



The design of learning spaces matters: perceived impact of the deskless school on learning and teaching

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Abstract

This exploratory case study examined the kinds of activity that a ‘deskless school’ (i.e., flexible physical school spaces) engenders among pupils and teachers. We also considered the meaning and significance that pupils and teachers attach to various features of the school, as well as the associated action possibilities. The data were gathered in a new school in the Helsinki capital area that was architecturally designed to have flexible learning spaces (FLS) without traditional classrooms or desks for pupils in an attempt to encourage pedagogical renewal. The participants comprised 17 pupils in one second-grade class and their two teachers. The data were collected by participant observation (15 lessons over 3 weeks) and interviews with the teachers and groups of pupils. Those working in FLS engaged in collaborative learning and teaching activities. Pupils worked constantly in pairs or small groups and studied collaboratively. They also incorporated mobility into their own learning activities and developed agency by choosing how and where they would work. In particular, they appreciated being able to collaborate with their peers and freely choose where and how to study. Teachers approved of the school environment’s facilitation of collaborative learning and highlighted the importance of professional co-planning and other aspects of collaboration. Overall, the design of school environments matters at the pedagogical and professional level. With thoughtful planning, such design can support deeper collaboration among teachers and pupils, foster knowledge sharing, and even develop pupils’ agency. Although the learning space itself does not ensure change, it does enable new kinds of interaction and joint learning activities.

Keywords Affordance · Agency · Collaborative learning · Learning ecology · Learning space · Primary school · Teacher collaboration

Introduction

The purpose of this exploratory case study (Yin 2014) was to assess the impact of newly designed flexible learning spaces (FLS) in a ‘deskless school’ on the practices of teaching and learning. With a view to preparing pupils for a changing society and working life,

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Finnish education is undergoing a profound digitalization process in accordance with the new Finnish National Curriculum of Basic Education (FNBE 2016). In this context, digitalization means more than mere technological change; it involves radical transformation of the operational and pedagogical culture of the schools (Lavonen and Korhonen 2017). Some radically-redesigned schools have been built as living laboratories that foster next-generation pedagogy. The deskless school is a Finnish equivalent of open-plan or open-space schools (Sigurðardóttir and Hjartarson 2016) and it realizes the idea of flexible learning spaces by using easily transformable furniture and an architectural layout that consists of different kinds of physical spaces. The purpose of eliminating encapsulated classrooms with traditionally-arranged pupils' desks is to change the traditional roles of pupils and teachers, thereby promoting collaborative forms of learning and teaching.

The creation of novel physical learning environments is intended to have systemic effects on the operational culture of the school, beyond the mere alteration of the physical layout. According to Gislason (2010, 2018), a school's learning environment comprises four aspects: physical design, organization, educational culture, and student dynamics. Thus, flexible learning spaces are not just about changing the furniture or architectural layout within the school; rather, they are intertwined with more systemic changes in curriculum, school culture, and values (Gislason 2010, 2018). Changes in curriculum, school spaces, and school culture challenge school practitioners to rethink the meaning of education and the role of teaching and learning which, according to Biesta (2009), should be at the heart of educational discussions. This discussion is closely related to the debate on 21st century skills, which highlights teamwork and collaborative knowledge building as the main components of current and future skills.

Learning spaces that support collaborative learning and agency

Many countries are in the midst of reviewing their prevailing practices of learning and instruction and are finding them inadequate for preparing pupils to participate in the emerging innovation-driven society, with its associated collaborative processes of solving nonroutine problems and creating knowledge. Scientists specialized in learning have researched and developed various environments for improving quality and cultivating collaborative practices of learning and teaching (Bransford 2000 ; Scardamalia and Bereiter 1996; Hakkarainen 2010). Mutual interaction and collaboration among learners facilitate problem-solving, the pooling of partial or fragmented knowledge, and the accessibility of new understandings to the whole group (Hollan et al. 2000). There is a critical need to transform the overall school-based learning environment because the development of pupils' agency is poorly supported by traditional individualized, acquisition-oriented, and externally regulated schoolwork (Gee 2005; Hakkarainen 2010; Rajala et al. 2013). Strengthened agency in pupils has been associated with FLS, with FLS enabling types of agency other than the traditional sovereign one, thus broadening pupils' action possibilities (Charteris and Smardon 2018a, 2019). Pupils' agency needs to be observed from different perspectives (given or self-directed, socially produced or individual, situated or general, affected by material environment or not), because doing so make it possible to improve pedagogical solutions (Charteris and Smardon 2018a). To improve such solutions in teaching, one must also focus on teachers and support their capacity to have an impact on pupils (Toom et al. 2015).

