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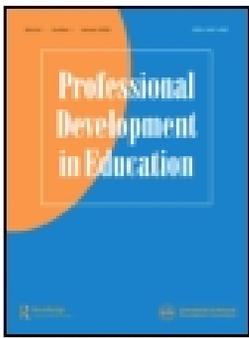
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Towards a learning community: understanding teachers' mental models to support their professional development and learning

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ABSTRACT

Amidst societal, demographic and educational changes, teachers are expected to engage in professional development and learning (PDL) throughout their careers. This study explores school teachers' mental models about their work in the framework of Senge's learning organisation, aiming to support their PDL during curriculum reform and organisational changes. The study's data comprise 41 semi-structured interviews with each teacher in one school community. These interviews were analysed using qualitative, data-driven yet theory-informed content analysis. In the first analysis phase, fragments of mental models concerning teachers' work and their school community were explored. These fragments included themes such as school rules, principal's role and working with colleagues. The findings show that the teachers' mental models regarding their work and school community can be characterised as contradictory and even opposite. In the second phase, these fragments were brought together to form a systemic, holistic picture of the school community, consisting of mental models on system management, teaching community, classroom, students and leadership. Finally, the teachers' mental models are discussed vis-à-vis their importance in individually and socially supporting teachers' PDL when the school community is undergoing diverse changes.

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Professional development and learning; systems thinking; mental models; school community

1. Introduction

What makes a school community a learning organisation, or a school that learns? This question is relevant to the education field since teachers' professional development and learning (PDL) is considered to be an important part of supporting students' learning. For example, the results of the OECD Teaching and Learning International Survey (Taaajamo and Puhakka 2019) emphasised the need for in-service teacher education that meets teachers' individual needs and inspires them to develop their own teaching practices while allowing opportunities for collaboration and shared learning (Taaajamo and Puhakka 2019, OECD 2020). The literature on schools as learning communities or organisations has emphasised collaboration, continuous learning, broadening learning networks and shared leadership (Kools and Stoll 2016). Perhaps the most acknowledged literature on 'schools that learn' is by Senge *et al.* (2012).

In the current case study, we explored Finnish basic education teachers' mental models of their work to support teachers' PDL in collaboration between a school and a university. Furthermore, the study aimed to deepen the literature's understanding of mental models in order to create and implement an enduring, supportive model for school and teacher development. The study was based on Senge's (1990, 2012) five disciplines framework, which considers PDL at the individual,

team and school organisational levels (Fullan and Hargreaves 2016, Stoll and Kools 2017). Mental models are understood as deeply ingrained assumptions and generalisations that influence how teachers understand the world – that is, their school organisation – and how they take action (Senge 2006, p. 8). The terms *professional development* and *professional learning* signify various practices and approaches involved in teachers' continual development of skills, knowledge and expertise, as well as their professional growth (OECD 2014, Fullan and Hargreaves 2016, Campbell 2017). Teachers' PDL is not merely an individual process; rather, it draws from a learning school community's sociocultural contexts that shape how teachers live and act (e.g. Fullan and Hargreaves 2016).

Despite the lack of clarity about the differences between the *learning organisation* and *professional learning community* concepts (Stoll and Kools 2017), we regard teachers as 'learning how to learn together, becoming a learning community' (Senge 1990, p. 4). Following Senge *et al.* (2012), we approach school communities as learning organisations where teachers should have opportunities to learn and develop professionally and develop their schools through collaboration with other teachers, school staff and students. In Finland and globally, teachers should work in continuously evolving environments caused by global and societal changes such as digitalisation, migration and climate change. Additionally, more local changes – such as curriculum reforms and changes to school communities – might challenge teachers' profession and mindset. Thus, teachers are expected to engage in PDL throughout their careers; moreover, as institutions, schools should respond to multiple societal changes and support staff members' work, aligning with educational reforms and the individual needs of students from diverse backgrounds (e.g. Avalos 2011, Opfer and Pedder 2011). However, teachers' PDL is a complex process that requires individual and collective emotional and cognitive involvement, facing and challenging teachers' beliefs and raising awareness of policy environments and school cultures – including resources that change these settings (e.g. Guskey 2002, Avalos 2011).

The theories characterising learning's situatedness and social nature have shifted the literature's focus from individuals and separate courses and lectures to PDL's systemic, complex nature within the communities of practice (e.g. Lave and Wenger 1991, Bullough 2007), focused on improving schools and supporting PDL through systemic changes (Adelman and Taylor 2007) or supported the implementation of learning-organisation disciplines (Senge 1990). Hence, teachers need adaptive expertise, the opportunity to take responsibility for their own PDL and the ability to continually learn from their colleagues (Hammerness *et al.* 2005, Postholm 2012).

This paper focuses on teachers' mental models – that is, the kinds of beliefs, assumptions and expectations amongst teachers at one school about their work and current school community, as well as their views on the school community's future management to facilitate PDL amidst organisational changes and curriculum reform. As we have stated previously in this section, we regard the school itself as not just a work community but also a PDL environment (e.g. Postholm *et al.* 2018), particularly when a school undergoes changes, challenging staff to reframe their work. Accordingly, we ask the following research questions: What kinds of representations of mental models do teachers narrate their work at its current and future states, and how can fragments of these models be constructed into a systematic image of their school community? Based on our findings, we discuss how teachers' mental models characterise PDL-related opportunities and challenges to enhance their learning community. This study offers two contributions to the literature. First, it improves the field's understanding of mental models' complexity – that is, deep-seated assumptions and beliefs, as well as teachers' approaches to filtering information about current changes. Second, the study shows that teachers' mental models should be considered and discussed to support their PDL during systemic changes to a school community.

