Activity Centred Signature Pedagogies for the Creation of Digital Educational Publications

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Abstract

In this paper, we draw together three sets of ideas to create a framework for understanding and improving the networked creation of digital educational artefacts. We combine ideas on learning networks and networked learning, activity-centred analysis and design (ACAD) and signature pedagogies. Focusing on establishing a framework for understanding the network practices, the participation of people from different professions and the nature of learning in doing, the paper explores the possibility of constructing a framework that can be customised to the needs of specific professions or of industry-specific multi-professional networks. The case on which we focus, and which we use to inform, illustrate and sharpen some of the argument, is that of digital educational publishing – specifically, the activity of the educational publishing company Systime. However, we see the framework as applicable to a much more extensive range of situations. Consequently, the paper contributes to wider theoretical and practical work on the creation of digital educational artefacts. It also contributes to thinking more deeply about assumptions and practices involved in professional knowledge-building networks: especially where participants develop what we describe as a 'reflexive designerly disposition', capable of improving what a network achieves and how it functions.

Keywords

Signature pedagogies, Design for learning, Activity-centred analysis and design, Networked learning, Design of digital educational publications

Introduction

Networked learning is a field of research and practice that pays particular attention to learning in doing, especially in circumstances where people are learning through collaborative engagement in jointly valued activities and where digital communication technologies play a significant part in their work (Networked Learning Editorial Collective (NLEC), 2020). In the case we examine, high school teachers are working as authors of digital educational books. They collaborate with specialists who are employed by the leading Danish educational publishing company Systime to provide services and support in various areas of digital publishing. The teacher-authors typically come into this work without any training in publishing or educational design. They learn to become authors by authoring, in interaction with a network of other people, engaged together in creating digital educational books and making them available to Danish schools.

One practical goal of our work is to see how these teacher-authors might be helped to become better at what they do: to find ways of working that are reflective, efficient and enjoyable. A complicating but positive feature of our case is that when teacher-authors get better at what they do, implications can flow in several directions. As they become more familiar with, and more capable at, design for learning, beneficial effects may be felt by the teacher-authors themselves, seen in the digital books they produce, and registered in the broader networks of people, artefacts and processes creating and using digital educational books.

The paper falls into three main sections. Firstly, we provide some detail about the empirical case at hand. We describe some of the messiness and complexities that characterize the creation of digital educational publications. We sketch relevant network practices, the participation of people from different professions and the nature of learning in doing. We use the ACAD framework to help distinguish between different kinds of design components involved in networked learning – epistemic, set and social – and between what is designable and what emerges in the unfolding activities of learning networks (Goodyear et al., 2021). The second main section introduces the concept of signature pedagogy (Gardner & Shulman, 2005; Shulman, 2005; Stables, 2020) and explains how we use this particular approach to construct a framework that can be customised to the needs of specific professions or of industry-specific multi-professional networks. Signature pedagogy usually focuses on how practitioners within a particular profession are introduced to, and enculturated into, their profession (Canals & Mor, 2020; Chick et al., 2012). In the final section, we outline a framework for combining different signature pedagogies to understand and improve learning and development opportunities for teacher-authors in multi-professional educational publishing networks.

Through this, the paper contributes to the networked learning literature in the following ways. Firstly, it offers a theory-based framework which can be used to articulate the assumptions and practices involved in the networked professional formation of creators of digital educational artefacts, such as digital textbooks. We see this as a necessary advance on the use of highly generic theories and decontextualized concepts that are the norm in 'onboarding' and 'upskilling' new participants in fields like this. In essence, we are advancing the case for a distinct signature pedagogy for teacher-authors' design of subject-specific digital educational publications. Secondly, and perhaps paradoxically, the paper shows how a framework developed for a specific networked industry can be used as a resource for analysis and design in other fields: through similar reasoning and the transformation of one specific framework into another specific framework. It shows how close pragmatic analysis of how a business's productive networks actually function can be used to guide improvements to processes, relationships and outcomes, including by putting pedagogical expertise, learning theory and design in the limelight.

