On the Definition of Learning

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Exploring ways of investigating learning from a spatial perspective

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Introduction - what do we know so far on the interplay between space and learning?

Churchill once said: "We shape the buildings, and then the buildings shape us", indicating the interplay between space and its occupants. In an educational setting this means that both students and teachers are influenced by the physical contexts in which learning occurs. Nevertheless, so far there hasn't been an overwhelming focus on the furnishing of classrooms (and built environment as a whole) in universities as being of importance to the student learning experience (Temple 2008). In this chapter preliminary findings from a small-scale research project are presented aiming at exploring ways of investigating learning from a spatial perspective. The research project focuses on teachers' perceptions of the impact of space on their personal experiences of learning – that is, how teachers shape the room and how the room then shapes their teaching.

All though the spatial conditions for learning in university settings is an under-researched topic there has been a lot of interest into designing learning spaces at primary and secondary school level. Research demonstrates that quality in school buildings can have a positive impact on achievement and, in particular, on teacher and pupil behaviour (Clark 2002). Most of this research, however, is less likely to establish direct causal between spatial features and educational outcomes than to show how physical conditions indirectly affect pupil outcomes. In a higher education setting the little focus on learning spaces there so far has been, concentrates on designing spaces for a new generation of students and according to "new" views on learning (Bennett 2006; Grummon 2009; Jamieson 2003; Villano 2010). It is argued that the traditional lecture theatre manifests particular power relations between teacher and students and that interactive or group-

based learning cannot occur in lecture halls (Jamieson 2003). New learning spaces, on the contrary, should be designed as adaptable, flexible, multi-dimensional, accesible and secure in order to meet the needs of students learning in a collaborative, active and problem-based way (Jamieson, Dane, & Lippman 2005).

Recently, the focus of literature on learning spaces in higher education is not just on designing them, but also on evaluating them. Reviews on evaluations (Pearshouse et al. 2009; Temple & Barnett 2007) reveal that even though evaluations focus on student experiences as a means to understand the effectiveness of a particular learning space, they lack any theoretical background from research on the interplay between space and learning. Hence, many evaluations can still be described as conventional post-occupancy evaluations, such as surveys on students' experience of comfortable chairs, appropriate brightness and temperature in the room or visibility between desk and blackboard (Bligh & Pearshouse 2011).

This chapter strives at creating ways of investigating the impact of space on learning by exploring how teachers perceive the kind of learning possible in a particular space. The interplay between space and learning has in this way the teacher as the intermediate given that the teacher – in the learning space of this project at least - is the planner and facilitator of learning activities.

Methods – how can space be analysed?

The relation between space and the activity taking place in the space is often regarded as binary; either the space "works" for the social activity planned to take place or it doesn't work. However, the relation is much more complex and it is naïve to imagine that any specific architectural design should work at all times, for everybody or for every reason. One way of analysing the complex relationship between space and its occupation is proposed by Lefebvre (1991) in his famous "spatial triad". The first aspect of the triad is the *spatial practices*; the routines and unconsidered actions that both are formed by and constitute the space – what you do and are able to do in for example a public swimming pool's changing room. The second aspect is *representations of space*; the conceptualisations of space done by architects, city planners or engineers through maps, plans, models or designs. Lefebvre's third

aspect is *representational space*; the way people intervene with and try to adapt space to their own purposes using the symbols and images of the space. Lefebvre also calls this triad the *lived*, the *conceived* and the *perceived* space and he argues that the production of space is a "trialectical" negotiation between these three aspects – space is not only decided on by architects or city planners, but space is also produced by the way people use it and by the meaning they inscribe on to it.

The meaning-making of space requires some form of visual literacy. The signs, symbols, images, affordances (Gibson 1977) of a given space all communicate meaning to the user. To focus on the grammar of visual design is hence also important in order to understand how space influences its occupants. Kress and van Leeuwen have worked with visual grammar as a means to understand how meaning is communicated through spatial configurations (Kress & Leeuwen 1996). In this context the concept of visual grammar is interesting, not only as the tool of designers of learning spaces, but also as a way for the users of a learning space to describe their perception of the space – their *representational space*. When describing an object, physical or semiotic, Kress and van Leeuwen label this act as sign-making, and they see "representation as a process in which the makers of signs [...] seek to make a representation of some object or entity [...] and in which their interest in the object, at the point of making the representation, is a complex one arising out of the cultural, social and psychological history of the sign-maker and focused by the specific context in which the sign is produced."(Kress & Leeuwen 1996, p. 6)

Building on both Lefebvre and Kress I suggest a three-fold methodological framework for investigating the relation between space and teachers' view of learning:

- Lived space – observational studies of how teaching proceeds focusing on how teachers and students use the learning space in a teaching situation
- Conceived space – teachers' sketching their perception of the learning space and analyses of these sketches as to which elements are drawn and in which order
- Perceived space – interviews with teachers describing actions and activities that can and will take place in the learning space

Four teachers were interviewed in semi-structured sessions of approximately 45 minutes. The interview guide consisted of four themes:

• How does the space look like – make a sketch
• How do you usually teach in this space?
• How are you going to teach in this space next time?
• Could you teach in the same way in another space?