2. Theoretical underpinnings

2.1. Mental models in Senge's work on learning organisations as a concept

The current study's theoretical framework draws from Senge's (1990) work on *learning organisations*, which involve all of a system's participants' expressing their aspirations, building awareness and developing capabilities together. At a school that learns, people who may have traditionally been suspicious of one another recognise their common stake in each other's future and their community's future (Senge *et al.* 2012, p. 5.) Senge's (1990) approach refers to the five disciplines that build and promote a learning organisation: *personal mastery*, *mental models*, *building a shared vision*, *team learning* and *systems thinking*. *Systems thinking*, the fifth discipline, integrates the other four disciplines by critically and proactively analysing, for example, an organisation's current status, future goals, connections to the world and underlying tensions (Senge 1990). *Mental models* refer to understanding and working with cognitive representations of an organisation (Senge 2006). Senge (2006, p. 164) describes *mental models* as deeply ingrained assumptions, generalisations or even pictures or images that influence how individuals understand the world and act. In the remainder of the current subsection, we explore mental models through a review of the current literature to conceptually frame the current study.

Mental models have been researched in various fields, including the social sciences, human sciences, education and psychology. According to the cognitive science and psychology literature, people draw from their prior experiences to develop mental models as a framework with which to understand events, allowing people to interact with the world (Johnson-Laird 1983, Jones *et al.* 2011). Individuals create such models based on prior knowledge, existing ideas and past experiences to interpret and explain world events (Moseley *et al.* 2010, Jones *et al.* 2011). Thus, mental models can be considered individuals' representations of phenomena to explain those phenomena (Libarkin *et al.* 2003) or cognitive representations of real and imaginary situations (Johnson-Laird and Byrne 2002).

Mental models can be understood as organised knowledge structures that humans need to interact with their surroundings (Rouse and Morris 1986, Mathieu *et al.* 2000). Based on previous studies, Rouse and Morris (1986) stated that mental models' three functions are to allow people to (1) describe a system's purpose and form, (2) explain the system's functioning and observed system states and (3) predict future system states. The first function refers to conceptions of why a system exists, what it contains and how it looks (Rouse and Morris 1986). The second function represents explanations of what happens in the system and why the system works as it does (Rouse and Morris 1986, Carroll and Olson 1988, Mevorach and Strauss 2012). The third, a predictive function represents anticipated changes (Rouse and Morris 1986) and system events (Jones *et al.* 2011).

Mental models' tacit nature means people are often unaware of the models' effects on their behaviour (Senge 2006, Mevorach and Strauss 2012). Furthermore, mental models are always incomplete and only partially based on real data and observations (Norman 1983, Senge *et al.* 2012). People with different mental models may experience and describe the same events differently because they focus on different details (Senge *et al.* 2012). They tend to perceive and remember only information that reinforces their existing mental models because it reduces their mental effort (Norman 1983, Senge *et al.* 2012). Moreover, an individual may harbour several mutually conflicting mental models (Norman 1983).

In the education context, teachers' mental models (including pre-service teachers' and teacher educators') have been studied in relation to subject matter, teaching and learning – for example, environment education (e.g. Moseley *et al.* 2010), science (e.g. Thomas *et al.* 2001) and second languages (e.g. Haim *et al.* 2004). Furthermore, the relationship between teachers' mental models, implicit representations and classroom practices has been examined in teacher research (e.g. Mevorach and Strauss 2012, Manrique and Sánchez Abchi 2015). Haim *et al.* (2004) showed that teachers' mental models, not the depth of their content knowledge, drove their instructional practices; moreover, even when teachers had deepened their subject matter knowledge, they did

not reshape their pedagogical practices until they had elaborated upon their mental models. Mevorach and Strauss (2012) discovered that teaching by someone with a twofold position (as both a teacher and teacher educator) could be described via several in-action mental learning models and that these in-action mental models informed and guided one's actual teaching.

As stated in this section, mental models are seldom discussed, and they remain tacit in educational communities despite their impact on teachers' everyday decisions and actions (e.g. Jones *et al.* 2011, Senge *et al.* 2012, Mevorach and Strauss 2012). Because mental models reflect people's belief systems acquired through observation, educational and cultural influences (Libarkin *et al.* 2003), learning how to work with mental models through reflection and safe, open discussion might be challenging for schools aiming to become learning communities. Since mental models play a significant role in filtering incoming information, and people tend to seek information that fits their current understandings (Jones *et al.* 2011), unexamined mental models may limit people's ability to change (Senge *et al.* 2012). Therefore, particularly when reforms or changes make mental models explicit via discussion, reflection and dialogic process, teachers might enrich their understandings of teaching and learning, advancing their pedagogical expertise and PDL. From a community perspective, learning about the degrees to which teachers and school leaders share an understanding of pivotal professional matters – such as curricula, leadership, collaboration and classroom practices – is also essential. However, studies on teachers' professional-development-related mental models are relatively scarce; therefore, this study aimed to fill that research gap. Our research sought to identify teachers' belief systems as their school community underwent diverse changes.

2.2. Professional development and learning in the school community

To understand how school systems' closely interrelated parts (i.e. a school, teachers, principals, students, a curriculum, policies, assessments, materials, pedagogical practices and families) are integrated and connected with PDL, school communities should be studied from both the individual-teacher-as-a-learner and professional-community perspectives (Senge 1998, Senge *et al.* 2012, Fullan and Hargreaves 2016, see also Borko 2004). Research has indicated professional development programmes' effective elements for teachers to include the joint construction of pedagogical knowledge and skills in collaboration with other teachers and the learning community, as well as applying these new methods and activities to classroom teaching (Penuel *et al.* 2007, Desimone 2009). In her theoretical review of teachers' professional development, Postholm 2012, p. 405) concluded that 'learning in schools is the best arena for further development of teachers'. Furthermore, data from the Teaching and Learning International Survey (OECD 2014) showed that teacher self-efficacy and job satisfaction can be enhanced through various collaborative PDL activities, including peer feedback systems and collaborative teaching activities, such as team teaching, observing other teachers' classes, providing feedback and engaging in joint activities across classes and ages (OECD 2014). Collaborative professional learning has been particularly strongly associated with self-efficacy, suggesting that when teachers collaborate to enhance their individual and collective teaching capabilities, they gain confidence in their teaching, student engagement and class behaviour management abilities while tending to enjoy their work more (Burns and Darling-Hammond 2014, p. 44–45). When schools provide teachers with well-designed and meaningful professional learning opportunities, teachers can better create learning opportunities for students (Darling-Hammond and Richardson 2009). Furthermore, a development-oriented school culture may nurture teachers' informal learning (Jurasaite-Harbisson and Rex 2010).

