How Co-design Can Contribute to the Ongoing Development of Hybrid Learning Spaces by Empowering the Users

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Introduction

Physical spaces are an important consideration in education and essential to understand when planning any kind of learning situation. It is almost impossible to understand the practice of social relations without the spatial distributions they take place in (Crampton and Elden, 2007). The link between the design of educational spaces and various types of pedagogy has received growing attention in recent years (e.g. Woolner, 2010; Brøns, 2019, 2021; Boys, 2011; Bøjer, 2019b, 2021; Martin, 2009). However, large funds are being invested in building and rebuilding educational environments with questionable educational underpinnings, resulting in new-built spaces that do not match the pedagogical practices (Goodyear et al., 2018).

Martin (2009) calls the building a 'finished beginning' (p. 87) and argues that the teachers have a tendency to passively accept the spaces as provided. There is a need to find ways through which teachers can gain authority to redesign or reconfigure the spaces and incorporate these as active elements in hybrid learning spaces. A challenge in this process is that skills in or knowledge about architecture, design or spatial behaviour are not part of teacher professional development. Although teaching is a spatial practice, teachers' understanding of the relation to the physical environment is limited and often influenced by personal experiences from their schooling. The profession is shaped by its history and the buildings it has taken place

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in, therefore lacking professional spatial understanding, reflections and discussions (Brøns, 2021).

'Hybrid learning space' is a relatively new concept of growing interest within educational research, in particular in relation to higher education. The term refers to an interplay of 'spaces' that are not just physical but also digital, social, conceptual and informational (Kohls, 2019), thereby enabling different forms of learning activities (Köppe et al., 2018a, b). Hybridity in education dissolves existing dichotomies and divisions such as physical-digital, formal-informal contexts, learning-teaching, student-teacher roles and individual-collective as it stresses the mixture and fusion of these traditionally separate parts (Hilli et al., 2019; Kohls, 2019). Therefore, in a hybrid learning space, learning is pursued in a network of entangled activities, relations and roles and takes place in both digital and physical spaces.

Little research exists about hybridity and the role of the physical space in hybrid learning spaces in primary education. Thus, this chapter builds on research about hybrid learning spaces in higher education and research on the relationship between learning spaces and pedagogical practices in primary education.

As researchers and practitioners, we have often experienced how newly built spaces aiming at supporting new pedagogical practices, often influenced by notions of hybridity, were not used as intended by the designers. This can either be attributed to the designers' and architects' lack of understanding of the pedagogical environment, lack of support by the school organisation in the transformation and inhabitation process or the users' lack of understanding of the potential of the physical framework as a tool in their methodology. In this chapter, we pursue the latter perspective as we examine the potential of co-design as a means of developing a hybrid learning space, where the physical space is included as part of the teacher's pedagogical toolbox. Our hypothesis is that approaches from co-design can support interdisciplinary collaboration between the designers and users of learning spaces and through this, inform a development towards hybrid pedagogy and hybrid learning spaces in primary education.

To answer this, we will first define what characterises a (hybrid) learning space in primary school. The primary teachers' role is of great importance in hybrid learning spaces; thus, the aim of the two following sections is to discuss what teacher professionalism is, how it is (dis-)connected to the physical setting and how teachers can develop an environmental awareness. In the fourth section, we clarify why we work with interprofessional collaboration and co-design as a tool. Building on the understanding that there is a need to develop better awareness and competence to utilise space as part of teacher professionalism, we then present the empirical study. In the study, co-design was used as a means of collaboration, joining professions and aiding teachers to develop competences to create and use hybrid learning spaces. We present the findings from the study before finalising the chapter with a discussion and conclusion of the overall research question that this chapter pursues: *How can co-design contribute to interprofessional collaboration between designers, teachers and students and hence support the development and use of hybrid learning spaces in primary education?*

Hybrid Learning Spaces and Primary Education

In this chapter, we alternate between the terms 'space', 'learning space' and 'hybrid learning space' as we refer to either the physical setting in which educational practices take place (space) or the combination of the physical setting and educational practices (learning space and hybrid learning space). Our choice of the terminology 'space' over 'place' is made from the perspective that the term 'place' is conditioned by lived experiences (Ellis & Goodyear, 2016, p. 157) whereas 'space' can be used in the discussion on a conceptual level without getting into the users' personal perceptions (for an elaborate discussion on the use of space/place see e.g. Ellis & Goodyear, 2016).

