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Dirckinck-Holmfeld, L., et al. (2019). Modes of Teacher Participation in the Digitalization of School. *Designs for Learning*, 11(1), 63–71. DOI: https://doi.org/10.16993/dfl.109

RESEARCH

Modes of Teacher Participation in the Digitalization of School

Lone Dirckinck-Holmfeld*, Bertil Johannes Ipsen†, Andreas Lindenskov Tamborg†, Jonas Dreyøe†, Benjamin Brink Allsopp† and Morten Misfeldt†

Previous research has emphasized the importance and potential of actively involving teachers in the design and implementation of educational technologies in schools. However, only a few studies have explored the development of methodologies for engaging teachers in the appropriation of digital technologies, as the increased digitalization of many education sectors demands. Drawing on experiences from two large-scale participatory research projects, this paper investigates two approaches to involving teachers in the design and implementation of digital learning platforms. Specifically, the paper draws on case examples to examine how participatory data design and future workshops can help to cultivate communities of practice in support of teachers' appropriation of digital technologies.

Keywords: Participatory data design; future workshops; educational technology; teacher participation; digitalisation

Introduction

In recent years, many European countries have increased investment in digital technologies and platforms for educational purposes (Johnson, Adams Becker, & Hall, 2015), reflecting the positive aspiration or belief that digital learning platforms can enhance student learning (Edmunds & Hartnett, 2014; Lu & Law, 2012; Psycharis, 2013), streamline teachers' work (KL, Ministry of Education, Ministry of Finance, & Ministry of Children, Gender Equality, Integration and Social Relations Ministry of Economy and Home Affairs, 2014; Johansson & Glauman, 2014) and support teachers in the collaborative production, sharing and development of teaching materials (Gueudet, Pepin, Sabra, & Trouche, 2016). However, there is evidence that exploiting the potential of such platforms poses significant challenges. First, teachers often find that the available functionalities lack epistemic value, and that these tools add to their workload rather than saving time (Underwood & Stiller, 2014). Additionally, teachers often express concerns about inadequate information and their own lack of involvement in how platforms could and should be implemented (Lochner, Conrad, & Graham, 2015). Many studies have argued the need for greater teacher involvement and participation in deciding what functionalities and technologies such platforms should include, and how they should be designed and implemented (Lochner et al., 2015; Tamborg, Bjerre, Andreasen, Albrechtsen, & Misfeldt, 2017). The present paper draws on experiences from two large participatory research projects exploring these issues in a Danish context. The first method is participatory data design (PDD) (Jensen, Madsen, Misfeldt, Munk, & Tamborg, 2017), which involves teachers in the selection, visualization, and interpretation of data to be included in a digital learning platform prototype (Misfeldt, 2016). The second is the future workshops (FW) approach (Jungk & Müllert, 1984), which was used to support the mandatory implementation of learning platforms in Danish elementary schools (Misfeldt et al., 2018). These two approaches are analyzed within the communities of practice (COP) framework (Wenger, 1998) to investigate how such communities can be cultivated and sustained (Wenger, McDermott, & Snyder, 2002). The paper explores how PDD and FW invite for aliveness in the communities of practice involving teachers in the design, implementation, and appropriation of learning platforms. More precisely we investigate the potential for cultivating COP among teachers using these two approaches. To begin, the paper provides a context for the two projects by describing the current implementation of digital learning platforms in Denmark.

The Danish curriculum and learning platforms

In 2014, a new curriculum was implemented in Danish elementary schools, inspired by international competence-based curricula such as the Ontario Curriculum (Rasmussen & Rasch-Christensen, 2015). The intention was that the new curriculum would be short, easily understood (by teachers, students, and parents), systematically constructed, and usable in daily teaching practice.

