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The changing role of ICT-coordinators in schools: a longitudinal study

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ABSTRACT

As schools become more digitalized, teachers need strong skills in teaching, learning, and administration. Some teachers, known as ICT coordinators, play a key role in promoting digital technology use, acting as liaisons between management and teaching. This study, based on a literature review and interviews with Norwegian ICT coordinators over five years, found increasing diversity in their tasks and roles. With the rise of one-to-one digital device use (e.g., Chromebooks, iPads), the ICT coordinator's role is expected to grow in importance. The study highlights the complexity of this role and its future development.

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Digitalisation; 1:1 coverage of digital devices in schools; ICT coordinator; professional development; teaching and learning

Introduction

As schools are becoming increasingly digitalised, there is an urgent need for schools and teachers to have adequate competence in teaching, learning, and administration (Castañeda et al. 2021; Fernández-Batanero et al. 2020). Norway is among the countries that have broad coverage of one-to-one digital devices in schools. All students in lower and upper secondary schools have their own digital devices, such as iPads, Chromebooks, or PCs. The devices are offered to them by the school owners, most likely through the school districts (Fjørtoft, Thun, and Buvik 2019). Some teachers play a more central role than others in the implementation of one-to-one devices and the use of them in teaching and learning. These teachers are often provided with additional responsibility in the implementation process or in the daily use of the digital devices (authors, 2021), and they are usually acknowledged Information Computer Technology (ICT) coordinators, a term that denotes a coordinating function between management and teaching (e.g. Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020).

Because schools may differ in organisation, governance, size, teaching profile and technological equipment, the ICT coordinator role may vary across schools and school districts. In the present article, we draw on a review of the international literature and empirical data on the ICT coordinator role from a formative case study of one municipality/school district spanning more than a five-year period. The schools under study have

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various experiences with the organisation of the ICT coordinator role as well as the support and coordination involved both before and during the COVID-19 pandemic.

Against this backdrop, the purpose of this article is to further elaborate on ICT coordinator roles, or role dimensions, as suggested in the international literature. The context of our study is a country (Norway) that had early digital adoption and a mature digital school district (Ifenthaler and Egloffstein 2020; Tømte et al. 2023) both before and during the COVID-19 pandemic. One of the most recent studies in the literature we identified addressed the ICT coordinator role (Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020) in a Spanish school context prior to the COVID-19 pandemic. Our study, however, draws on empirical data collected before, during, and after the pandemic in a Norwegian school context. We therefore believe that our study provides further insights into the concept of the ICT coordinator role and further illuminates how the role has developed in coherence with the overall changes in schools where digital resources and technologies influence teaching and learning in diverse ways. Moreover, our study demonstrates how the digital transformation of schools and education systems call for new competences and roles among teachers, including the ICT coordinator. It also shows how the heterogeneity of schools including their various digital maturity may impact how this role is perceived and practiced.

Given the various digital transformations in education during the pandemic (Kolog et al. 2022; Tømte et al. 2020), we first assumed that ICT coordinators as facilitators of digital transformations play a central role in organisational learning, at both the individual school and school policy levels. Furthermore, we assumed that the ICT coordinator functions as such have undergone transformations during the pandemic during longer periods of home-schooling. Given the digital transformations of education systems over time, we also expected increasing diversity in the ICT coordinator role functions over time. Based on these assumptions, the following research question guided the present article: How are ICT coordinator roles practised in a school district with one-to-one coverage of digital devices for teaching and learning?

The study is informed by a social-cultural perspective and theories of professional agency (Vähäsantanen 2015; Vygotskiï 1997). In the following, we first provide an outline of the research context, a review over the international literature on the ICT coordinator role and its functions in compulsory schooling. The results of the review then inform and further specify our formulation of the research hypothesis and provide a tool for our analysis. In the methods section, we describe our data and the design of our studies that are used for analysis. This is followed by a presentation of findings which is further discussed and concluded in the remaining parts of the article.

Research context: a municipality in Norway

In Norway, the municipalities serve as administrating units of compulsory education. The context of our study is a medium sized municipality with about 60,000 inhabitants, located in East Norway. In 2016, the municipality consisted of 24 schools (16 primary schools: grades 1–7; 8 lower secondary schools: grades 8–10). At that time, the municipality introduced a one-to-one device program to all schools, meaning that all students and teachers were provided with individual Chromebooks. The municipality labelled the program as a pedagogical development project with the aim of increasing

students' learning outcomes and their digital skills to be prepared for further study, as a citizen, and for working life. At that time, this was the only municipality in Norway with an implementation strategy including competence development aligned for teachers and principals. After the merger with two other municipalities in 2020, our case municipality comprised 40 schools. Moreover, the previous one-to-one implementation program was finalised, and a newer implementation program was introduced to all schools. The newer program aimed to build on the previous implementation program of one-to-one Chromebooks and to further strengthen competence development for teaching and learning with digital resources. In both programs, dedicated teams from each school were appointed to lead this process. These teams included a group of teachers and members from the school leadership. Most teachers from the teams were entitled ICT coordinators. The municipality organised joint meetings for the teams about twice a year where the agenda was to share information, experiences, and ideas about the implementation process and innovating teaching practice with the support of digital technology.

Literature review

The literature on ICT coordinators in schools has mainly addressed the technical function (e.g. Avidov-Ungar and Shamir-Inbal 2017; Devolder et al. 2010; Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020; McGarr and McDonagh 2013; Wollscheid et al. 2021; Woo 2020). This literature denotes ICT coordinators as 'computer fixer[s]' (McGarr and McDonagh 2013, 279), 'technical supporters' (Rodríguez-Miranda et al. 2014, 267), contact persons for 'technical questions and problems' (Devolder et al. 2010, 1654), or in a wider sense, 'technological leaders' (Blau, Shamir-Inbal, and Hadad 2020, 673). Further, this literature refers to the relations between technician and planning functions in addressing the 'planning and maintenance of ICT equipment in school' (Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020).