Over the years, the idea of the learning space as identical with the confines of the classroom has been challenged and a broader notion has emerged (Hilli et al., 2019, Zitter & Hoeve, 2012). Mulcahy et al. (2015) define a learning space as a product of interrelations and materially embedded practices that comes into existence with its users. Behind this definition lies a relationalist perspective, where space and its occupation are understood as inseparable and interlocked parties in a mutually constitutive relationship. This is in opposition to a realist perspective, where space and occupation are considered in a binary framing as separate and different aspects that reflect each other (Mulcahy et al., 2015). In the latter perspective, the space-practice relationship is considered causal, which means that the physical surroundings are expected to change pedagogical practices automatically. However, as both practice and research show, a new spatial design does not automatically lead to a change in practice (Brøns, 2019; Bøjer, 2018; Imms & Byers, 2017). Space is, as Boys (2011) points out 'a relationship rather than a setting or entity' (p. 31). In this perspective, the interplay between space and practice is intricate, dynamic and dependent on a variety of social and material factors (Bøjer, 2019b). Thus, a learning space can be described as a network rather than a fixed entity and is continuously developing and changing. This applies to traditional as well as hybrid learning spaces.

In hybrid learning spaces, contexts, roles and media are intertwined and fused in new ways (Hilli et al., 2019). Hilli et al. (2019) explain the hybrid learning space as:

> 'a context of learning that not only moves beyond distinctions between online and offline spaces, but also often challenges divisions between teacher/student roles, formal/informal contexts, analogue/digital communication/media and other traditionally separable dimensions. Hybrid Learning Spaces and hybrid pedagogy offer new 'complex hybrid breeds' and as such potentially new possibilities for collaboration in higher education' (p. 67).

Thus, in a hybrid learning space, the interplay between physical space and practice is increasingly complex and interdependent as they enter into a network consisting of multiple relations and elements. The physical spatial settings can no longer be ignored and separated from the pedagogical practices but form part of the relations that collaboratively constitute the hybrid learning space.

The idea of blurring the lines between or dissolving the dichotomies of teacher-student, formal-informal, local-online is also present in the discussion of primary

education development in the twenty-first century. Pedagogical approaches such as blended learning, deep learning, creative learning and project-based learning, emphasizing e.g. collaboration, exploration, creativity and student agency, increasingly become the new norm along with other hybrid principles such as collaborations with cultural institutions and other real-life resources in society to facilitate learning activities.

In primary education, teachers have a more prominent role in guiding the students than in higher education and even more when hybrid principles and hybrid learning spaces are applied. The students are too young and inexperienced to be responsible for their own learning and when dichotomies such as physical-digital, formal-informal, student-teacher and individual-collective are blurred or even dissolved, navigating the context and environment becomes more complex and difficult. The younger the students are, the more important it is for the teacher to be physically present to guide them (as we have seen evidence of during COVID-19 (Qvortrup et al., 2020; OECD, 2020)). Thus, the main activities and learning take place at the school, even when using digital/virtual spaces.

In primary school development, it is commonly accepted that the physical spaces can enable or hinder certain pedagogical practices. Therefore, new/innovative learning spaces with emphasis on, as is the case for hybrid learning spaces, openness to 'collaborative learning where student agency is important for the collective efforts of students to be beneficial' (Hilli et al., 2019, p. 67), are coveted. These are often characterised by a flexible and/or open layout with breakout spaces off the main teaching spaces in order to support creative and innovative teaching methods that will promote the development of competences such as creativity, communication, collaboration and critical thinking. Competences which hybrid principles also aim to foster (see e.g. Köppe et al., 2018a, b). As such, the physical space plays a vital role in hybrid learning spaces in primary education, which is why we address the relation between space and practice in this chapter.

Teacher Professionalism and Relation to Space

Applicable to hybrid learning spaces, whether for higher or primary education, is that a reflected and purposeful pedagogy is expected (Guerriero, 2017; Hilli et al., 2019). The dynamic and flexible frameworks require a different way of teaching than traditional schooling and thus, a conscious reconsideration of pedagogical practice. The educational environment is characterised by a willingness to experiment and collaborate, have more dialogue than instruction and working with enquiry-based exploration instead of towards a known result (Hilli et al., 2019). Hence, the expectations for the teacher are higher and more complex than in a traditional setting (Guerriero, 2017).

In most schools, teacher practices still take place in traditional settings, which support explicit teaching and have well-defined places for the teachers, strongly influencing their pedagogical choices (Brøns, 2019, 2021). In Australasian schools,

for instance, classrooms still make up for approx. 75% of learning spaces (Imms et al., 2017) despite Australasia heavily investing in innovative learning environments. The traditional spaces and teacher-centred pedagogy have been produced and reproduced by the teachers' agency through a long history (Brøns, 2021; Martin, 2002).

There is a dynamic relationship between the physical environment and the teacher's pedagogy, which the teachers should be aware of and which should be deliberately developed (Martin, 2002, 2009; Bøjer, 2019b). Several researchers (Martin, 2002; Lackney, 2008; Bøjer, 2019b) put forward a call for teacher training and retraining in both awareness of the possibilities of the spaces in relation to practices and the competences to use these didactically.