Case introduction: networks and network practices in the creation of digital educational publications

Core concepts and methods

The notion of 'network' foregrounds *connections* between people, ideas, activities and resources across time, space and media (Carvalho & Goodyear, 2014; Goodyear et al., 2021; Öztok, 2021). A learning network simultaneously situates, and is constructed by, the social activities of people who are learning something of significance to them. In this paper, we focus on situations where a network of people – mainly teacher-authors and publishing professionals – work together towards the goal of producing digital educational publications that potentially support other teachers' designs for their students' learning. The case and empirical data on which this article is based is part of an ongoing project, namely the PhD project of the first author, focusing on investigating and redesigning the publishing framework offered to teacher-authors of digital educational publications. In Bülow & Nørgård (2021) Systime, and the design space they offer to teacher-authors, were analysed as a potential collaborative space for networked learning. The current article extends this work by developing a framework for understanding and supporting the roles, processes and networks teacher-authors enter into when creating digital educational publications in a publishing company such as Systime.
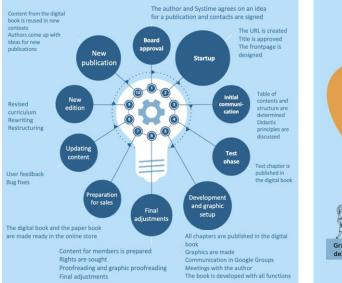
Here, the analysis draws on multiple sources of data collected over a period of two years (2019-2021). This includes 1) *Observations:* Networked practices were observed in real time in three delimited publishing processes. Both physical and online meetings involving teacher-authors were observed and recorded. 2) *Interviews:* November 5th, 2021, 49 teacher-authors in 11 groups participated in semi-structured group interviews. Each group spent 30 minutes in dialogue describing the networked practices that defined each stage of their publishing processes. Subsequently, they video documented 8-10 minutes of reflection on similarities and differences in their experiences. These recordings were later analysed to map networked practices. 3) *Participant workshops:* 18 hours of video recordings have been segmented and analysed. Inspired by Iivari (2018) and Carvalho et al. (2021), participant interpretation techniques were used to position the participants as co-interpreters: constructing meaning in their own activities and for the interpretations of these activities (Carvalho et al., 2021; Iivari, 2018). Through analysing participants' reasons for collaboration, the role-taking and the competences needed in collaboration, we have also been able to map digital, physical and hybrid spaces, seeing where connections and tools are supporting valued activities - and where they make things more difficult.
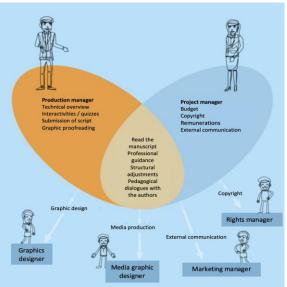
Systime Case Study

As part of the oldest and largest publishing company in Denmark, Gyldendal Group, Systime is a leading supplier of educational materials to K-12 students and teachers in Denmark, Greenland and the Faroe Islands. The majority of Systime's publications are digital and they are distributed either as single publications, as subject packages or via a subscription scheme that gives students and staff access to the publisher's total library of more than 550 digital publications. From its birth, Systime has had a distinctive 'take' on the publishing business (Freytag & Philipsen, 2019). The author's influence in editorial processes is considered crucial. Editors work as project managers rather than content experts. Also, the company saw itself as one of the first publishers to try out digital publication formats (Riis Ebbesen, 2016). Systime considers itself a frontrunner with both the digitalisation of educational publishing and the involvement of end users. The company's vision statement underscores the importance of the relationships between teacher-authors and the different user groups - students and teachers:

> Being 'The Collaborating Publisher', our goal is to develop our publications in collaboration with the teachers and students who use our materials. We believe the publications will be better when users help to shape them. Partnership, networking and user involvement are therefore key elements in our work. At Systime, we do not consider a publication as a finished product, we see it as a dynamic and ongoing process - a common meeting place for users and authors. Our most important role as a publisher today is to build and nurture vibrant communities of authors and their users so that publications are constantly developing and improving. Learning and development is no longer an individual matter; it is a social act. (Systime, 2021)

Figure 1 can also be found included on the official company website. It is aimed at informing future authors about the publication processes and according to the accompanying text the processes are to be understood as a so-called 'open publishing process', where future users (colleagues or students) are invited to comment on the developed materials, before the official release. The website also provides a description of the people and roles associated with each of the ten steps in the process. The ways in which the publisher expects the collaboration between the teacher-author and the in-house design team – the project manager, the graphic designer, the production manager, and others – are explained with examples and advice regarding not only the digital collaboration and production platforms, but also the teacher-author's role in marketing and editing.

