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Simona Bernotaite

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Teachers' pedagogic knowledge in the digitalization of curriculum support

Simona Bernotaite

Department of Education, University of Oslo, Oslo, Norway

ABSTRACT

Digitalization in education and the continuously growing presence of digital curriculum instruments have been approached as networked governance with a focus on private commercial actors. By comparison, teachers have been perceived as mere users of the digital instruments provided to support them. This study explores the Norwegian Knowledge Promotion reform as a translation of the policy intention to support teachers' local curriculum work into a digital Curriculum Planning Tool (CPT) with a particular focus on teachers' pedagogic knowledge. The findings illustrate how the Norwegian Directorate for Education and Training emerges as a boundary actor by delegating to other actors the activities of research and evaluation, consultation and conducting collaborative service design and development of the CPT. Through collaborative practices, teachers' experiential knowledge contributed to the problematization of the lack of curriculum support, consultation with private consultancy companies that developed the CPT and adjustments to the CPT rather than to the decision-making about digital curriculum support. The network of digital curriculum support making emerges through an entanglement between the programmatic discourse of national curriculum making and practical discourse consisting of local curriculum work, blurring their boundaries and shaping a new space of networked governance.

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Introduction

Various policy instruments have been imported and used as the state undergoes restructuring, moves towards becoming a regulatory state, and/or adopts neoliberal ideas (Lascoumes & Le Gales, 2007). Policy instruments, such as legal documents, software or support materials, are technical and social devices organizing specific relations between the state and other actors. In national education policymaking, curricula are one of the central authoritative instruments that state authorities use to govern school organizations, content, teachers' work and students' learning (Karseth & Sivesind, 2009). Contemporary curriculum making is based on the introduction of digital policy instruments which are an effect of changing governing structures while they also change governance processes. This digital curriculum transformation happens through relations between various actors rather than through an automatic diffusion of technology operationalizing policy ideas across the system of education (Landri & Gorur, 2021; Lascoumes & Le Gales, 2007). These can be recognized as relations between actors at a programmatic level where curricula are made by negotiating the political, public and pedagogic expectations (Hopmann, 1999, 2023). Through these relations, diverse actors are afforded participation opportunities, resulting in the emergence of varied forms of knowledge that

CONTACT Simona Bernotaite simona.bernotaite@iped.uio.no Department of Education, University of Oslo, Oslo, Norway

shape digital technology. This article explores teachers' participation in digital curriculum support making to elucidate the entanglement of the teaching profession, technology and governance.

The existing research has predominantly examined the role of commercial actors as pivotal in curriculum making and the digital governance of education by shaping curriculum format, content and enactment. Commercial actors participate in the development of curriculum policies based on narratives of personalization, flexible learning, enterprise, technology and innovation (Williamson, 2012) or 'learning to code' (Williamson et al., 2019) and reconfigure curriculum objectives and syllabuses through the digital instruments they provide (Andreasson & Dovemark, 2013). Commercial actors have evolved into fundamental players in identifying educational problems and providing solutions (Ideland et al., 2021). Research studies have criticized this emergence of commercial actors in policymaking through a combination of business and political interests (Jobér, 2023) and have defined this development as the hidden privatization of, in and through education (Ball, 2009).

The proliferation of commercial actors in curriculum development and digitization may also contribute to the marginalization or exclusion of teachers. Both political and commercial discourses on digital learning and technologies position teachers as the receivers of useful tools (Selwyn, 2007) and compliant users of technologies, which McGarr and Engen (2022) have called 'bypassing' mechanisms. Haugsbakk's (2011) study of Norwegian curricula and governmental papers demonstrated a gradual shift in the perception of teachers from being key actors defining premises for new technology development to being the mere recipients of ready-made solutions. Despite being invited to policy spaces with commercial actors and policymakers, teachers are expected to promote technology in their schools instead of contributing to policy development (Player-Koro et al., 2017). Research has revealed tensions when digital instruments are imposed on teachers through top-down approaches rather than bottom-up approaches enabling teachers' ownership of the instruments (Masterman, 2020).

Amidst increased curriculum digitization and the involvement of private actors, it becomes imperative to explore changing teachers' professional roles. Transnational organizations support increased teacher involvement in curriculum digitalization (see e.g. OECD, 2020). Research also encourages examining the ways, times and spaces in which teachers are significant actors in curriculum making (see e.g. Alvunger et al., 2017). This study explores Norwegian curriculum renewal (LK20) to demonstrate how teachers' pedagogic knowledge encompassing didactic and educational experiences contributes to curriculum support digitalization. This case is particularly interesting because Norway is among the few countries that have a digitized curriculum (OECD, 2020) and teacher involvement in curriculum making was an essential condition for the renewal of the Norwegian curriculum (Ministry of Education and Research, 2016). Multiple collaborations, consultancies and partnerships between public and commercial actors and teachers throughout the curriculum renewal offer an opportunity to explore new dimensions of education governance.

This study aims to explore the entanglement of the teaching profession, technology and governance in curriculum support digitalization and poses the following research questions:

RQ1: How is curriculum policy translated into a digital instrument for curriculum planning through relations between different actors?

RQ2: How does pedagogic knowledge contribute to the development of a digital instrument for curriculum planning?

This study employed actor—network theory to guide data collection and analysis. The central premise of actor—network theory is to follow the actor without predetermined analytical schemes (Callon, 2001; Latour, 2005), which led to an extensive internet search conducted in 2021–2022. The dataset comprised evaluation reports, green papers, white papers, curriculum renewal project documentation and informational articles from the website of the Norwegian Directorate for

Education and Training (the Directorate). In addition, other digital documents from events, communications, information sharing and invitations were collected. The data analysis was based on the concept of *translation* which focuses on occurrences, or events where actors try to associate with one another (Landri & Gorur, 2021). The main focus of the analysis was on occurrences where teachers' pedagogic knowledge emerged in the digitization of curriculum support.