As described above, both individual and organisational factors influence teachers' PDL (e.g. Opfer *et al.* 2011, Postholm 2012). In any school development endeavours, teachers' autonomy is important; changed must be motivated by teachers themselves and implemented in school contexts (e.g. Darling-Hammond and Richardson 2009, James and McCormick 2009). Yet, evidence has emphasised external resources' importance, such as research-based support and co-operation

between university teacher trainers to promote PDL (e.g. Sales *et al.* 2011, Hauge and Wan 2019). This kind of collaboration is worth considering because research has also shown that schools struggle to create constructive interactions amongst teachers when promoting teacher PDL (e.g. Biesta *et al.* 2015, Bridwell-Mitchell 2015). Therefore, attempts to enhance teacher PDL should be based on joint planning and schools' specific needs, rather than usually predetermined seminars, courses, workshops and various introductions to new teaching methods and techniques (Kennedy 2005, Opfer and Pedder 2011, Timperly 2011).

3. Methodology

3.1. Context and data

This study is part of the Creative Expertise – Bridging Pre-service and In-service Teacher Education project, funded by the Finnish Ministry of Education and Culture (2017–2021). The project is also part of the national Finnish Teacher Education Forum, which has prepared the Development Programme for Teachers' Pre- and In-service Education (life-long and life-wide professional development), supporting its implementation as part of the national Teacher Education Development Programme. The project aims to explore how enduring, supportive models can be created and implemented for PDL-supporting professional activities, enhancing agency and collaboration amongst teachers, teacher educators and teacher students to support students' learning. The project relies on collaboration amongst university staff, teacher students, school leaders, teachers, school students and education providers to promote life-long learning, create hybrid learning environments and utilise expertise across disciplines.

The study's data were collected comprehensively from a school that voluntarily participated in the project in 2018–2019. This school was undergoing structural changes in the midst of the national curriculum reform: Finland provides nine-year basic education within a single structure, lacking division into *primary* and *lower-secondary* education at the policy level, though this distinction manifests culturally and physically in school buildings. Most subjects are taught by a primary teacher in grades 1–6 and subject teachers in grades 7–9. Both primary and subject teachers have MA degrees. Primary teachers major in education, and subject teachers major in their school subject. In Finland, 22% of comprehensive schools are unified, providing primary and lower-level education (grades 1–9), and the percentage of unified comprehensive schools has risen by 10% over the last 10 years (Statistics in Finland 2020). The school that participated in the current study was undergoing this unifying process and preparing to transfer to a new building. Its basic education is based on the national core curriculum determined by the Finnish National Agency for Education. It contains objectives and core contents for different subjects, as well as principles for pupil assessment, special-needs education, pupil welfare and educational guidance. The core curriculum also addresses the principles of a good learning environment and working approaches, as well as the concept of learning community development (FNBE (Finnish National Board of Education) 2014). The national core curriculum is renewed approximately every 10 years, and the current version came into force in 2016.

Figure 1 depicts the study's collaboration between the school and the researchers' university. Phase 1 involved mapping the school's and its teachers' current status and development needs, planning educational projects and experiments, forming teams and collecting data. At the beginning of this phase, all staff members – including principals, teachers, special-needs assistants, a community health nurse and a school psychologist – participated in the semi-structured interviews used as the study's data. This study however only focuses on the teachers. Phase 2 involved implementing educational projects and experiments in collaboration with the school's staff, the university's teacher educators and pre-service teachers. Data collection continued during Phase 2.

This study focused on semi-structured interviews with all teachers ($n = 41$) conducted at the beginning of the project's collaboration. When these data were collected, 21 interviewees worked

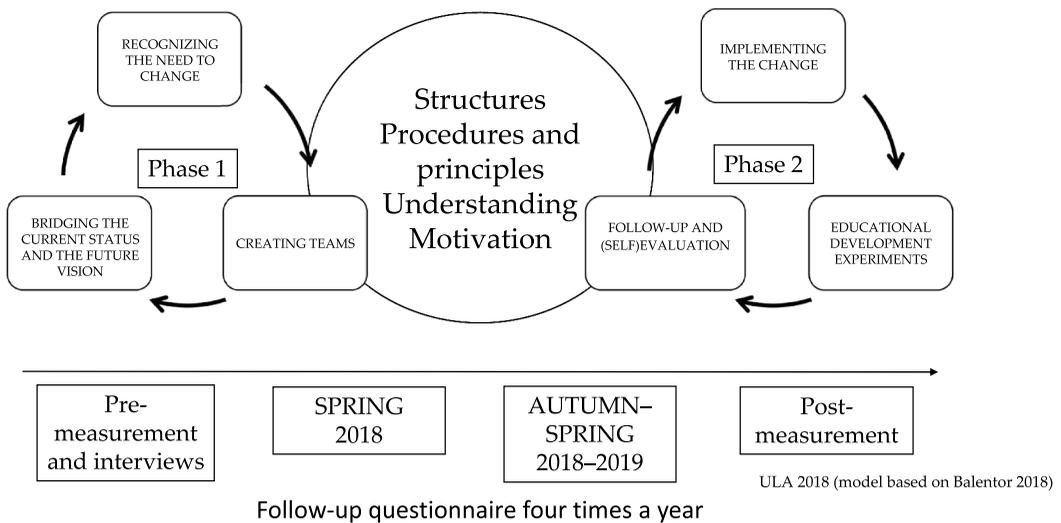


Figure 1. Co-operation between school and university.

as primary teachers (grades 1–6) and 20 worked as subject teachers (mainly grades 7–9). Their teaching experience varied from one year to 34 years. Ten of the teachers were male, and 31 were female. Each teacher participated voluntarily. The interview themes were (1) *PDL*, (2) *collaboration*, (3) *school as a work community* and (4) *classroom-related work*. The interviews' average duration was 45 minutes. All interviews were recorded and transcribed word-for-word for analysis.