The evolving activities of pupils and teachers can lead to collaborative learning in transforming traditional roles and rules, which are determined in part by physical arrangements

and the temporal and spatial organization of activity (Charteris and Smardon 2019; Gee 2005) and in part by educational culture, organization, and student dynamics (Gislason 2018). Many pupils have limited capabilities in connecting their informal experiences and expertise with school activity (Barron 2006; Ito et al. 2013). The traditional school environment often ignores pupils' ideas and personal knowledge and thus fails to support the sharing of experience among pupils (Gee 2005). Also bullying by peers is less frequent in open-plan schools because simultaneous activities are transparent to everyone (e.g., Grannäs and Frelin 2017). Openness in school facilities also can enhance the motivation and learning of pupils because enlarged reference groups reduce the weight of within-class social comparison (Prain et al. 2014) and pupils' self-regulation and self-determination skills are supported by FLS (Charteris and Smardon 2018a; Gislason 2010).

In contrast to the architecture typical of traditional schools, open-school architecture used in FLS is likely to help teachers increase their professional collaboration, especially at primary schools, where co-teaching is more common (Gislason 2010; Husu and Toom 2016; Sigurðardóttir and Hjartarson 2016). Teachers are dependent on the school premises in their activities related to orchestrating learning processes, and modifiable spaces can enable them to use novel instructional approaches. Their professional development could also be enhanced through activities such as co-planning which, in turn, presents opportunities for co-teaching (Roth 2002). Physical boundaries such as doors and walls between classes limit further learning opportunities. Moreover, redesigned physical spaces can influence general social relationships within the school and encourage spontaneous interaction among pupils and teachers. When appropriated through local community activity, such learning spaces can become information ecosystems that integrate people, practices, technologies, and values (Nardi and O'Day 1999), thus creating opportunities for learning and teaching in novel ways. Despite these developments, however, few studies have investigated the effects of modifying school architecture from the perspectives of the users and their actions (Grannäs and Frelin 2017).

Affordance theory and school practices

Our aim was to investigate the functional roles of school spaces through affordance theory, focusing on how spaces are perceived, how meanings related to those spaces are created, and how this influences the actions and practices of pupils and teachers. According to Gibson (1979), each affordance is unique: a person perceives and interprets the space, thing, or object from his or her own activity-dependent point of view. Therefore, affordances are specific to enacted activities and therefore cannot be measured objectively. More recently, Norman (1999) distinguished between actual and perceived affordances, and Mehan (2017) differentiated potential and actualized affordances (Mehan 2017). According to Mehan (2017), affordances can also be categorized as physical (functional), epistemic (cognitive), emotional, and social. Redesigned learning spaces create novel affordances for personal and social learning and teaching activities. The use of space is driven not only by perception, but also by physical (furniture, layout, walls, separate sections or floors), conceptual (interpretations of action possibilities), and cultural (established routines and practices) constraints (Norman 1999). Affordance theory (Gibson 1979; Mehan 2017; Norman 1994, 1999; Pedersen and Bang 2016) posits that the design of physical places shapes and directs the activities of the people using them in significant ways—but without fully determining their courses of action. For instance, the practice of placing pupils at their desks facing the teacher and placing teachers behind their desks in encapsulated classrooms restricts

knowledge exchange and collaboration on multiple levels of the school community (Hernes 2004). From the perspective of school transformation, critical factors include opportunities that spaces offer for participant activity and how learners and teachers read spaces and interpret their transformative opportunities. The potential affordances prevailing in redesigned school spaces do not necessarily promote novel learning and teaching activities, particularly if participants do not exploit novel action opportunities.

Novel learning spaces require rethinking pedagogy and time. Gislason (2018) underlined the importance of curriculum renewal for changing the pedagogical culture of schools. He argued that in-depth pedagogical transformations take years rather than months because teachers have to make changes both in school practices and their own pedagogical thinking. The chosen pedagogy should be compatible with the school's physical environment to avoid potential new affordances ignored (Gislason 2010). For instance, the student-centered approach supported by FLS has to be internalized by teachers for significant changes to take place (Alterator 2018).

Both the new affordances of FLS and the pedagogical methods it promotes encourage teachers to orient their practices towards more interactive teaching and collaborative learning (Sigurðardóttir and Hjartarson 2016). However, teachers and pupils have many degrees of agentic freedom in interpretatively directing their activity. Given their high level of professional independence (Hargreaves and Shirley 2009), teachers in Finnish schools can neither be forced to change their practices nor expected to appropriate activities that they cannot influence (Senge et al. 2012). Further, their social practices are institutional routines (Reckwitz 2002), which cannot be changed without introducing novel practices to enable the achievement of professional objectives; this requires continuous professional learning (Hopwood 2016). Spaces provide potential affordances that are realized when (social) practices evolve or are deliberately changed through sustained efforts (Hopwood 2016; Mehan 2017; Shove et al. 2012). Significant social transformation appears to require expansive learning, which takes time: it involves problematizing existing forms of learning and teaching and jointly designing, exploring, and consolidating changes (Engeström 1987).