An OECD investigation into teacher professionalism and twenty-first century demands stresses that teaching is a complex and cognitively-demanding activity and improving teaching requires specific and purposeful professional development and time (Guerriero, 2017). According to the report, it takes 5–7 years for a teacher to develop their knowledge and skills sufficiently to have an impact on student outcomes. One of the main differences between a novice and an expert teacher, Guerriero (2017) explains, is their ability to apply knowledge and make a professional judgement, which derives from both theoretical and practice-based knowledge'. They define this as 'working knowledge of contextually-specific experiences' (in Guerriero, 2017, p. 104). Neglecting to recognise either the theoretical or the experience-based knowledge would be a devaluation of teacher professionalism (Guerriero, 2017). Again, we are reminded that teaching is a spatial practice, because in order for experiences to be contextually-specific, the space in which they take place would have to be considered. What is more, this calls for ongoing professional development of the teachers' spatial skills if they are to include spatial considerations in their professional judgement, which we elaborate on in the following.

However, current systems of teacher education and training often fail to provide the training needed in this matter, as teachings in the interrelations between space and practice and the didactical potential of physical spaces are not part of the curriculum. Furthermore, teachers of today are submitted to a lot of internal and external pressure and demands concerning i.e. learning goals and rarely have the time to experiment with spaces and practices (Bøjer, 2019b).

From Unaware to Competent Users of Hybrid Learning Spaces

> When teachers realise that they have control, they can feel empowered by the same environment that once would have defeated them (Martin, 2002, p. 154).

As the quote implies, there is a strong link between a teacher's awareness and understanding of the possibilities provided by a physical environment and ability

to actually use these possibilities as part of their pedagogical toolbox. However, as Martin (2002) points out, awareness in itself does not necessarily lead to active exploitation. Being aware of the qualities of a space is not equal to feeling in control of and being able to take advantage of them. Therefore, according to Martin (2002), it is necessary for teachers to learn how to constructively question their physical environment as well as to proactively look for redesign solutions if they are to take control and feel empowered by the spatial settings.

Martin (2002) defines these two abilities as *environmental awareness* and e*nvironmental competence*. She explains awareness as the ability to understand how the environment relates to human activities and competence as the knowledge of and ability to redesign the environment to fit teaching practices. The same terms are used by Lackney (2008), who explains environmental awareness and competence as 'the ability to understand and effectively use physical instructional space for pedagogical advantage' (p. 133). In a study about teacher environmental competence in elementary school, Lackney (2008) discovered how educators generally lack a common language for discussing their environmental experience and concerns in relation to practice and the competences to effectively use the physical environment to support their practices (Lackney, 2008). This dilemma continued even after Lackney (2008) had facilitated workshops to raise the environmental awareness and competence of a group of teachers. Only a few of them were able to articulate problems and come up with alternative solutions and very few were motivated and prepared to act to improve their conditions afterwards.

Thus, we claim, training teachers in environmental awareness and competence is about establishing a consciousness about the space-practice relations, developing a language for discussing these and gaining on-going practical experiences with the use of spaces. As we will discuss in the following sections of this chapter, it is our hypothesis that participatory design methods, e.g. from co-design, have the potential to create an arena for the training of these competences in the form of a hybrid learning space, especially if the methods are applied in situ as part of the regular educational practices.

Often, a learning environment is used unconsciously without consideration of the spatial settings and their influence on practices. Therefore, a third condition, besides environmental awareness and competence, deserves attention: environmental unawareness.

Summing up, there are three ways to inhabit a space:

(1) *Being there,* which means using the space as a neutral frame or container (*environmental unawareness)*;
(2) *Being aware* of the possibilities of the space in relation to practice, but not feeling confident and empowered to use them actively (*environmental awareness)* and;
(3) *Being confident,* knowing how to use and redesign the space to support one's teaching practices (*environmental competence)*.

By addressing and working with the possibilities of the space, users can move from environmental unawareness to awareness and competence. This will enable

them to challenge and develop their spaces to fit individual requirements and teaching strategies (Martin, 2002). An arranged space can be used as a deliberate teaching strategy that complements and reinforces other strategies to support learning (Martin, 2009), thus becoming part of the teacher's professional toolbox. As Lackney (2008) showed, there is a need for theoretical as well as practice-based training in the relations between space and practice in order to achieve the goal of environmental competence. As discussed earlier, the teacher's professional judgment derives from theoretical as well as practice-based knowledge. This also applies to hybrid learning spaces. When planning hybrid educational practices, teachers need to be aware of the role of the physical space as part of the hybrid learning space. By obtaining environmental competences, teachers become aware of the possibilities and limitations the space poses for the dissolvement of the dichotomies between e.g. informal-formal learning, teacher-student role and virtual-physical presence and are thereby able to work with these in order to create the arena for learning.

Co-developing Environmental Competences Through Interprofessional Collaboration

Creating successful learning environments requires interprofessional collaboration between designers, managers and users (teachers and students) in order to secure the space-practice relationship. Not just during the design phase but also after the users take over, in order for them to inhabit and feel authority in their new spaces (Bøjer, 2019b). There is a need for an exchange of knowledge concerning creation, management and use of the spaces. Goodyear et al. (2018) suggest that it is necessary to become more sophisticated about the forms of knowledge that are associated with the different practices and participants in the (design) project. They explain that the kinds of knowledge relevant to the designers in the design process are not equal to the kinds of knowledge that are needed to organise the use of the spaces by the managers or to actually use the new spaces by the teachers and students. Thus, it is crucial for the parties to collaborate and exchange different kinds of knowledge in order to secure the alignment of space, practice and organisation. As experts of each their field, designers, users and managers have extended knowledge concerning their professional relation to the learning environment. However, these three areas might be difficult and sometimes impossible to match if the parties do not collaborate to align knowledge and practices.