* Department of Communication and Psychology, Aalborg University, DK

† Department of Learning and Philosophy, Aalborg University, DK

Corresponding author: Lone Dirckinck-Holmfeld (lone@hum.aau.dk)

Denmark's new curriculum (Undervisningsministeriet, 2017) was designed to be goal-oriented and competency-based, centered on the so-called *simplified common goals* (Forenklede Fælles Mål), which organize teaching as a three-level structure (Misfeldt, Bundsgaard, Slot, Hansen, & Jespersen, 2015). At the highest level, each subject has a general goal that describes what the student should learn. On the next level, each subject has up to four competency areas, further articulated as competency goals for each grade level. On the third and lowest level, competences are broken down into knowledge-skill pairings that students must acquire. While the competencies provide an overview of the subject and form the basis for dialogue between staff, parents, and students about the student's learning, the knowledge-skill pairs describe in more detail what the student needs to learn. Along with the political focus on digitalization, these learning objectives and the increased requirement for teachers to document their work motivated the development and implementation of new platforms to support documentation and preparation as well as actual teaching in the classroom (KL, Ministry of Education, Ministry of Finance, & Ministry of Children, Gender Equality, Integration and Social Relations Ministry of Economy and Home Affairs, 2016). By the end of 2017, all municipalities in Denmark had acquired a learning platform to be implemented in the coming years.

Putting more data in the hands of teachers may prove beneficial in the classroom (Earl & Fullan, 2003); student data can be used both internally by teachers and externally as a management resource. The learning platforms that gather and create this data should ideally serve a double function, centralizing the collection and aggregation of knowledge about student performance and providing feedback to teachers based on these data. This should facilitate the individual school's own self-governance while making teachers accountable for externally determined learning outcomes. Our research into the implementation of the learning platforms shows that the collaborative aspects of learning platforms have to date proved difficult for teachers and schools to exploit (Misfeldt et al., 2018). In exploring how to better capitalize on these new opportunities, we have employed various participatory research-based methods. To analyze the potentials and shortcomings of these methods, we draw on the theory of communities of practice (Wenger, McDermott, & Snyder, 2002).

Theoretical Framework: Communities of Practice and their Cultivation

The present paper builds on Wenger's (1998) concept of communities of practice. As opposed to other modes of collaboration (such as teams), communities of practice are organic and may entail as many objectives as there are members (Wenger, 1998). As a voluntary and informal means of collaboration, a community of practice builds on mutual engagement, joint enterprises, and a shared repertoire (Wenger, 1998). These characteristics can typically be found in schools, as teachers are engaged in the mutual enterprise of educating pupils; they are competent professionals sharing didactic repertoires and methods for teaching, learning, and goal-setting; and they are engaged in cultivating and further developing the teaching profession. As documented in Sørensen, Levinsen & Skovbjerg's (2017) research on IT experiments in Danish schools, teachers are deeply engaged in the agenda of digitalization and its potential contribution to teaching and learning practice and to student wellbeing. Danish school culture is characterized by horizontal communication practices, where teachers participate in discussions of professional issues with administrators and leaders, with school authorities in the municipality, and with politicians.

In *Cultivating Communities of Practice*, Wenger et al. (2012) listed seven principles as guidelines to help community designers to create a structure that invites *aliveness* in the community, based on the authors' many studies of work practices and social groups in Silicon Valley and beyond. Their focus on *aliveness* differs from other approaches to community design by focusing on the community's organic growth as a primary design goal to "bring out the community's own internal direction, character, and energy" (Wenger et al., 2002, p. 51) by applying the following seven principles:

1. Design for evolution
2. Open a dialogue between inside and outside perspectives
3. Invite different levels of participation
4. Develop both public and private community spaces
5. Focus on value
6. Combine familiarity and excitement
7. Create a rhythm for the community

Based on this framework, the present paper argues for a relational understanding that views the use of technology as an iterative process of participation and reification. Similar perspectives have been developed in extensions of structuration theory, where the use of technology is seen as "recursive interaction between people, technologies, and social action" (Orlikowski, 2000, p. 404). Viewing technology through this participatory, practice-oriented lens allows us to see technology use as both enactment and appropriation (Orlikowski, 2000). As the scope and focus of the present paper is confined to technology appropriation and enactment in schools, it falls within the wider literature on designing and implementing educational technologies, which already encompasses participatory and continuous approaches to technology in the domain of IT and education, notably in design-based research (Christensen, Gynther & Petersen, 2012), learning design (Wenger, 1998), and interaction design (Kaptelinin & Bannon, 2012).