1a: The publication process: tasks as they are perceived from the project manager's perspective

1b: A graphical representation illustrating the different roles of the in-house design team

Figure 1: The publication process and the roles involved

During the conducted fieldwork, it became clear that each publishing project follows a unique path from first idea to final publication. All parties show great diversity in the ways they incorporate the available communication and production tools. Depending on the type of publication (for example, a publication with

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extensive interactive multimodal content), the teacher-authors collaborate with the publisher's internal staff in different, but still predominantly path-dependent, ways (Carvalho & Yeoman, 2019, p. 1112). The typical duration of a successful publication process is between 1 and 3 years: a relatively long period of collaboration and co-creation in networks with highly adaptable configurations. Both the authors and the external editors are in most cases practicing K-12 teachers who have chosen to spend some of their spare time on creating teaching materials. They are initially not paid for this work. In most cases, remuneration only occurs when (and if) the publication is used in the schools that subscribe to Systime's digital library.

Networks, networking practices and ACAD

The unfamiliar context of a publishing company challenges the teachers' practical and theoretical knowledge. The methods and routines they have developed for preparing for classroom teaching cannot be transferred directly to the process of authoring digital publications. Becoming a teacher-author is a learning process and it is supervised by a group of professionals playing distinctive and essential roles. The project manager and the external editor must acknowledge – and preferably activate – the teacher-author's 'teacher knowledge', but at the same time they must help form a safe and productive learning space in which the teachers can experiment and iteratively improve the educational materials they create, and the methods they use. Designing for networked learning involves much more than formulating tasks and instructions. It also includes consideration of how social and physical elements contribute to the functioning of a productive learning network. These social and physical elements can also provide new possibilities and impose new limitations in the process of designing digital educational materials.

We use the Activity-Centred Analysis and Design (ACAD) framework (Carvalho & Goodyear, 2014; Carvalho & Yeoman, 2021; Goodyear et al., 2021) to scaffold reasoning about the functioning and improvement of specific sets of learning arrangements. This operates at two levels. In order to understand the teacher-authors' work, when they are designing for other people's teaching and learning, we acknowledge that they face a difficult task of anticipating intended outcomes while designing for emerging learning activities to be engaged by unknown others (ACAD's principle of indirection (Goodyear & Dimitriadis, 2013)). Also, we can use ACAD to distinguish between three different kinds of designable components from which the teacher-authors' learning networks are created: set design, epistemic design and social design. All of these are open to alteration through interventions by project managers and teacher-authors:

- The social design accounts for roles and the division of labour in a network; the distribution of work across individuals and teams, peer and cross-functional collaboration, etc.
- The set design includes digital and physical technologies and spaces. The character of a learning network develops over time, and this evolution is often visible in the changing use of technologies for communication and production.
- The epistemic design describes the typical tasks that the in-house design team will tackle (e.g., the project manager and teacher-author in collaboration with graphic designers, production managers and others).
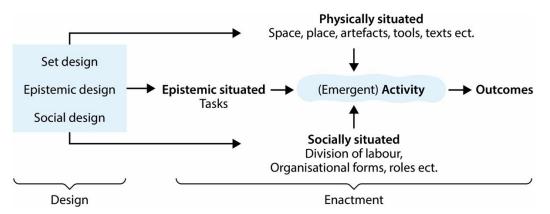

Figure 2: The Activity-Centred Analysis and Design (ACAD) framework (Muñoz-Cristóbal et al., 2018)

The Systime publication process typically differs on all three design dimensions, from the contexts and routines that teachers associate with designing for students' learning in day-to-day teaching. The process also progresses in a significantly different way. This evolution can be analytically divided into three different stages with distinctive design configurations and intended outcomes. In contrast to the 'steps' illustrated in Figure 1, the

analysis illustrated in Table 1 is based on the concepts of social, set and epistemic design – structured temporally in relation to the expected outcomes from the different phases.

Table 1: Collaboration, resources and tasks as they are perceived from the teacher-author perspective

	Social design	Set design	Epistemic design
1: From initial project idea to acceptance of book proposal	The teacher is not yet formally working with the publishing company. The primary activity takes place in school-contexts or in other informal teaching professional networks.	Contact is established between author and publishing company through the publisher's website. Communication with the publisher takes place via email or phone. Set design is primarily the future author's school (workplace) and private home with physical/digital resources (e.g., local LMS).	Sketching the project idea and synopsis First contact between the publisher and the future teacher-author is not epistemically scaffolded.
2: From acceptance to the point where the author(s) finalize the written parts of the manuscript	The teacher-author has entered into a formal contract for publication. Digital collaboration spaces established, supplemented by physical and synchronous online meetings.	The writing is situated in the teacher-author's private home or at the school of employment. Digital tools like Office365/Google Workspace are used to write the manuscript. Testing materials with students is done through the local LMS.	Writing texts, developing suggestions for assignments, activities, etc. Pedagogical reflections between authors / author and external editor.
3: Digitalization, editing and production of interactive and multimodal content	Depending on the character of the process and type of publication the teacher-author participate in both formal and informal communities of practice onsite and online.	A subject-related digital resource ecology that contains both definite subject specific software and the use of generic technologies as cognitive partners and means for production of various graphical or epistemic designs.	In collaboration with publishing professionals, teacher-author prepares teaching videos, podcasts, lecture plans and adaptive formats.