This paper is organized into five sections. The first section clarifies the concepts of curriculum making and network governance focusing on the teaching profession. This is followed by a brief contextual presentation of Norwegian curriculum digitalization. Methodological considerations and decisions are outlined in the third section, followed by the findings that present a network of digital curriculum support making and particularly practices through which teachers' pedagogic knowledge contributes to the development of the Curriculum Planning Tool. Finally, the paper concludes with a discussion of the relation between governance, the teaching profession and technology.

The teaching profession and curriculum making

Rather than approaching curriculum making as a linear process of recontextualization, the research explores curriculum making as a work across the policy, programmatic and classroom areas (Deng, 2022). Hopmann (1999, 2023) discussed the political level that sets the framework for curriculum making, the programmatic level where the curriculum is made and the practical level of lesson planning. In the context of this study, the programmatic level is particularly interesting because, during this level of curriculum making, curriculum support materials are developed. At the programmatic level, curriculum making means balancing political concerns and public expectations while using pedagogically sound methods that are widely accepted by the pedagogical profession (Hopmann, 1999, 2023). For insights into the arrangement of relations between various actors with different intentions for and interests in curriculum making, the licence model identified by Hopmann (1999, 2023) is relevant to the context of this study.

Dividing the labour between the planning of teaching, or curriculum making, and the planning of lessons is the main principle of the licence model (Hopmann, 1999, 2023). The division of labour in this model identifies the roles of various actors in curriculum work. In the licence model, the planning of lessons is restricted by subject-specific requirements set by the curricula while providing teachers with methodological freedom (Hopmann, 1999, 2023). In other terms, the licence model ensures teachers' autonomy in teaching practice within the boundaries of the national curriculum (Hopmann, 1991). This means that national actors responsible for curriculum making refrain from participating in the planning of lessons or local curriculum work. However, Hopmann (2023) discusses a noticeable move of actors from national curriculum making to local curriculum work in the past three decades due to an emerging system of mediating activities such as further training for teachers and the development of recommendations, teaching models and other support materials. Contemporary developments in curriculum making with digital curriculum support materials can be understood as a movement between the programmatic level of curriculum making and the practical level because support instruments touch upon teachers' autonomy in the planning of lessons. Such developments demonstrate that the relations between actors determined by the division of labour in the licence model are changing.

The change in actor relations of curriculum making, traditionally ordered through the licence model, can be approached through the lens of networked governance. Within a decentralized system of education, the need for more support for curriculum work is often provided through digital instruments developed by commercial actors. Contrary to the division of labour between different actors in curriculum making (Hopmann, 1999, 2023), in networked education governance, government delegates state work through relations and responsibilities to commercial and other actors that provide advice, evaluations, service and technology (Ball, 2009). Networked governance depends on the government's capability to use decentralized governance strategies, tools and work processes that organize actors from public and private arenas into partnerships

and collaborations instead of in a hierarchical and bureaucratic education system (Ball, 2009; Paulsen, 2019; Williamson, 2013). Within networked governance, the role of private commercial actors is often the main focus in understanding education governance. For instance, studies from Sweden (Ideland et al., 2021) and the UK (Selwyn, 2007) demonstrate the extensive production of documents by government and private commercial actors promoting educational technology as solutions for educational issues, establishing 'edupreneurial' actors as an essential part of the education system.

Parallel with changing public—private relations, teachers' participation in curriculum making and the development of curriculum instruments is changing. An ongoing discussion in education governance revolves around the issue of teachers' expertise and the boundaries within which teachers' knowledge becomes relevant (Gerrard & Holloway, 2023). Such discussions are vital in defining teachers' position in curriculum making and the development of curriculum instruments. As Kirk and MacDonald (2001) asserted in their study of two Australian curriculum development projects, the teachers' ownership of curriculum innovations depends on their position in the curriculum reform integrating top-down and bottom-up strategies, partnerships and collaborative relations. Cross-boundary collaboration between the public sector and communities is a strategy to facilitate community empowerment through participation in public governance and stimulate innovation (Ansell & Torfing, 2021).

Concurrently, teacher participation in curriculum making and the development of curriculum instruments presents opportunities to align the instruments with teaching practices. Nilsson and Lund (2023) have emphasized the significance of collaborative settings in developing curriculum instruments, which enhance teachers' pedagogical, content and technological knowledge and facilitate the integration of this knowledge into their teaching practices. Pozzi et al. (2020) acknowledged the balance between understanding teachers' practice and challenging the practice in the development of more effective curriculum instruments and enhancing digital practices. For instance, such practice enhancement is possible through digital instruments that are based on theory (Laurillard et al., 2013) or technology that opens other possibilities for practice (Conole, 2013).

Studies have identified challenges related to cross-boundary curriculum making when teachers act as co-designers of software. For instance, Penuel et al. (2007) concluded that collaboration between teachers and software developers is complicated and undemocratic. Software developers found it challenging to find a common understanding of teaching practices and teachers' requirements for the instrument while teachers experienced their role as focused on testing the instrument and giving feedback on it rather than designing the instrument.