The choice of communities of practice and their cultivation as a theoretical framework (Lave & Wenger, 1991; Wenger, 1998; Wenger et al., 2002) was based on its capacity to build on and strengthen the teacher's professional agency (Biesta, Priestley, & Robinson, 2015) and to support our analysis of the methods we have used to explore the appropriation and enactment of learning platforms. In particular, this framework's conceptualization of joint

participation enabled us to investigate the dynamics and aliveness of these processes. Additionally, the engaged teachers, administrators, parents, and students that typify Danish school culture provide a solid foundation for building meaningful change based on active participation. This makes the school an obvious setting for participatory approaches that build on the concept of communities of practice to support, cultivate, and develop community resources as a basis for the implementation of learning platforms and the evolution of teachers' competences and pedagogical and didactical practices.

The next two sections introduce the two approaches to participatory design we have chosen to explore (FW and PDD). In each case, we briefly describe the research project where the approach was applied before relating it to Wenger's principles for cultivating communities of practice.

Future Workshops: Designing for Implementation

The *future workshops* approach was applied in the large-scale research and development project "Use of Digital Learning Platforms and Learning Materials" (Danish: Anvendelse af digitale læringsplatforme og læremidler) (Svensson et al., n.d.), which was funded by the Danish National Agency for IT and Learning (STIL). In total, 28 researchers and education consultants and 15 schools across Denmark participated in the project, which employed a participatory approach to explore the implementation of learning platforms. Focusing on pedagogy, technology, and organization, the project combined future workshops, user involvement, and design-based research methods to understand and address the problems and opportunities experienced in practice.

Future workshops (Jungk & Müllert, 1984) is a democratic method for solving social problems that gives participants a voice—in this case, in shaping and implementing a technology. Our workshops involved a critique phase, a fantasy phase, and an implementation phase, which was organized as a situated design experiment. In the first place, this process allowed the participants (primarily teachers) to voice all their criticisms of learning platforms and their implementation before formulating positive solutions. After voicing their visions and wishes for the technology and their values for teaching and learning, they applied these in small situated design experiments. The advantage of this approach was that it actively involved teachers in discussion and exploration of the learning platform and in decisions about implementation and use at their own school—decisions in which they would otherwise have had no involvement.

In reporting this project (Misfeldt et al., 2018), we considered how schools related to the learning platforms through the future workshops, as well as the problems and opportunity spaces created in implementing the platforms. As such, the study explored some of the pedagogical, professional, and organizational concerns that are likely to arise when implementing learning platforms in classrooms. The future workshops addressed the processes of appropriation and enactment rather than the design of the platforms themselves. One of the main findings was that potential didactical advantages could not be actualized without first addressing some of the teachers' core issues, relating in particular to the platforms' embodied didactic values, how they impact organization and teamwork, and their usability.

According to the teachers, the most problematic issue was "humanity and formation" (Misfeldt et al., 2018). Among other key findings, teachers felt that the learning platforms embodied competitive values, and that children were being objectified as "things" (Dirckinck-Holmfeld & Ræbild, 2017). In the specific case considered here, enforced student evaluation was based on a scale of absolute values, even though teachers favored formative assessment and an educational culture based on trial and error. It also emerged that the learning platforms did not afford new didactic approaches based on problem-oriented or practice-based learning. On the contrary, the very structure of the goal-oriented curriculum implemented in these systems affords a detailed output- and task-oriented pedagogy that is the same for each discipline and so becomes boring for students. Another key insight was that identifying these issues (and handling them adequately) requires an implementation process that gives teachers a voice; in many cases, the future workshops succeeded in facilitating this involvement.

Using Future Workshops to cultivate communities of practice

In cultivating a successful community of practice in schools, giving teachers a say in developing the prevailing technologies is a necessary part of the process. In Wenger's framework, the duality between reification and participation sustains communities of practice. The participatory nature of future workshops and their focus on creating shared ideas and representations contributes to their utility as a tool for building strong communities.