The impact of changes in physical, social, and virtual learning environments tends to be systemic and, therefore, it can be difficult to identify factors that truly transform activities and affect the outcomes of learning. Hence, changes in physical teaching spaces are likely to influence the enacted pedagogical practices of teachers in unpredictable ways (Beery et al. 2013). Given the interdependence between spaces and pedagogies, it could be hard to determine whether changes are attributable to the novel physical architecture or a parallel change in teachers' pedagogical practices (Sawers et al. 2016). According to Gislason (2010; 2018), the learning environment includes not only the physical space but also the culture, values, and organizational structures of the school and the social climate among students. Because these aspects are intertwined, successful school development is systemic in nature and based on developing the curriculum, redesigning school spaces, and strengthening teachers' agency.

Research goals

The purpose of this study was to investigate how the new, flexible learning spaces in the target school were used by pupils and teachers and to examine the association between changes in the physical learning space and collaborative forms of learning and teaching. We were interested in the affordances that the novel learning spaces provided. We

examined the occurrence of these affordances in both pupil and teacher interviews. We also studied how these affordances related to collaborative forms of teaching and learning. Furthermore we investigated the interrelation of collaborative ways of working with meanings and values associated with the school environment. We addressed the following research questions:

- (1) How do the affordances of flexible learning spaces support collaborative practices among teachers and pupils?
 - What kinds of collaborative practices are emphasized at the school?
 - How do different types of physical spaces mediate the collaborative practices of teachers and students?
- (2) What kinds of meanings related to the impact of the flexible learning spaces on collaborative practices do teachers and pupils mention in the interviews?
 - Are the meanings expressed by pupils and teachers compatible with one another?
 - How do teachers reflect on changes in collaborative practices and their effects on school improvement?

Methods

Participants and setting

The focus of the study was a newly-built school with flexible learning spaces instead of encapsulated classrooms with traditional pupil desks arranged to support frontal teaching. We believe that such radical architectural renewal allows the school to function as a testbed for developing a new culture of schooling. The school is located in a high-tech suburb that is currently being constructed in the Helsinki capital area in Finland. Teachers had voluntarily applied to teach at the school, partly because they were interested in the open-plan architecture and the associated pedagogical potential of cultivating a novel school culture. For pupils, the new suburb has no other schools yet. At the time of the study, the school had been functioning for only a year, and its activity planning was guided by the aim of developing a novel kind of learning environment and associated pedagogy. As a research target, we selected a second-grade general-education class with 5 girls and 12 boys aged 8–9 years. The class had a class teacher (A), one school assistant, and a resource teacher (B) who was present during some lessons. Both the class teacher and resource teacher were male and had over 10 years of teaching experience, including in special education.

At the time of the study, the school had two similar working units, or ‘cells’ (Fig. 1). The center of the cell constituted a large open area, Agora (1), along whose walls were pupils’ lockers, entrances to separate breakout rooms (2; 3; 4) (three per cell), and a small Teacher’s Room, which was also used for storing instructional materials (5) (Fig. 1). Each breakout room had window walls looking onto Agora, and a few breakout rooms were divided by window walls as well (6). There were doors (7) between some of the breakout rooms so that pupils and teachers could move from one space to another without going through Agora. Agora was furnished with a large and stable circular sofa unit with two levels of soft seating, which doubled as places for gathering and working. The breakout rooms differed from one another. Two of them were smaller (2; 3). One was furnished with