Until recently, less attention has been put in the literature on diverse, multiple, overlapping, and ambiguous ICT coordinator role functions, however (see e.g. Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020; Top et al. 2021). Blau, Shamir-Inbal, and Hadad (2020, 673), for example, describe ICT coordinator roles as 'broad', meaning that ICT coordinators are expected to be not only 'technological leaders' but also pedagogical-technical experts in addition to 'middle managers' in their schools. McGarr and McDonagh (2013) distinguished between policy and school level, at which the ICT coordinator is located. While the ICT coordinator mainly has a visionary role at the school policy level, the role function is particularly technical and narrow at the school level. Others describe the ICT coordinator role as 'hybrid' (Margolis 2012) and ambiguous (Skues and Cunningham 2013). Drawing on survey data of ICT coordinators in Spain, Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada (2020) derived a typology that demonstrated how ICT coordinators perceive their role, suggesting three understandings of this role. The first understanding was most dominant – namely, 'promoting ICT use in the classroom' – followed by 'supporting ICT use in the classroom' and 'planning and maintenance of ICT equipment in the school' (Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020).

In our review of the literature, we identified the following role dimensions, in addition to that of technician described above: school manager (leader) and administrator; educationalist, curriculum leader, and professional developer.

School manager and administrator

The ICT coordinator role is closely related to that of a leader at medium level, combining different skills, among them leadership skills, high levels of knowledge and mastery of ICT and pedagogy (Avidov-Ungar and Shamir-Inbal 2017). Thus, ICT coordinators should be able to act as a role model, independent, and willing to take responsibility, and be motivated to facilitate digital transformations. Avidov-Ungar and Hanin-Itzak (2019) found that study participants felt personal, subject-area, and leadership empowerment in their new role as ICT coordinator. Further, Avidov-Ungar and Shamir-Inbal (2017) showed that ICT coordinators played an active part in shaping the school's vision together with the school management staff. From the authors' perspective, defining the vision was not just one of their job requirements but proof that ICT coordinators play a core role in structuring innovative organisational processes at schools from an overall systemic perspective (Lai and Pratt 2004). Findings also indicated the need for management involvement, teamwork, and cooperation between the ICT coordinator and teaching staff at the school level. Teamwork atmosphere and cooperation with teachers helped facilitate the workloads of the ICT coordinators and help them take responsibility for ICT implementation (Avidov-Ungar and Shamir-Inbal 2017; Shamir-Inbal et al. 2009).

Other scholars defined an ICT coordinator as a planner or administrator. According to Devolder et al. (2010, 1654), the ICT coordinator role comprises the enactment of tasks in the planning, development, facilitation, and monitoring of an ICT vision and policy (see also Lai and Pratt 2004, 468). Furthermore, the role of a planner is often related to that of an 'agent of change' (Vanderlinde et al. 2009). This role might also comprise the promotion of ICT in class and the prioritisation of educational functions (Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020). Finally, it has been said to include administrative skills, such as budget planning and resource allocation, which could be categorised as planning skills (Lai and Pratt 2004). Devolder et al. (2010) defined this role as the 'expending and administering of an ICT budget in function of the development and optimisation of ICT integration in the school' (1654).

Educationalist, curriculum leader, and professional developer

More recently published research shows even greater variation in the role dimensions. Blau, Shamir-Inbal, and Hadad (2020, 673) stresses the diversity of the ICT coordinator role, from technological leadership to pedagogical-technological expertise and organisational knowledge, and, in addition to teaching, tasks related to middle-management positions in schools. Woo (2020), defines ICT coordinators as a separate occupational group in schools, showing that more than half of the ICT coordinators in their study, did not intake any additional formal position in their schools.

Several scholars have referred to the function of an educationalist, professional developer, and curriculum leader (e.g. Devolder et al. 2010; Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020). Devolder et al. (2010) defines the function of an

educationalist, professional developer and curriculum leader as supporting the 'implementation of ICT in the classroom and training teachers in the area of ICT and its use in the classroom' (1654). In this case, the ICT coordinator has the functions of a 'teaching assistant' related to work developed in the classroom to guide teachers about available resources from the Internet; the function of a facilitator of ICT content to encourage the creation of educational contents, and finally, the function of 'management tools' facilitating the use of digital educational tools. Rodríguez-Miranda et al. (2014) shows that the 'technical support' function was that on which ICT coordinators spent more time, followed by the functions of 'teaching assistant' and 'management tools'.

Further, McDonagh and McGarr (2015) show that ICT coordinators can be assigned to teacher teams as well as a curriculum team (cited in Woo 2020). This finding is also partly supported by Lai and Pratt (2004) who showed that the ICT coordinator role can be divided between technical and curriculum support. Avidov-Ungar and Shamir-Inbal (2017) argue that ICT coordinators consider the enrichment of their technological-pedagogical knowledge to be an important issue that requires the development of unique knowledge and skills. They found that ICT coordinators spend a lot of time with professional development, taking in-service courses and learning independently to become experts at implementing ICT in the school setting.