The first of Wenger et al.'s principles for building alive communities of practice is *Design for evolution.* The central claim is that good community design is more like "shepherding" than designing from the ground up (Wenger et al., 2002, p. 51). In this case, as the learning platforms enter an already existing structure of personal networks, academic and didactic expertise, and practices, the future workshops should aid platform adoption by opening a dialogue about what the technology can do for the community in question and how it relates to, conflicts with, and expands current practice. As mentioned earlier, the future workshop revealed many discrepancies between teachers' values and the objectification they felt the platforms embodied. It follows that opening this dialogue also invites discussion about the kind of evolution the community's members desire, and how the learning platform can be used or adapted to support this evolution.

Wenger et al.'s second principle for cultivating communities of practice is *Open a dialogue between inside and outside perspectives.* "Good community design requires an understanding of the community's potential to develop and steward knowledge, but it often takes an outside perspective to help members see the possibilities" (Wenger

et al., 2002, p. 54). While insiders are often aware of core issues and problems, outsiders may be better at seeing new opportunity spaces for the community. In many cases, deciding how to implement a new technology such as learning platforms in schools is seen as the school leader's job, perhaps in collaboration with a local pedagogical ICT supervisor. However, future workshops actively involve teachers in supporting the implementation of learning platforms; their insider knowledge and perspective on how technology might facilitate their daily work is an important asset in deciding how platforms are to be implemented. This can simultaneously help and hinder decisions that may compromise teachers' values and preferred pedagogical approaches. Thinking about the design and implementation of learning platform as continuous rather than as a one-time activity corresponds to the development and evolution of communities of practice as ongoing and often long-term processes (Wenger et al., 2002).

Wenger et al.'s 3rd and 4th principles were not in the focus in the research project, however future workshops can also be used to bring *different levels together*. As an example in one school, the school leader as well as the school consultants from the municipality participated at the local school in the final presentation of the detailed experiences from the future workshop and the intervention, and this facilitated a detailed and grounded exchange of data and knowledge between the different stakeholders.

Wenger et al.'s fifth principle for cultivating communities *focus on value*. Cultivating a community of practice of teachers and school leaders around learning platforms (or anything else) is always an attempt to deliver value for members of the community. However, those values are not necessarily clear to the community throughout its lifetime. According to Wenger et al., community designers should not seek to determine a community's values in advance; rather, the community needs to "create events, activities, and relationships that help their potential value emerge and enable them to discover new ways to harvest it" (Wenger et al., 2002, p. 60). As previously noted, the issues that were assigned the highest priority in the future workshops related to values such as "humanity and formation." In this way, the workshops clearly opened a space in which to discuss and re-evaluate not only the kinds of value promoted by the learning platforms but also the values considered important for the community itself.

In cultivating the community of teachers and building on their aliveness and engagement, one goal was to spark *excitement* among the learning platform's users. The future workshops (including the design experiments) facilitated a renegotiation of practices when working with the platforms, corresponding to Wenger et al.'s sixth principle: *Combine familiarity and excitement*. When cultivating communities, it is important to sustain some level of familiarity, as this ensures the necessary comfort level for candid discussion (Wenger et al., 2002, p. 61). At the same time, it is important to let community members participate in discussions of the project "with no risk of getting entangled in it" (Wenger et al., 2002, p. 61) to allow them to make freer inputs. The vision phase of the Future Workshop provided exactly that — a space where the teachers could envisage how the learning platform might support their daily work with students and parents while implementing curriculum reform.

The last of Wenger's principles is *Create a rhythm for the community*. In the case of learning platforms, as many rhythms are already simultaneously present, successful implementation depends on integrating the platforms in a way that ensures continuous rethinking and dialogue. To sustain this rhythm, it is important that teachers and administrators—the community's core group—meet regularly to discuss their experiences of the platforms. In combination with small and situated design experiments, future workshops can provide a rhythm for incremental development.

Overall, future workshops as a method of intervention mirrored several of the principles for cultivating a community of practice by establishing a mutual space in which community members could discuss and renegotiate the learning platforms. Additionally, the workshop phases (critique, vision, implementation) and the dialogical learning situation that emerged provided a common ground for teachers and researchers to build engagement and excitement in further exploring the learning platforms and the development of locally informed and embodied policies and strategies. As such, the workshops contributed to the community's further aliveness. However, maintaining this momentum might require new initiatives and workshops to provide the teachers with spaces for continuous enactment and renegotiation of the learning platforms in close interaction with their practice, the designers, and the municipality as owners of the platform.