3.2. Data analysis

The study's analysis process was conducted in two phases. The first phase comprised in-depth reading and preliminary coding of the data. The coding scheme's creation, with main categories and sub-categories, was guided by aspects that evolved from the research questions and interview topics (Bernard and Ryan 2010, DeCuir-Gunby *et al.* 2011, Schreier 2014). The coding scheme relied on Rouse and Morris (1986) three-part description of mental models; we sought definitions, explanations and predictions of the participants' work and school community. The first analysis phase was data-driven but theory-informed (Bernard and Ryan 2010, DeCuir-Gunby *et al.* 2011, Schreier 2014), guided by a systemic approach to schools as learning organisations. Coding was conducted using Atlas.ti Cloud, a qualitative analysis programme that allowed simultaneous use by multiple users, as well as real-time co-operation. We used triangulation in this phase to cross-check the coding and ensure consistency, and we negotiated and carefully checked the coding's logic and discrepancies. The resulting codes were then discussed to ensure agreement and clarification.

An application of the framework for schools that learn by Senge *et al.* (2012) followed the coding phase. We collaboratively reviewed quotes coded for matters related to teachers' mental work models and subsumed them into sub-categories. During this phase, we created sub-categories and, if needed, divided or combined them (Figure 2). Then, the data were examined to identify patterns with which to answer our first research question and, finally, to create an analysis storyline from which to draw conclusions responding to our second research question. The analysis process was conducted through collaborative discussions, allowing an in-depth understanding of the data. The process's end results was a representation of the teachers' mental models (Figure 2).

Phase 1 Generating initial codes: issues mentioned by participants as meaningful	Phase 2 Identifying themes	Phase 3 Naming sub-categories	Phase 4 Forming main categories
<p>Present culture</p> <p>“I hope for something that would help us create this good collaboration, sort of a spirit of collaboration—and this atmosphere that we are doing this together, even though we all have our own things and subjects to teach and we plan everything on our own. So that we would feel like we are all together here, and it should be more than the break room and the discussions by the coffee, but how it could be done, maybe by forming teams and whatnot, but how to create this sense that it is not some extra work, but it should feel like something that is really beneficial and brings us together. (Subject teacher)</p> <p>The curriculum</p> <p>The new curriculum talks a lot about self-evaluation and peer-evaluation and formative assessment, and yet we have these traditional (laughs), very traditional school reports and we should give grades, and maybe the teachers, that’s how I perceive it, maybe they get the feeling that they have to arrange these traditional teaching periods with exams in the end, so that somehow they can show the parents what the grade is based on. (Primary teacher)</p>	<p>→ Collaboration</p> <p>→ Atmosphere</p> <p>→ Discussion culture</p> <p>→ Attitude towards teamwork</p> <p>→ Assessment</p> <p>→ Praxis vs. Curriculum</p>	<p>Sense of community</p> <p>Pedagogy and curriculum</p>	<p>Teaching community</p> <p>Classroom</p>

Figure 2. An example of the four-phase analysis.

4. Findings

Our analysis focused on representation teachers’ mental models of their work amidst an organisational change and curriculum reform. To collect the study’s data, interviews were conducted at the beginning of the school’s and university’s co-operation. We sought to identify how mental models are constructed individually and the degree to which they are shared when individuals interact and work in the same school community. In general, our findings illustrate how teachers described and explained their work and the school community’s current state and predicted future aspirations. The teachers mentioned various objects, aspects, parts, attributes or mechanisms of the school system that illustrated their experiences, assumptions, perceptions and values (Senge 2006). In the following subsections, we report how the participants explained these components.

4.1. Teachers' mental models

The participants discussed the teaching community in terms of *teacher collaboration* and *a sense of community*. According to some teachers, a lack of collaboration had hindered the school community's development. Despite the school's different teacher teams, the teams' was perceived as inefficient, and the teachers explained that collaboration had been impeded by an ethos of working alone, organisational structures, a lack of time and school leader support, differing work practices and an understanding of – and orientation to – the school community's development. Moreover, teachers sensed cliques and resistance to change amongst other teachers in the school community. Additionally, they criticised the community's discussion culture as insufficiently open, and some teachers felt that their ideas and suggestions were not heard; they were treated as informational objects rather than agents in the community.

Regarding the sense of community, teachers described the school community as relaxed, functional, communal and welcoming to new employees. However, they also described problems in teachers' attitudes and the school community's discussion culture. They also discussed the sense of community in terms of physical conditions since some teachers had been working in temporary buildings, separate from the other teachers, before moving to the new school building. Thus, some teachers considered the new school building an important factor in developing the sense of community. However, some teachers expressed concerns about the new building maintaining separate primary and lower-secondary levels. Some teachers also wanted more discussion, especially about developing a future community and the time required for this development. Developmental challenges were also associated with an incoherent workload division and a reactive orientation in everyday life, instead of a proactive plan for the future. One teacher noted:

I hope for something that would help us create this good collaboration, sort of a spirit of collaboration – and this atmosphere that we are doing this together, even though we all have our own things and subjects to teach and we plan everything on our own. So that we would feel like we are all together here, and it should be more than the breakroom and the discussions by the coffee, but how it could be done, maybe by forming teams and whatnot, but how to create this sense that it is not some extra work, but it should feel like something that is beneficial and brings us together. (Subject teacher)

Since the participating teachers were experiencing organisational changes during the study, they discussed *management* – and particularly the principal's role and information sharing. Teachers expressed two views of the principal's role: some were content with the principal's leadership approach while others were not. When teachers positively discussed the principal's leadership, they referred to shared responsibilities, a non-authoritative leadership style and support in their everyday life. The teachers with positive views of the principal's leadership also expressed having a voice and emphasised the meanings of *personal activity* and *willingness*. Some teachers said that they could influence decisions and had some power but that they do not want to contribute because of possible extra work or a lack of ideas to share with their colleagues.

Interviewer: And why are you satisfied?

Teacher: I feel like the principal is listening when he should, and he is like a support, and he is there when he is needed. And then there are things that he can communicate well, like, 'You should talk to the contact teacher', or, 'Why don't you contact this and this person?' Like, he has been able to share the responsibilities to others as well. (Primary teacher)

The teachers who viewed the principal's work less favourably were concerned about his availability and authoritative leadership style. The availability concerns were related to his presence at the school and involvement in the new school building project, and the authoritative leadership concerns were related to his controlling and delegating tasks. Some teachers felt unable to influence the decision-making process or sufficiently address administrative issues; rather, such issues had already been decided and introduced during staff meetings. Thus, these teachers did not experience

support or motivation from the principal. For a better future, some teachers called for the principal to make better decisions and consider teachers' feedback and suggestions.