A call for professional development

Table 1 offers a simplified picture of the countless ways in which publishing projects are realized (or abandoned) in a changing interplay between productive networks and networking practices. Using the ACAD framework to understand the current challenges, it became clear during the fieldwork, and through conversations with teacher-authors and other members of publishing project teams, that the work of a teacher-author involves several paradoxes – and they all seem to be related to the networking practices analysed above:

- **The social design paradox**: The publisher's aspiration to "build and nurture vibrant communities of authors and their users" is not seen by the teacher-authors as well-facilitated, organizationally or technologically. The tasks that teacher-authors and editors are given rarely include 'community-building'. The publisher's vision of making learning and development a social act is – according to some teacher-authors – seen as contradicted by the fact that there is a lack of support and communication for long periods, especially in phase 2.
- **The set design paradox**: Digital spaces are being created, but according to the authors, they are (too) rarely used for establishing collaborative design spaces or productive learning networks - within the project as well as with other authors. For example, teacher-authors request better opportunities to improve their draft texts and activities, through real-world online trials.
- **The epistemic design paradox**: According to some of the interviewed teacher-authors and project managers, the publisher's vision of making innovative materials of a high professional and pedagogical standard (Systime, 2021) is contradicted by the fact that there is limited subject-specific knowledge about, or ongoing schooling in, methods for designing good digital teaching materials.

The described challenges for teachers to transform themselves into authors and designers of digital educational publications, as well as the identified paradoxes within the publishing company, together create barriers for the development of well-designed digital educational publications. Publishing companies, such as Systime, need to nurture and scaffold the *profession of teacher-authors* from entry level (teacher as first-time author and designer of digital educational publications) to skilled level (teacher as experienced author and designer of digital educational publications).

For publishing companies to facilitate such an enculturation of teachers within a certain profession (e.g., Mathematics) into a new profession (e.g., authoring and designing digital educational publications for teaching Mathematics) requires that the publishing company has the capacity and competence to establish, integrate and develop this new profession within the teacher's existing profession. To achieve this, the publishing company needs to be able to distinguish between and design for four distinct *profession spheres*:

1. The native profession sphere: The teacher's native profession of teaching a subject in the classroom – and the ability to think, act and have an identity as a teacher within that profession.
2. The new profession sphere: The teacher's new profession of authoring and designing digital educational materials for teachers within a profession and in collaboration with a publishing company – and the ability to think, act and have an identity as an author-designer within that profession.
3. The relational profession sphere: The teacher's ability to interlink native and new profession in such a way that subject knowledge from the native profession is delivered in the form of a well-designed digital educational publication using the new profession – through the ability to think, act and have an identity as teacher-author by drawing simultaneously on both professions.
4. The maturing profession sphere: The supported professional development of an identity within the interlinked profession through incremental, iterative, networked and repeated experience transforming the teacher-author from novice to veteran teacher-author, capable of contributing to the improvement of professional practices.

To support publishing companies in designing for and offering such teacher-author networks, spaces and processes, the next section introduces a reworking of the 'signature pedagogies' framework.

A signature pedagogy framework for the profession of teacher-authors

The signature pedagogy framework: hand, head and heart; surface, deep and implicit structure

Signature pedagogy was introduced to a broad readership by Lee S. Shulman in the seminal article: 'Signature pedagogies in the professions' (Shulman, 2005). The core idea of signature pedagogies comes from research into the different ways in which universities prepare students for specific professions (Gurung et al., 2009; Shulman, 2005). Shulman and colleagues argued that while there are broad pedagogical patterns horizontally cutting across the disciplines (e.g., lecture hall presentations), there is also a distinct 'signature' patterning a particular profession (e.g., the studio 'crit' practice of design or the exegesis of texts in theology). As Thomson et al. (2012) put it, there is something as distinctive as a handwritten signature about the characteristic pedagogy when educating for a profession (Thomson et al., 2012).