Collaboration is important for the teachers' sense of professional development, growth and competence. Research suggests that professional development through collaboration 'can be a source of support and empowerment for teachers in schools undergoing change' (Rutkowski et al., 2013, p. 27) and lead to higher job satisfaction, which is important for the continuation of any development at a school. If the teachers choose not to get involved with the development of the physical

environment, there is a risk that they, influenced by the history of their profession, unintentionally, will arrange furniture in ways that do not support their pedagogical intentions (Brøns, 2021; Martin, 2009). They will either let the spatial setting control their teachings or attempt to teach in ways that are obstructed by the space.

The move from unawareness to competence can be pursued in various ways. Our suggestion is to use participatory design methods, in particular co-design, as means to engage the teachers in active exploration of the relations between pedagogical practices and the physical environment. A goal in this process is to empower the teachers with the competences to utilise and experiment with their spaces as a part of their pedagogical toolbox. Through working with and in the space and in collaboration with the students and designers, as the empirical studies presented in this chapter will exemplify, an understanding of the design as well as ownership of the space emerges - and simultaneously, a hybrid learning space is created.

Co-design

Co-design derives from a participatory design tradition, the origin of which is linked to Scandinavian systems design in the 1970s. The core of co-design is the collaboration between designers and non-designers (a term that refers to people who are not trained in design) throughout the design process from problem clarification to design solution. In co-design, the users play a central role in the design process as experts of their own experiences, contributing to the formulation of and the solution to a given problem (Sanders & Stappers, 2008). Through this, the design process becomes a democratic and collaborative arena engaging both designers and users simultaneously (Storni, 2015).

Co-design offers a wide repertoire of tools, applications and techniques aimed at making participants *talk* about existing practices and future visions, *make* tangible things or prototypes to describe future objects, concerns, opportunities or ways of living and *enact* possible futures (Brandt et al., 2012; Bøjer, 2019a). The 'tell', 'make' and 'enact' activities are often intertwined, take place simultaneously in participatory design practices (Brandt et al., 2012) and aim to inform the design process that follows. Each co-design process is planned in relation to the particular participants and context.

Co-design is mostly used in the pre-design phase to create a common platform from where the design can evolve. However, in the empirical studies described in this chapter, the co-design activities were separated from any design phase in order to explore whether this approach could contribute to the development of environmental awareness and competence. Co-design was selected due to its active inclusion of non-designers in the design activities and its potential to initiate and facilitate discussions about imaginable futures (Bøjer, 2019a).

Effective collaboration in participatory design processes of learning spaces requires more than the sum of the individual knowledge involved in the project. The reason for this is, according to Goodyear et al. (2018), that the key users

of the spaces might have difficulty explaining their experiences in relation to the environment as they mostly react to it unconsciously. Co-design supplies the tools and methods to help the participants communicate about abstract and hidden needs and experiences (Bøjer, 2019b).

Using Co-design to Break Down Boundaries

The empirical studies took place in a Danish public school in 2018 and were performed using a Research through Design (RtD) methodology (Frayling, 1993) as part of Bøjer's PhD-project 'Unlocking Learning Spaces – an examination of the interplay between the design of learning spaces and pedagogical practices' (Bøjer, 2019b). In RtD, research reflections are generated in action (Schön, 1983) through the design processes and tools that become means to acquire knowledge (Bøjer, 2019a). The qualitative methods used to collect data consisted of a mix of co-design tools (Sanders & Stappers, 2012, 2014) and ethnographic methods, e.g. photo documentation (Holm, 2014), participant observation (Szulevicz, 2015) and semi-structured interviews (Tanggaard & Brinkmann, 2015).

For 3 months, two teachers and their class (24 students, 11–12 years old) participated in a co-design process, actively exploring the relationship between space and new pedagogical practices. They tested two furniture prototypes (Fig. 1), aimed to support explorative and hybrid learning processes, and participated in three workshops, facilitated by a spatial designer and Bøjer.

Fig. 1 One of the furniture prototypes. Source: Bøjer (2019b)

The project took place at the school during regular school hours and involved both teachers and students in their classroom and adjacent breakout space. The sliding glass wall dividing the class and adjacent space was kept open to create an activity-based learning space better suited for a pedagogy incorporating hybrid principles. We altered the physical layout of the spaces during the workshops in order to blur the lines between the traditional roles of teachers and students. With room for the students to be more active and less need for the teachers to control movements, we asked the participants to choose their working spots according to individual preferences. These physical alterations, together with the prototypes, were meant to foster actual in situ experiences for the teachers, that would support their development of environmental awareness and competence.