Our school should have a principal who connects with the students, who gets along with the students at a different age, and who is this 'good guy' but also strict when needed, and who supports, inspires and motivates employees. So, they should be some sort of a wizard . . . and then one should be a visualist as well, engaged to their job, and get others excited, too. (Primary teacher)

When teachers discussed *pedagogy*, they mentioned the national curriculum for basic education and its implementation at their school. This curriculum came into force in 2016, and discussions about it – whether direct or indirect – had been vivid and critical since the curriculum's publication in 2014. Some teachers found the current curriculum inspiring and positive; others found it negative, challenging and even difficult to understand. The teachers who viewed it negatively did not feel that it had reformed or renewed their pedagogy or introduced any new elements to their teaching practices. Interestingly, some proponents of the curriculum also felt it had scarcely affected many teachers' practices. Some teachers expressed a desire to obtain further education or receive additional support in implementing the curriculum, and many teachers felt they had received insufficient support during the transition. The new curriculum also introduced multidisciplinary learning modules for the first time. The teachers with positive views praised these modules while some teachers expressed uncertainty about having the necessary experience to implement them; for example:

Interviewer: Yes, so what could it be, that multidisciplinary learning in your class?

Teacher: I don't know. That's probably something that the people who wrote the new curriculum wanted us to do. So, it would be nice for them to come and tell us what to do. (Subject teacher)

The new curriculum talks a lot about self-evaluation and peer-evaluation and formative assessment, and yet, we have these traditional (laughs), very traditional school reports, and we should give grades, and maybe the teachers – that's how I perceive it – maybe they get the feeling that they have to arrange these traditional teaching periods with exams in the end so that, somehow, they can show the parents what the grade is based on. (Primary teacher)

The teachers' attitudes towards pedagogical development also differed, and some teachers expressed unwillingness to further develop their practices. They also approached current pedagogical ideas, such as learner-centredness and transversal competence, suspiciously. However, other teachers identified the need to develop pedagogy through planning, new ideas and implementing differentiations and a functional pedagogy. Teachers also discussed other current methods and trends, such as formative assessments and digitalisation, and similarly contrasting opinions emerged. Some teachers found these approaches laborious and challenging while others deemed them essential parts of their pedagogy. Some teachers considered developing a pedagogy challenging because of resistant attitudes amongst some of their colleagues or the school's physical conditions since some teachers worked in separate buildings at the time of their interviews. However, they also regarded the school's unification process as opening new possibilities for teachers:

I think it is an incredible opportunity. Of course, there will be lots of new things all us teachers will have to learn to do, and if teachers have to do more than before, there will certainly be some opposition. But, nevertheless, I think it's a great opportunity. (Subject teacher)

Generally, the participating teachers' discussed about students little, and their views of students' roles in the school community varied. The teachers seemed to harbour fairly opposing understandings of students' power and voice. At the school's current stage, some teachers believed students had been heard and involved in the school community's activities and development. These teachers explained that students had been members of the new school's planning group and students' board and that students had also shared ideas about the school community's development. Some thought students had been heard but allowed limited involvement. According to these teachers, for instance, students could only contribute to planning the new

schoolyard. Further, other teachers noted that students' involvement was less extensive, especially regarding their own learning and pedagogy:

We do have the student council, which arranges some ping-pong tables and chairs somewhere. But on pedagogical or practical matters, the students' opportunities to influence are very limited. We have the teachers, and then we have the students. And the students have their own rules, and us teachers have our own. (Subject teacher)

These teachers thought students were not heard, played a passive role and were excluded from the development process or – if they were heard – were only heard because of a single teacher, not a community-level effort. These teachers discussed the importance of encouraging students and their voices, and they thought a participative role might strengthen students' motivation, decreasing possible behaviour problems. Some teachers also thought students should be able to participate in diverse ways. Especially regarding the future, some teachers explained that students could be more actively involved and play more versatile roles in the school community:

In the new, unified, comprehensive school, it would be wonderful if its mission statement was that the older student helps the younger student and the older student could learn when they scaffold the younger one. I would enjoy the situation where the students were together, and the older ones could get self-confidence. (Primary teacher)

Finally, teachers often discussed the *school's structures and practical issues* that were relevant to their understanding of their school community but did not fall under the previous themes. When describing and explaining their school's current working conditions, many teachers discussed the school community's rules, as well as their opinions about these rules. The teachers who discussed rules and disciplinary-related structures had hoped for clearer, shared rules and sanctions. They perceived the communication of rules to be unclear, expressing notions of primary and subject teachers' different and inconsistent practices and views on discipline. Furthermore, they hoped the teacher community as a whole would agree on disciplinary rules that everyone should follow. These rule-oriented teachers considered rules essential in developing the school's culture. They especially worried about how the behaviour of grade 7–9 students might affect the grade 1–6 students in the future since all pupils would be in the same building:

Now that we have seen this situation with the [older] pupils, it has terribly shocked me, this shouting, cursing, laying on the corridors. So, a sort of an amendment is in place. So, certain rules and practices, they must be kept, and we all must commit to them. (Primary teacher)

All teachers did not discuss rules as such but they did describe management structures, such as current and future architecture and room divisions, and meetings that the teachers did not find meaningful but had to participate in. While some teachers perceived the future school's planning (for example, emphasising floor plans' availability) as meaningful and important, others thought it participating in this planning was neither their interest nor their responsibility.