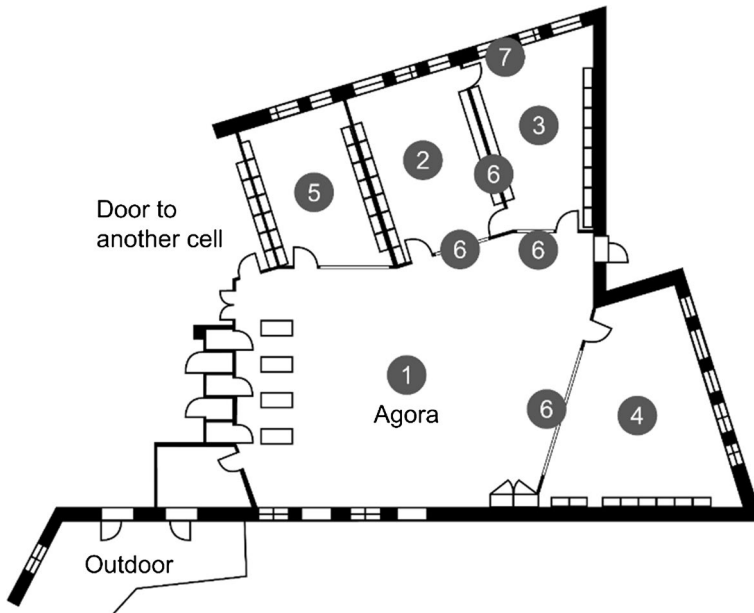


Fig. 1 A rough architectural plan of the learning spaces in one cell of the target school (1=Agora, 2=Beanbag Chair Room, 3=Exercise Ball Room, 4=Table and Chairs Room, 5=Teacher's Room, 6=window walls, 7=doors between breakout rooms)

bean-bag chairs (Beanbag Chair Room, 2) and the other with a few small square desks and exercise balls (Exercise Ball Room, 3). In addition, a narrow tabletop and chairs were fitted alongside the wall between the two rooms. The wall between the rooms was glass from waist level to the ceiling. The third breakout room was larger and furnished with tables and chairs (Table and Chairs Room, 4). The desks were lighter than typical school desks, and the office-type chairs were equipped with wheels. However, the tables and chairs were too high for short pupils whose legs could not reach the ground. Each breakout room also had an armchair and a small table for the teacher's laptop and other materials. There were no traditional teacher desks.

The rooms were also equipped with the necessary digital and instructional instruments and wireless network connections. The walls were mostly empty; pupils' drawings and artwork were displayed in Agora. Instructional tools and materials were kept in the top closets of the rooms, and each room had a few boxes with pens, erasers, and so on. One learning cell was used by one bigger group of 17 pupils (the target group of this study) and three smaller groups of five to eight pupils (special-education students). Because the groups usually used one room at a time, the original reason for having one large common area and breakout rooms was not realized because of the different needs of pupil groups.

Data-acquisition methods

The study was qualitative in nature, which is natural in studies of social practice (Schatzki 2012). Moreover, interviews and observations can be considered suitable research methods for investigating emergent socio-material practices, such as the use of physical school

spaces. We collected observation data and interviewed a sample of pupils and two teachers in the spring of 2017. The observation period was 3 weeks, during which time the first author observed 15 (45-min) lessons encompassing mother tongue, mathematics, and environmental studies. The observation focused on personal and collaborative activities taking place during the lessons (activity level), how the teachers acted, how the pupils reacted to events, and variation in activities across different spaces used. The observer assumed a passive role and simply followed the ongoing activity without actively making her presence felt in the learning space. She took notes about the physical space, the teacher's activity, the pupils' activities, and other events of interest (Lodico et al. 2010, p. 121). We carried out 2 h personal interviews with the teachers and conducted four group interviews with 11 pupils (10–15 min per group and 2–3 pupils per group). The semi-structured teacher interviews focused on the use of the physical spaces for learning and teaching, experiences of using various spaces, and the role of collaborative learning. In the group interviews with pupils, we discussed the spaces that gave them the best learning experiences, their favorite places, and movement between the spaces.

Methods of data analysis

Data analysis was inspired by theories of affordances and flexible learning spaces; at the same time, it was inductive and data driven (Yin 2014). Although theories of affordances and previous research on flexible school spaces informed the analytic process, in practice, we relied more on the data than on any predetermined theoretical considerations. The physical space provides the stimulus for various kinds of affordances (e.g., Gibson 1979; Mehan 2017). These affordances produce various kinds of activity and reactions (e.g., Gibson 1979; Mehan 2017; Pedersen and Bang 2016) and they affect how spaces are used and how different kinds of constrained (accessible only to a certain group) or closed (locked with restricted access to keys) spaces are considered (Grannäs and Frelin 2017; Hernes 2004). We relied on Mehan's (2017) distinctions for the identification of affordances, but we concentrated mainly on physical and social affordances in order to determine how these novel school spaces supported collaboration. In addressing the first research question, we considered the activities that these affordances enabled and elicited. With regard to the second research question, concerning the views of pupils and teachers about the functions and meanings of the FLS, we relied on a data-driven approach. The analysis of interviews revealed meanings related to how pupils and teachers valued different aspects of their educational activity and how, in their experience, the space affected learning and teaching. Bringing the two perspectives—activities and interviews—into the same analysis enabled us to examine the correspondence between the two.

