Postdigital Science and Education (2024) 6:98–113
https://doi.org/10.1007/s42438-023-00431-7

ORIGINAL ARTICLES

# Makers, Not Users: Inscriptions of Design in the Development of Postdigital Technology Education

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Accepted: 12 September 2023 / Published online: 20 October 2023


## Abstract

This paper directs attention to a recent government-led school development initiative in Denmark, where a broad concept and practice of *design* became central to imagining and reworking technology education for the postdigital condition, in which schoolchildren were imagined to become makers, not users of technological society. Using an analytical apparatus inspired by Science and Technology Studies (STS), the paper examines how and what understandings of design were propagated in the trial of technology comprehension in the public school. The paper examines two design models as didactic-pedagogical translation of design into the epistemic practices of the public school, articulated in the intellectual traditions of *Bildung* and *Didaktik*. Examining the knowledges that make knowledges, the paper contributes an elucidation of the features, capacities, and limitations of the concept and practice of design, as it is mobilised to make knowledge and subjectivities about agency and change for schooling in the postdigital educational future.

**Keywords** Technology comprehension · Design · Postdigital · Education · Inscriptions · Mattering

## Introduction

Many recent efforts to introduce, develop, and expand technology education in national compulsory school systems are grounded in computing (see Bocconi et al. 2016, 2018, 2022). In this paper I direct the reader's attention to a recent government-led school development initiative in Denmark, where a broad concept and practice of *design* in particular became central to imagining and reworking technology education for the postdigital condition (see Macgilchrist et al. 2023).

During 2018–2021, the Danish Ministry of Education (The Ministry) ran an experimental programme centred on developing a new potential mandatory

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school subject about technology in the public primary and lower secondary school, the *folkeskole* (the public school). The school subject was called technology comprehension (TC), congruent with an also emerging academic knowledge field of 'technology-understanding'. TC combined elements of computer science, design, and the humanities (Wagner et al. 2020) to make understanding of technology a multidisciplinary school subject that could equip children to become critical and creative in their encounters with technology. The dominant political vision for TC was that young people ought to become not just consumers of technology, but creators of the digital technological society they live in, both at present but also further along the trajectories of life-long learning and citizenship that the public school is tasked with preparing Danish schoolchildren for through the ten years of statutory education.

As the trial programme launched, first, a new subject matter was described by a group of subject matter experts appointed by the Minister of Education. Next, over the course of 2.5 years, the newly described subject matter was tried out in 46 schools, namely to facilitate the pedagogical development work on how to teach this new subject, and to see how it fared as a subject in everyday schooling. In both of these tracks of the experimental programme, *the broad concept of design was mobilised* by education researchers, school practitioners, pedagogical consultants, and subject matter experts to frame and drive knowledge-production. That is, as an approach to schoolchildrens' critical and creative-constructive learning about technology, and to organising large-scale pedagogical development work on a novel school subject and subject matter. When the trial programme concluded political decision-makers, now in a new government configuration, decided not to pursue further development of TC. Regardless, the trial programme was an engine for knowledge-production attending to postdigital technology education where design was made to have a significant though ambiguous and opaque role.

The confidence in design expressed by the trial programme's actors and stakeholders is not surprising. Design and its auxiliaries have become ubiquitous and familiar, no longer confined to the tasks of systems development or the trade of crafting functional and/or aesthetic objects. Nor is it solely associated with the professions of designer or developer. In a keynote on design, delivered on invitation to an academic society for design philosophy, sociologist, and science and technology studies (STS) scholar, Bruno Latour remarked that 'design has been extended from the details of daily objects to cities, landscapes, nations, cultures, bodies, genes' (2008: 2). According to Latour, in the contemporary 'design is applicable to ever larger assemblages of production' (2). Not least, then, to the (re)production of society that is the purview of public statutory education. In that regard *thinking and doing in terms of design* has in studies of education and schooling been everything from a curricular issue of design competences (Rusmann and Ejsing-Duun 2021) to a techno-optimistic culture of metropolitan public school reform (Sims 2017). The utility of 'design thinking' (Cross 2011) has been unfolded by education researchers for its potential in developing pedagogy and design for learning (Paaskesen and Nørgård 2016), as well as how participatory design's practices and philosophies can help realise the democratic goals of public schooling (Iversen et al. 2018).