Thus, the gap between primary and subject teachers was associated with different school cultures between the primary and lower-secondary levels, conflicts between the subject and primary teachers and different qualifications and assumed schisms amongst teachers:

I kind of have this fear that when we will move [to the new school], the primary school will be at one end and the lower-secondary school at the other end of the building and that we will be in different floors, so it [collaboration] might not work in a way it was supposed to work. (Subject teacher)

4.2. From fragments to a system: the school community's image

Based on the study's analysis, participants' mental models of their work and the school community can be grouped into five components: *system management*, *teaching community*, *classroom*, *students* and *leadership* (see Figure 3). In Figure 3, these five components present a holistic picture of the

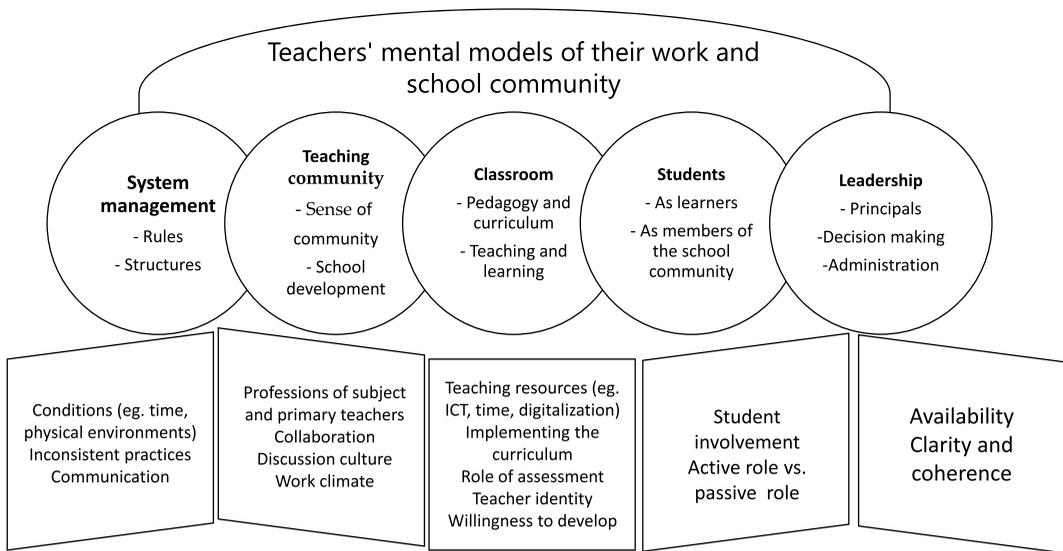


Figure 3. The school community's image.

school community according to its teachers. Below, the five components – component-specific ‘fragments’ of the school community – that the teachers discussed and explained during the interviews are presented. These fragments illustrate the components’ verbalised aspects, such as *physical environment*, *primary and subject teachers’ professions* and *student involvement*. As described in the previous subsection, these fragments were contradictory and contrasting, sometimes consistent yet sometimes tacit and ambiguous. Thus, [Figure 3](#) aims to consolidate teachers’ views, assumption and predictions about their work and the school community, mapping their current and future situations and creating a more holistic understanding to support teachers’ PDL in the school community.

[Figure 3](#) expands the literature’s knowledge about teachers’ views and assumptions, and it also illustrates their theory of action and, indirectly, their capacity to challenge their ways of working individually and collectively at one school. From a PDL perspective, [Figure 3](#) reveals the complexity and diversity of interpretations related to teachers’ own work and a single school community and, therefore, shows how PDL needs vary from one individual to another. For example, the weight and priority of organisational norms or the new curriculum’s implementation, as well as the necessary professional support, were not collectively shared or officially discussed. Therefore, [Figure 3](#) presents a starting point for communication as part of a systemic change and the construction of practices enabling more tailored PDL support.

5. Discussion

The study presented in this paper investigated one school community and its teachers’ mental models about their work, based on Senge’s (1990) framework of a learning organisation, to support their PDL during a curriculum reform and organisational changes. An awareness of one’s mental models, as well as these models’ visibility, is crucial during transitions because unspoken mental models may limit people’s ability to change (Senge *et al.* 2012), learn and develop professionally (Darling-Hammond and Richardson 2009). Thus, our research aimed to explore teachers’ current and future mental models of their work, as well as how the models’ fragments can construct a more systematic image of a whole school community. Using qualitative content analysis, we regarded these perspectives as representations of the teachers’ mental models that mirrored their views about teacher collaboration,

a sense of community, management, pedagogy, students and their school's structures and practical issues. The teachers' various and sometimes contradictory representations of mental models became visible, explaining some teachers' views. For example, many teachers held somewhat strict opinions towards establishing and following rules, mirroring their mental models about what is important in their school community and the changes they feared regarding the school's future. Although we appreciate the incomplete, contradictory and inaccurate nature of mental models based on generalisations and analogies from experience, our findings show how teachers' mental models of the same school community, leadership, management, classrooms, students and sense of community can differently relate to their PDL, particularly regarding its current stage.

Amidst educational reforms and structural changes, establishing strict rules and longing for a clear leadership style seemed to increase some teachers' sense of safety, whereas other teachers were inspired by a new, unified school structure and content with their principal's leadership and management. Moreover, amidst such changes, students' roles seemed to remain marginalised in the school community although the school community, as a learning organisation, should also involve students (Senge *et al.* 2012).

However, teachers shared the desire for a new school – not only physically but also culturally – although some also seemed anxious or suspicious towards uniting the two previously separate school levels (primary and lower-secondary). As the hitherto separate school units united as a comprehensive school, teachers confronted their relationship to their PDL vis-à-vis their well-being and their abilities to learn and adapt to a new school community, collaborate with colleagues, encourage and involve students and create a responsive learning community (Senge *et al.* 2012, Fullan and Hargreaves 2016).

Reflecting on this study's findings, we suggest that ensuring the visibility of these assumptions, views and expectations is essential, they must be considered in order to support teachers' PDL in their school community – including their ability to collaborate with colleagues and jointly construct pedagogical knowledge (Desimone 2009) with external resources, which the school community alone may be unable to accomplish (Hauge and Wan 2019). Indeed, since our research group was about to begin a longitudinal collaboration with the studied school, we wanted to begin by getting to know the school staff, which led to the present study on teachers' mental models. However, as our findings show, our analysis of these models might reveal very sensitive and contradictory views on community and collegial relationships; therefore, considering how principals co-operate with the school community and how the partner university can enhance psychological security and constructively facilitate sensitive situations, e.g. tension between co-workers is essential. If a systemic, school-tailored approach to supporting teachers' PDL is implemented, its facilitators should have diverse expertise and be prepared to face unexpected tensions that could affect the school as a whole.