The data were subjected to qualitative content analysis. The interview and observation data were transcribed into text documents and imported into the Atlas.ti program for analysis. We used both descriptive and process coding (Saldaña 2009). The descriptive coding helped to address the second research question (concerning the meanings emerging from the interviews), whereas the process coding enabled us to trace the activities taking place in the learning spaces (Saldaña 2009). The first coding cycle was fully data driven. We coded all issues that appeared important, and we then combined the original codes and clustered them in the Atlas.ti program, using different colors, in accordance with Freise's (2012) instructions. In the second coding cycle, we used the color coding generated in the first cycle to construct higher-level categories via the Atlas.ti code group manager function. Having formed the categories, we reviewed the codes once more and, when appropriate,

combined certain individual codes to form bigger groups using the Atlas.ti merge codes function. During the last categorization round, we finalized the research questions and removed unnecessary categories in order to include only categories related to collaborative practices.

The analysis resulted in four higher-level categories, two of them representing activities (shown in the upper part of Table 1) and the other two involving the main aspects of meanings (shown in the lower part of Table 1). For the most part, the observation data served to address the first research question, concerning the activities of the pupils and teachers. The interviews were used only as support material at this point. With regard to the second research question (regarding the meanings pupils and teachers attached to FLS), we relied on the meanings and themes that the pupils and teachers expressed when discussing school spaces in the interviews. The meanings expressed in the interviews varied appreciably between the two groups. Both pupils and teachers emphasized the importance of a collaborative culture but, understandably, only teachers talked about school spaces in terms of enabling new kinds of learning and teaching.

Results

Analysis of results focuses on how the affordances of the flexible learning spaces were used by pupils and teachers (“[Effects of physical space on collaboration activities of pupils and teachers](#)” section) and how they reflected on the significance of flexible learning spaces in their interviews (“[Teachers and pupils attributed meanings to various features of FLS](#)” section).

Effects of physical space on collaboration activities of pupils and teachers

Practices of joint studying and interaction could be seen as a response to the social affordances of school spaces (Mehan 2017). As the observations and interviews revealed, such practices were frequently present in pupils’ and teachers’ actions as a cross-cutting phenomenon. Interaction was observed among pupils (collaborative learning), among teachers (co-planning), and between pupils and teachers. Pupils worked together during each of the observed lessons, either in pairs or in larger groups. Collaborative studying was a norm in the class and appeared to come naturally. On the other hand, the teacher had to give specific instructions when asking pupils to carry out a learning task individually.

Collaboration was observed in the Beanbag Chair Room as pupils sat in either the same or adjacent beanbag chairs, lay on the floor, or sat side by side around the small table by the wall. The Exercise Ball Room had small tables, around which pupils formed natural small groups. Pupils individually clustered into bigger or smaller groups by the sofa unit in Agora whereas, in the Table and Chairs Room, they tended to move the tables side by side to work together. The physical arrangements and furniture in each room appeared to encourage collaborative interaction.

The teachers construed the pupils’ interaction as mutual knowledge sharing and collaborative learning: “Yes, it [collaborative learning] is automatically happening in this type of place” (Teacher A). Moving around during the lessons appeared to elicit interaction, and the premises seemed to encourage collaborative learning when the desks did not artificially separate the pupils from one another: “We have a very different type of movement here and then they [the pupils] are ... interact[ing] during the lessons much

Table 1 Categories of collaborative activity and meaning emerging from the qualitative analysis of observations and interviews

Category of collaborative activity	Actors	Examples of codes
Joint studying and interaction	Pupils and teachers	Approaching the teacher; collaborating; enabling collaborative learning; helping; taking contact; working together
Co-planning	Teachers	Coordinating; discussing how to use the spaces; planning concretely
Category of meaning	Significant for whom	Examples of codes
Collaborative culture	Pupils and teachers	Approachability; attachment to a bigger group; close interaction; creation of a common space; openness and informality of the spaces
What the space enables	Teachers	Challenging oneself; changes in behavior; emphasis on agency; emphasis on flexibility; school renewal

more than in a classroom where you often are around desks” (Teacher A). The pupils sat next to the teacher when he was reading a story, even leaning on his feet during one lesson. They could also sit in the teacher’s armchair when the teacher either sat in another chair or walked around to see how the schoolwork was progressing. The fact that the rooms were not structured to force pupils to sit in rows facing, attending to, and constantly listening to the teacher as an authority figure seemed to give the pupils many opportunities to work together and interact freely, both with each other and with the teacher. Teacher A found that the lack of a teacher’s table made him more accessible, especially in terms of constantly moving among the pupils. Without a large teacher’s table in the classroom, the teacher has to establish authority by other means. Accordingly, the social space, that is, the space for interaction and collaboration, appeared to be shaped by the physical spaces of the open-plan school, making social affordances visible (Sigurðardóttir and Hjartarson 2016). On the other hand, emphasis on collaboration could also highlight outsidership. To some extent, this was seen in the school under investigation: some pupils were readily left to undertake tasks alone if working with a pair was voluntary. As we stated in our observation notes: “Pupils do tasks together (in pairs), but the most quiet pupil works alone” (math 18.5.2017). Some pupils were left alone more than once. Consequently, we can plausibly assume that the effects of the social affordances sometimes can be reversed, thereby limiting the social participation as well as the social status of pupils.