These patterns that together constitute a certain signature pedagogy of a profession comprise the particular ways of thinking, doing and being characterising the profession: "… novices are instructed in critical aspects of three fundamental dimensions of professional work – to think, to perform, and to act with integrity" (Shulman, 2005, p. 52). Shulman refers to these as "habits of the head, habits of the heart, and habits of the hand" (Shulman, 2005, p. 59). According to Shulman, signature pedagogies are holistic as they bring head, heart and hand together within a deep vertical structure organised in three dimensions:

> First, it has a surface structure, which consists of concrete operational acts of teaching and learning […] Any signature pedagogy also has a deep structure, a set of assumptions about how best to impart a certain body of knowledge and know-how. And it has an implicit structure, a moral dimension that comprises a set of beliefs about professional attitudes, values, and dispositions. (Shulman, 2005, pp. 54–55)

Table 2: Surface, deep and implicit structures

	Habits of the head	Habits of the heart	Habits of the hand
Surface structure	Body of knowledge	Identity traits	Repertoire of actions
Deep structure	The profession as a certain way of thinking	The profession as a certain way of acting	The profession as a certain way of performing
Implicit structure	Embodied dispositions	Embodied attitudes	Embodied habits

Combined, the signature pedagogy framework encapsulates the ways a person is enculturated in three areas of the professional work involved. There are 'thinking as a professional,' 'acting as a professional' and 'performing as a professional' (Hobley, 2021).

Applying signature pedagogy to the case at hand: Vertical, horizontal and diagonal signature pedagogies

Through a reworking of the signature pedagogies framework, that takes into account the three paradoxes identified through the ACAD framework and the four distinct profession spheres, publishing companies like Systime can be aided in supporting and designing for teachers to become teacher-authors. Originally, signature pedagogies capture the essence of thinking, performing and acting within a profession, e.g., teaching Geography or History in a classroom. This deep or 'vertical' signature pedagogy is the professional habits of the head, hand and heart that teachers enter the publishing company with and use to create the content of digital educational publications. Multiple examples of such 'vertical' signature pedagogies can be found in Gurung et al. (2009) *Exploring signature pedagogies* – e.g., signature pedagogies for Literature studies, Geography or Agriculture (Gurung et al., 2009).

However, upon entering the publishing company, teachers, no matter what profession they are educated in, are faced with a new profession, that of creating well-designed digital educational publications. This new 'horizontal' signature pedagogy cutting across the teachers' native 'vertical' signature pedagogies needs to be facilitated by the publishing company so that teachers can fuse their 'vertical' habits of the head, hand and heart with the habits of head, hand and heart of this new 'horizontal' signature profession. That is, the publishing company needs to enculturate and support teachers in establishing a new practice within their existing profession through creating strong and reflective interlinkages between the vertical and horizontal profession. Such examples of a 'horizontal' signature pedagogy, cutting across the professions, can be found in Julia Horn's description of the Oxford tutorial system (Horn, 2013) or in Tünde Varge-Atkins article on disciplinary digital capabilities as the interlinking of discipline-specific vertical signature pedagogies with cross-disciplinary horizontal digital capabilities (Varga-Atkins, 2020)
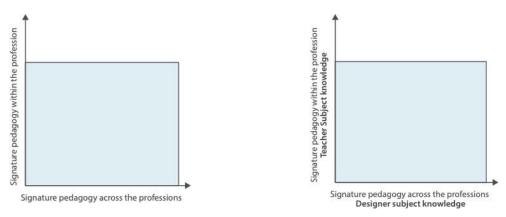

Figure 3: Vertical and horizontal signature pedagogy

Figure 4: Vertical and horizontal signature pedagogy distinguishing the professions of teacher-authors
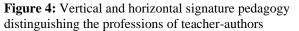
Figure 3 illustrates the two axes of vertical signature pedagogy within a discipline-specific profession and horizontal signature pedagogy cutting across the professions. In the context of teacher-authors creating digital educational publications with publishing companies such as Systime, figure 4 illustrates the dual role of the teacher-authors. They enter Systime with their subject knowledge as teachers and are faced with a new signature pedagogy requiring a designerly disposition towards designing digital educational publications.