For us, as researchers and teacher educators, this type of research-based co-operation with school communities provides not only insight into teachers' mental models but also an ability to understand and work with teachers while developing our own PDL and, presumably, improving our work with teacher students. Our systematic exploration of one school's teachers' views and understandings of their present and future work enabled us to systemically plan our collaboration's next steps, tailored to the particular school community's specific needs. However, our empirical findings in this study should be considered in light of some limitations. On the one hand, we understand that the school community studied here represents only one school, and our findings must be interpreted through a case-study perspective. On the other hand, the school's entire staff was interviewed, and the school can be considered to represent other schools in terms of its size and location, except that it was transforming into a comprehensive school covering both the primary and secondary levels. Such unifying processes are increasingly common in the Finnish school system. Noted that our interviews took place at the beginning of the project's school-university collaboration; thus, the teachers' expectations, beliefs and assumptions had not yet been affected by this educational collaboration. Furthermore, our analysis can be considered trustworthy since the coding scheme's construction and analysis were conducted collaboratively amongst research team

members, increasing the study's objectivity, decreasing its subjectivity and raising our collective awareness of mental models' complexity through deep discussions vis-à-vis the literature.

Finally, we highlight the notions of mental models that led to our systemic – rather than fragmentary – understanding of the school community. According to Senge *et al.* (2012), working with mental models plays an essential role in developing a learning community. When mental models are contradictory and even resistant, they should not be solely interpreted as negative since such attributes might indicate a need to pay attention to these models. As we know, mental models may remain tacit, and they are seldom discussed in educational communities despite their impact on teachers' decisions and actions (e.g. Jones *et al.* 2011, Senge *et al.* 2012, Mevorach and Strauss 2012). However, mental models have also been noted to be generally poorly rationalised, often misinterpreted and potentially subconscious, and they can be extremely difficult to identify and represent (Senge 1990). Thus, enhancing psychological security and a culture of trust is crucial to share, discuss and reflect on mental models collaboratively, providing opportunities for reflection that may support PDL (see also Camburn 2010). Teachers can learn the most when afforded an opportunity to discuss their experiences in a trusted, confident and constructive atmosphere (Zwart *et al.* 2009). But to make this happen, most school communities might need external but engaged and competent facilitators to improve communication and transparency of working practices (see also e.g. Hauge and Wan 2019). Instead of having only seminars and adding knowledge more sustainable, situated and in-actions solutions should be designed and explored to support PDL in the sense of learning organisation.

Based on this study, we encourage educational researchers to further explore teachers' mental models, e.g. elaboration of in-action mental models and how they might relate to PDL and school communities. Throughout the processes of allowing teachers' to voice their views about their work and school community and exploring their mental models from a systemic perspective, new ways to develop schools into learning organisations may be revealed.

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References

- Adelman, H.S. and Taylor, L., 2007. Systemic change for school improvement. *Journal of educational and psychological consultation*, 17(1), 55–77.
- Avalos, B., 2011. Teacher professional development in teaching and teacher education over ten years. *Teaching and teacher education*, 27(1), 10–20.
- Bernard, H. and Ryan, G., 2010. *Analyzing qualitative data: systematic approaches*. Thousand Oaks, CA: Sage.
- Biesta, G.J.J., Priestly, M., and Robinson, S., 2015. The role of beliefs in teacher agency. *Teachers and teaching*, 21(6), 624–640.
- Borko, H., 2004. Professional development and teacher learning: mapping the terrain. *Educational researcher*, 33(3), 3–15.
- Bridwell-Mitchell, E.N., 2015. Theorizing teacher agency and reform: how institutionalized instructional practices change and persist. *Sociology of education*, 88(2), 140–159. doi: 10.1177/0038040715575559.