The process was designed as a hybrid learning space, where design, space and pedagogy as well as process and product were interwoven. The hybrid approach encouraged entangled and interprofessional collaboration between teachers, students and designers. During the process, they worked together to explore new pedagogical practices and the relations between space and practice, moving between roles (designer/user/learner/teacher) and media (tactile materials/spatial elements/digital platforms). The overall aim was to explore how to support the development of teachers' environmental competences.

Often teachers' professional development take place disconnected from the everyday practice on a location off the school premises in a course, conference or workshop without students, or during student free days within the school grounds. This makes it harder for the teachers to utilise the knowledge acquired because of its contextual-specificity. Things that seem easy when tried without students or physical/material boundaries can be too complex to incorporate in everyday situations without additional training. Thus, it is pertinent that the teachers become learners in their own habitat in real time, while being bound to their professional teacher role and identity. One could claim that during the process the teachers are themselves in a hybrid state of learner and teacher.

Co-designing often needs staging in order for the participants to be able to express themselves creatively and move beyond the obvious and well-known. In order to promote critical and creative reflection on space and practice, we applied a hybrid collaboration pattern, Re-mediation, as proposed by Köppe et al. (2018a, b):

> Re-mediate the task and ask the learners to do something somewhat familiar, but in a different way or through a displaced or refocused lens, in order to promote more reflection on what they're doing and critical inter/action through playful confrontation with unexpected opportunities and challenges' (p. VII).

Re-mediation was attempted by providing the teachers and students with a variety of materials and individual and collaborative co-design assignments that required them to re-think their usual way of teaching and learning in relation to the physical surroundings. The intention was to examine whether co-design would provide the teachers with insights into the social, relational and physical elements of the space-practice relationship, i.e. the needs and experiences of the students in relation to the interplay between learning activities and the physical learning

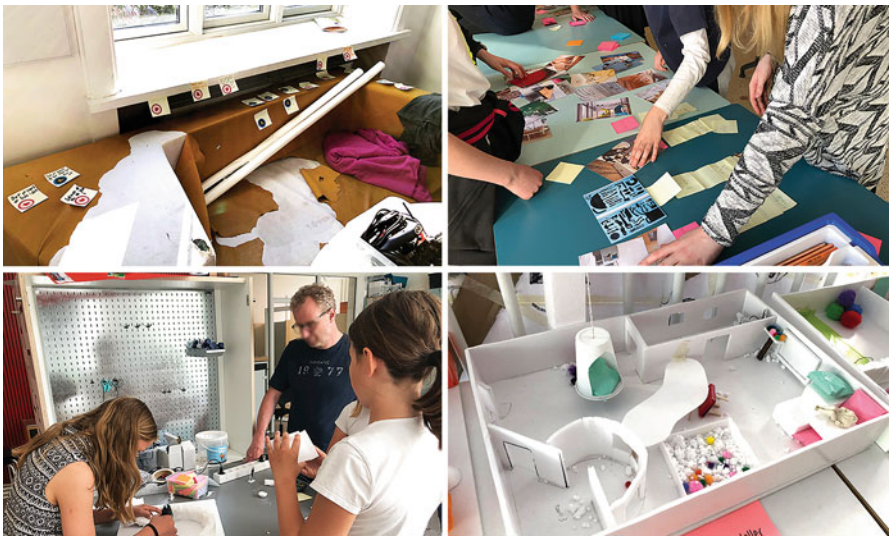

Fig. 2 Dotting spaces, categorizing learning activities and building models of furniture and spaces. Source: Bøjer (2019b)

environment, thereby contributing to the development of environmental awareness and competence.

This was achieved using a so-called 'toolkit' (Brandt et al., 2012). Sanders (2000) explains that toolkits help the participants express their thoughts, feelings and ideas in e.g. collages, maps and stories, because 'the stuff that dreams are made of is often difficult to express in words but may be imaginable as pictures in your head' (p. 4). The assignments in the workshops combined materials, activities, spatial elements and pedagogical practices in collaborative design processes focusing on the entanglement between teaching and learning practices and the qualities of the physical surroundings.

They included dotting of spatial objects and areas, categorising learning activities and building small models of imaginative learning spaces and furniture (Fig. 2). They were planned to consist of in situ exemplar activities, using the furniture prototypes in the model making, activating the physical environment as part of the discussions and sharing experiences via online platforms. The teachers participated in the workshops, sometimes solely as learners doing the assignments and at other times also as teachers, helping the students.

