online offerings. Moreover, students may connect with the digital resources in their own pace and based on their own learning preferences, and thus fostering personalized learning paths (Ito et al., 2020; Smith et al., 2020).

Development of digital competences

One key issue in a digital maturity framework for educational institutions is the professional digital competence of school leaders, teachers, and students (Redjep et al., 2021). Being a school leader in a school with 1:1 tablet coverage requires competence in many complex areas. While traditional work tasks are becoming increasingly digitised, new areas of responsibility are also emerging due to digitalisation. School leaders' digital competence impacts their work with digital transformation in schools (Håkansson Lindqvist and Pettersson, 2019), and it is important for school leaders to be good role models during this transformation (Milman, 2020). A school leader's knowledge and perception of digital transformation thus includes facilitating teachers' development of digital competence, setting aside sufficient time for digital competence training, and creating a culture where school staff can share experiences and support one another's professional development (Islam and Grönlund, 2016; Håkansson Lindqvist and Pettersson, 2019; Leithwood et al., 2020).

Teachers' professional development is crucial to improving school quality and ensuring students' success. School leaders must enable teachers' professional development and engage in their teaching alongside their traditional technical and administrative tasks. In some cases, school leaders can receive support from school owners; in others, they are expected to handle these processes on their own.

ICT cultures

In countries where society and education have been digitalised for a while, most teachers are positive about digital competence training (Fernández-Batanero et al., 2020; Fraillon et al., 2020). However, their digital competence varies (Islam and Grönlund, 2016; Genlott et al., 2019). School leaders should thus create opportunities for teachers to share experiences and exchange best practices (Milman, 2020). These may be formal aspects of the school's digital development or informal opportunities during professional discussions among staff. Furthermore, these exchanges can take place on school premises or online; they may occur within school districts or extend across district divisions (Lantz-Andersson et al., 2018). Several schools have organised resource teams to enhance teachers' development of digital competence. Such teams can consist of a group of teachers or of teachers and school leaders, all of whom are interested in pedagogical development, subject didactics, and/or technology and have a stated mandate to work with the teachers' college (Genlott et al., 2019; León-Jariego et al., 2020; Tømte et al., 2020).

Technological infrastructure

An adequate digital infrastructure includes the availability of ICT resources, both hardware (e.g., digital devices and keyboards) and software (e.g., pedagogical, and administrative). It also includes network infrastructures within and across schools, technical support

and maintenance of ICT resources, and information security systems (Đurek et al., 2018). School owners may provide schools that offer compulsory education with standardised hardware (1:1 coverage) and educational software (programs and apps). School leaders may ensure that the school has an adequate infrastructure that corresponds to the school's goals and strategies. School leaders may also provide an overview of the availability and condition of software and hardware and develop plans for maintenance and operation. In addition, school leaders must determine which tasks are the responsibility of the school and which are the responsibility of the municipality; they must also plan for any future purchasing needs. School leaders should also be aware of the quality here understood as available options of hardware such as PCs, networks, power outlets and broadband, and of software, including digital learning resources. Some municipalities in Norway manage these issues centrally, while in others, schools make these choices independently (Islam and Grönlund, 2016; Gjerustad, 2019; Tømte et al., 2020; Gilje, 2021). Since the General Data Protection Regulation (GDPR) was introduced in 2016, schools have a much clearer responsibility to safeguard privacy and ensure information security (Krumsvik, 2020). These factors have become more important due to the increase in 1:1 coverage and because many students take the school's digital devices home to do schoolwork there (Olsen and Tokerud, 2020; Caspersen et al., 2021).

Research design, data, and analytical approach

Whereas most digital maturity frameworks hold quantitative instruments that are used for measuring the various levels of maturity, as the studies reported here demonstrate, the present study takes another approach. Here we take a qualitative approach to investigate how school owners and leaders support and perceive the implementation of 1:1 tablet coverage in their schools. In so doing, we use the five areas suggested by Redjep et al. (2021) to inform the design of an interview guide. This way we explore how the five areas are perceived and practiced by school districts and schools. We argue that this approach may help us investigate, and further analyse the complexity of digital transformation in schools, as caused by 1:1 tablet coverage.