PDD: Designing for Use

PDD is a concretization of a broader capacity building framework. As a resource used in teaching, capacity building can be seen as an alternative to New Public Management tools, instead seeking to manage complexity and unpredictability through active deployment of co-production and co-creation methodologies between stakeholders (Jensen et al., 2017). PDD is the "involvement of stakeholders in the development of data and data structures that can be used to describe, support, attribute value to, set goals for, and develop the stakeholders' own work" (Jensen et al., 2017, p. 174–175). PDD attempts to turn the digital traces increasingly left by actors into internal resources for individuals, organizations, or states. Three important aspects of PDD are datafication, open data production, and an open use process (Jensen et al., 2017).

To illustrate the use of PDD, we refer to another large-scale research project, entitled "Digital Object Oriented Teaching" (Misfeldt, 2016). In this project, the so-called *goal arrow* was developed to address the problem of linking the externally defined learning outcomes of the national curriculum to concrete teaching situations in the classroom. The goal arrow is a prototype technology that enables teachers to construct their own interpretation of learning goals from the national curriculum, and to visualize and evaluate students' progress in relation to those goals (Misfeldt et al., 2015).

Working with the goal arrow, teachers first define a goal of their own, which they then divide into three categories: what *all* students must be able to do, what *most* students should be able to do, and what the *most advanced* students should be able to do. The teacher must then relate each goal to one of the objectives from the national curriculum. The tool enables the teacher to develop a lesson plan that operationalizes teaching goals for the rest of the course. Additionally, each learning objective specifies three concrete indicators of learning that can be identified in students' performance. The tool aggregates data on the students' progress as indicated by the teacher in relation to learning goals throughout the course. When the teacher documents a student's progress, the data are collected and displayed digitally as shown in **Figure 1** above. This enables the teacher to use the tool in the classroom to talk to students about their development, based on a visual representation of the individual's development and of the class as a whole. The goal arrow helps teachers to describe lesson plans, to specify situated learning goals, and to relate these to the national curriculum. The indicators can then be used as a yardstick to determine how well the individual student is performing in relation to the learning objectives, and as a device for communicating with students about the subject goals and objectives.

As discussed above, a key goal of PDD is to place the production and use of data in the hands of local actors (Jensen et al., 2017, p. 177). The goal arrow enables teachers to develop their own goals for students and to evaluate their students on the basis of those goals. As such, it is an example of a learning platform that can be used for PDD. One of the tool's potential benefits is that single-situation assessment practices (e.g. tests) can be integrated as a ubiquitous and ongoing element of teaching practice. Additionally, allowing teachers to define their own goals for students affords a sense of ownership of the data and of the goal pursued by means of those data (Jensen et al., 2017).

Using PDD to cultivate communities of practice

PDD's capacity to place the production and use of data into the hands of teachers themselves makes it a useful method for cultivating communities of practice. In the project, the researchers tried to use the data to link the simplified common goals to local classroom practices (Jensen et al., 2017). The datafication and subsequent visualization of complex information about students' progress and the teacher's didactic vision offers members of the community tangible and shareable ways of relating to and with the curriculum and classroom practice. This projection of abstractions onto material objects is what Wenger calls reification, allowing us to create objects around which to organize negotiations of meaning (Wenger, 1998, p. 73). As previously mentioned, reification is one half of Wenger's reification-participation duality, and it is through this participatory datafication of abstract problems that PDD can help to cultivate communities of practice.