Through re-mediation the boundaries between pedagogy and space, teacher and learner and user and designer dissolved. The teachers became learners as well as designers in the process, actively re-designing spaces and practices by which it became visible how space and pedagogy are inseparably intertwined. In between the workshops, the teachers explored new pedagogical strategies to include the prototypes in their teachings and in the process, they transferred re-mediation to their own teachings, i.e. asking the students to create literature reviews as a 3D

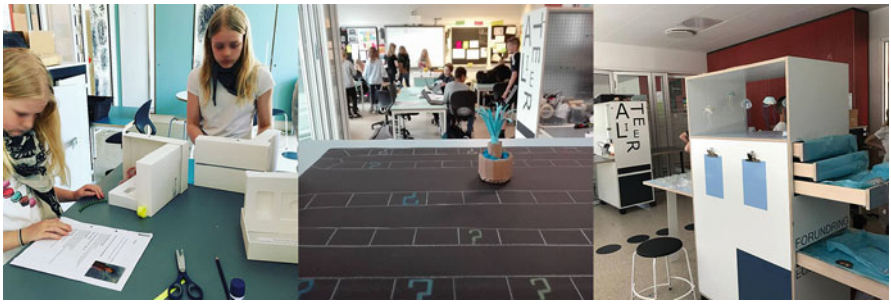

Fig. 3 Hybrid principles were applied in between the workshops when exploring new types of assignments such as 3D-literature reviews in boxes, mathematical board games and an exhibition about goblets. Photos uploaded to the project's Instagram account 'unlockinglearningspaces' by the teachers, 2018

installation in a cardboard box instead of a text. The focus on breaking down the barriers of the traditional spaces and introducing the possibility of creating tangible formats resulted in various new ways of working with routine school assignments, which also included the development of mathematical board games, a sensuous exhibition about goblets and an interdisciplinary project about good cities in collaboration with two other classes and their teachers (Fig. 3).

Findings

The intention of the entire process was to examine whether the hybrid collaboration between teachers, students and designers brought forward by the co-design activities, materials and the prototypes would contribute to the development of the teachers' environmental awareness and competence and hence, support a pedagogical move towards hybrid learning spaces.

Through observations during the workshops and information from the semi-structured interviews, co-design was experienced to provide means to actively engage teachers and students in an experimental process in collaboration with the designers, where they explored the interplay between space and practice in relation to their everyday practice. They gained practice-based experiences of the spatial possibilities while also reflecting on the space-practice relationship, hence linking environmental awareness and competence. The methods and activities inspired by co-design and the prototypes were found to initiate and facilitate discussions about abstract pedagogical philosophical issues concerning learning and teaching (i.e. how do individual students learn best or how can we (teachers) implement creative practices in our literary assignments to the students?) through very concrete artefacts, activities and subjects (i.e. the experience and spatial layout of a learning space). The co-design process created a hybrid learning space where the roles of the

designers, teachers and students were entangled as they collaboratively researched the interplay between space and practice. The co-design approach brought forward information on the students' spatial needs and preferences in relation to different learning situations and made the teachers explore, discuss and reflect on their practice and use of the spatial settings. The prototypes prompted the teachers to rethink their teaching practices and apply a more hybrid pedagogical approach. In addition, the process provided insights into the actual practices of the users, which the designers can use when designing new educational spaces. Thus, the designers became learners as well.

Our findings show that participatory design methods have the potential to facilitate teacher training processes in environmental awareness and competence and thus, contribute to the development of hybrid learning spaces. Follow-ups on the empirical studies indicate that the process of teacher training in environmental awareness and competence should be ongoing or at least, take place for more than 3 months and three workshops. In the semi-structured interviews performed after the process, both teachers explained that they felt more aware and competent of the spatial possibilities. However, approx. 18 months later only one of the two teachers was using the space more actively since the process (explained in an email correspondence with Bøjer). This corresponds with the findings by Lackney (2008), showing that teachers participating in workshops had gained enhanced awareness but still lacked competence.

Discussion and Conclusion

In this chapter, we have explored how co-design can be used as a hybrid pedagogical activity to contribute to the interprofessional collaboration between designers, teachers and students and hence support the development of teacher environmental awareness and competence. In turn, this has the potential to further the inclusion and development of hybrid learning spaces in primary education.

The physical setting of learning spaces tends to remain quite stable over the course of a year, even when teachers have the possibility to make changes (Brøns, 2016; Martin, 2009). Martin (2002) points out how teachers, who question the physical settings, are also the ones less satisfied with their own classroom environments, which seems to be a first step towards change and empowerment of the teacher in activating the spaces. However, a flexible physical setting does not produce a flexible or open-ended organisation or practice (Brøns, 2021). Innovative spaces with flexible furniture and digital media do not automatically lead to innovative and hybrid teaching practices. As Rivlin and Wolfe explain, 'it is rare for a person to move a chair once it has been placed—even in one's own living room' (Woolner et al., 2007, p. 62). This requires a change in mindset towards enhanced awareness of the spatial qualities and imperfections.

Teachers need organisational support and professional training in environmental awareness and competence if they are to be able to use the physical spaces to

integrate hybridization into their pedagogical toolbox. Unfortunately, it is rare for schools to prioritise ongoing professional development of the teachers' spatial mindsets amidst all the other daily responsibilities (Brøns, 2021). If the organisation does not support the innovative and risk-taking behaviour that accompanies modern education, it will hinder teachers' willingness to experiment (Ellis & Goodyear, 2016). Uncertainty or lack of confidence within the teaching staff will hinder professional development and teachers will seek refuge in familiar physical settings and pedagogy. This retreat into old practices can be seen as a result of lack of training in how to utilise the (new) possibilities of the space as part of their pedagogy, thus returning to the safety of default practices (Lackney, 2008).