Earlier, Lai and Pratt (2004) found that ICT coordinators themselves play a crucial role in professional development, as they keep themselves up to date with new innovations in the field, deciding future directions of their schools, organising, and providing in-school professional development, providing pedagogical support for the use of ICT in their schools, envisioning ways to lead staff, and presenting at conferences and leading staff development sessions at other schools. Lai and Pratt (2004), however, showed that nearly 60% of the ICT coordinators were frequently asked to deliver professional development at their schools, while only 13% were regularly given time to provide it.

Working assumptions based on previous literature, and a theoretical framing

The diversity in understandings of the ICT coordinator role might have weakened the identity of the 'traditional' ICT coordinators who was mainly involved in solving technical issues. Moreover, the literature reveals an increasing trend towards the separation of the technical from pedagogical functions linked to the role, suggesting strengthening the training regarding planning skills for the ICT coordinators and assisting them in developing a shared view with the vision of the actual schools with which they are affiliated.

Our study is informed by a socio-cultural perspective (Vygotskiï 1997), and we adopt the lenses of a subject centred sociocultural framework for professional agency (Eteläpelto et al. 2013; Roumbanis Viberg, Forslund Frykedal, and Sofkova Hashemi 2023; Vähäsantanen 2015). Recent studies on professional agency suggest that professional agency is exercised for a purpose, it implies a variation in exercise, from maintaining to transforming. Moreover, individuals' subjectivity is temporarily dependent on the socio-cultural context. According to Eteläpelto et al. (2013), agency happens when the individual and/or communities exercise influence, make choices, and take a position to influence their work and/or their professional identities (Eteläpelto et al. 2013). Following this, Roumbanis Viberg and colleagues suggest that the socio-cultural context needs to be

examined including its contextual factors (Roumbanis Viberg, Forslund Frykedal, and Sofkova Hashemi 2023).

We believe this approach may help to understand the role of the ICT coordinator over time. For example, various contexts, such as curricula reforms, digital infrastructure, financial situation, local governance, and the Covid 19-pandemic may impact the role of the ICT coordinator and the professional agency associated with it. Furthermore, these contexts may impact the perceptions of the role and the identity of the ICT-coordinator.

Our review showed that the role functions of ICT coordinators are diverse, spanning from a technician, administrator, and school manager (school leader) to an educational leader and professional developer; this led to the following assumptions. First, we assume that the ICT coordinator role has become increasingly hybridised over time with a decreasing focus on the technician function alone. Second, we assume a gradual formalisation of the ICT coordinator function/role and a transformation from an individualist to a team player, as well as towards a closer connection to leadership. Third, we assume the changing of roles in different school contexts. These assumptions or working hypotheses further informed our own empirical study and analyses.

Methods, data, and analytical approach

In the following, we briefly describe the methodological approach including data collection and analysis.

Empirical data: interviews and observations and findings from a literature review

In our analysis, we drew on a sub-sample of interviews with ICT coordinators ($n = 33$) and their principals ($n = 13$) at selected schools (grades 8–10) along with observations and participations at joint team meetings organised by the municipality. Our longitudinal case study design provided us with rich data, from different sources and collected at several points in time regarding how school leaders and teachers with and without anyone serving as ICT coordinators within their school cope with the ICT coordinator role. Moreover, our rich data has provided us with new insights into how this role may impact pedagogical change and innovation in schools.

The interviews with the ICT coordinators at five time-points spanned a period of five years and involved two cohorts of ICT coordinators and school leaders, here referred to as two distinct studies, Study 1 (S1), and Study 2 (S2). The rationale for interviewing ICT coordinators and school leaders was to get a grasp of two different perspectives on the ICT coordinator role. From the ICT coordinators, we can gain a bottom-up, or teacher-oriented, perspective. From the school leaders, we can gain a top-down perspective.

We interviewed the same persons at the same schools (School A and School B) once every year for three years in S1. In S2, we included a new cohort of ICT coordinators and school leaders from two new schools (School C and School D). These schools were new to the ongoing implementation process due to the municipality merger. They were included in the study since we believe that they may add a greater variety of perceptions of the ICT coordinator role, as they had not undergone the same implementation program with Chromebooks as Schools A and B. The number of interviews differ from S1 and S2, and it is mainly caused by the COVID-19 pandemic, a context that gave us limited access to

schools and recruitment of informants. Nonetheless, even if the number of interviewees decreased in S2, those who are included represent a broader context in that two more schools are included (C& D). To ensure transparency of the data, [Table 1](#) provides an overview over the interviews for the present paper.

In the interviews, we asked about how the schools organised their ICT resources and who the members of the resource teams were. Further, we asked who was associated with the ICT coordinator role, as well as what the ICT coordinators' areas of expertise were, their responsibilities, and their expectations regarding their role functions. Finally, we asked them about their actual tasks and if there have been any changes in tasks and the role over time. Before the pandemic (during year 2017,18,19), interviews were conducted by the researchers at schools where the ICT coordinators worked; during the pandemic, and beyond (2021–22), interviews were conducted online via videoconferencing systems such as Zoom. All interviews were audio recorded, transcribed, and uploaded to the coding software Nvivo12. We followed ethical guidelines on privacy and data storage as suggested by the Norwegian Centre for Research Data.

We aimed to gain a better understanding of how the actual school owners prepared schools for pedagogical change due to the implementation of the one-to-one coverage of Chromebooks and the role of the ICT coordinators in these processes. Thus, we attended meetings organised by the municipality for school leaders and teachers for grades 8–10 selected for the role of ICT coordinator. This gave us insights about the challenges related to the implementation and organisational change processes across schools. From each meeting, we produced a short memo including observation notes addressing the scope of the meeting, our role as observants, and key takeaways including how participants were reacting and acting throughout the meetings. In total, we attended eight meetings-three meetings in 2017, one in the years 2018, 2019, and 2022, and two in 2021.