In this paper I explore relations of design in the development of postdigital technology education, attending to the trial of TC as an assemblage of material, discursive,

social, and technical agencies. For one, despite the varied disciplinary make-up of computing, design, and humanities, TC's subject matter had a significant and deliberate critical, explorative, and maker-oriented 'design approach' to comprehension of technology (Iversen et al. 2019; see also Wagner et al. 2020), routinely espoused by the main architects of the school subject, who were prominent scholars in the fields of interaction design, informatics, and child-computer interaction. Second, the above was in part also the rationale for organising the local school trials of this newly conceptualised subject matter as a design project (rather than an implementation), in which subject matter experts and teachers at volunteering schools worked to 'co-create' (Tekforsøget 2018: 3) TC by collaborating on prototypical lesson plans called *didactic prototypes*. The Ministry and the consortium of institutions it contracted to conduct these school trials expressed that this conceptualisation and testing was an effort in gathering and joining theoretical and practical knowledge, becoming familiar with the new subject matter, and sharing experiences of teaching. To this end, *a variety of visualisations of a design approach for knowledge-making* proliferated in the trial programme to illustrate, scaffold, and pedagogically address taking a design approach to learning and development of technological pedagogy.

As design is looking more and more like a broad theory of action (Latour 2008), and a style of problematisation in the postdigital condition, it also formats the very concepts and practice of social change and human agency in various, but often technologically determined ways. As such, design becomes potent to everything from large-scale social innovations to curricular content. The sheer ubiquity of design as a concept and tool to navigate what is commonly understood as an increasing socio-technical complexity in the educational landscape is remarkable and warrants investigation. Particularly into how design is translated into the many layers of epistemic practice in compulsory schooling, where it intersects with the shaping of human individuals, communities, and societies. In this paper I ask: How is the concept of design translated into TC? What comprehensions of technology and society follow from the emerging design approach to TC and are thus set to be amplified and sanctioned by the public school? What are the implications of this in the context of a school system that seeks to produce citizen subjects?

While education does not determine lives, it does shape them. Schooling routinely meditates on the future, e.g. in the style of a national curriculum, which, according to curriculum scholar Thomas S. Popkewitz, mobilises ideas of the future to legitimise organising the present (2008). As technologies of government and power 'at a distance' (Rose and Miller 2010), national school curricula (of Western countries) and their development are acts of making society by making the child into 'the cosmopolitan citizen' (Popkewitz 2008). Or, as seen in recent policies about education technology, by imagining a variety of desired as well as marginalised twenty-first century 'digital' subject figures, e.g. 'The Social Designer' (Macgilchrist 2019). In the EU-centric commensurate space of education, there is 'growing understanding that digital competence goes beyond basic digital skills' (Bocconi et al. 2022: 5). The trial programme as a development project and the herein emerging experimental school knowledge of TC are problematisations of this, understood as efforts to make and remake educational content with complex digital transformation in mind. One EU survey of such initiatives remarks that Denmark has been 'extensively

piloting actions of this kind' (Bocconi et al. 2022: 5). As I explore in this paper, through such piloting actions, design's politics and social philosophies were actively leveraged by knowledge persons and educational actors to legitimise it as a foundational disciplinary undertaking in schooling due to its seeming capacity to traffic the purpose and ideals of the public school and Danish democracy while also holding digital technologies at arm's length. However, there is a need to elucidate the features, capacities, and limitations of design when it is translated into educational and pedagogical concerns.

Using STS approaches, I aim to contribute an understanding of these, by examining two distinct but interrelated translations of design into school subject matter to understand what knowledges make knowledge, and how. The study in this paper is based on a combination of desk materials (reports, promotional and inspirational material, and the subject matter description) and ethnographic data collected through fieldwork. I observed three months (September, October, and November, 2020) of in-person teaching of TC for pupils aged 9–13 at a school in the Greater Copenhagen Region of Denmark (which I will refer to as The School). During this time, I also shadowed and interviewed teaching staff, and saw how these actors approached design through visualisations and models.