Moreover, the issue of power and the role of decision-making are important in networked curriculum making. Cross-boundary collaborations are bound by institutional contexts, and they become instruments of subtle education regulation, changing relations between policymakers, education professionals, private companies, interest organizations and even pupils (Griffiths et al., 2009). Actors such as teachers might have a role to contribute to decisions concerning new policies through various collaborative activities without necessarily being a part of the decision-making (Ansell, 2012). Gerrard and Holloway (2023) in their work on teachers' professional expertise have claimed that, despite consultations with teachers and teachers' involvement in debates about educational issues related to teachers' practice, it is governments that make decisions. As illustrated by Finnanger and Prøitz (2024), even a national strategy to ensure the extensive involvement of teachers in curriculum making might lead to national curricula that omit teachers' suggestions on content. An Australian study by Griffiths et al. (2009) illustrated that partnerships are established with specific collaboration agendas, allowing government actors to assert control over policy agendas and partnership structures by empowering certain actors and excluding others. Policy partnerships might serve as a legitimization strategy to promote specific policies and create the image of a bottom-up reform process (Griffiths et al., 2009). Hence, teachers in curriculum making partnerships may lack decision-making control and have predefined roles set by the initiating government actor.

In summary, approaching curriculum making from the perspectives of the licence model (Hopmann, 1999, 2023) and networked governance (Ball, 2009; Williamson, 2013) provides insights into relations between different actors, and more particularly the role of teachers' pedagogic knowledge in curriculum making. The cross-boundary movement of actors traditionally divided by the licence model (Hopmann, 2023) establishes new relations in curriculum making that can be explored as networked governance focusing on fluid relations that change and move in curriculum making. Exploring this movement of actors across boundaries established by the licence model as networked governance can unveil a nuanced complexity where the division of labour set by the licence model might become less distinct and actor roles might be transformed. Simultaneously, the network itself can be shaped by the traditional division of labour of curriculum making and actor roles that derive from the licence model. This study approaches such transformations as the translation of digital curriculum support in the renewal of the Knowledge Promotion reform (LK20) in Norway.

Digital curriculum support in the renewal of the Knowledge Promotion reform

The renewal of the Norwegian curriculum was proposed a decade after the introduction of the Knowledge Promotion reform (LK06) to respond to current changes in education and create a better connection between different parts of the curriculum (Ministry of Education and Research, 2016). The renewed national curriculum of the Knowledge Promotion reform (hereafter LK20) was published as a web page that enables teachers to examine the curriculum digitally, switch between different components of curriculum text and access explanations. In addition, it offers a Curriculum Planning Tool that enables teachers to plan teaching with core curriculum and subject curricula as a basis. Within this instrument, teachers can access a variety of functions such as sorting and using different parts of a curriculum, commenting on it, planning teaching for a school subject and across different subjects, collaborating with others and sharing teaching plans with pupils and their parents (Norwegian Directorate for Education and Training, 2021).

Several evaluations of the LK06 reform problematized the provided guidance or lack of it for teachers working with the local enactment of the curriculum (Aasen et al., 2012; Engelsen, 2008; Hodgson et al., 2010; Møller et al., 2009; Ottesen & Møller, 2010; Rødnes & de Lange, 2012; Solstad, 2009; Solstad et al., 2012). Furthermore, the need for support for curriculum work was discussed in White Paper 28, *Subjects, In-Depth Learning—Understanding. A Renewal of the Knowledge Promotion Reform* (Ministry of Education and Research, 2016). However, Karseth (2022) has noted that while White Paper 28 requested some guidance developed in parallel to the national curriculum, it did not specify the development of a digital curriculum with an integrated Curriculum Planning Tool. The White Paper 28 stipulates that curriculum renewal is a collaborative process with professionals, teacher communities and their representatives, school leaders and school owners (Ministry of Education and Research, 2016). The collaboration is expected to contribute to the legitimacy of the renewal, ensure local ownership of the curriculum and prepare teachers for changes. Although LK20 curriculum development is described in some detail, White Paper 28 does not specify how curriculum and support should be digitized or which actors will participate in the process. Hence, to understand how curriculum policy was transformed into a digital instrument for curriculum planning, this article approaches curriculum making as translation through relations between various actors, particularly focusing on practices where teachers' pedagogic knowledge shaped the Curriculum Planning Tool.

Translating digital curriculum support into an instrument

In studies on education reforms, the concept of *translation* refers to tracing how introduced practices or technologies transform from foreign and incompatible with the existing condition into new norms of education practice (Fenwick, 2012). Through translation, digital curriculum technologies become

mobilized as an accepted part of the teaching planning process. The concept of translation addresses the network construction process and enables the analysis of how different human and nonhuman actors come into existence, expand or gain power within a network (Latour, 2005). In this study, the concept of translation allows exploring how an educational issue, or rather a solution to an identified issue, is translated into a digital instrument for curriculum support.

This kind of exploration entails focusing on complexities which lead actors into coexistence rather than explaining them as causality-related arrangements of relations between actors (Latour, 2005). The analysis of translation focuses on explaining how new actors are created and how differences between various actors are reconciled (Hamilton, 2012). In addition to complexities and tensions emerging during the process, the concept of translation contributes to insight into non-linear or unpredictable changes (Landri & Gorur, 2021). As in the above-described Norwegian context, a policy does not necessarily prescribe specific technological innovations to be developed and implemented. Instead, such technologies emerge and transform through actor relations into unplanned or unforeseen actors that perform specific functions and shape actor relations. According to Elmholdt and Ratner (2021), the translation of digital instruments can be analysed by exploring transformations, negotiations, interests and visions that were a part of the development process. Hence, through translation, it is possible to trace how a policy intention to support teachers in local curriculum work was transformed into a digital curriculum support instrument.

The analysis of translation in this article is based on Callon's (2001) model *moments of translation*. Callon identified four moments of translation that are concerned with different points of transformation: problematization, interessement, enrolment and mobilization.

During problematization, an issue that needs a solution is defined and actors that are necessary for a network are identified. During problematization, it becomes clear how it is in the interests of each actor to engage in the network and solve the issue (Callon, 2001). Landri and Gorur (2021) explained this as 'the interdefinition of actors in the processes of making alliances'. Hamilton (2012) described problematization as hypothetical because a project or an instrument exists only as a technical description, an intention or even as an imaginary.