The empirical case displayed the contribution of co-design to the ongoing development of hybrid learning spaces by adding hybridity to collaborative activities and engaging teachers, students and designers in collaborative and experiential exploration of the space-practice relationship. Through this, environmental awareness and competence developed, which in turn empowered the teachers to understand the physical space as an integrated part of their pedagogical toolbox. Potentially, this will prompt teachers towards a more hybrid pedagogy, where the dichotomy between space and practice is dissolved as both become inseparable parts of the same pedagogy. By becoming environmentally aware and competent, the teachers are empowered to use and alter the physical spaces to support a variety of online and onsite teaching and learning activities.

The co-design process took place in situ in a real-life educational context and through this, alignment of the learning environment was created. Through dialogue, experimentation and open-ended collaboration involving the physical environment as a pedagogical tool, the users and designers dissolved the dichotomy between designer/user, learner/teacher, process/product and space/pedagogy. Instead, they co-existed and, influenced by each other, teachers, students and designers co-designed a shared educational world.

The challenge concerning interprofessional collaboration with external partners such as designers in change processes is that most often this takes place as a short-term praxis. External partners will leave the collaboration at some point, which, if it happens too early, endangers the integration of the new practices.

The co-design activities and materials were found to work as a mediating method for communication and collaboration between teachers, students and designers, bridging the gap between theory and practice. Potentially, the approach could also be used with a larger group of teachers using the same learning space and during the design process of a hybrid learning space as it creates an arena for discussion and provides activities and tools to explore new ways of combining space and practice (Bøjer, 2019b). However, co-design processes are time-consuming, context-specific and have to be planned for each specific situation, which might be seen as a challenge and hindrance in the everyday educational context.

This study was limited to one project involving designers and users. Further studies are needed to substantiate the potential of co-design as a means to support teachers' professional development of environmental awareness and competence and its significance for the further application of hybrid learning spaces in primary education.

References

Bøjer, B. (2018). Creating a space for creative learning: The importance of engaging management and teachers in the design process. In *Transitions 2017: Europe 79*.

Bøjer, B. (2019a). Can participatory design support the transition into innovative learning environments? *Artifact: Journal of Design Practice, 6*(1–2), 7–1.

Bøjer, B. (2019b). *Unlocking learning spaces: An examination of the interplay between the design of learning spaces and pedagogical practices*. PhD thesis. Royal Danish Academy – Architecture, Design, Conservation. https://doi.org/10.13140/RG.2.2.30247.70562/1

Bøjer, B. (2021). Creating a space for innovative learning: The importance of engaging the users in the design process. In W. Imms & T. Kvan (Eds.), *Teacher transition into innovative learning environments*. Springer. https://doi.org/10.1007/978-981-15-7497-9_4

Boys, J. (2011). *Towards creative learning spaces: Re-thinking the architecture of post-compulsory education*. Routledge.

Brandt, E., Binder, T., & Sanders, E. B.-N. (2012). Ways to engage telling, making and enacting. In *Routledge international handbook of participatory design* (pp. 145–181). Routledge.

Brøns, M. G. (2016). *Teacher collaboration and physical space – How teachers divide and share an open learning space through their practices*. Master thesis, Aarhus University.

Brøns, M. G. (2019). *Professional collaboration in teaching teams – Sharing students, space and time*. In W. Imms & M. Mahat (Eds.), What are teachers doing (well) when transitioning from traditional classrooms to innovative learning environments? (pp. 115–120). Proceedings of International symposia for graduate and early career researchers in Australasia, Europe and North America.

Brøns, M. G. (2021). The mobility of people, not furniture, leads to collaboration. In W. Imms & T. Kvan (Eds.), *Teacher transition into innovative learning environments*. Springer. https://doi.org/10.1007/978-981-15-7497-9_11

Crampton, J., & Elden, S. (2007). Introduction. In *Space, knowledge and power: Foucault and geography*. Ashton Publishing.

Ellis, R. A., & Goodyear, P. (2016). Models of learning space: integrating research on space, place and learning in higher education. *Review of Education, 4*(2), 149–191. https://doi.org/10.1002/rev3.3056

Frayling, C. (1993). *Research in art and design*. Royal College of Art research papers, 1.

Goodyear, P., Ellis, R. A., & Marmot, A. (2018). Learning spaces research: Framing actionable knowledge. In P. Goodyear & R. A. Ellis (Eds.), *Spaces of teaching and learning* (pp. 221–238). Springer.

Guerriero, S. (Ed.). (2017). *Pedagogical knowledge and the changing nature of the teaching profession* (Educational research and innovation). OECD Publishing. https://doi.org/10.1787/9789264270695-en.