Data for this article were collected in two large municipalities, each with approximately 65,000 inhabitants (MA and MB); in one medium-sized municipality with 30,000 inhabitants (MC); and in one smaller municipality with 18,500 inhabitants (MD). The municipalities are in south-eastern, eastern, and south-western Norway. One large and one medium municipality in the study had 1:1 coverage in all primary and secondary schools (MA and MC), and one large municipality (MB) and one smaller one (MD) had 1:1 coverage in some schools. These four municipalities were selected for our study for two reasons. First, together, these four municipalities include some variations in geographical location, size, and overall organisation and school governance. Second, the included municipalities differ in their implementation of 1:1 coverage: Two had 1:1 coverage in all schools, and two had 1:1 coverage in some schools. Moreover, the included municipalities use a range of digital devices in schools, including iPads, Chromebooks, and PCs. These four municipalities thus include some variety in several factors.

Our empirical data include interviews with two groups of informants: school owners ($n = 4$) and school leaders ($n = 11$). In all four municipalities, interviews were conducted with a representative of the school owner and some school leaders. Within each municipality, we randomly chose schools and invited their school leaders to interview. Prior to the interviews, participants were informed about the aims and scope of the study and about how the collected data would be stored and treated in accordance with the national guidelines on research ethics. All the informants agreed to participate in the study. Table 1 summarises the basic characteristics of the municipalities included in our study.

As noted, the interview guide was informed by the five areas in the framework of digital maturity for schools (Redjep et al., 2021) and included planning, management, and leadership; ICT in learning and teaching; development of digital competence; ICT culture and ICT infrastructure. The interviews were semi-structured, and the same guide was used for both groups of informants. The areas mainly served as general topics and there was room for variation across municipalities and between schools. We asked the informants open-ended questions with the intend of reflection about the areas. Follow-up questions involved asking the informants to elaborate on, explain, or discuss issues that emerged during the interviews. Some examples of questions are: "How would you describe the technological infrastructure at your municipality/school?" "How would you describe the level of digital competency at your school?" "In your opinion, what are the main challenges that teachers face as caused by 1:1 coverage?" "Are there any special issues related to classroom settings and teaching when teaching with digital technology?" The interviews were conducted in Norwegian, and the quotes in the findings section have been translated by the authors. The first author conducted the interviews in MB, and the second author conducted the interviews in MA, MC, and MD. All interviews were audio recorded and transcribed.

When developing a coding scheme, we first constructed five categories that reflected the five areas recognised within the digital maturity framework. The data were then analysed and interpreted by both authors individually and in collaboration in conjunction to the main categories, following a qualitative content analysis approach (Krippendorf, 2004). While there are several similarities between thematic and content analysis, content analysis differ in that this approach may include both quantitative and qualitative approaches (Vaismoradi et al., 2013). In our case, informants either related themselves to t the five overall areas within the digital maturity framework, expanded them or refused them. This way, we got information on how well the areas fitted to their own digitalisation practices. To avoid misrepresentation and possible sources of error during analysis, the co-authors discussed the findings at several stages until they agreed on an interpretation of the data. This process was used throughout the analysis. This initial observation demonstrated various understandings and perceptions of the areas. There were also differences across the two groups of informants and across the school districts studied. We thus added subcategories based on the content within each area (Krippendorf, 2004). For example, in the area Planning, management and leadership, one subcategory would be "financial support," another would be "pedagogical support." Another observation from the interviews was that the areas "ICT in learning and teaching," "development of digital competence," and "ICT culture" were closely connected. We have thus merged them in our presentation of findings, Nonetheless, the areas "planning,

TABLE 1 Basic information about the municipalities.

Municipality	Municipality A	Municipality B	Municipality C	Municipality D
Devices	PC	Chromebook	iPad	iPad
1:1 coverage in all schools	Yes	Yes	Yes	No
Informants (*N*)	School owner: *N* = 1 School leaders: *N* = 3	School owner: *N* = 1 School leaders: *N* = 2	School owner: *N* = 1 School leaders: *N* = 3	School owner: *N* = 1 School leaders: *N* = 3
Interviews (*N*)	4	3	4	4

management and leadership," and "ICT infrastructure" are treated separately.

Findings: digital transformation in schools via 1:1 tablet coverage

Various perceptions on the responsibility of providing technological infrastructure

Digital transformation in schools depends on adequate digital infrastructure. In our study, school owners reported that all schools were provided with infrastructure that secured the use of digital tools (e.g., internet broadband connections and tablets for all students). School owners mostly dealt with the overall digitalisation strategy, and the school leaders received financial support for purchasing digital tools (e.g., PCs, iPads, or Chromebooks). Thus, the school owners had overall responsibility for the technological infrastructure (e.g., internet broadband connection or technical support), and the school leaders could choose what to prioritise and how to develop competence at their local schools: "We mainly received financial support to purchase the digital tools. How we chose to develop digital competency was up to us as school leaders" (MC, school leader).