Below, the distinction between teacher-authors expanding their native profession sphere (figure 5a), publishing professionals expanding their native profession sphere (figure 5b) and teacher-authors acquiring a relational profession sphere by interlinking and expanding both native and new profession sphere (figure 5c) is illustrated. As shown, teacher-authors initially have a narrow horizontal signature pedagogy which implies that the teacher-author has limited knowledge in designing digital educational publications, yet has knowledge concerning the taught subject (figure 5a). In contrast, the in-house design team at the publishing company holds a broader horizontal signature pedagogy with knowledge in designing digital educational publications, however they often have limited knowledge of the taught subject (figure 5b). Finally, the enculturation of teacher-authors into the profession of designing digital educational publications brings about a diagonal expansion where the teacher-author gains knowledge along both the vertical and horizontal axis (figure 5c).
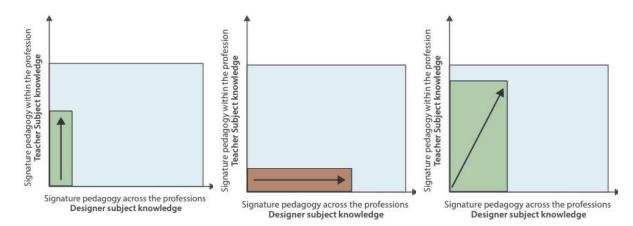
Figure 5a: Teacher-author with some subject knowledge in Math and with limited subject knowledge in designing digital educational publications

Figure 5b: In-house design team with some subject knowledge in designing digital educational publications and with limited subject knowledge in Math

Figure 5c: Teacher-author with growing subject knowledge in Math and with growing subject knowledge in designing digital educational publications

This implies that publishing companies with the ambition of supporting teacher-authors in creating well-designed materials must develop and implement frameworks and processes that take into account and create reflective connections between vertical and horizontal signature pedagogies (ACAD design space). Thus, the publishing company must offer a situated signature pedagogy that supports teacher-authors in creating connections between the vertical and horizontal axis. It furthermore suggests that publishing companies should position themselves as networking 'design collaboratoriums' (Bødker & Buur, 2002; Bülow & Nørgård, 2021) wherein both teacher-authors and publishing professionals enact and develop progressively more advanced and deep practices for designing digital educational materials (ACAD enactment space). A design collaboratorium is a design space that supports and promotes mutli-professional design teams in aquiring designerly dispositions through collaboration and joint action. In this way, a design collaboratorium is a distinctive type of space that is particularly suited to facilitate networked design practices.

In the context of teachers with one professional identity that have to be enculturated into a new professional identity, this is especially complex. Because many teachers-to-become-authors occupy a full-time job within their profession, enculturation of teachers into becoming designers of digital educational publications entails complexities not associated with teaching a subject in a classroom. Teachers must be both professional practitioners of a subject (vertical signature pedagogy) while simultaneously engaging in complex learning networks and processes of educational design (horizontal signature pedagogy). This, in a way, entails a specialisation or expertise within their field while entering as a novice into a new learning network and community. To enable this, they need support from the publishing company in connecting and merging the hand, head and heart of their subject domain with the hand, head and heart of designing educational publications. This creates professional challenges on both the vertical and horizontal axis as teacher-authors integrate the signature pedagogy of their subject into the signature pedagogy of being a designer of educational materials.

This calls, in turn, for publishing companies to develop ways of scaffolding and promoting these complex connections. Furthermore, it also highlights the need for competency development of the publishing companies themselves: to progress from positioning 'teachers as individual textbook authors' to supporting 'teacher-authors as collaborators in the design of digital educational publications.' Here, attention to the diversity of roles, expertise and capabilities is crucial if publishing companies wish to develop the capacity and culture of these new and evolving professional practices. In the last section of the paper, we combine the above ideas from networked learning, ACAD and signature pedagogies into a composite framework for publishing companies to move towards this goal.

A composite framework for publishing companies to support teachers in becoming authors and designers of digital educational materials

The idea of expanding diagonal signature pedagogies for publishing companies supporting teachers in becoming (better) designers of digital educational publications can be elaborated through juxtaposing the following frameworks.

Prestructural framework (PF): The absence of horizontal design and enactment space within the publishing company. Teachers are more or less 'left to their own devices' and write a manuscript based on their native signature pedagogy, transforming its habits of head, hand and heart into text. Here, no distinction is made between professional starting points. No matter what vertical profession identity a person brings with him or her into the profession as a future author of educational publications, the same repertoire of educational and general learning theoretical assumptions will be at play.