In the present article, we thus draw on interview data and observational data from meetings organised by the municipality, in addition to the previously mentioned findings from a literature review. Observations from the meetings provide a deeper understanding of the research context, here understood as the municipality and its schools, the organisation of the implementation of Chromebooks (one-to-one devices), the professional development of teachers, and the various stakeholders' perceptions of tasks and responsibilities associated with the ICT coordinator role. The interviews that include two groups of informants – the school leaders and the ICT coordinators – provide insights from several schools regarding the organisation, perceptions, tasks, and maintenance of the ICT coordinator role. Moreover, they serve as an empirical source for understanding the complexity of expectations, tasks, and roles associated with the ICT coordinator role, as well as the attendant changes over time.

Table 1. Interviews 2017–2022.

Year	Study 1 (School A&B)			Study 2 (School A, B, C & D)		Total
	2017	2018	2019	2021	2022	
Interview ICT coordinators	N=8	N=12	N=9	N=2	N=2	N=33
Interview School leader	N=2	N=2	N=2	N=3	N=5	N=14
Total	N=10	N=14	N=11	N=5	N=7	N=47

Analytical approach: thematic analysis

In our analysis, we sought to construct cases of perspectives of ICT coordinators in a purposeful sample of interview and observation data collected at schools in a Norwegian municipality/school district recognised as an early adopter of digital technologies (authors 2020). Our approach was informed by thematic analysis to identify, analyse, and map patterns in the data of the two studies in the municipality for several points in time (2017, 2018, 2019; 2021, 2022). These data were validated by findings from the literature review in an iterative process. This implied the simplification and presentation of the transcribed material and findings from the literature review by grouping and coding the raw text in relevant categories, such as combining inductive and deductive strategies (Braun and Clarke 2006).

The categories identified thus comprised those from the research literature such as educationalist, curriculum leader, professional developer, 'motivator; school manager (school leader) and planner', 'team player', and 'technician'. In addition, some new categories emerged from the empirical data. Those were 'administration, funding, and statuses' and 'emergency remote teaching in times of the pandemic'. Most categories overlapped to some extent, as some of the statements from the interviewees resonated with several of the categories. The coding procedure thus involved an iterative process wherein the researchers elaborated and further developed the categories via a line-by-line coding of the interview transcripts. By drawing on data from the empirical sources and the review of the research literature, we thus combined two different perspectives, a particularly top-down perspective by school leaders and an ICT coordinator/group leader/teacher perspective and validated our findings. Additionally, the analyses were validated by the two authors in an iterative process.

Findings

We present the findings of our analyses grouped according to four main themes that emerged from our analysis: 1) ICT coordinator as leader, planner, and administrator; 2) change of the ICT coordinator functions; 3) hybrid role functions and increasing role diversity; and 4) ICT coordinator functions across schools.

ICT coordinator: leader, planner, and administrator

We found indications in our material that the ICT coordinator function is located at two levels: the municipal or school owner level, framed as the 'central level', and the school level, framed as the local level.

Central level

At the central level, staff resources ($n = 3$) are engaged with overall ICT coordination for all schools in the district. The ICT coordinator's task is to organise the implementation process of one-to-one coverage and to promote professional development for teachers. Moreover, ICT coordinators visit schools to hold workshops, and they organise joint meetings for all ICT coordinators in the school district, where participants were exposed

to new ways of teaching with digital resources and shared their experiences from their own schools. These meetings also served as networking arenas for the ICT coordinators, which was much appreciated among the teachers. One ICT coordinator (S2, School C, 2021) stated:

I have participated in this network, and I think they [central ICT coordinators] have done a fantastic job, really built a good, solid network, and provided the opportunity for . . . that is, the starting point where there were incredibly large differences between levels, approaches, and school cultures not least So, the work they did there was far more about educating people in how to conduct pedagogy digitally, it was also a strong cultural builder, a building of a learning culture, a way of building together in three different municipalities.

As demonstrated here, the central ICT coordinators provide local schools with adequate knowledge and resources in terms of digitalisation, in addition to building a shared understanding of the ICT culture within the school district. Their efforts can also very well be seen as effective means in cultivating the schools' digital maturity. This can be done by the school's provision of services to ICT coordinators, such as providing a joint learning culture across schools, with a strong focus on pedagogical use of digital technologies in the classrooms, as listed in the citation.

Local level

The number of participants serving as ICT coordinators may vary among localities and depends on the size of the schools, which can span from about 100 up to 400 students. Schools with many students are most likely to have a group of three to four persons associated with the role. Moreover, scheduling and planning the times for professional development were mentioned as the responsibility of all the teachers, as stated here in an interview with a one ICT coordinator in 2017 (S1, School A, 2017):

But everyone contributes a little to schedule the time for professional development each week. So, we divide the work to be done during the next half year, and plan when and how this will be done.

We found support that ICT coordinators at the local level often are referred to as a 'facilitator of change' (Devolder et al. 2010). One of their main tasks relates to setting up plans for digital change at their schools. Most ICT coordinators in our study were thus involved in professional development to foster digital competence among teaching staff locally at their own schools. This was typically organised within the local schedule of professional development within each school. At one school, several ICT coordinators formed a so-called resource group of teachers with regular meetings and a pre-defined schedule.