Unclear areas of responsibility between the school leaders and school owners

However, school leaders reported that they sometimes received insufficient support for digital infrastructure: "…last year, when we implemented 1:1 coverage with iPads, the system [internet] broke down" (MC, school leader). In other cases, the division of responsibility between school owners and school leaders was unclear. For example, one school leader reported that one teacher at their school was responsible for technical support for the Chromebooks used there. This was considered a resource-heavy solution, since that teacher spent his teaching hours maintaining the Chromebooks instead of teaching. The school leader concluded, "Teachers should teach" (MB, school leader).

Limited attention towards privacy and ethical issues

In the interviews, only one school owner (MB) addressed issues related to privacy or information security. In this municipality, one employee was responsible for juridical and overall ethical issues related to the school tablets (Chromebooks). Information and guidelines related to GDPR were published on the school's website. The other three school owners who were interviewed did not have specific task forces assigned to these issues. All municipalities reported to have 1:1 coverage and digital infrastructure, yet only one has advanced systems in place to protect information security and privacy. Moreover, none of the interviewed school leaders demonstrated awareness of these issues or considered information security to be part of their role as leaders. This may indicate that all municipalities share an understanding on what comprise basic technological infrastructure when implementing 1:1 coverage. However, their own responsibility and support towards schools on these matters may vary.

Leadership, management, and planning: larger school districts are more advanced than smaller school districts

Interviewed school owners described varying plans and priorities related to implementing 1:1 coverage in schools. The owners of the two smallest municipalities felt solely responsible for financing 1:1 coverage with tablets (MC and MD): "The municipality does not really play any role in the implementation; it's done by the school and the school leaders. I think this wporks fine" (MC, school owner).

Enhancing professional development for teachers

The two largest municipalities in our study took a more comprehensive approach that included technical and pedagogical support for the implementation of 1:1 coverage (MA and MB). These school owners also reported facilitating teachers' development of professional digital competence. This could involve training that was provided to teachers at multiple schools or courses offered by school owners:

> We have courses and training for teachers. They sign up and then they take the courses. We also guide teachers at the schools. And we have a "technology coach network." This helps the "super advanced" teachers, the ones who know more about digital technologies than the average teacher. (MA, school owner)

School leaders' various perceptions of being a role model in digitalisation

School leaders in different municipalities had varied perspectives on their roles in leading schools in the implementation of 1:1 coverage. Some sought to be role models for the use of digital technology in educational settings: "I have to set a good example, so I tried out the Chromebook myself" (MB, school leader A). Others were less likely to consider the digital transformation of their schools to be relevant to their own competence; these were more likely to delegate the work of digitalisation to others: "My inspector takes care of the digitalisation; I just make sure that he/she does so" (MB, school leader B). School leaders' varied perceptions of their own roles in the digital

transformations of the schools thus also influenced the organisation of professional training for teachers in the use of digital devices for educational purposes. Responsibility for teachers' professional development could be assigned to school leaders, to various staff members such as inspectors or school team leaders, to teachers who were early adopters of technology, or to the entire teaching staff. For example, at one school, the school leader selected individuals from the teaching staff for further competence development and expected them to support and guide their colleagues in their use of digital resources for pedagogical purposes (MA). At another school, the school leader promoted an "all-in" approach. There, all the teachers at the school participated in a training program on digital proficiency for teaching and learning: "We have assembled teams to guide the students, and the same teams work together to expand our digital competency. We try to use interdisciplinary teams so both superusers and beginners can share ideas and help each other" (MC, school leader A). Here, the school leader argued that organising teacher teams with different levels of digital competence promoted knowledge sharing and allowed teachers to help each other.

School owners' perceived role for professional development in schools

All school owners supported their schools financially in the implementation of 1:1 tablet coverage, yet only the two largest described a comprehensive plan for them to raise the awareness towards professional development of staff as part of this digital transformation. The two largest municipalities used a top-down approach to digital transformation and offered diverse types of guidance and support. The two smallest prioritised schools' autonomy and promoted local organisation of professional development programs. Under a digital maturity framework, this may indicate that only the two largest municipalities had developed a comprehensive approach to enhancing, leading, and monitoring the digital transformation caused by the implementation of 1:1 tablet coverage.