Unistructural framework (UF): The publishing company offers tools, how-to scripts, technical support and in-house design and layout to teachers writing a manuscript. While staff within the publishing company might have an advanced understanding of the horizontal design and enactment space, teachers only engage the surface layer of the horizontal signature pedagogy. This, in effect, creates a decoupling between the teacher's vertical signature pedagogy and the publishing company's horizontal signature pedagogy. In other words, the publishing company prepares the teacher to become an author through a 'toolbox approach' offering technical solutions, technological possibilities and how-to guides that provide the author with new concrete or technical knowledge, skills and competencies. However, this does not create a strong interlinking between the vertical and horizontal axis or scaffold the formation of a designerly disposition in the teacher-author.

Relational framework (RF): The publishing company has an enactment space in place for the individual teacher-author that scaffolds the interlinking of vertical and horizontal axis in order for the teacher to, over time, develop a holistic identity as teacher-author. That is, the publishing company's enactment space serves as the teacher-author's design space, when designing digital educational materials. The relational framework is author-centred, focusing on professional development of the individual teacher to be transformed into a teacher-author with designerly ways of thinking, doing and being. Through the fusion of vertical and horizontal signature pedagogies a composite professional identity and reflective designerly disposition is developed. This, in turn, presupposes a substantial professionalization of the practices associated with becoming a teacher-author. This might be achieved through individual training as well as collaboration and meetings between teacher-author and publishing professionals.

Networking framework (NF): The publishing company has in place an enactment space that functions as a collaborative learning network, design collaboratorium or community of practice. Here, the interlinking of vertical and horizontal axis happens through multi-professional design teams or networks where e.g., teacher-authors, subject experts, learning designers, publishing professionals and others work together around the creation of digital educational publications. That is, the publishing company's enactment space serves as a networked design collaboratorium focused on getting people to work together to create well-designed digital educational publications. The networking framework is community-centred, focusing on professional development of the collective as a teacher-author network with a reflective designerly disposition through the interlinking of the various vertical and horizontal signature pedagogies present within the network. This might be achieved through joint peer-review processes, round table discussions, collaborative design experimentation, participatory design workshops and peer-to-peer learning. The individual teacher-author's networked and situated professional development thus takes place within a collaborative professional community (which are maintained as hybrid learning networks) (Bülow, 2022; Nørgård & Hilli, 2022).
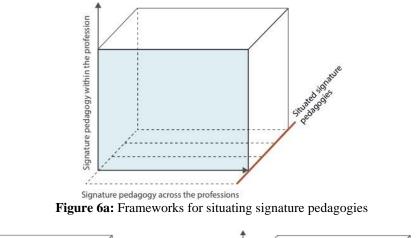
Table 3: Frameworks to support teachers in becoming authors/designers of digital educational materials

	Prestructural framework (PF)	Unistructural framework (UF)	Relational framework (RF)	Networking framework (NF)
The publishing company's approach	The teachers native signature pedagogy	Toolbox-focused	Author-focused	Community-focused
Scaffolding	General introduction to the publication process	Technical solutions, technological possibilities and how-to guides	Individual training as well as collaboration and meetings between teacher-author and publishing professionals	Peer-review processes, round table discussions, collaborative design experimentation, participatory design workshops etc.

We have referred to the above presented as signature pedagogies, however, a more appropriate term may be 'initial signature pedagogy' (Dawson et al., 2011), given that the framework offered here is more of a skeleton structure that can be used to intentionally and reflectively develop a signature pedagogy for publishing companies in relation to position themselves within the different frameworks (PF, UF, RF and NF) and support teachers in becoming teacher-authors with designerly dispositions. However, as we have done here, combining signature pedagogies with networked learning and the ACAD framework gives publishing companies a powerful and reflective way forward if they wish to create spaces and processes that enable teachers to become creators of well-designed digital educational publications: either as individual teacher-authors within the learning network of the publishing company (UF) or as part of a teacher-author collective that together establishes networking design collaboratoriums within and in collaboration with the publishing company (RF). This requires that the publishing company creates an internal design space where such situated signature pedagogies frameworks are developed and enacted when teachers enter the enactment space of the publishing company to take on the task of becoming teacher-authors. In doing so, the enactment space of the publishing company transforms into the teacher-authors' design space.