Hilli, C., Nørgård, R. T., & Aaen, J. H. (2019). Designing hybrid learning spaces in higher education. *Dansk Universitetspædagogisk Tidsskrift, 15*(27), 66–82.

Holm, G. (2014). Photography as a research method. In *The Oxford handbook of qualitative research* (pp. 380–402).

Imms, W., & Byers, T. (2017). Impact of classroom design on teacher pedagogy and student engagement and performance in mathematics. *Learning Environments Research, 20*(1), 139–152. https://doi.org/10.1007/s10984-016-9210-0

Imms, W., Clarke, D., Cleveland, B., Fisher, K., Grocott, L., Hattie, J., & Newton, C. (2017). *Innovative learning environment and teacher change project: Phase one report*. Victoria.

Kohls, C. (2019). Hybrid learning spaces for design thinking. *Open Education Studies, 1*(1), 228–244. https://doi.org/10.1515/edu-2019-0017

Köppe, C., Kohls, C, Pedersen, A. Y., Nørgård, R. T. & Inventado, P. S. (2018a). *Hybrid collaboration patterns*. In 25th Conference on pattern languages of programs (PLoP) (pp. 1–14). ACM International conference proceeding series.

Köppe, C., & Nørgård, R. T. & Pedersen, A. Y. (2018b). *Towards a pattern language for hybrid education*. In Proceedings of the VikingPLoP 2017 conference (pp. 1–18). https://doi.org/10.1145/3158491.3158504.

Lackney, J. A. (2008). Teacher environmental competence in elementary school environments. *Children Youth and Environments, 18*(2), 133–159.

Martin, S. H. (2002). The classroom environment and its effects on the practice of teachers. *Journal of Environmental Psychology, 22*(1–2), 139–156.

Martin, S. H. (2009, August). Environment-behaviour studies in the classroom. *Journal of Design & Technology Education*, *9*(2). ISSN 1360-1431.

Mulcahy, D., Cleveland, B., & Aberton, H. (2015). Learning spaces and pedagogic change: Envisioned, enacted and experienced. *Pedagogy, Culture & Society, 23*(4), 575–595. https://doi.org/10.1080/14681366.2015.1055128

OECD. (2020). *Schooling disrupted, schooling rethought: How the Covid-19 pandemic is changing education*. OECD policy responses to coronavirus (COVID-19). OECD Publishing. https://doi.org/10.1787/68b11faf-en.

Qvortrup, A., Qvortrup, L., Wistoft, K., & Christensen, J. (2020). *Nødundervisning under corona-krisen – et elev- og forældreperspektiv*. https://ncs.au.dk/fileadmin/NCS/Projekter/Noedundervisning_under_corona-krisen/Corona-rapport_-_generel_rapport_NCS_version.pdf. Accessed 2021-01-02.

Rutkowski, D., Rutkowski, L., Bélanger, J., Knoll, S., Weatherby, K., & Prusinski, E. (2013). *Teaching and learning international survey TALIS 2013: Conceptual framework*. Final. OECD Publishing.

Sanders, E. B. N. (2000). Generative tools for co-designing. In S. A. R. Scrivener, L. J. Ball, & A. Woodcock (Eds.), *Collaborative design* (pp. 3–12). Springer.

Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *Co-Design, 4*(1), 5–18. https://doi.org/10.1080/15710880701875068

Sanders, E. B. N., & Stappers, P. J. (2012). *Convivial toolbox*.

Sanders, E. B. N., & Stappers, P. J. (2014). Probes, toolkits and prototypes: Three approaches to making in codesigning. *CoDesign, 10*(1), 5–14.

Schön, D. (1983). *The reflective practitioner*. Basic Books.

Storni, C. (2015). Notes on ANT for designers: Ontological, methodological and epistemological turn in collaborative design. *Co-Design, 11*(3–4), 166–178. https://doi.org/10.1080/15710882.2015.1081242

Szulevicz, T. (2015). Deltagerobservation. In L. Tanggaard & S. Brinkmann (Eds.), *Kvalitative Metoder* (2. udg., pp. 81–96). Hans Reitzels Forlag.

Tanggaard, L., & Brinkmann, S. (2015). Interviewet: Samtalen som forskningsmetode. In L. Tanggaard & S. Brinkmann (Eds.), *Kvalitative Metoder* (2. udg). Hans Reitzels Forlag.

Woolner, P. (2010). *The design of learning spaces: A&C black*.

Woolner, P., Hall, E., Higgins, S. E., McCaughey, C., & Wall, K. (2007). A sound foundation? What we know about the impact of environments on learning and the implications for building schools for the future. *Oxford Review of Education, 33*(1), 47–70. https://doi.org/10.1080/03054980601094693

Zitter, I., & Hoeve, A. (2012). *Hybrid learning environments: Merging learning and work processes to facilitate knowledge integration and transitions*. OECD education working papers, no. 81. OECD Publishing. https://doi.org/10.1787/5k97785xwdvf-en.