## STS and the Study of Knowledge-Production: Matters and Translations

In the trial programme, modes of knowing from distinct yet seemingly complementary fields of design and schooling coalesce to reconcile struggles and hopes for human society's continued existence with digital technology in a condition where problems are wicked, democracy is in crisis, and the planetary future is under threat. This is an immense scale of societal concerns, but they can be examined by looking at situated performances of knowledge and with attention to the material and social agencies that enact such phenomena. The field of STS has a long-standing interest in examining knowledge-production and its methods, and in particular the heterogenous arrangements of it in, e.g. experimental sites like the laboratory setting (see Latour and Woolgar 1987) as well as more public kinds of experimentation (see Shapin and Schaffer 1985). STS research has thus contributed conceptualisations of science 'in action' (Latour 1987), and as 'epistemic cultures' (Knorr-Cetina 1999).

STS offers a vocabulary and analytic suited to examining the contemporary mobility of design in educational matters and schooling. One analytic is Latour's proposition about how to think of and with phenomena as 'matters of concern' and 'matters of fact' (2004). The phenomenon of design can on one hand be conceptualised as a matter of fact, that is, as a stable phenomenon, the boundaries and veracity of which appear fixed, e.g. as a vocation, a piece of furniture, or an epistemic practice. Matters of concern, on the other hand, are contested phenomena, aptly understood as socially constructed and unsettled, with fuzzy boundaries, and, for better or for worse, not easy to agree on. Latour adds that 'matters of fact are not all that is given in experience. Matters of fact are only very partial and, I would argue, very polemical, very political renderings of matters of concern' (2004: 232). In this paper, the utility of the concepts

of matters of fact and matters of concern is, indeed, less as a binary, and more so as a heuristic to empirically explore the enactment of knowledge(s) and knowing(s) in relations where design is put to work to knot together imaginaries of the future, young people's education, pedagogy, and technology.

One of the central tensions in the trial programme echoes Tara Fenwick and Richard Edwards' remark that 'disciplinary canons (…) are not simply received; their reception requires certain practices, discourses, inscriptions and rituals' (2014: 39). I conceptualise the trial programme as an 'enactment of knowledge as matter-ing' (43; see also Law 2004). My attention is on translations of design into models as instances of epistemological scientific fact, and the social and material agencies that arise in the relations of these models. The models give an entry point into the matter-ing of design. In this paper, two such design models are entries to following actors', human and non-human as they problematise technology education, draw together existing practices, and translate and inscribe knowledges in the course of experimentally making TC. The models are performative and they perform knowledges and knowing persons: they perform, e.g. the technologically educated child, TC subject matter developers, or the pedagogically informed TC teacher—as much as they are made to represent knowledge and matters of fact, i.e. core educational aims, intellectual traditions, organisational frameworks, and practical realities of the Danish public school.

## The Danish Public School: Who Should Children Become, and How?

Denmark, population 5.9 million, is regarded as a highly digitalised country, having undergone more than two decades of comprehensive digitalisation of the public sector, including schools and schooling. A total of 86% of all children aged 6–16 attend the public school, which is the public offer of the ten years of statutory education. While technology has been on the school agenda in a variety of ways, as content, in infrastructure, with pedagogy, and for organisational communication (Caeli and Bundsgaard 2019), the trial programme for strengthened understanding of technology was a historic event not because it dealt with digital technologies, but because it could potentially add a new school subject to mandatory schooling. It is extremely rare that the public school gets a new school subject at all. More than 25 years have passed since it last did so. The public school has a stated concern for conceptualising and practising education grounded first and foremost in the question: 'who should children become?', rather than 'what should children learn?'. To this end, the German-Scandinavian intellectual traditions of *Bildung* and *Didaktik* are important.

Danish law states that schooling should support the pupil's process of personal development to become a self-determining individual that can participate actively and constructively in a democratic society. The public school is responsible for the early period of school education, and through this also much of the formative development of the school-aged child. This is expressed in the term Bildung and denotes 'personal development guided by reason' (Retz 2021: 145). In education theory, Bildung is increasingly put in contrast to, e.g. curriculum instruction (Krogh et al. 2022). The purpose of learning and undergoing compulsory schooling in the public primary and lower secondary school is not the employability of

the child but preparing them for the socially and culturally desired trajectories of life-long learning and coexistence in a democratic civil society. To this end, The Ministry defines the learning goals of all school subjects. These are known as the Common Objectives, and often formulated advised by experts in the subject matter at hand. The public schools are managed by the municipalities in which they reside, and each school has a local leadership that handles daily affairs. Notably, the teachers have 'freedom of method': they are free to plan and conduct their teaching as they see fit using their professional pedagogical knowledge and discretion, as long as they aim for the general goals formulated for the subject area.