In the very early days of the one-to one implementation, in the interviews, the ICT coordinators reported that they did not have much prior experience with sharing ideas and ways of teaching with peers (S1). This was also our impression as participants at the joint meetings hosted by the central ICT coordinators in that period (2017). For example, one local school leader elaborated on how they planned to work towards a culture of sharing among teachers (S1, School B, 2017):

We are going to reorganize, which means that we will get a school development group with the digitalization group included [...]. A culture of sharing is something new for many who have worked at school for many years, with no routines for sharing. [...]

Two years later, in 2019, the same school leader referred to an established culture of sharing at this school, reflecting non-hierarchical organisation:

We are using resources, which means digitalization team and other with expertise on different things [...], ICT coordinator-group and other staff who have competencies in different areas and [...] we do a lot of sharing of experiences and presenting stuff for each other.

As demonstrated, the teachers who serve as local ICT coordinators play a crucial role in fostering digital competence among peers as part of the professional development work at schools. Moreover, the focus on this type of work associated with the role has become stronger over time since the initial phase of the implementation of the one-to-one coverage. We may also interpret this development of a stronger focus on fostering professional digital competence among peers in terms of how schools are becoming increasingly digital mature over the years, which has raised an awareness of strengthening of professional digital competence among teachers.

Change of ICT coordinator functions

In general, we found indications of change over time related to the ICT coordinator role, from a strong focus on the technician role function to that of broader function. For example, in 2021, one local ICT coordinator referred to a meeting with several colleagues and an opportunity for discussions that was perceived as useful, indicating a change in the function to being less technical: 'Now, the focus is on pedagogics, but earlier we have discussed technical issues. I am happy that we are done with that issue' (S2, School B, 2021). At the same time, this informant highlighted that the technical responsibilities left to the ICT coordinator role have remained: 'I still feel that there are some technical issues [...], even if they tell us that we shall use time for pedagogical development; it is still the case that there is technical work to be done [...]'.

Another theme in our data and in the review of the literature was the shift in the ICT coordinator role from being an individualist to a team player. One informant (Study 2, School A, 2021) referred to a digitalisation group, to which they contribute, as supporting their colleagues. Another ICT coordinator (S2, School C, 2021) mentioned that they were alone in that role at the given school, referring to five more people in the group with diverse competencies. This ICT coordinator said, 'However, in practice, it's changing how many of them contribute or not. Not all of them are so independent in terms of these things'.

Furthermore, our data revealed that the formalisation of the ICT coordinator role has become more important over time, which has been much debated among those serving as ICT coordinators. Here, issues related to the administration, funding, and outlining of the characteristics of tasks related to the role were addressed. For example, independent of school type, the ICT coordinators raised issues regarding how they should be rewarded for their extra investments in having such high levels of commitment. While some received extra payment for serving as ICT coordinators, others received spare time in their working scheme/calendar for doing so. The central ICT coordinators from the

municipality argued that it was difficult to maintain a common standard of reward/funding due to the various types of schools in their district. Nonetheless, the issue was raised at all joint seminars with the ICT coordinators organised by the school districts, which again may indicate that there is still more to be done to develop a shared and mutual understanding of what tasks should be associated with the ICT coordinator role and how these should be acknowledged and funded.

Hybrid role functions and increasing role diversity

During the years of our study, the ICT coordinator role became more oriented towards professional development tasks, involving fostering digital competence among peer teachers, and building a local culture for sharing teaching experiences. Yet, we found indications that the work of the ICT coordinators still includes a significant amount of technical work. One informant referred to a common chat room for ICT coordinators in the municipality that also involves technical staff from the central administration (S2, School D, 2021). During the pandemic, the local ICT coordinators were expected to help teachers at their schools with emergency remote teaching. In that context, the central ICT coordinators provided them with updated resources. One local ICT coordinator stated the following (S2, School C, 2021):

Those at [name of the central ICT coordinator unit] made a complete package of how we should use the various resources such as software for online meetings, instructions on how we create good online meetings with the students, and how to respond to technical challenges. We also got invitation for courses, which have been initiated by those who supplied these learning resources. However, it was a bit difficult to find the way within the local website for those resources, to find the necessary tips since the overall web organization lacked some logics.

Furthermore, we also found statements that indicated a certain role diversity related to that of ICT coordinators. One school leader referred to a so-called 'e-teacher' who has the role of an ICT coordinator but is 'also very competent with pedagogical issues' (S1, School B, 2019). Another informant from a local school has a similar understanding of the ICT coordinator role comprising 'these who work with the technical device and those who work more pedagogically' (S2, School C, 2021).

We may interpret this diversity of perceptions of the ICT coordinator role in the context of the local schools' digital maturity. For example, we observed a trend towards a more holistic approach of the ICT coordinator role including both technical and pedagogical tasks in schools that had a longstanding collaboration with the central school district ICT coordinators, and with a dedicated school leadership that aimed at fostering and supporting teachers' professional development towards digital competence.

Formalisation of the ICT coordinator function

As the data were collected over several points in time, we found a change towards an increasing formalisation of the ICT coordinator functions. In the data from 2017, one ICT coordinator stressed 'that when only the real enthusiasts among our teachers are those who try out most new digital resources; only few classes that get this type of instruction' (S1, School A, 2018), further adding: 'I wish that people figured out and experimented

a little more. And that they had the courage to ask for help [...]'. In 2021, the ICT coordinator function was institutionalised at the school owner level, with appropriate support by the central ICT coordinator function, as demonstrated in the citations from the following two ICT coordinators (S2, Schools C and D, 2021):

Yes, I got much [support] as an ICT coordinator [...]. Including e-mail and tips, and [name of the central ICT coordinator unit] made a full description on how we could use different resources in Meet. [...]