Working together was present among teachers as well as pupils. For pupils, collaboration meant concretely engaging in joint activities during the lessons and, for teachers, it involved co-teaching, co-planning, and the sharing of experiences. Collegial professional activities such as these were necessary in terms of learning together to discover new teaching practices. The school spaces were experienced as supporting interactive, joint work between the teachers: “In the old days you went to your own classroom and shut the door. Here that’s not possible, you have to use the spaces flexibly, take others into consideration and also collaborate more with other teachers” (Teacher B). Beyond the development of co-teaching practices, the open architecture appeared to facilitate teacher collaboration, given the physically easy access to colleagues and constant visibility in other spaces. As Sigurðardóttir and Hjartarson (2016) reported, teachers intensified their co-planning to support new ways of doing things in terms of coming to joint agreements about who would teach in what space, who would bring the necessary materials to the right learning space beforehand, and how to adjust teaching to the possibilities of the space at hand.

Teachers did not view particular spaces as being suitable only for one subject but emphasized the importance of planning in this context: “I think a little about what is enjoyable and best to do there” (Teacher A). Although each cell had its own small teacher’s room, it was used mostly for short-term activities (e.g., telephone calls or giving reading tests to individual pupils) or storing instructional materials. Interviews confirmed observations concerning the importance of joint planning. Teachers wanted to have a separate co-planning meeting every week, because their work had changed in emphasis from individual to more-collaborative working practices across classroom boundaries; the changes that they described were not only in physical design but also in educational culture and organization (Gislason 2010, 2018). Spaces were experienced as supporting collegial practices because common cells made knowledge sharing and co-teaching easier, leading to de-privatization of teaching practices (Charteris and Smardon 2018b). The change in the physical space of the school therefore had brought about a change in collegial activity, which also affected the teachers’ use of time within and between lessons. Co-planning is considered the first

step towards team teaching, enabling teachers to reciprocally learn from one another (Roth 2002); this was also how the teachers proposed to change their activities.

Teachers and pupils attributed meanings to various features of FLS

In the interviews, both pupils and teachers claimed that FLS facilitated a collaborative culture of learning. Pupils talked about what their friends meant to them, the importance of interacting with friends during school days, and the importance of studying together with them:

Pupil 7: "...with a friend. If one doesn't know the answer..."

Pupil 6: "Then the other can help."

Pupil 7: "...the other can help. So not to tell you the answer but to help."

Teachers, on the other hand, emphasized the collaboration, approachability, and social contacts that the school facilities and emerging practices helped to create. Whereas pupils valued the closeness of friends, teachers saw the value of interaction in terms of expanding pedagogical possibilities. From the teachers' perspective, it was critical that the social affordances of the learning spaces helped to engender a collaborative learning culture. According to Teacher A, close social relationships reduce and even eliminate harsh disputes and bullying between pupils (Grannäs and Frelin 2017): "Even though we have pretty different types of learners here, there has been very little bullying. I'd like to think that the kids are in interaction with each other and know each other a bit better and see more of each other; so that could be the reason why these fights and disputes are avoided." It seems that there was less bullying because pupils were attached to a larger group and not just to their own class. Teacher B felt that the school's furniture facilitated closer interaction between teachers and pupils by eliminating the physical and institutional structures that constrained approachability. Teacher A, in turn, experienced a "more informal and closer interaction" with pupils than in a traditionally-furnished school. Moreover, not only did the close interaction affect the relationships among the pupils and between the pupils and teachers, it also changed the relationships between the teachers themselves. Open spaces and glass walls made teachers more visible, making contacts more likely to emerge naturally: "There [in a traditional school building] you are still mainly in your own class, doors closed, and here we're not. That is a significant difference. Here the contacts come more naturally between adults as well as between kids" (Teacher A).

The close interaction helped to create common spaces in both cells, by both sharing the spaces and displaying the pupils' handicrafts and drawings in Agora: "We immediately started to use the spaces flexibly. Somehow, we were thinking of the cell as a kind of home base where drawings and other work are displayed, that there is not that kind of home 'classroom.' The daily activities are structured in the cell, and it becomes a safe place, and all the adults know all the kids and all the kids know each other" (Teacher B). Teachers felt that the collaborative culture that evolved through close interaction served as a foundation for many other benefits, such as maintaining learning engagement and interconnecting ideas. Conversely, one teacher mentioned exhaustion because of constant social contact: "Social contact is much more frequent than in a traditional classroom, which can also tire you. You notice that, in the afternoon, you don't really want to see anyone anymore [laughs]" (Teacher A).