Thus, teaching is a relatively autonomous affair in the everyday of schooling, substantially articulated as Didaktik, a prism through which schooling is conceptualised in Denmark, in contrast to, e.g. curriculum. Didaktik is a 'language in which a common framework and set of referents [govern] discussion of educational theory, the practice of teaching, schooling, curriculum making and lesson design, teacher education, school administration, textbook production, the sites of exchange between teachers, teacher associations and in-service professional development, as well as issues concerning individual school subjects, academic disciplines, and forms of knowledge' (Retz 2021: 415). To Anglo-American audiences, the adjective to be didactic may conjure up the image of 'an overbearing person prone to moralizing and lecturing others' (2022: 415). This definition has little to no bearing in the Danish educational context, where the word primarily operates to denote the intellectual field and practice of Didaktik. Following this, a *subject-specific Didactik* is specific to the subject matter at hand, and the issue of 'individual school subjects, academic disciplines, and forms of knowledge' (415), including how to plan, conduct, and evaluate teaching, and the concrete work methods the pupils will be engaged in. In addition to defining TC 'on paper', a major challenge in the TC trial programme, then, was to establish a subject-specific Didaktik by actually trialling TC and putting it to work in a 'school reality'; to familiarise teachers with the pedagogies required to realise TC's educational goals and embed teachers' practical knowledge into the subject, and feed these experiences back into the further conceptualisation of TC as a school subject and subject matter.

The following analysis of the translation of design in the public school's encounter with TC falls in two parts, attending to two distinct but interrelated concerns and practices in developing TC for the public school: 1) the composition of the subject matter; 2) the organisation of the large-scale trial phase, in which the subject matter was subsequently tried out. I attempt to articulate the translation of design in the trial of TC in terms of matters of fact and matters of concern; and of practices, discourses, inscriptions, and rituals that are matter-ed. I then discuss and conclude on the results with the aim of expanding the understanding of design's mobility and morphology in postdigital educational presents and futures.

## The Design Process Model and the Formative Potential of Design Processes

Let us first turn to the subject matter of TC as it was articulated in the subject matter proposal. This was a collection of documents that conceptualised and defined TC as a subject matter and potential school subject for the public school. It contained a description of learning outcomes (Common Objectives), a teaching guide, and a curriculum. The proposal was drafted by the Minister of Education's experts in 2018. The group was given the task of defining the subject matter as a formative, educational, creative, critical, and constructive subject. The expert writing group came up with a description modelled on four interconnected 'competency areas'. According to the description in 1) 'Computational Thinking', the pupils learn to translate a complex problem or phenomenon into something a computer can understand. In 2) 'Technological Knowledge and Skills', they learn about and to handle digital technologies, like computer systems and programming languages. In 3) 'Digital Design and Design Processes', the pupils learn to plan and execute a design process. In 4) 'Digital Empowerment', the pupils explore the possibilities, consequences, and impacts of digital artefacts (Undervisningsministeriet 2018). Notably, the proposal stressed that all competency areas should receive equal attention in the teaching, but that *the methodology that cuts across is a design approach*, driven by design processes. To this end, the design process model, shown hanging on a classroom wall in Fig. 1, was an important device in making design matter to pupils' learning and workflows in TC.

The design process model illustrates the categories of activities involved in a design process in TC. It shows a circle, an iterative process, of exploration, creation, and framing from the design task, doing field studies, generating ideas, fabricating and materialising, argumentation, and reflection. The gradient colouration of green through red, yellow, and back to green indicates the flow between what can be conceptualised, and visualised, as discrete activities, but in practice would be more of a fluid process of moving from divergent to convergent thinking (and doing). On field visits to The School, I encountered the model printed, laminated, and hung on the wall of the designated TC room, among other posters, e.g. about 'Corona hygiene rules' and the popular nationwide after-school coding club initiative Coding Pirates, which has been doing so-called 'IT creativity' since 2014. The design model resembles many such process models, and also pre-dates the TC trial programme. It was made by researchers in the 2014 FabLab@School.dk project at Aarhus University, which explored digital fabrication's educational potential (Hjorth et al. 2015). The model has since 'lived' on the project's website as one of many outcomes of FabLab@School.dk. As stated on the website, the model is now a resource that conveys what a design process is (or can be). Relevant to the trial programme, then, the model has been reproduced in textbooks, pedagogic literature, and inspirational material about TC.