Activities or strategies utilized by an actor or a group of actors in an attempt to stabilize actors' identities defined during problematization are part of interessement (Callon, 2001). In education, reforms and the introduction of new programmes for practices, instruments and other measures are recognized as such strategies. According to Callon (2001), this list is unlimited and anything that is deemed as fitting the issue might be included. In this process, not only potentially competing relations are eliminated but some relations might be weakened or cut where certain actors initially identified during problematization might leave the network (Callon, 2001; Landri & Gorur, 2021).

Successful interessement through a variety of negotiations, power competitions or acts results in enrolment (Callon, 2001). In some cases, enrolment happens through persuasion and negotiations, while in others proposed strategies of interessement are accepted unconditionally. Enrolment can be explained as the acceptance of interessement strategies (Landri & Gorur, 2021) and includes the solution to an issue and actors' roles defined through negotiations.

Callon (2001) defined the mobilization of allied entities as a process of making all entities mobile in a way that was previously unachievable. In other words, the innovation becomes a part of an established practice (Fenwick, 2012). That implies that transformations have happened, and a new reality is formed. A network of actors is created where translation constrains and limits their identities to make the network durable (Landri & Gorur, 2021).

While the above-explained moments of translation are presented in a linear manner that might suggest that translation starts with problematization and ends in modification, it is a fluid process where transformations or movements of aims, interests and actors are happening continuously (Callon, 2001). Following an education reform and reading it through the moments of translation might reveal the complexity of the reform as continuous, interchangeable movements between these four moments of translation. Translation reveals how reform ideas and actor identities can be continuously negotiated, redefined, accepted and potentially redefined again.

Table 1. Data summary.

Document Type	Number
Green paper	2
White paper	5
Recommendation	1
Hearing letter	38
Report	22
Strategy document	8
E-communication	5
Meeting/course programme or note	5
Video	6
Website page	8

Data collection and analysis

Data collection was accomplished by following the actors without predetermined schemes (Callon, 2001; Latour, 2005), an approach in actor-network theory that imposes two important conditions. First, it was imperative to identify an actor to follow. Any technological project begins as an idea or intention that does not yet exist until it transforms through relations of actors into a digital technology (Hamilton, 2012; Latour, 1996). At the initial data collection stage, the identified actor was the intention to support teachers in local curriculum work which moved through different actor relations and translated into the digital CPT. During curriculum renewal, various documents mentioned different forms of support, hence, it was crucial to restrict data collection only to instances of support for local curriculum work that was the actor followed in this study. This leads to cutting the network as the second important aspect of data collection.

Inspired by Ball's (2016) network ethnography, internet searches were conducted to collect documents revealing relations that were a part of events, histories and exchanges of network activities. While network cutting is often decided before a study, further cuts might be necessary depending on the collected data (Decuypere, 2020). In this study, collected data were sorted and reconsidered repeatedly to cut the network only to relations of digital curriculum support making. This required reading and rereading of collected documents interrogating whether the support which was a part of the document concerned local curriculum work and paying attention to relevant words such as 'local curriculum work' or 'curriculum guidance', examples and discussions about support given in the documents. In this way from a large pool of data, only documents containing the intention to support local curriculum work and describing the development of the CPT were selected. The study is based on 100 documents and videos (Table 1) spanning the period from 2008 to 2023.

The following categories were used to systematize the collected data: document type, actors, (types of) relations and moment of translation. These were supplemented with thick descriptions of the relations. Many of the collected documents were extensive and concerned a wide range of curriculum issues. Only relevant parts related to the support of curriculum work were analysed. The Gephi programme was used to visualize the network. The default layout algorithm ForceAtlas2 which places nodes representing each actor depending on the relations between them (Jacomy et al., 2014) was selected to create network visualization.

The analysis was a constant movement between the visualization that revealed clusters of actors and actor relations and thick descriptions of these relations. First, the analysis comprised the entire network to explore emerging boundary actors. Then, based on the aim to explore the entanglement of the teaching profession, technology and governance, the analysis followed teachers and explored relations that revealed how teachers participated in the translation of the CPT. The analysis focused on changed or new actor relations to examine teachers' participation and shifts in their participation during or between the moments of translation.

Translating the lack of curriculum support into a digital curriculum planning tool

The first part of the analysis focused on exploring how the need for curriculum support is translated into a digital instrument for curriculum planning through relations between different actors. The network analysis revealed the entanglement of various actor relations through moments of translation, as illustrated in Figure 1. Organizing the relations into moments of translation reveals how actors join and leave the network at different stages of the digital curriculum support making. This demonstrates the fluidity of the network.

First, Figure 1 visualizes a dense cluster of various interest actors at the moment of interessement. Although not directly involved in the making of digital curriculum support, the visualization includes the 'hearings' of the recommendations for the curriculum renewal in the Green Paper *The school of the future: Renewal of subjects and competences* (NOU, 2015, p. 8) as the process was open for public debate. Such hearings fall under what Hopmann (2023) identified as a political discourse that enables maintaining the perception of curriculum making as a public matter through political and public discussions of general matters while leaving concrete curriculum decisions closed to the public.