The teachers repeatedly used the words "possibility" and "enabling" in their interviews when describing the school spaces. They did not think that the space itself determined the change but that the space made it possible to act in a new and different way. For instance,

they felt that it was easier to implement the new curriculum (FNBE 2016) in the new school than in traditional school facilities, linking it to benefits such as transparency, collaboration, and more-flexible use of facilities. They seemed to have deliberately changed their way of thinking in response to the novel potential of the school space: “You have to consciously shake that kind of [burden] from yourself so that you won’t do what you did before” (Teacher B). The facilities enabled but also seemed to require flexibility and a flexible mindset: “You have to use the spaces flexibly and take others into consideration and then also collaborate more with other teachers” (Teacher B). “But maybe it demands that kind of flexibility from the teacher, or somehow conscious orientation that you also allow it” (Teacher B).

The flexibility not only influenced teachers’ practices, but also fostered pupils’ agency. Both teachers said that desks kept pupils in one place for too long and that, when they are allowed to move, they are at the center of their own learning and their agency is emphasized precisely through action: “Pupils are themselves at the center of what’s going on. They are the ones who take action” (Teacher B). The FLS made it possible for pupils to interact and to share their knowledge and understanding. The learning spaces thus enabled students not only to act differently but also to learn from others, to collaborate and share knowledge, and thereby to develop their own work and understand their own studying methods: “There are the beanbag chairs and there one can concentrate so well” (Pupil 9). The pupils emphasized the importance of choosing where to be during the classes, because most of them had their favorite place: “in front” (Pupil 9), “in the middle” (Pupil 5), and “close to the wall” (Pupil 4).

As both interviewed teachers pointed out, a new type of school space does not in itself create a new kind of teaching or innovative activity (cf Sawers et al. 2016). As Teacher B put it, “you can do very traditional teaching in the new spaces as well”; it is up to the teacher to orchestrate the use of the space. The FLS appeared to enable rather than to create, direct, or impose change. Teachers reported challenging themselves to promote changes in the school’s operational culture, so “that you wouldn’t do what you did before” (Teacher B). They experimented with different environments to “create new, totally new, structures and practices” (Teacher A), and “shake that kind of novelty from yourself” (Teacher B). It was also “easier to get stuck in traditional thinking or with familiar things [routines] that would be easier for you” (Teacher A). In other words, new types of spaces emerged in the interviews as enabling factors in which teachers could lean into their own activities when creating novel ways of supporting pupil interaction and learning.

Discussion

In Finland, open-plan schools or FLS are currently being built in many communities, and old school buildings are being renewed based on the FLS approach, especially for primary schools. Both school practitioners and policy makers are calling for research to help them develop schools’ operating culture, organize professional development for teachers, and plan the changes needed in curriculum design and implementation. The purpose of this case study was to investigate how the creation of an open-plan school influences practices of teaching and learning. At the time of the data collection, the newly-built school with FLS had been operational for only a year, such that its working culture was still developing. Teachers were contracted to the school according to their willingness to explore the novel pedagogical approaches that FLS enabled. Pupils were rather young (second graders)

and assessed the school environment from their own perspective. Any interpretation of the results should take into consideration the likelihood that teachers were motivated to give a positive impression of the school and its functioning. According to the Hawthorne effect, people involved in interventions tend to be motivated to evaluate any changes positively. Nevertheless, observation and interview data yielded rather coherent views regarding the effects of the redesigned school architecture on interaction, collaborative learning, and co-planning among teachers.

The first research question concerned how the affordances of FLS supported collaborative practices among teachers and pupils. The analysis revealed that joint studying and collaboration was the norm in the school, and pupils worked either in pairs or groups practically all the time during the observation period. Moreover, collaboration was common among teachers, particularly in the form of extensive co-planning, the importance of which has been emphasized by Gislason (2010). Although the sharing of knowledge was enabled by the spaces, it also required active participation from the teachers. The second research question addressed the meanings brought up by the teachers and pupils in the interviews concerning the impact of FLS on collaborative practices. As analysis of interviews revealed, pupils and teachers mentioned and valued collaboration, although in different ways. It was important for pupils to have the opportunity to interact and work with peers during the lessons, whereas the teachers emphasized the value of broader interaction throughout the cell in terms of expanding the learning community. The open-plan environment was also credited with having prevented bullying from developing in the same way as in regular schools. The teachers also emphasized the collaboration between teachers and its importance in terms of sharing professional and practical knowledge. Overall, the results indicate that the defining features of the open-plan school are also found in Finnish schools designed as FLS: an emphasis on planning (Sigurðardóttir and Hjartarson 2016), increased interaction (Gee 2005; Sigurðardóttir and Hjartarson 2016), a reduction in bullying (Granäs and Frelin 2017), and the use of spaces as enablers (Sawers et al. 2016).