Key subject matter experts (among them one of TC's main architects who is an interaction design scholar) explain the significance of design processes for TC, expanding on the official subject matter proposal. They discuss and introduce

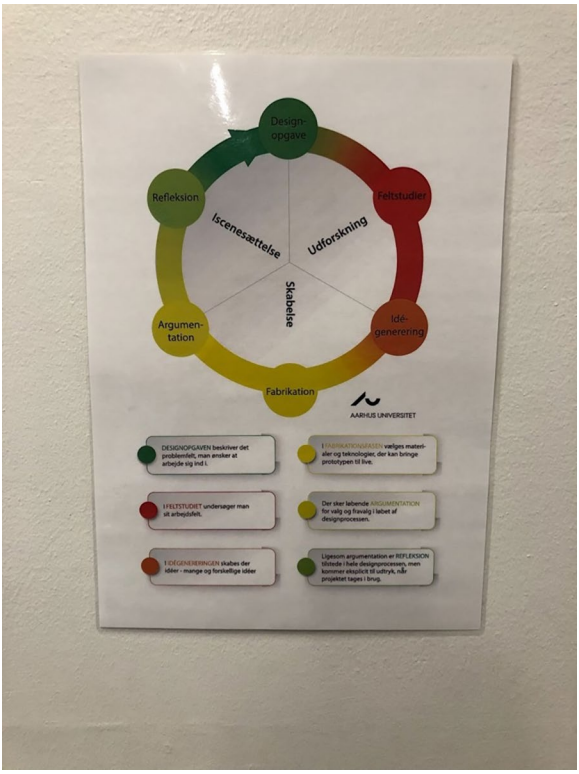


**Fig. 1** A laminated poster of a Danish-language version of The Design Process Model, attributed to Aarhus University (see Hjorth et al. 2015). The poster has a legend with small plain-language blurbs about what each activity entails. The poster hangs on a wall in The School's TC classroom. Author's fieldnotes September, 2020

both TC and the design approach. Importantly, they reflect on the design process model and note how it has made its way into the emerging disciplinary canon of TC by adapting design knowledge and techniques for school knowledge: 'The process model is in many ways similar to other design models, as it describes how we get from a challenge, through studies, to the construction of a digital artefact. However, it stands out by not being a model directed at professional designers, but rather at people who want to engage in Technology Comprehension' (Iversen et al. 2019: 44). This is an example of actors visibly doing and reflecting on the translation work involved in making a school knowledge from more general phenomena, vocations, practices, and knowledges.

Popkewitz describes such translation work as the 'alchemy of school subjects' (2004), 'an analogy for thinking about the translation "tools" of pedagogy as disciplinary knowledge (e.g., physics, biology, literature, sociology), which are made into problems of teaching and learning. Schools require translation and transportation models, as children are not scientists or historians' (Popkewitz 2008: 95). That is, learning to design is not intended to make children into designers, nor is learning to design a mirror of what happens outside of the school where design is undertaken. It is a unique inscription of design, which, however, necessarily translates, among other things, a set of social principles, civic values, and political desires that become translated into the school subject.

But even such a concern for who children become, rather than *what* they should become (what skills and competences they should acquire), routinely constitutes a discursive marker of 'struggle' over rather than reconciliation in debates about schooling in Denmark. The question of experts, observers, politicians, leaders, and practitioners becomes: Is *this* proposal, model, or approach formative? Indeed, it is often the question of whether a course of education or its content is formative that becomes the centre of debate, and where proponents and critics leverage subject matter knowledge and research to struggle over and debate the emphasis of, in this case, a design approach in realising the formative educational goals of TC.