As an ICT coordinator I have a certain overview, and I am in touch with staff in [name of the central ICT coordinator unit] and the corresponding resource group. What I tried was to help my teachers by directly showing them teaching resources that might be useful for them.

ICT coordinator functions across schools

Additionally, our data reflected differences across schools for the ICT coordinator function, as it is strongly related to the profiles of the schools. In the school district, the number of students may vary from about 100 up to 400, and while some schools are for students from grades 1–7, others are dedicated those in grades to 8–10, which also means that the curricula vary among school types. The leadership perceptions of the importance of the professional development of digital competence among teachers may vary, as well as the level of the digital maturity of schools. All these circumstances may impact the ICT coordinator functions. This multitude of the ICT coordinator function was also perceived by the ICT coordinators themselves, as reflected by the following statement from one teacher in 2021 (S2, 2021): 'There are important differences in the role of resource teachers from school to school'.

Discussion and concluding remarks

The purpose of the present article is to elaborate on ICT coordinator roles, how this role is perceived and reflected in a digitally mature school district in Norway, and if there have been any changes to this role over time, as outlined in our research question. In the research literature, several tasks are associated with this role, from taking care of purely technical issues within the schools' digital infrastructure to pedagogically oriented tasks regarding teaching with digital resources to the enhancement of professional development for teachers.

Since we have studied one distinct school district over several years, we have data that reflects this role before, during, and after the COVID-19 pandemic. In the following, we discuss the core findings of our study with findings from the research literature.

Given the various digital transformations in education during the pandemic (Kolog et al. 2022; König, Jäger-Biela, and Glutsch 2020), we assumed that ICT coordinators as facilitators of digital transformations might play a central role in their schools. Our findings indicated that this was perceived as the ICT coordinators often being responsible for initiating and running the professional development of digital competence for teachers. This happened at two levels in the school district studied here. Central, as the school owners' staff served as overall ICT coordinators for the schools in the district, and local, where local ICT coordinators facilitate and run the professional development

processes within the schools. Our findings resonate with studies that address professional agency demonstrating how individual staff, and/or working communities may communicate, act, and make choices that influence their work and/or their professional identities (Eteläpelto et al. 2013). For example, our findings demonstrated that as schools increased their level of digital maturity, the ICT coordinator role became more complex, with an increase in the area of responsibilities. We may interpret this as if the professional agency of the ICT coordinator role also expanded and developed to meet these demands.

Furthermore, we assumed that the function of an ICT coordinator might have undergone a transformation before and during the pandemic with longer periods of home-schooling and emergency remote teaching. Here, we assumed that the ICT coordinator would be expected to support teachers with technical issues of teaching online, since this was a new situation to most of them. Nevertheless, our data provided a more nuanced picture, which may relate to the schools' levels of digital maturity. Schools that have had some years of experience with digital resources for teaching and learning had apparently established routines and a culture of professional development, and teachers at these schools were relatively tech savvy. They reported that they needed less technical support for teaching online during the pandemic period with emergency remote online teaching. On the other hand, schools with fewer years of this type of experience were more dependent on ICT coordinators' technical support for this type of teaching. In such cases, as demonstrated, both central and local ICT coordinators' support was welcomed by teachers and their school leaders. In the light of professional agency (Vähäsantanen 2015), we may understand this finding as the ICT coordinators at digital mature schools also expanded their areas of expertise and responsibility. From solving purely technological issues the ICT coordinator also influenced schools' pedagogical situation, such as mentoring their peers about new pedagogical approaches supported by digital technologies.

Given the digital transformation of education systems, we also assumed an increasing diversity of ICT coordinators' tasks and roles over time. Findings from our review on the ICT coordinator role and from our empirical study confirmed this assumption. While several role functions and tasks are suggested by the literature (e.g. Avidov-Ungar and Shamir-Inbal 2017; Blau, Shamir-Inbal, and Hadad 2020; Leon-Jariego, Rodriguez-Miranda, and Pozuelos-Estrada 2020; Woo 2020), these were further expanded on by our empirical data.

As schools are facing various forms of digital transformations due to the one-to-one coverage, the ICT coordinator role will most likely become even more important in the future. We thus believe that the present study might be useful in informing the future shaping of the role, as we have demonstrated how it has developed throughout the years in terms of complexity and formalisation.

The ICT coordinator role may have some similarities with what is often framed as that of a 'teacher leader', a role that most likely involves various tasks such as updating one's own practice by reading research as well as trying out new methods and reflecting on the consequences of these methods before turning their attention to guiding and supporting their colleagues (Fairman and Mackenzie 2015). Moreover, teacher leaders are not formal leaders and depend on the trust of their colleagues to be able to perform the dual role (Mangin and Stoelinga 2008). Furthermore, they may impact school development and organisational learning (Ifenthaler et al. 2021)

by influencing colleagues and principals to develop and advance teaching practices with the aim of improving students' learning. Research on the teacher leaders has thus revealed some interesting observations that may relate to how we can understand the complexity of the ICT coordinator role and their professional agency (Vähäsantanen 2015). In both cases, the labelling of the role comes with a certain level of ambiguity involving several tasks, and likely role conflicts, as well as areas of responsibilities. Yet, there are also some important differences between the role of a teacher leader and that of an ICT coordinator. For example, Lønnum and Kringstad (2021) have suggested that core qualifications and competencies of teacher leaders tend to be more strongly related to pedagogics and specific subjects. Our findings suggest that this is less important for ICT coordinators, as they have been more closely related to technical ICT skills, and with a more generic approach towards pedagogy, with less attention on subject competencies. Yet, as demonstrated in our study, the professional agency of the ICT-coordinators has changed over time, and their areas of competences and expertise are becoming increasingly like that of the teacher leader. Likewise, the professional agency between these two groups of professionals in schools are becoming blurred, and it can be difficult to grasp their differences, other than that the ICT-coordinators still serve as an expert on the technical sides of education and schooling.