Of the 184 submitted hearing letters, 38 commented directly on the proposal to develop guidance materials that are well integrated with curricula and to develop them in parallel. The analysis of the hearing letters demonstrates that many actors support the proposal; however, attempts to negotiate the making of curriculum support also emerged. Among the negotiations, the role of curriculum support materials in reshaping the relation between national education authorities and teachers that are *licensed* to the autonomous use of the

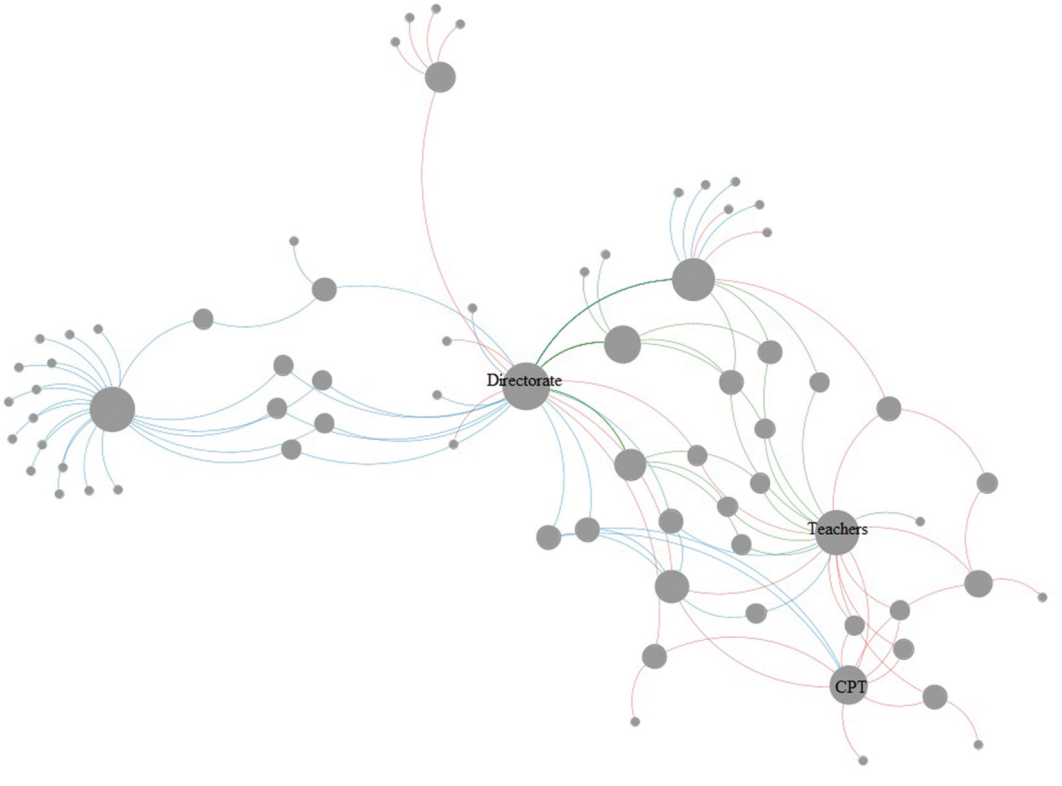

Figure 1. Actor relations in the translation of the digital curriculum planning Tool. The colour green is used to illustrate problematization, blue indicates interessement and red indicates enrolment.

national curriculum (Hopmann, 1991) emerged as an issue. Some actors (i.e. Eidsberg municipality, Aust-Agder and Finnmark county governors) suggested support materials, local meetings and communication with school leaders to increase the governing of local curriculum work, while other actors (i.e. the Faculty of Educational Sciences at the University of Oslo, Oslo and Akershus University College) cautioned against restricted local autonomy. Moreover, through the hearings, some actors (i.e. The Norwegian Association of Local and Regional Authorities, Stord/Haugesund University College, the Norwegian Association of School Leaders) negotiated teachers' place in the development along with national education authorities. As the preceding examples highlight, negotiations were not particularly concerned with the specifics of the curriculum support but rather with broader issues of curriculum making, such as teachers' autonomy and the presence of teachers' expertise in curriculum support making.

Contrary to interest actors, that emerged only during the moment of interessement, the Directorate appears in all moments of translation of curriculum support into a digital CPT. Decuypere (2020) defined such actors as boundary actors that become important or gain authority because other actors relate to them instead of defining their importance through their position in the bureaucratic hierarchy. Their significance is observed both when many relations to other actors are identified and through their role in these relations.

In the period 2006–2012, the Directorate commissioned several research institutions and research projects in the higher education sector to conduct an extensive evaluation of the LK06 (Norwegian Directorate for Education and Training, 2012) that were an essential part of problematization. During interessement, the Directorate assigned the Nordic Institute for Studies of Innovation, Research and Education to conduct a survey, also known as the Directorate's queries (Norwegian: *Utdanningsdirektoratets spørringer*), and explore school owners' and school leaders' perceptions of functionality and possibilities of providing support on the Directorate's official website (Federici et al., 2017).

At the same time as seeking knowledge about schools' needs for curriculum support, the Directorate positioned itself as a provider of curriculum support through its official website. This position was maintained when the CPT was developed and made available for use during enrolment. Instead of solely relying on school owners to inform teachers, the Directorate used social media to communicate with teachers directly. The Directorate also provided a designated email address for teachers to send feedback on the CPT and contribute to its further adjustments. The Directorate also reported on conducted and planned updates of the instrument on its official website (Norwegian Directorate for Education and Training, 2021).

Moreover, the Directorate participated in various collaborative practices directly related to the development of the CPT. Once responsibility for the reform was delegated to the Directorate, contracts were signed with several commercial actors to conduct a collaborative service design and develop other measures to support schools and teachers in curriculum work. One of the private consultancy companies, Comte Bureau, organized a series of seminars and user workshops with activities involving various actors, such as teachers, instructors, school leaders, school owners, Directorate and Ministry representatives, as well as researchers. The project report after the seminars and workshops reveals negotiations between participating actors to ensure the status of the renewed curriculum as a legal document while digitalizing it to provide support and governance for the school sector (Comte Bureau & Norwegian Directorate for Education and Training, 2018, p. 12).