Part of the translation of design into TC is this struggle, done, e.g. in the waves of pedagogical literature that emerged alongside the trial programme and TC's introduction to the Danish educational landscape, and which aimed to explore how to actively *work with* and develop the proposed form of TC. In what could be characterised as more critical and reactive literature, some of which leverage STS perspectives, critique is directed at the working methods and pedagogies of TC, what disciplines are 'invited' to compose TC, or for raising concerns about the 'technology-comprehensions' of TC. Peter Danholt has critically examined the proposed 'comprehension of technology' that is enacted in the subject matter proposal (2021), discussing the limitations of the anthropocentric view of technology it performs, and suggesting a 'more-than-human' technology comprehension that allows for a more complex understanding of co-existing with digital technology that is not a 'human-technology' binary. Bjarke Lindsø Andersen and Oliver Tafdrup remark on the lack, and potential, of history to balance the design and computing content (2021). Johannes Fibiger asks of a design approach: 'But is it [formative] to design a gadget?' (2020). Such probes show resistance to the underlying logics and, as Fibiger puts it, understanding(s) of technology that TC itself has. Proposals and critiques are as much a part of the translation of design, performing design as a knowledge that can make knowledge, but with disagreement about what it includes and excludes.

Among the experts who drafted TC for the trial programme, some have expressed profound frustration with what the discontinuation of TC's development means for Denmark, but also about what it projects about Denmark as a leader in digitalisation and an exemplar of technology education. Throughout the introduction of TC to the Danish school system, academic pedagogical research and commentary have made design matter by inscribing participatory design, stating: 'In a Danish educational context, the philosophy in participatory design can be viewed as a driving force for ensuring that the students don't just learn programming skills in school, but also become involved to such a degree that they can begin to cognise and create with the technology' (Wagner et al. 2020: 10). Design is made to matter as a mirror of the values of Danish public school education. TC is consistently touted as a Danish brand of technology education, even explicitly so in the subject matter description, which states that TC is 'inspired by descriptions of similar subjects internationally, but with a Danish angle with special emphasis on digital design and digital empowerment' (Undervisningsministeriet 2018). Design was made to matter for postdigital technology education by many pedagogically informed public gestures about design providing a balance to the computing fixation that other nations' technology education seemed to be developing from.

However, design in TC can be understood as reproducing a technological determinism, regardless of 'all the humanity' that is put into the equation. It thus keeps change within the limits of technological fixes because it encourages framing social problems as design problems. This is a potential limitation of design being put to work in technology education, and it appears in the same gesture that attempts to recoup human agency over technology by prescribing 'hands-on' critical and creative-constructive design processes as a central activity in learning TC and in young people being makers, not users, of digital technological society. The design process model is put to use by its proponents as a suggestion, a proposal, but still as a matter of fact. However, it is also received as a matter of concern for the Bildung question that the public school must contend with.

## The Prototype Model and Co-Creating Didactic-Pedagogical Knowledge

The trial of TC was an ambitious large-scale experiment responding to the ongoing technological transformation by intervening in one of the most established institutions of the Danish state: the public school. It was an effort of great political value in a highly digitalised democratic society that was galvanised to compete on a global economic and labour market, and in an increasingly commensurate transnational educational landscape. The TC experiment was not the first of its kind in Denmark. The public school has a long history of conducting so-called 'school experiments', now more formally referred to as pedagogical development work to avoid invoking the idea of the schoolchildren being lab rats or guinea pigs. Experiments in pedagogical development work have throughout the years been organised and mandated by different configurations of practitioners, councils, ministerial bodies, funding mechanisms, exemptions from regulation, and political mandates (see Skov 2006). Relative to earlier in the school's history, today the programmes are often responses to political goals that come to bear in, e.g. the Common Objectives, which thereby function as a key instrument of governance and power in Danish schools and schooling.