To conclude, the data analysis indicated that flexible learning spaces can foster collaborative learning and pupil agency. According to the interviews, collaborative learning is the direct result of the interactive use of spaces to provide opportunities for mutual learning. Our results also show how the flexible learning spaces are perceived to facilitate the implementation of the new curriculum, but only if the opportunities are acted upon. As a part of learning-environment renewal (Gislason 2010, 2018), changing spaces can make new ways of working and new perspectives visible. Findings imply that changes in physical space potentially allow and provide affordances for different activities, but this does not dictate or determine the nature of any pedagogical changes. Our examination of the practices in FLS suggests that spatial solutions supported the new learning and teaching culture. The school appeared to have built a novel space for social learning in which collaborative practices expanded through intensive interaction. Simultaneously, the teachers' pedagogical use of the space appeared to have strengthened the process of collaborative learning. Accordingly, the school's spaces functioned as a primary affordance for teachers and a secondary affordance for pupils.

The operating culture is likely to continue transforming if novel pedagogical opportunities are deliberately built on and developed, thus resulting in comprehensive systemic change. It is noteworthy, however, that teachers in this school had not been involved in the planning of the school's learning environment before the school year but had started more extensive pedagogical planning during the school year. This could have affected their descriptions of the school spaces as "enabling" because, according to Gislason (2018), teachers should be involved in the planning phase. The analysis also reveals

that teachers thought that the FLS supported the implementation of the new curriculum better than traditional spaces but, at the same time, it highlights that, as a working community, teachers had not deliberately planned *common* pedagogical approaches based on new curriculum, because they still had the freedom to decide on how to use the spaces and how to implement the new curriculum. Because the target school was one of the first in Finland to have FLS and the experiences gained are to be utilized in later school space renewals, the current process for bringing FLS into use involves teachers at an earlier stage.

Potential affordances (Mehan 2017) were emphasized in the way in which teachers and pupils talked about the possibilities that the spaces opened up. Teachers perceived FLS as a place that encouraged different types of activities, interaction, and learning than in schools with traditional, physically-separated classrooms with rows of desks. Nevertheless, the physical premises did not directly determine the pedagogical changes: teachers and their pupils all had to individually take the opportunity to act differently and thus to turn potential into actualized affordances (Mehan 2017). Teachers recalled how they deliberately forced themselves to abandon their old routines and take advantage of the novel affordances that the spaces offered. By deliberately challenging themselves to go beyond prevailing practices in the use of learning spaces, they appeared to change their task perception and enhance their own transformative agency. New social routines (Reckwitz 2002), such as continuously working in pairs or small groups, also emerged and mediated pupils' learning. Co-planning and professional collaboration are essential if teachers are to make sustained changes in school practices. Co-planning involves gathering several teachers around the same table in a competence-sharing mode, and it creates a basis for generating and elaborating novel ideas to a greater extent than any individual teacher could do alone (Roth 2002). In the school context, co-planning and learning from colleagues are important aspects of the development of professional competence among teachers, although the implementation of new practices requires time and support from the workplace community (Husu and Toom 2016).

Whereas traditional school buildings tend to feature long corridors with no comfortable places in which to spend time, as well as classrooms with closed doors, FLS are radically different, featuring interactive agoras and breakout rooms surrounding them. In fact, the architectural structure of a centralized agora surrounded by smaller, glass-walled rooms is reminiscent of Foucault's (1980) panopticon. All activities are visible, potentially causing distraction and preventing private study. Nevertheless, pupils appeared to become accustomed to working in open spaces, movement within the rooms did not visibly distract them, and they did not report challenges in terms of concentration. Teachers were set free from their closed spaces to work more closely with others and to find stimulation not only from the environment but also from their colleagues. The open space released pupils from their individual desks to move and interact with their peers, and teachers emphasized pupils' active engagement and intensive participation that could foster the emergence of their agency (Charteris and Smardon 2018a). It thus appears that pupils were able to take advantage of the potential physical and social affordances of the spaces, thereby developing their own roles through free choice, mobility, and collaboration, in accordance with the emerging affinity space (Gee 2005). Furthermore, previous studies have revealed that increased interaction reduces bullying (Grannäs and Frelin 2017). In the present case, this could be attributed to the expansion of the pupil community to include the whole cell instead of just one class. Knowledge and ideas spread better when they are not enclosed but freely accessible to everyone.

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