There are some limitations to our study. First, our literature review comprises scientific articles published over 20 years of time, i.e. covering the period before and after the COVID-19 pandemic. Thus, findings from older studies might be of relevance to a lesser degree than findings from more current studies, published during and after the pandemic. However, the rationale for including this time span in the literature review has been to elaborate on how the role has developed over the years, and to demonstrate its increasing complexity as societies and education become more infused by digital technologies.

Second, there are limitations in the data set given that we only studied one municipality/school district; this means that the situation might look quite different in other school districts across Norway and beyond. That said, the school district studied here might be considered an early adopter of digital technology in schools offering 1:1 coverage of digital devices to students and teachers. This is an increasing trend in Norway and in other countries. Our study may thus illustrate changes in the role and how it adjusts to schools' digital maturity (Tømte et al. 2023).

Third, studying digitalisation in schools is a moving target as newer technologies constantly emerge. For example, schools are currently coping with Artificial Intelligent large language models such as Chat GPT (Lim et al. 2023). By no doubt ICT coordinator in schools are to cope with this technology. Moreover, how this will come about remains yet unanswered for researchers and schools. That said, we believe that findings from our study may find merit for the research community interested in newer trends in digital technologies in schools.

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References

- Avidov-Ungar, O., and L. Hanin-Itzak. 2019. "Sense of Empowerment Among School ICT Coordinators: Personal, Subject-Area and Leadership Empowerment." *Technology, Knowledge, and Learning* 24 (3): 401–417. <https://doi.org/10.1007/s10758-017-9346-8>.
- Avidov-Ungar, O., and T. Shamir-Inbal. 2017. "ICT Coordinators' TPACK-Based Leadership Knowledge in Their Roles as Agents of Change." *Journal of Information Technology Education* 16 (1). <https://doi.org/10.28945/3699>.
- Blau, I., T. Shamir-Inbal, and S. Hadad. 2020. "Digital Collaborative Learning in Elementary and Middle Schools as a Function of Individualistic and Collectivistic Culture: The Role of ICT Coordinators' Leadership Experience, Students' Collaboration Skills, and Sustainability." *Journal of Computer Assisted Learning* 36 (5): 672–687. <https://doi.org/10.1111/jcal.12436>.
- Braun, V., and V. Clarke. 2006. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3 (2): 77–101.
- Castañeda, L., F. M. Esteve-Mon, J. Adell, and S. Prestridge. 2021. "International Insights About a Holistic Model of Teaching Competence for a Digital Era: The Digital Teacher Framework Reviewed." *European Journal of Teacher Education*: 1–20. <https://doi.org/10.1080/02619768.2021.1991304>.
- Devolder, A., R. Vanderlinde, J. Van Braak, and J. Tondeur. 2010. "Identifying Multiple Roles of ICT Coordinators." *Computers & Education* 55 (4): 1651–1655. <https://doi.org/10.1016/j.compedu.2010.07.007>.
- Eteläpelto, A., K. Vähäsantanen, P. Hökkä, and S. Paloniemi. 2013. "What is Agency? Conceptualizing Professional Agency at Work." *Educational Research Review* 10:45–65. <https://doi.org/10.1016/j.edurev.2013.05.001>.
- Fairman, J. C., and S. V. Mackenzie. 2015. "How Teacher Leaders Influence Others and Understand Their Leadership." *International Journal of Leadership in Education* 18 (1): 61–87. <https://doi.org/10.1080/13603124.2014.904002>.
- Fernández-Batanero, J. M., M. Montenegro-Rueda, J. Fernández-Cerero, and I. García-Martínez. 2020. "Digital Competences for Teacher Professional Development. Systematic Review." *European Journal of Teacher Education*: 1–19. <https://doi.org/10.1080/02619768.2020.1827389>.
- Fjørtoft, S. O., S. Thun, and M. P. Buvik. 2019. "Monitor 2019: En deskriptiv kartlegging av digital tilstand i norske skoler og barnehager."