The above-described relations reflect the networked governance of curriculum support making where the government delegates state work to commercial actors to provide advice, evaluations and services such as seminars and technology development (Ball, 2009; Paulsen, 2019; Williamson, 2013). Within this network, the Directorate emerged as a boundary actor through practices that delegated various roles of providing knowledge, organizing collaborative seminars or curriculum support making to other actors. Through delegated activities, different

forms of knowledge were also governed in the making of digital curriculum support. This raises an important issue of what knowledge is essential in making digital curriculum support instruments.

The analysis revealed different knowledge emerging through the moments of translation. For instance, various surveys and reports produced by actors from the field of research were part of the problematization and enrolment. These surveys and reports rely on teachers' expertise regarding local school contexts and curriculum work collected, analysed and synthesized by researchers. This can be perceived as the transformation of teachers' pedagogic knowledge into evidence that legitimizes specific innovations as digital instruments or reform processes. During interessement other actors emerged as providing knowledge for curriculum support making. White Paper 28 for curriculum renewal LK20 contributed to the stabilization of actor relations in the network and other Green and White Papers legitimized the curriculum renewal LK20. This aligns with research conducted by Baek et al. (2018) which characterized the LK20 reform as relying on highly specialized, non-academic or non-peer-reviewed knowledge. The shift in actors contributing evidence during problematization and enrolment, in comparison to the moment of interessement, highlights how different knowledge emerges as significant during moments of translation of curriculum support into a digital CPT.

To explore the above, this study further focused on teachers' pedagogic knowledge and the practices through which this knowledge emerged in digital curriculum support making. Contrary to previous research (Haugsbakk, 2011; McGarr & Engen, 2022; Selwyn, 2007) demonstrating that teachers have a rather marginal role in curriculum digitalization, this study further focuses on teachers as boundary actors whose pedagogic knowledge emerged throughout all moments of translation. Hence, practices through which teachers and their pedagogic knowledge emerge in digital curriculum support making require greater attention to understand the governing of teachers' profession.

Teachers' experiences as problematization

The moment of problematization emerged through White Paper 31 (2007–2008) *Quality in School* (Ministry of Education, 2008) which identified a gap between expectations and the limited capacity of teachers and school leaders to respond to these expectations without proper support from school owners. White Paper 31 defines the role of teachers as actors of the curriculum in need of support through instruments provided by the Directorate on its website (Ministry of Education, 2008). This aligns with Haugsbakk's (2011) findings revealing that curriculum policies define teachers as mere recipients of ready-made instruments.

Reports from extensive evaluations of the LK06 reform (Norwegian Directorate for Education and Training, 2012) where researchers analysed national, regional and local documents and conducted interviews and surveys with various actors, including teachers, gave voice to teachers' experiences in the problematization of lacking support for local curriculum work. The 'experiential knowledge' (Gerrard & Holloway, 2023) that teachers gained through practical work with the LK06 curriculum became an important aspect defining teachers' professional expertise and their participation in the network of digital curriculum support making. The analysis of the reports identified two types of teachers' pedagogic knowledge contributing to the problematization.

First, teachers' experiences in the analysed evaluation reports related to teachers' knowledge about the requirements for support, including, for instance, issues such as the timing of curriculum support that should be given as early in the reform as possible (Engelsen, 2008; Møller et al., 2009; Solstad, 2009; Solstad et al., 2012). Teachers also shared their knowledge about other support materials, such as subject books, that are used for local curriculum work (Rødnes & de Lange, 2012). Moreover, teachers' experiences in the evaluation reports were concerned with available support materials that did not reflect school conditions and school language, situations and available time (Engelsen, 2008; Hodgson et al., 2010; Ottesen & Møller, 2010).

The second type of teachers' knowledge refers to local working conditions, specifically the barriers that hinder the adoption of available curriculum support materials. One specific experience was related to teachers' lack of time to keep updated with changes in the curriculum support published on the Directorate's website (Ottesen & Møller, 2010). Furthermore, one of the evaluation reports (Hodgson et al., 2010) identified teachers' experiences with lacking digital skills that restrict their use of digital curriculum support resources.

Through the LK06 evaluation, teachers' pedagogic knowledge emerged within the network of digital curriculum support making during the moment of problematization. As the above examples illustrate, the 'experiential knowledge' (Gerrard & Holloway, 2023) at the moment of problematization is based on teachers' pedagogic knowledge about the requirements for curriculum support materials and more general issues related to the teaching profession. This reflects the licencing approach to curriculum making (Hopmann, 1991), where teachers have autonomy in local curriculum work, and thus they are perceived as having knowledge based on their experience.

Teachers consulting consultants

The beginning of *interessement*, where the stabilization of actors' identities in the network takes place, can be considered as the appointment of the Ludvigsen Commission. This commission provided recommendations for the renewal of the Norwegian curriculum in Green Paper 2014:7 *Pupils' Learning in the School of the Future: A Knowledge Base* and Green Paper 2015:8 *The School of the Future: Renewal of Subjects and Competencies*. These Green Papers highlighted the importance of nationally designed curriculum support (2014, p. 96; 2015, p. 66). The suggested support was based on a 'three-part model consisting of statutory national subject curricula, nationally designed guidance resources and other supporting material' (2015, p. 74).