The Ministry contracted a consortium of research and teaching institutions to organise and conduct the development work in the school trial portion of the trial programme. The consortium adopted the shorthand Tekforsøget. The purpose of Tekforsøget's efforts was 'primarily to qualify and revise teaching materials and exercises in an iterative process with involvement of the participating teachers and other pedagogical staff from the participating schools' (Undervisningsministeriet and Styrelsen for IT og Læring 2018: 20). As stated in their start-up material for participating schools, Tekforsøget saw the school trial as 'fundamentally […] a co-creation project, where the participating schools and [Tekforsøget] collaborate closely' (Tekforsøget 2018: 4). To this end, Tekforsøget performed the task of turning the Ministry's steering documents and the expert-written subject matter proposal into materials that could be the focal point of a subsequent co-creative process of building the didactic-pedagogic foundation of TC with schools and teachers. The bulk of the materials that Tekforsøget's consultants, called subject matter developers, made were templates of lesson plans and courses of teaching, inscribed into.

pdf documents and PowerPoint slide decks that they uploaded to their website and made available for download to any and all. The materials were dubbed didactic prototypes, indicating that these were drafts, if not explicitly prototypes, of the subject-specific Didaktik of TC. Teachers (and others interested) could navigate to Tekforsøget's website and find the materials in 'the prototype bank'. These didactic prototypes were central in designing TC itself, a notion explained by Tekforsøget on their website (see Fig. 2), where the prototype model features.

This prototype model is a model about design because it illustrates the school trial's purpose of trying out the subject matter in relation to the subject matter description, Common Objectives, and the teaching guide. At the centre of this were the didactic prototypes: a suggestion for a subject-specific Didaktik that subject matter developers invited teachers to elaborate and modify. As such, in the trial the teachers and subject matter developers were also co-existing in an iterative design process, exploratively attempting to solve a problem of conceptual-theoretical knowledge being put to work in the field of everyday practical knowledge and conduct by working on prototypes that might bridge what was understood as a gap between the aforementioned. The statements and inscriptions by Tekforsøget perform the trial as a whole as a design project, if not a participatory design process, with Tekforsøget as the designers who invite teachers-cum-users into a co-creative process, to develop and iteratively design TC in an experimental frame constructed by Tekforsøget and dictated earlier by The Ministry. The prototype model and its use to illustrate the


**Fig. 2** A screenshot of the subpage at www.tekforsoget.dk/forlob/didaktiske-principper (accessed 29 September 2023) about didactic prototypes where the term and format were explained with a graphic that shows the role of the didactic prototypes ('prototype') and their relation to other steering documents, which were, from the top and clockwise: 'Goal descriptions', 'Formats', 'Teaching Guide', and 'Curriculum'. Author's fieldnotes, January, 2021

organisation of the trial phase around conceptual and theoretical artefacts perform teachers as makers of technological knowledge.

As I observed at The School, teachers did not always adopt the language of design and prototyping used by the subject matter developers, e.g. calling lesson plans didactic prototypes. Subject matter developers, too, would switch back and forth between calling them prototypes and lesson plans. This initially confused me, as I believed myself to be missing a crucial distinction. One teacher explained that the terms were interchangeable in the day to day; that didactic prototypes were for all intents and purposes courses of teaching, lesson plans, and examples of the progression of instruction, to use the known didactic-pedagogic 'field' terms for materials of this kind. When I enquired with Tekforsøget about why the materials were called didactic prototypes and not simply lesson plans or another term immediately known to teachers, a consultant affiliated with Tekforsøget explained that it was to give teachers 'some of their own medicine'. That is, the school trials and the experimental resources that circulated were deliberately conceptualised in the same design terminology that they aimed to teach the schoolchildren in TC. The consultant did also remark that giving the same medicine caused some 'conceptual confusion', because, indeed, in addition to prototyping with Tekforsøget, practically the teachers were also supposed to be helping the pupils make prototypes in the design processes embedded in TC lessons (which I discussed earlier).

In addition to being modelled into the prototype model, teachers and Tekforsøget also related through face-to-face meetings. In such a meeting, a subject matter developer from Tekforsøget, who was assigned to the school, would visit and spar with the teachers about their experience with teaching TC, the didactic prototypes, or things more general to the trial programme. The subject matter developer would introduce the latest relevant research and development in TC and contribute helpful tools to conduct the experimental teaching, e.g. co-teaching. As illustrated by these practices of design, conceived broadly, yet visualised 'simply' in the prototype model, the trial programme as a design project was about filling a perceived practical gap by building on prototypes of that practice. This is what, in the prototype model, the dotted lines around the space of the word prototype openly suggest. That the didactic prototype is a deliberately ill-structured object (Star 1989; Star and Griesemer 1989), but is a materialisation of an emerging, not finished, TC practice that teachers could meaningfully contribute to as makers, not users.