- Bullough, R.V., 2007. Professional learning communities and the Eight-Year study. *Educational horizons*, 85 (3), 168–180. Available from: <http://www.jstor.org/stable/42923688>
- Burns, D. and Darling-Hammond, L., 2014. *Teaching around the world: what can TALIS tell us?* Stanford, CA: Stanford Center for Opportunity Policy in Education.
- Camburn, E.M., 2010. Embedded teacher learning opportunities as a site for reflective practice: an exploratory study. *American journal of education*, 16(4), 463–489.
- Campbell, C., 2017. Developing teachers' professional learning: Canadian evidence and experiences in a world of educational improvement. *Canadian journal of education*, 40 (2), 1–33. Available from: <http://journals.sfu.ca/cje/index.php/cje-rce/article/view/2446>
- Carroll, J.M. and Olson, J.R., 1988. Mental models in human-computer interaction. M. Helander, ed.. *Handbook of human-computer interaction*. Amsterdam: Elsevier, 45–65.
- Darling-Hammond, L. and Richardson, N., 2009. Teacher learning: what matters? *Educational leadership*, 66 (5), 46–53.
- DeCuir-Gunby, J., Marshall, P., and McCulloch, A., 2011. Developing and using a codebook for the analysis of interview data: an example from a professional development research project. *Field methods*, 23(2), 136–155.
- Desimone, L.M., 2009. Improving impact studies of teachers' professional development: toward better conceptualizations and measures. *Educational researcher*, 38(3), 181–199.
- FNBE (Finnish National Board of Education), 2014. *National core curriculum for basic education 2014*. Helsinki: Finnish National Board of Education.
- Fullan, M. and Hargreaves, A., 2016. *Bringing the profession back in: call to action*. Oxford, OH: Learning Forward.
- Guskey, T.R., 2002. Professional development and teacher change. *Teachers and teaching: theory and practice*, 8(3/4), 381–391.
- Haim, O., Strauss, S., and Ravid, D., 2004. Relations between EFL teachers' formal knowledge of grammar and their in-action mental models of children's minds and learning. *Teaching and Teacher Education*, 20(8), 861–880.
- Hammerness, K., et al. 2005. How teachers learn and develop. In: L. Darling-Hammond and J. Bransford, eds. *Preparing teachers for a changing world. What teachers should learn and be able to do*. San Francisco, CA: Jossey-Bass, 358–389.
- Hauge, K. and Wan, P., 2019. Teachers' collective professional development in school: a review study. *Cogent Education*, 6(1), 1–20.
- James, M. and McCormick, R., 2009. Teachers learning how to learn. *Teaching and Teacher Education*, 25(7), 973–982.
- Johnson-Laird, P. and Byrne, R., 2002. Conditionals: a theory of meaning, pragmatics, and inference. *Psychological Review*, 104(9), 646–678.
- Johnson-Laird, P.N., 1983. *Mental models*. Cambridge: Cambridge University Press.
- Jones, N.A., et al., 2011. Mental models: an interdisciplinary synthesis of theory and methods. *Ecology and Society*, 16 (1), 46. Available from: <https://www.jstor.org/stable/26268859>
- Jurasaitė-Harbišon, E. and Rex, L.A., 2010. School cultures as contexts for informal teacher learning. *Teaching and Teacher Education*, 26(2), 267–277.
- Kennedy, A., 2005. Models of continuing professional development: a framework for analysis. *Journal of In-Service Education*, 31(2), 235–250.
- Kools, M. and Stoll, L., 2016. What makes a school a learning organisation? *OECD Education Working Papers*, 137. Paris: OECD Publishing.
- Kurdziel, J., Beilfuss, M., and Kurdziel, J., 2003. Research methodologies in science education: mental models and cognition in education. *Journal of Geoscience Education*, 51(1), 121–125.
- Lave, J. and Wenger, E., 1991. *Situated learning: legitimate peripheral participation*. New York: Cambridge University Press.
- Libarkin, J.C., Beilfuss, M., and Kurdziel, J.P., 2003. Research methodologies in science education: mental models and cognition in education. *Journal of Geoscience Education*, 51, 121–126.
- Manrique, M. and Sánchez Abchi, V., 2015. Teachers' practices and mental models: transformation through reflection on action. *Australian Journal of Teacher Education*, 40(6), 13–32.
- Mathieu, J.E., et al., 2000. The influence of shared mental models on team process and performance. *Journal of Applied Psychology*, 85 (2), 273–283.
- Mevorach, M. and Strauss, S., 2012. Teacher educators' in-action mental models in different teaching situations. *Teachers and Teaching: Theory and Practice*, 18(1), 25–41.
- Moseley, C., Desjean-Perrotta, B., and Utley, J., 2010. The Draw-An-Environment Test Rubric (DAET-R): exploring pre-service teachers' mental models of the environment. *Environmental Education Research*, 16(2), 189–208.
- Norman, D.A., 1983. Some observations on mental models. In: D. Gentner and A.L. Stevens, eds.. *Mental models*. Hillsdale, NJ: Lawrence Erlbaum Associates, 7–14.
- OECD. 2014. *TALIS 2013 results: an international perspective on teaching and learning*. Paris: TALIS, OECD Publishing.

- OECD. 2020. *TALIS 2018 results (Volume II): teachers and school leaders as valued professionals*. Paris: TALIS, OECD Publishing.
- Opfer, V.D. and Pedder, D., 2011. Conceptualizing teacher professional learning. *Review of Educational Research*, 81 (3), 376–407.
- Opfer, V.D., Pedder, D.G., and Lavicza, Z., 2011. The influence of school orientation to learning on teachers' professional learning change. *School Effectiveness and School Improvement*, 22(2), 193–214.
- Penuel, W.R., Fishman, B.J., and Gallagher, L.P., 2007. What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal*, 44(4), 921–958.
- Postholm, M.B., 2012. Teachers' professional development: a theoretical review. *Educational Research*, 54(4), 405–429.
- Postholm, M.B., Boylan, M., and Boylan, M., 2018. Teachers' professional development in school: a review study. *Cogent Education*, 5(1), 1–22.
- Rouse, W.B. and Morris, N.M., 1986. On looking into the black box: prospects and limits in the search for mental models. *Psychological Bulletin*, 100(3), 349–363.
- Sales, A., Traver, J.A., and García, R., 2011. Action research as a school-based strategy in intercultural professional development for teachers. *Teaching and Teacher Education*, 27(5), 911–919.
- Schreier, M., 2014. Varianten qualitativer Inhaltsanalyse: ein Wegweiser im Dickicht der Begrifflichkeiten. *Forum: Qualitative Sozialforschung*, 15(1), 1–27.
- Senge, P.M., 1990. *The fifth discipline: the art and practice of the learning organization*. New York: Doubleday/Currency.
- Senge, P.M., 1998. The practice of innovation. *Leader to Leader*, 9(9), 16–22.
- Senge, P.M. 2006. *The fifth discipline: the art and practice of the learning organization*. Revised and updateded, New York: Doubleday.
- Senge, P.M., et al., 2012. *Schools that learn: a fifth discipline fieldbook for educators, parents, and everyone who cares about education*. New York: Crown Business.
- Statistics in Finland, 2020. *Peruskoulujen määrä jatkoilaskuaan, oppilaitokset aiempaa suurempia*. Available from: https://www.stat.fi/til/kjarj/2019/kjarj_2019_2020-02-12_tie_001_fi.html [Accessed 3 Nov 2020].
- Stoll, L. and Kools, M., 2017. The school as a learning organisation: a review revisiting and extending a timely concept. *Journal of Professional Capital and Community*, 2(1), 2–17.
- Taajamo, M. and Puhakka, E., 2019. *Opetuksen ja oppimisen kansainvälinen tutkimus TALIS 2018. Perusopetuksen vuosiluokkien 7-9 ensituloksia, osa 1*. Finnish National Agency for Education. Available from: <https://www.oph.fi/fi/tilastot-ja-julkaisut/julkaisut/opetuksen-ja-oppimisen-kansainvalinen-tutkimus-talis-2018> [Accessed 3 Oct 2020]
- Thomas, J.A., Pedersen, J.E., and Finson, K., 2001. Validating the draw-a-science-teacher-test checklist (DASTT-C): exploring mental models and teacher beliefs. *Journal of Science Teacher Education*, 12(4), 295–310.
- Timperly, H., 2011. *Realizing the power of professional learning*. London: McGraw-Hill Education.
- Zwart, R.C., et al., 2009. Which characteristics of a reciprocal peer coaching context affect teacher learning as perceived by teachers and their students? *Journal of Teacher Education*, 60 (3), 243–257.