To teach and learn with ICT calls for the development of professional digital competence

School leaders and school owners in our study highlighted the importance of teachers' digital competence, and they emphasised the difference between general and professional digital competence. One school leader explains:

> I would like to point out that digital tools and services do not change didactics as such. That is why it is important to guide learners (e.g., teachers and students) in the use of the technology. Teachers and leaders need to have a critical perspective on the technology they use. (MD, school leader A)

While some teachers might be good at communicating didactic perspectives to peers and students, school leaders believe that others are better at the technical side of digital resources. Thus, the school leaders aimed to balance implementing digital tools with what students learn while using them. Here, one of the school leaders pointed out that teachers' pedagogical digital skills were not influenced by the teacher's age but by their mindset, creativity, and approach to innovation: "Professional digital competency has nothing to do with young vs. old; it has more to do with thinking innovatively and having the courage to try new approaches" (MA, school leader D).

Various perceptions of teachers' professional digital competence

In the context of digital maturity in schools and school districts, these various perceptions of teachers' professional digital competence might influence school governance and the organisation of professional development opportunities. School owners' perceptions of teachers' digital competence might influence how they facilitate professional development programs in schools. Furthermore, school leaders' views on what constitutes professional digital competence may also impact local governance. As demonstrated here, a digital maturity framework may involve a more consistent approach to developing teachers' professional digital competence.

Discussion: various views on 1:1 coverage and various support

One observation from our study is that the digital transformations of schools with 1:1 coverage is perceived differently in different municipalities and schools. It seems that these different perceptions of these matters influence how school owners support the implementation of 1:1 coverage (Håkansson Lindqvist and Pettersson, 2019). School owners' views of their role in this process fall into two categories. Some see themselves as responsible only for finances and infrastructure, while others consider themselves responsible for a comprehensive pedagogical change. The two larger municipalities in our study (MA and MB) take the latter perspective, while the two smaller municipalities (MC and MD) take the first. One explanation for this finding could be the municipalities' different economic profiles; the finances of the two larger ones are rather more robust than those of the two smaller ones. This difference might influence school owners' abilities to support their schools. For example, larger municipalities might have more access than smaller ones to staff and services that provide comprehensive technological and pedagogical support. We found this to be the case, but more comprehensive research is required before we can draw any specific conclusions. A similar observation is reported in the review of 1:1 learning initiatives across Europe (Bocconi et al., 2013).

Within schools and across municipalities, school leaders had different perceptions of 1:1 coverage as a way of digitalising their schools (Sterrett and Richardson, 2020). Here as well, their various perceptions influenced how they supported pedagogical changes and teachers' development of professional digital competence. While some highlighted the need for teachers to master the technical side of digital devices, others focused on integrating and innovating their schools' pedagogy through technology. These perspectives are also identified in previous literature on teachers' views of technology in education (Prestridge, 2017; Skantz-Åberg et al., 2022). However, this duality might impact school owners' and leaders' implementation of 1:1 coverage in schools. For example, if school owners and leaders focus only on the technical aspects of coverage implementation, teachers may not receive the support they need to develop professional pedagogical competence. However, the reverse might occur if the implementation of 1:1 coverage is viewed primarily as a pedagogical change. Moreover, if school leaders maintain a narrow focus on finances and technology, they will not see themselves as part of the implementation process,

which means they will be more likely to delegate responsibility to other staff at their schools, whether inspectors or early adopters among teachers. This means that they will also lose ownership of the process and weaken or eliminate their position as good role models, and if that might result in a slightly less fruitful approach towards the digital transformation in schools. Previous studies have clearly demonstrated that school leaders must serve as good role models if digitalisation is to be successfully implemented (Islam and Grönlund, 2016; Dexter and Richardson, 2020; Leithwood et al., 2020). Moreover, if the process of digital change is delegated to one staff member or teacher (a so-called superuser), the digital transformation could be at risk if that person changes jobs, becomes sick, or is unable to provide support for any reason.