## Conclusive Discussion: Approaching a Comprehension of Design in TC and Beyond

As much as the trial of TC caused commotion because subject matter development of such consequence and scale rarely occurs in the public school, and new school subjects seldom become mandatory, the political outcome at the programme's natural end was just as controversial. Politically, the public school (as well as the corresponding national teacher education and training programme) was *not* made available to scale and develop TC from an experimental to a mandatory school subject. Yet TC and design as a foundation in its didactic-pedagogic conduct live beyond

the spatiotemporal configuration of the Ministry's four-year trial programme in the material artefacts, e.g. models and didactic prototypes that circulated in the trial. What is harder to inscribe and make material is the embodied tacit knowledge in those educators and subject matter developers who took part in the school trials and the months of immersion in TC. As much as TC and a design approach to engaging with digital technologies has become, if not a school subject, then a different kind of obligatory passage point, the lack of translation for embodied experience with learning, teaching, and developing TC renders its future as a school subject in the Danish public school uncertain.

In the preceding sections, I have attempted to show the role of pedagogical research, theories, conceptualisations, discourses, rituals, and visualisations in inscribing design into TC's epistemic practices. When introducing a new subject matter to the public school, it must contend with, e.g. Bildung and Didaktik, Common Objectives and 'freedom of method' and the friction and reconciliations of these discourses that are ritual in the public school and schooling. One point of tension, which critical studies of postdigital education should intervene in is exactly the Bildung question of who children should become through various schooling activities. With TC, children are to become more 'active' in their encounters with technology, and while that previously meant learning to be proficient in using technology, 'use' is now problematised as 'inactive' or 'passive'. This binary drives the imaginaries about desired and less-desired subjectivities and what 'the educated subject' looks like, favouring makers, not users. The rigorously researched, pedagogically conceptualised, and well-intentioned design process model shows that TC is modelled on participatory design, which highlight many of the same values and subjectivities as the very institution of the Danish public school. However, as remarked by Macgilchrist (2019), if the present and future world is consistently performed as 'digital' and scarcely imaginable as anything but digital, then there is an argument to be made that 'active' is 'reactive' to the digital building blocks of society. This is not an inconsequential limitation to design in postdigital education.

What can be seen in these inscriptions, performances of knowledge, and emerging subjectivities is a proposition that citizen subjects can (with design approaches) and should (because it is set to become part of statutory education) be makers of a technologically determined democratic society. This crystallises a particular form of agency and change, but keeps these within limits of the technologically determined. Such an imaginary raises questions of those forms of agency and change. Are all problems design problems? Can you say no to designing? Who can demarcate the terms of participation, and who has to be invited to participate?

On another but related note the participatory ideal of design is performed in the inscriptions of the trial programme itself when subject matter experts invite teachers to create and be makers, not users. The implication is that TC can be designed, but should be designed by merging 'theoretical knowledge' and 'practical knowledge' from the 'field' of everyday schooling. The prototype model, e.g. is a research-based, didactic-pedagogically sound 'fact' that the field relates to, because it promises to reconcile the tension between exactly both types of knowledge, 'theoretical' and 'practical'.

It is just as critical to examine the performances of knowledge and subjectivities in schooling's subject matters as it is to examine those of platforms, data analytics, and proctoring software. As the scope of both critical studies of EdTech is growing (Selwyn et al. 2020; Williamson 2021), scholars have also directed a critical eye to what could be termed 'TechEd' (see Hansbøl 2019), where it is the social, discursive, and material configuration of educational content about technology that is empirically examined and/or theorised as new curricula, literacies, or competencies, e.g. 'data literacy' (Pangrazio and Selwyn 2021), 'critical data education' (Pangrazio and Sefton-Green 2020).

Subject matters and school subjects have the appearance of matters of fact, but as Latour remarks, all matters of fact are unruly bundles of concerns, and there is merit to engaging with the unruliness, e.g. such as it is enacted in a trial programme for a new school subject about technology in a public school system. An institution like the Danish public school is positioned to amplify and 'give scale' to the knowledges, facts, and concerns it puts on the school schedule, and which its practitioners and experts perform in the day to day, thus implicating educational futures in its very present design engagements.

**Funding** Open access funding provided by IT University of Copenhagen



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