Wenger et al.'s (2002) first principle, *Design for evolution*, addresses how design elements can catalyze a community's natural development. On this view, communities are not created from scratch but evolve from pre-existing networks. The purpose of introducing new design elements, then, is not to impose a preconceived structure but to aid the evolution of the community in what Wenger et al. (p.53) refer to as *community design*. Applying this principle to the design and implementation of learning platforms invites us to consider the particularities of the school's existing physical, social, and organizational structures. Setting the teachers' experiences of using the goal arrow against their reception of the learning platforms, this application of PDD seems capable of taking account of the pre-existing environments and structures within which the technology is being implemented. In using the goal arrow, teachers did not report any sense of imposed technology-embedded values or practices (as was the case with the learning platforms). One explanation was the greater flexibility afforded by the technology, which

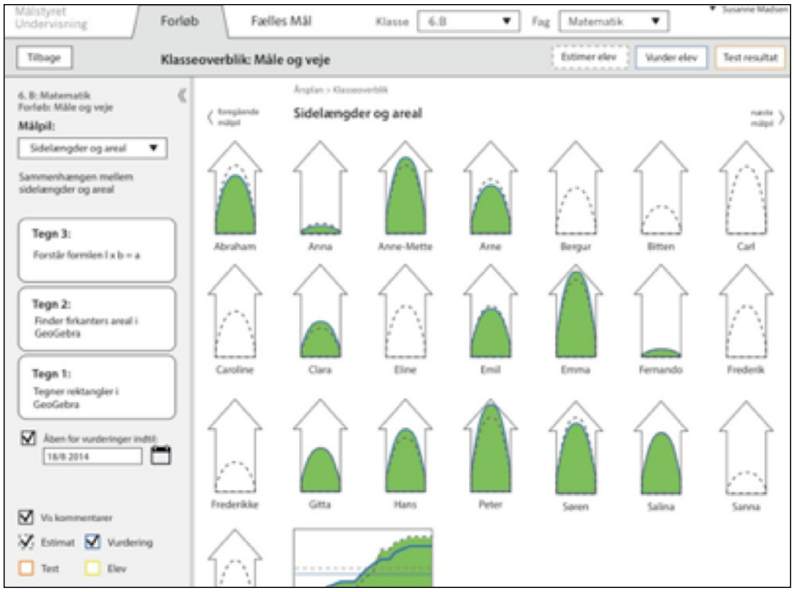

Figure 1: Screenshot of the goal arrow.

gave the teachers an opportunity to renegotiate the simplified common goals and to link them to local practices and by this contributing to the evolution of the classroom community.

According to Wenger, *insider perspectives* are necessary, but an *outsider* can often help the community to see new opportunities and challenges: "Only an insider can appreciate the issues at the heart of the domain (…) but it often takes an outside perspective to help members see the possibilities" (Wenger et al., 2002, p. 54). In relation to learning outcomes, the teachers expressed clear concerns regarding the implementation of the new curriculum and the new learning platforms, as described in our literature review (Tamborg, Bjerre, Albrechtsen, Andreasen, & Misfeldt, 2017). By allowing teachers to formulate their own learning goals and to relate these to the simplified common goals, PDD (as used here) seeks to address these outside decisions in locally anchored ways.

The members of communities of practice exhibit *different levels of participation*. Wenger et al. (2002) categorizes members as core group, active participants, and peripheral members. They claimed that peripheral members' involvement is often discouraged in communities because their participation may appear half-hearted to core and active members. Nevertheless, Wenger et al. (2002) advocated an approach that makes all participants feel like full members. In the case of the goal arrow, it is not easy to identify those who participate actively and those who do not. However, the developers of the learning platforms, the politicians who created the national curriculum, and the advisers that assist implementation and use of the platforms may all be considered peripheral members of the community. The goal arrow opens up a collaborative digital space among teachers and school management, but it does not actively engage those on the community's periphery. The collection and visualization of data provides reification of a kind that can be shared with peripheral members to ensure their inclusion.

Finally, the externally determined learning objectives of the national curriculum, which may seem rigid, are renegotiated by the teachers working with the goal arrow, opening up a space for dialogue about interpreting and applying those learning objectives. This may help to provide a *rhythmic* structure, within which teachers can continue to discuss their use of the platforms.

Discussion: Participation in Communities of Practice

When teachers, students, and management appropriate digital technologies, they effectively make themselves at home in new ways and new places (Wenger, White, & Smith, 2009). Focusing on the communal aspects of technology implementation enables us to see the work with learning platforms in terms of members of the community learning together. In this regard, the analyses described above sought to establish how PDD and FW bring aliveness to the teachers communities of practice appropriating and enacting learning platforms.