Through the design of digital educational publications, teacher-authors have the possibility, with the right support from the publishing company, of maturing this designerly disposition over time as they gain experience with the 'horizontal' signature pedagogy: in effect, developing a new professional capacity, that of being reflective designers of digital educational publications within their subject-specific profession. This capability can be obtained through a personalized approach, as with professional development of the individual teacher-author, or through a collective approach, by establishing collaborative teacher-author learning networks. Establishing such intentional, incremental and iterative practices within the publishing company in relation to enculturing teacher-authors into this designerly disposition can be framed as an expanding signature pedagogy that, over time and through a step-by-step sophistication of the practice, moves the teacher-author from novice to reflective designer. An example of such an expanding 'diagonal' take on signature pedagogies can be found in Stables' resent paper 'Signature pedagogies for designing' (Stables, 2020).

In figure 6a, the frameworks for situated signature pedagogies to support teacher-authors are placed into the model of vertical and horizontal signature pedagogy enabling the elaboration of a diagonal signature pedagogy framework. Examples of how such diagonal signature pedagogies within the different frameworks of supporting teacher-authors can be situated, are illustrated in figure 6b, 6c, 6d, and 6e. These juxtaposed figures illustrate the potentials of relational and networking frameworks in particular, given that they offer broader diagonal signature pedagogies through collaborative scaffolding that holds the potential to expand the 'diagonal knowledge' of the individual teacher-author or networks of teacher-authors, designers and publishing professionals.
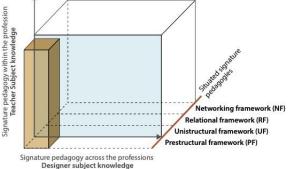
Figure 6a: Frameworks for situating signature pedagogies

Figure 6b: Teacher-author with expert subject knowledge in Math and with limited subject knowledge in designing digital education publications (PF)
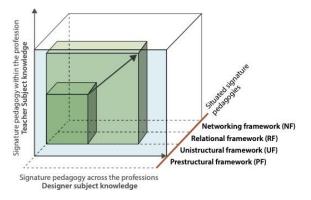

Figure 6c: Teacher-author with some subject knowledge in Math working together with the in-house design team with some subject knowledge in designing digital education publications (UF)

Figure 6d: Teacher-author with growing subject knowledge in Math and with growing subject knowledge in designing digital education publications (RF)
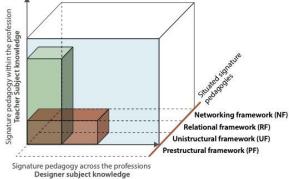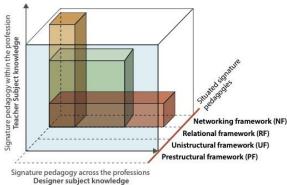

Figure 6e: Multi-professional network of people with varying levels of teacher subject knowledge and designer subject knowledge (NF)

For the publishing company to develop such an enactment and design space for the design of digital educational publications several distinct but connected development processes need to be undertaken: A) The establishment of a company design space with the set design, epistemic design and social design that will enable the creation of an enactment space for teacher-authors and the design of digital educational publications. B) The creation of an enactment space with the necessary set design, epistemic design and social design for teachers to become teacher-authors and design well-designed digital educational publications. C) Processes of enculturating teachers into a reflective designerly disposition in relation to the identified three paradoxes and four profession spheres in order to provide teacher-authors with the requisite design space and professional development (signature pedagogies). D) The identification of, on the one hand, the habits of head, hand and heart of teacher-

authors, designers and other professionals involved in the design of digital educational materials, and, on the other hand, the implicit, deep, and surface structure of the processes and practices of creating well-designed digital educational materials. E) The development of horizontal signature pedagogies for the profession of (becoming) teacher-authors as well as ways of supporting the interlinking of vertical and horizontal signature pedagogies. F) The creation of an intentional diagonal signature pedagogy framework with distinct spaces, processes and learning networks for PF, UF, RF and NF, that support teachers in identifying their needs and capabilities as authors (professional development) as well as bringing about this new practice and culture of becoming teacher-authors with designerly dispositions.

Conclusion

In this paper, we have outlined, and sketched the rationale for, a framework that combines ideas about signature pedagogies with ideas about the design and functioning of professional learning networks. The framework can be applied to enhancing the professional development of teacher-authors who are working with publishing companies to create digital educational publications. Although the framework has emerged while investigating the activities of one specific publisher, we suggest that it is potentially applicable across contexts where people who have been encultured into one profession need to link this with a new profession and collaborate in productive multi-professional networks.

Publishing companies that wish to create powerful enactment spaces and signature pedagogies for teacher-authors face expansive and complex development work. In turn, this requires capacity building and competency development in the publishing companies themselves. This article cannot provide all the answers, but it helps such companies point themselves in the right direction.

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