After open hearings involving a political discourse to ensure the perception of curriculum making as a public matter (Hopmann, 2023), the Green Papers were followed by White Paper 28. The White Paper described curriculum support materials as part of local curriculum work and inspiration or help for teachers in teaching planning by supplementing curricula with teaching content examples, methods, learning activities and assessment in different subjects (Ministry of Education and Research, 2016, p. 46). While this description relates to the practical discourse about local lesson planning (Hopmann, 2023), teachers' role in the development of such curriculum support materials was only addressed during parliamentary discussions. Parliament's Church, Education and Research Committee stressed the importance of 'collaboration with teacher and school management organisations, to assess what the sector needs in the local work with curriculum, and to prepare support material/guidelines to facilitate this work' (Church, Education and Research Committee, 2016). Later in the interessement, the Norwegian Association of Graduate Teachers, the Norwegian Association of School Leaders, the Norwegian Union of School Employees, the Union of Education Norway and the Advisory Panel for Teacher Education were identified as relevant organizations for the development of curriculum support.

Teachers' participation in the curriculum support making changes with the Directorate's further follow-up of the curriculum reform. The Directorate's contracts with the Nordic Institute for Studies of Innovation, Research and Education to conduct surveys among school leaders and school owners and with commercial actors to provide collaborative service design and develop digital instruments opened a space for teachers' 'experiential knowledge' (Gerrard & Holloway, 2023). The survey mapped teachers' needs for more specific curriculum support types, for example, tips and advice for collaborative planning, instruments and charts for mapping and reflection on practice (Rogde et al., 2018). Activities organized by commercial actors, on the other hand, are particularly interesting because they opened a space for teachers' pedagogic knowledge in the discussions and making of the digital curriculum support instrument.

Seminars and workshops organized by Comte Bureau were a space for negotiations based on the expectations of teachers, instructors, school leaders and school owners for increased digital

technology possibilities. Despite that, the report produced after the negotiations proposed a limited selection of digital functions, such as the ability for teachers to turn on/off and to sort curriculum components (Comte Bureau & Norwegian Directorate for Education and Training, 2018, p. 12). Simultaneously, IT consultants from other consultant companies developed the CPT. A group of teachers participated as test users of the CPT and provided feedback about the digital curriculum support instrument before it was available to teachers across Norwegian schools. Teachers' pedagogic knowledge about teaching planning practice was essential in trying out the developed curriculum planning instrument and, according to the Directorate (Norwegian Directorate for Education and Training, 2021), finding mistakes in the instrument. This demonstrates that teachers were perceived as consultants for commercial actors developing the digital curriculum support instrument rather than participants in the development process. This aligns with earlier research (e.g. Haugsbakk, 2011; Selwyn, 2007) revealing teachers' position in the development of curriculum instruments as recipients of tools.

Such collaborative seminars, workshops and consultancy in the form of testing out digital instruments fall under what Lascoumes and Le Gales (2007) referred to as debates about instruments that can open spaces for short-term collaborations, negotiations and agreements while more problematic issues of policy instrumentation remain separate. These activities where teachers consulted commercial actors developing the CPT were conducted with a specific aim to balance political and public expectations in a manner that is pedagogically appropriate for the majority of the teaching profession on the programmatic level of the curriculum making (Hopmann, 2023). Hence, teachers' role in the above activities is to contribute to the alignment of the digital instrument with local curriculum practices under predefined institutional frameworks without necessarily participating in decision-making (Griffiths et al., 2009).

Redefining the CPT through teachers' feedback

The Directorate negotiated, promoted and employed different *enrolment* strategies to ensure that teachers use the developed digital CPT to support their local curriculum work. Teachers can access the CPT through the FEIDE[1] log-in solution which is provided to them by school owners. Thus, the first step of enrolment was the dissemination of information about the CPT and FEIDE to primary and lower secondary schools, municipalities, upper secondary schools and county municipalities. Informational emails were also sent to universities and colleges to reach student teachers and university or college employees. Various actors from the educational sector were engaged in communication about the CPT for successful enrolment.

When the CPT was introduced to Norwegian schools, the Directorate reached out to teachers through social media and designated an email address for CPT feedback. In this way, the Directorate could approach the local curriculum work practice or the practical discourse for the local planning of lessons (Hopmann, 2023). This enabled further alignment of the CPT with local curriculum work and provided insight into local curriculum work through teachers' use of the CPT and issues addressed in the feedback. The Directorate accounted for conducted and planned updates of the instrument on the official website (Norwegian Directorate for Education and Training, 2021). This type of collaboration between the Directorate and teachers creates a network of top-down and bottom-up strategies where teachers are invited to provide their feedback while the Directorate maintains the responsibility of decision-making. Hence, it is still the government actor that decides what teachers' pedagogic knowledge counts as important in the development of digital curriculum support instruments directed towards teachers' practice (Gerrard & Holloway, 2023). While teachers' feedback might vary greatly concerning different aspects of the CPT's functionality, an analysis of conducted adjustments reported by the Directorate reveals what pedagogic knowledge is perceived as important.

First, teachers' pedagogic knowledge of the school context and collaborative practices between teachers within a school is highlighted when the Directorate reports on the updates of the CPT. The

updates included a function that allows teachers to collaborate in teaching planning simultaneously which was initially restricted by the CPT functionality. Another update was to ensure the continuity of teaching planning and enable reusing the same plans even when a teacher who was the primary collaborator of the plan was removed from the CPT. Although the changes that enable collaborative planning activities were requested by the teachers, they also align with the intentions of the curriculum renewal LK20 to increase teachers' professional development through collaboration in local curriculum work (Ministry of Education and Research, 2016).

Another type of knowledge that emerges from the Directorate's account of feedback and the adjustments of the CPT is based on teachers' experiences of how teachers work with subject curricula and teaching planning. For instance, teachers requested an update of the CPT that gives them an overview of used subject curriculum parts. At first, the CPT included three separate parts designated for learning activities, learning resources and learning arenas. However, teachers commented that this division of teaching planning was not expedient. Finally, teachers requested the option to use different subject curricula in one teaching plan to adapt teaching to individual learners' needs or plan projects across a few classes.