As applied in the use of the goal arrow, PDD is especially useful as a tool to facilitate collaboration among teachers that will promote the evolution of educational practice. In this regard, the primary objective is to cultivate a community of practice around the *use* of a learning technology to facilitate goal setting and teaching objectives. On the other hand, the future workshops enabled us to understand how teachers relate to the learning platforms themselves. This allowed us not only to identify everyday issues of usability and reception in the classroom but also to characterize the teacher's experiences of the technology as fundamentally at odds with their own pedagogical and didactic values. Opening up this dialogue makes the future workshops approach especially fruitful when cultivating communities focuses on *implementation* of the platforms.

While the future workshops were mainly concerned with how the learning platforms can be renegotiated and enacted locally, PDD sought to actively produce, use, and display data with the participation of community members. That focus on data creation is one key difference between the two methods; another is that while PDD opens up a digital collaborative space between the stakeholders, FW rely primarily on the physically presence of participants. Additionally, the goal arrow's high degree of plasticity should be acknowledged in that it enables teachers to find their own ways of relating the simplified common goals to local practice. In contrast, the future workshops were meant to deal with learning platforms that were less flexible in the design.

A key strength of the goal arrow was the sense of ownership of learning goals that the platforms provided, leading to a stronger connection between the teaching situation and the externally determined curriculum and generalized learning outcomes. Similarly, the future workshops facilitated rethinking of platform *use* based on the teachers' own experiences, so allowing them a say in how the technology use might be interpreted and enacted. In this way, the future workshops also helped teachers to take ownership of the platforms themselves while the goal arrow, as one example of such a platform contributed to a sense of ownership of a certain functionality, that of formulating simplified common goals. Further, the collaborative spaces opened by the goal arrow gave teachers a feeling of ownership of the platforms themselves, while the future workshops provided a sense of ownership of new didactical ideas afforded by the platform *use*.

We believe that the FW and PDD approaches may complement each other in affording teachers a sense of ownership. One of the key criticisms of future workshops was that they did not form part of the process of changing the learning platforms themselves (Dirckinck-Holmfeld & Ræbild, 2017). While teachers appreciated being able to express their thoughts about the learning platforms and about how to make the best use of them, the inability to actually change the technology meant that taking ownership of the platforms did not occur at some schools. However, by providing a functionality for teachers to set up their own learning goals, as provided by the goal arrow as a functionality may alleviate some of these frustrations. This would require a dialogue not only between local stakeholders at the schools but between the schools and the developers of the technology.

Participation in PDD can be viewed on a spectrum, where stakeholder involvement means letting participants (in this case, teachers) have a say on even the most trivial, design concerns or, at the opposite extreme, not allowing them to participate at all. We believe that participatory data design and future workshops allow participants to navigate the different levels of participation as required. Both approaches raise concerns among outside stakeholders (politicians and municipalities) on how to establish a dialogue regarding the design, roll-out, the implementation and use of the technology. The FW seems to succeed in making outside stakeholders feel involved in a continuous implementation of the technology because they can participate in detailed discussion of the teachers' various interpretations of the technology and ways of using it. The PDD also opens up this kind of collaborative space for outside stakeholders, but in our case, the objective was instead to take outside decisions and to anchor these in local practices. In this case, an outside decision can be seen as implementation of the simplified common goals, which is then redefined and operationalized by the teachers.

The visualizations produced in PDD enable parents and other outsiders to follow students' progress, so serving as reifications that open up the participatory space to include outside stakeholders. In this sense, both approaches support the active participation of outside stakeholders; FWs are useful for ongoing interpretation and use of the technology, and PDD as applied here lets the teachers renegotiate outside decisions and create a digital collaborative space that allows outside stakeholders to participate. The two approaches address different aspects of appropriation and enactment, and in that context, it seems useful to introduce Kaptelinin and Nardi's (2006) reflections on the structure of activity as discussed in activity theory. In this case, activity theory is of value in helping to articulate how the approaches differ in addressing appropriation and enactment.