There could be several causes for these various views on 1:1 coverage. As mentioned above, municipalities' economic profiles might impact the levels and types of support resources they can access and their ability to support schools. However, other causes may include stakeholders' perceptions of what 1:1 coverage means. This shift may be understood as a technological change, a pedagogical one, or both. Compulsory education in Norway is governed by the Education Act and by the national curricula, which provide municipalities and school leaders guidelines for steering and supporting schools. These governing instruments establish overarching principles but leave school owners with considerable autonomy to make local adjustments. Moreover, these principles do not offer any specific guidelines for school owners or leaders regarding digital transformations in schools. A balance might involve providing earmarked economic support but allowing school owners or municipalities to choose which model they use to implement digital change and/or digital transformation in Norwegian schools. The question is whether school owners should provide non-financial (as well as financial) support (e.g., offering teacher training, addressing ethical considerations, and establishing technical support systems) or merely provide teachers and students with digital devices. Exclusively financial support might lead to widespread coverage with digital devices (as is now the case) but possibly low rates of didactic digital competence (Genlott et al., 2019). A combination of financial and non-financial support might lead to a better balance of teacher competence and resources (Tømte et al., 2020).

In Norway, different government agencies are responsible for distinct aspects of digitalisation, such as GDPR, information security, and technical standards for hardware and software. However, to our knowledge, national agencies currently provide little information on or guidance for monitoring the development of schools' digital maturity.

Until some years ago, there was a national service instrument that monitored schools' digital maturity (IKTplan.no), but, due to a reorganisation of government agencies, this is no longer the case. This situation might appear paradoxical since the digital transformation of education is proceeding rapidly (Erstad et al., 2021). National guidelines on digital maturity might help school owners and leaders facilitate their local digital transformation processes and establish more consistent standards across municipalities and districts. Moreover, the findings from this study might indicate that the lack of central governance results in different models for supporting digital change in schools. Financial support alone might lead to lower levels of pedagogical digital competence among teachers, as demonstrated in our study, and with resonance to previous research (see for example Genlott and Grönlund, 2016). This could negatively impact the overall goals of the Norwegian Education Act, in which only one of the five goals for students' digital competence is the ability to use digital tools (Krumsvik, 2011). However, Norway is a sparsely populated country with many local differences in infrastructure. Therefore, providing local authority and autonomy to school owners and leaders might empower them to make appropriate local adjustments to ensure successful digital transformation.

Conclusion

The present article offers some insights into school owners' and leaders' governance and perceptions of digital transformation in schools. A key finding is the considerable variation of school leaders' perceptions of what it means to lead a technology-intensive school (or schools) with 1:1 coverage with digital devices. While some believe that this digital transformation mainly impacts teachers' work rather than the work of school leaders, others are intrigued by their role as examples who can inspire others and identify what needs to be changed in their schools. These differences may impact teachers' development of professional digital competence, which may take place within a professional learning community or individually. School leaders' various perceptions of the digital transformation may also impact the school as an organisation. Schools' efforts to digitalise are influenced by the type of support and resources that school owners provide. As demonstrated here, these efforts also vary among municipalities. Additionally, digital maturity framework may guide school owners and leaders towards a more consistent digital transformation of schools and schooling. As demonstrated, such frameworks may provide some overall guidance if the autonomy of local municipalities and schools is maintained, and help local stakeholders set directions and future goals for digitalisation and improve their understanding of the digital transformation of schools. Future studies might further investigate these matters. As noted, the DigCompOrg digital maturity framework (Kampylis et al., 2015) may serve as a useful approach on educational organisations' capacity to integrate digital learning technologies. However, as areas of administration nor management are less highlighted in this framework, and since we in the present study highlight governance and digital transformation, we chose to adapt a more holistic digital maturity framework that also included these areas (Redjep et al., 2021). Our study demonstrated that an awareness of these areas is important in educational organisations' digitalisation work.

Of course, our study has some limitations. Although we have only explored the perspectives of a limited number of municipalities and school leaders on the implementation of 1:1 tablet coverage, we still believe that our contribution is valuable to the research community and practitioners. This is because there is still limited knowledge of how school owners and school leaders support the implementation of 1:1 tablet coverage, in Norway and beyond. Our study may thus contribute with some new insights on this topic.

Data availability statement

The datasets presented in this article are not readily available because the dataset are restricted in use. Requests to access the datasets should be directed to cathrine.tomte@uia.no.

Ethics statement

The studies involving humans were approved by SIKT Data Protection Services for research, Norway. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

CT has contributed with introduction, theory, findings, analysis, and discussion. JS has contributed with findings, analysis, and discussion.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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