In addition to illustrating what pedagogic knowledge was perceived as essential in the redefining of the CPT, the above feedback and adjustments demonstrate how digital technologies shape the sites where teachers' expertise is constructed and how that expertise is put to use (Gerrard & Holloway, 2023). Through the analysis of feedback, it is possible to see how the digital instrument limits teachers' teaching planning practice, and hence teachers' autonomy over local curriculum work where teachers are perceived as experts through licencing (Hopmann, 1991). At the same time, the introduction of the CPT as a curriculum support instrument shaped new relations between the Directorate and the teaching profession. The Directorate gained insight into previously hidden teachers' practices, while teachers were able to utilize their experiential knowledge by offering feedback and contributing to further development of the CPT.

Conclusion

This study presented an analysis of the renewal of the Knowledge Promotion reform (LK20) as translation of the intention to support teachers' local curriculum work into a digital Curriculum Planning Tool. Through the moments of translation, digital curriculum support making emerged as a network of actors related through different activities that contributed towards the translation of the CPT. Within the network, the Directorate emerged as a boundary actor by delegating various activities to other actors and shaping their roles in digital curriculum support making. Among such practices delegated by the Directorate to other actors were research and evaluation to provide legitimization of curriculum support materials, consultation and conducting collaborative service design and development of the CPT. These activities are part of decentralized governance strategies, tools and work processes that enable relations between various actors and shape networked governance (Ball, 2009; Paulsen, 2019; Williamson, 2013).

Moreover, teachers also emerged as boundary actors through activities where their pedagogic knowledge was essential to translate the intention to support local curriculum work into CPT. According to Gerrard and Holloway (2023), teachers' expertise is historically and socially defined and enacted through social, political and cultural arrangements. Approaching the CPT development through the moments of translation revealed how various activities arranged teachers' pedagogic knowledge in the translation of digital curriculum support, concurrently shaping teachers' professional identity. Teachers' experiential knowledge of local curriculum work was part of the problematization process that identified teachers' need for curriculum support. While private consultancy companies developed the CPT, teachers participated in activities where they provided consultants with the user's perspective. This aligns with previous research that demonstrated the perception of teachers' expertise as users of technology rather than active development partners (Haugsbakk, 2011; Selwyn, 2007). Finally, new relations emerged after the

introduction of the CPT when teachers were invited to provide feedback about the instrument based on their planning teaching practice. The relation between teachers and the Directorate was reshaped both through teachers' participation in the developed instrument and feedback and accounted adjustments to the instrument.

Research exploring educational reforms as networked governance stress the emerging fluidity and disorderliness of the policy networks which could also be seen through the moments of translation in this study. As described by Williamson (2013), curriculum is actively assembled, improvised and 'lashed up' from a messy and heterogeneous mix of people, groups, coalitions, organizations, institutional structures, each associated with different ideas, theories and knowledge; political, intellectual and historical associations; and a panoply of ongoing negotiations, decision making and compromises (p. 11). Although the messy network explored in this study can be perceived as a new arrangement of actors and relations, it is rather a rearrangement of previously established relations or governing practices. As Ball (2009) pointed out, the new networked governance does not eliminate conventional policy instruments but places them within the context of a network.

Such a new context of the network was also identified in this study. Through networked governance practices, teachers' pedagogic knowledge transformed from being solely attached to local curriculum work and moved from what Hopmann (1999, 2023) defined a practical discourse to the programmatic discourse of curriculum making. Nevertheless, practices where teachers participated and contributed their pedagogic knowledge to the development of the CPT were based on the licence model which perceives teachers as having curriculum work expertise (Hopmann, 1991, 2003). This demonstrates how teachers emerged in the programmatic discourse through the network, although their role remained defined as that of experts in the practical discourse. Therefore, the network of digital curriculum support making is an entanglement between the programmatic and practical discourses, blurring the boundaries between them and creating a new space of networked governance.

This study demonstrated that although teachers appear as boundary actors that are essential in the networked space of governance, their participation in various activities does not ensure the role of decision-makers (Ansell, 2012). Instead, such participation contributes to a feeling of ownership of digital technology (Masterman, 2020) and serves as a legitimization strategy creating a perception of a bottom-up process in digital curriculum support making (Griffiths et al., 2009). Teachers' pedagogic knowledge legitimizes both the need for the instrument as well as the design or functionality of the instrument that has the potential to govern teachers' curriculum work practices historically approached as autonomous through licencing (Bernotaite & Ottesen, 2023).

Recent curriculum reforms, like the Norwegian renewal of the Knowledge Promotion reform (LK20), recognize teachers' inclusion in curriculum making as an essential contribution to the professionalization of teachers (Ministry of Education and Research, 2016). International actors, for example, the OECD (2020), also promote teacher empowerment through the development of digital curricula and curriculum support. Consequently, further research is necessary to reveal new aspects of networked education governance. This includes examining how teachers' pedagogic knowledge shapes digital curriculum instruments and how the rearrangement of programmatic and practical discourses shapes teachers' professional roles.

Finally, it is necessary to recognize the limitations of this study. Although this study is based on data that represent digital curriculum support making over a period of time and across spaces and actors, it presents a particular part or picture of the reform. In actor-network theory, actors emerge through a web of relations that make and remake them (Law, 2009). Hence, specific identities of actors emerged through actor relations identified in the analysis of collected data. Furthermore, shifts in actor identities depend on new or changed relations, such as those between teachers and other actors. Additionally, approaching the translation of a digital curriculum support instrument focused on relations that emerged and were tangible in the collected data. Hence, other relations that disentangled or failed to form might become obscured in such data.

Note

1. FEIDE is a national solution for safe login and data sharing on digital platforms in Norway's education and research sector.

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ORCID

Simona Bernotaite http://orcid.org/0000-0002-7525-9573

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