Kaptelinin and Nardi (2006) propose a three-level dynamic division of subject-object interactions. The most fundamental of these is the *motive*, which relates to needs and values. The motive is "an object that meets a certain need of the subject" (Kaptelinin & Nardi, 2006, p. 59); the meaning of *activity* in activity system theory is determined by its role in attaining the motive. Activity and motive are the fundamental building blocks of activity theory. At the next level, embedded in motives and activity, are human *actions* and *goals*, where different actions may realize the goals. Finally, *operations* are interactions at a routine level, stressing that the relations Activity – Action – Operation; and Motive – Goal – Condition are both dynamic, vertical as well as horizontally related.

Returning to the discussion of FW and PDD, we have shown that FW can be used to establish a space for dialogue in research and development projects. In the cases presented here, this afforded teachers an opportunity to discuss their concerns and reservations about the learning platforms at a deep level. These included concerns about the motives and values informing pedagogy and didactics, as well as those inherent in the platforms. FW also helped the teachers to imagine how to make use of the learning platform, and how to act on these imaginings. As such, FW provided a space for teachers to discuss the meaning of activity at the motive level. This level is also acknowledged in Wenger et al.'s (2002) principle *Focus on value* when cultivating a community of practice. PDD was used at the more concrete action level to co-create with the researchers a practical way of simplifying goal-setting. PDD also confirmed the strength of visualization as a communication tool and to involve peripheral participants in the community of practice. As such, both approaches support the cultivation of aliveness and teachers' agency in appropriating the learning platforms, although on different levels. Both approaches can be used separately or hand-in-hand to negotiate the implementation process and cultivating communities of practice. The two approaches create spaces for subject-object interactions both at the fundamental level of motives and activity (FW), and at the more tangible goal and action-oriented level (PDD). Our findings also indicate that participatory design methods, which have primarily been promoted in a design context, should also be applied in local design and implementation processes to foster negotiation, interpretation and didactical advances and to further develop a school culture and community of practice based on teachers' ownership, aliveness, and engagement.

Conclusion

This paper has discussed how the cultivation of communities of practice can contribute to the implementation, appropriation, and enactment of learning platforms, using two distinct approaches to participatory design. We have further demonstrated how these methods may complement each other when implementing and using new technology in the classroom, and we can conclude that PDD and FW achieve this in different ways. While PDD helps to create participation and reification at the action level once teachers and researchers have agreed on the objectives of goal-setting, FW provides a mutual space for user dialogue at the value and motive level. In facilitating the appropriation and enactment of learning platforms, this level of engagement should not be underestimated. Our findings in relation to these two approaches align with the view that teachers should be more involved as active participants in the design and implementation of learning platforms (Lochner et al., 2015) and should be allowed space to explore epistemic value, exploiting both potentials and constraints (Underwood & Stiller, 2014).

The specific advantages of the two approaches were outlined in relation to Wenger's seven principles for cultivating communities of practice. As such, the paper contributes to the integration of learning platforms in a way that builds on teachers' professional agency while strengthening their communities of practice.

Competing Interests

The authors have no competing interests to declare.

Authors Contribution

- Lone Dirckinck-Holmfeld: Lead on process theory and analysis, lead on revisions – core participant LP project
- Andreas Lindenskov Tamborg: Contribution to first

draft and audits, as well as writing on both versions – core participant in both research projects (LP, PDD)

- Bertil Johannes Ipsen: Wrote the first draft – contribution to the first draft of the article
- Jonas Dreyøe: Supporting Bertil in writing the first draft – contributes to the development of PDD concept
- Benjamin Brink Allsopp: Supporting Bertil in writing the first draft – participating in both projects (LP, PDD) – contributes to the development of the PDD concept
- Morten Misfeldt: Sparing, mentoring and core participant/lead in both projects (LP, PDD)

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How to cite this article: Dirckinck-Holmfeld, L., Ipsen, B. J., Tamborg, A. L., Dreyøe, J., Allsopp, B. B., & Misfeldt, M. (2019). Modes of Teacher Participation in the Digitalization of School. *Designs for Learning*, 11(1), 63–71. DOI: https://doi.org/10.16993/dfl.109

Submitted: 01 May 2018 **Accepted:** 15 April 2019 **Published:** 24 June 2019

Designs for Learning, is a peer-reviewed open access journal published by Stockholm University Press.

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