- Ifenthaler, D., and M. Egloffstein. 2020. "Development and Implementation of a Maturity Model of Digital Transformation." *Technology Trends* 64 (2): 302–309. <https://doi.org/10.1007/s11528-019-00457-4>.
- Ifenthaler, D., S. Hofhues, M. Egloffstein, and C. Helbig. 2021. *Digital Transformation of Learning Organizations*. Springer Nature. <https://doi.org/10.1007/978-3-030-55878-9>.
- Kolog, E. A., S. B. Egala, R. Amponsah, S. N. O. Devine, and E. Sutinen. 2022. "COVID-19 Pandemic: How Can the Lessons Learnt Contribute to the Digital Transformation of Schools of Tomorrow?" *International Journal of Technology Enhanced Learning* 14 (2): 142–162. <https://doi.org/10.1504/IJTEL.2022.121814>.
- König, J., D. J. Jäger-Biela, and N. Glutsch. 2020. "Adapting to Online Teaching During COVID-19 School Closure: Teacher Education and Teacher Competence Effects Among Early Career Teachers in Germany." *European Journal of Teacher Education* 43 (4): 608–622. <https://doi.org/10.1080/02619768.2020.1809650>.
- Lai, K. W., and K. Pratt. 2004. "Information and Communication Technology (ICT) in Secondary Schools: The Role of the Computer Coordinator." *British Journal of Educational Technology* 35 (4): 461–475. <https://doi.org/10.1111/j.0007-1013.2004.00404.x>.
- Leon-Jariego, J. C., F. P. Rodriguez-Miranda, and F. J. Pozuelos-Estrada. 2020. "Building the Role of ICT Coordinators in Primary Schools: A Typology Based on Task Prioritisation." *British Journal of Educational Technology* 51 (3): 835–852. <https://doi.org/10.1111/bjjet.12888>.
- Lim, W. M., A. Gunasekara, J. L. Pallant, J. I. Pallant, and E. Pechenkina. 2023. "Generative AI and the Future of Education: Ragnarök or Reformation? A Paradoxical Perspective from Management Educators." *International Journal of Management Education* 21 (2): 100790. <https://doi.org/10.1016/j.ijme.2023.100790>.
- Lønnum, M., and T. Kringstad. 2021. "Hvilke forhold påvirker lærerspesialistens arbeid? En Nærstudie av 25 logger skrevet av lærere på videreutdanning for lærerspesialister i norsk." *Nordisk tidsskrift for utdanning og praksis* 15 (2). <https://doi.org/10.23865/up.v15.2549>.
- Mangin, M. M., and S. R. Stoelinga. 2008. "Teacher Leadership: What it is and Why it Matters." In *Effective Teacher Leadership: Using Research to Inform and Reform*, edited by M. M. Mangin and S. R. Stoelinga, 1–9. Portland: Teachers College Press.
- Margolis, J. 2012. "Hybrid Teacher Leaders and the New Professional Development Ecology." *Professional Development in Education* 38 (2): 291–315. <https://doi.org/10.1080/19415257.2012.657874>.
- McDonagh, A., and O. McGarr. 2015. "Technology Leadership or Technology Somnambulism? Exploring the Discourse of Integration Amongst Information and Communication Technology Coordinators." *Irish Educational Studies* 34 (1): 55–68. <https://doi.org/10.1080/03323315.2015.1010292>.
- McGarr, O., and A. McDonagh. 2013. "Examining the Role of the ICT Coordinator in Irish Post-Primary Schools." *Technology, Pedagogy & Education* 22 (2): 267–282. <https://doi.org/10.1080/1475939X.2012.755132>.
- Rodríguez-Miranda, F. P., F. J. Pozuelos-Estrada, and J. C. León-Jariego. 2014. "The Role of ICT Coordinator. Priority and Time Dedicated to Professional Functions." *Computers & Education* 72: 262–270. <https://doi.org/10.1016/j.compedu.2013.11.009>.
- Roumbanis Viberg, A., K. Forslund Frykedal, and S. Sofkova Hashemi. 2023. "The Teacher Educator's Perceptions of Professional Agency—A Paradox of Enabling and Hindering Digital Professional Development in Higher Education." *Education Inquiry* 14 (2): 213–230. <https://doi.org/10.1080/20004508.2021.1984075>.
- Shamir-Inbal, T., J. Dayan, and Y. Kali. 2009. "Assimilating Online Technologies into School Culture." *Interdisciplinary Journal of E-Learning and Learning Objects* 5 (1): 307–334.
- Skues, J. L., and E. G. Cunningham. 2013. "The Role of E-Learning Coaches in Australian Secondary Schools." *Journal of Computer Assisted Learning* 29 (2): 179–187. <https://doi.org/10.1111/j.1365-2729.2012.00488.x>.
- Tømte, C. E., M. M. Bugge, S. Wollscheid, and F. F. Vennerød-Diesen. 2020. "Ready to Go? Schools' Preparedness for Teaching and Learning within a One-To-One Program." In *Responsible Design, Implementation and Use of Information and Communication Technology*, edited by M. Hattingh,

- M. Matthee, H. Smuts, I. Pappas, Y. Dwivedi, and M. Mäntymäki, 569–580. Cham: Springer. https://doi.org/10.1007/978-3-030-44999-5_47.
- Tømte, C. E., C. Pedersen, F. F. Vennerød-Diesen, and S. Daus. 2023. "Early and Late Adopter Effects Between Schools in a One-To-One Computer Initiative." *Computers & Education* 207:104927. <https://doi.org/10.1016/j.compedu.2023.104927>.
- Top, E., M. D. Gurer, D. Baser, S. Akayoglu, and R. Akkus. 2021. "One-On-One Technology Mentoring for In-Service Teachers: The Experiences of Future ICT Coordinators." *International Journal of Technology in Education* 4 (4): 847–869. <https://doi.org/10.46328/ijte.104>.
- Vähäsantanen, K. 2015. "Professional Agency in the Stream of Change: Understanding Educational Change and Teachers' Professional Identities." *Teaching & Teacher Education* 47:1–12. <https://doi.org/10.1016/j.tate.2014.11.006>.
- Vygotskiï, L. S. 1997. *The Collected Works of L. S. Vygotsky: The History of the Development of Higher Mental Functions*. Vol. 4. New York and London: Springer Science & Business Media.
- Wollscheid, S., C. E. Tømte, H. Flittig-Aardalen, K. Vaagland, and F. F. Vennerød-Diesen. 2021. "A Balancing Act: Perceptions of How Teachers in Norwegian and Mathematics Combine Digital and Analogue Devices." *Nordic Journal of Digital Literacy* 3 (4): 102–114. <https://doi.org/10.18261/issn.1891-943x-2021-03-04-02>.
- Woo, D. 2020. "The Leadership of ICT Coordinators: A Distributed Perspective." *Educational Management Administration & Leadership*. <https://doi.org/10.1177/174114322097971>.