Furthermore, two of the teachers' teaching sessions in the space were observed. Due to time constraints, it was impossible to observe the teaching sessions of the remaining two teachers.

Results – what's space to learning?

All four teachers (Kathryn, Alan, Daniel and Andrew – anonymised names) taught in the same space (fig. 1).

In the centre of the space a table is placed with a main computer that is connected with several screens on the walls. Along the walls eight oval tables with computers are placed. Four to eight chairs are placed around each table. In the back of the room, there is an open space with no tables or chairs. Here, some of the teachers put up catapults and other experimental designs to use in their teaching. Other teachers leave the space empty. On the carpet there is three squares made of masking tape. The room has windows on two sides and the remaining walls are painted in a green colour. The chairs are also green.

All the teachers identify the group tables, the electronic equipment and the open space as distinct features of the learning space. In the following, data from the interviews and observational studies are presented and analysed according to these three features with significant implications for the teaching and learning processes in the space. Quotations from the teachers are in italic.

Fig. 1. The learning space where all four teachers taught.

Group tables

The tables placed around the room are for students. One teacher, Kathryn, describes these tables as places where "*students work*" (not sit), and another teacher, Andrew, highlights the group tables as working stations where he *"just gets everyone working and kind of walk around just helping people on the spot"* instead of a "*lecture-type teaching*". These two teachers use the group tables as vehicles for student-centred learning processes. Kathryn is a firm believer of problem-based learning and project-based teaching and her entire course is designed with that in mind. The students work in groups on a project formulated by them but within a framework introduced by the teacher. During the course Kathryn asks the students to participate in exercises and games to help them onwards in their projects or to give them subject input. She uses brown paper and wooden bricks to make the students visualize their thoughts and knowledge and is very conscious about creating an atmosphere of safety and trust among the students in order for the group work aspect of her teaching to succeed. The tables make group work possible and ensure and prompt students and teacher to use movement as part of the teaching and learning. At the time of the observation the students are working in groups on their project (fig. 2)

Fig. 2. Students discussing their project in Kathryn's class.

and Kathryn and a teaching assistant are present to answer questions from the groups. It is a very informal teaching session running for three hours where the students work at own pace and with different media; some type on a computer, some draw concept maps on brown paper and some students just talk. If the groups have any questions the teacher and the teaching assistant discuss with them, sometimes for 30 minutes and sometimes just for two minutes. The students and teachers seem comfortable and trusting in each other's company in the physical setting. In Andrew's class the students partly work on questions set out for them beforehand and partly do small computer-based experiments together. If he thinks that a question is very important he'll *"stop and hop on the screens, perhaps grab a mike and tell everyone."* He prefers, however, to have the students work on the questions in a *"self-directed"* way. At the time of the observation the students sit in groups around a computer and a screen (fig. 3). There is a very informal atmosphere and students are talking and laughing and moving in and out of the room during the session. Andrew and the teaching assistant also move

Fig. 3. Students discussing an assignment in Andrew's class.

around the groups both to answer questions and to ask if there are any questions.

The two other teachers also point to the group tables as distinct features of the room. Alan points to the informal settings as being connected with his teacher role as not the expert providing students with the answers but the facilitator in the process of teaching the students how to learn and think for themselves. He sees the group tables as important for his philosophy of "*sharing not teaching*". However, the electronic equipment in the space makes Alan uncomfortable and prohibits his use of the group tables to enhance independent learning processes because this, in his view, requires him to use the computer at the lecturer desk. Daniel also recognizes the group tables as the main reason for the space being flexible, enabling teachers and students to walk around and probably being designed for students to work in groups, but he hasn't been introduced to teaching methods relevant to the space. Daniel would like *"to really adapt to the room"* but doesn't know how.

In all, the shape of the group tables, the moveable chairs around them and the in-built computers all signal student-centred, interactive and collaborative learning. The room is pointing to no particular spot for the teacher to be located and is signalling to the students that they are not there just to listen. The spaces for students being at the same level as the desk of the teacher point to a more equal distribution of the "right answers" and learning activity as opposed to the traditional lecture hall with its one-dimensional view on the active performer and the passive audience. All though the group tables is recognized by all teachers to correspond to interactive and collaborative learning processes, not all teachers respond in the same way to these spatial settings. In the cases of Alan and Daniel, the potential impact of the group tables on interactive learning processes are acknowledged, but the teachers feel intimidated by the electronic equipment in Alan's case and the perceived necessary new teaching methods in Daniel's case – an intimidation that also affects the learning processes.

The electronic equipment

The main computer at the desk in the center of the room is connected to several screens along the walls. This is for every student at the group tables to see what the teacher chooses to show on the main computer. At every group table there are also several computers with screens for the students to work on, individually or in groups. Teachers mention that the students can *"see things you put up, and they can also do things themselves on the screens in front of them."* The desk in the centre – the teacher's desk – contains various electronic equipment; different kinds of computers, document cams, audio techniques and microphones. Andrew uses these tools without hesitation as they help him creating an atmosphere of sharing and having fun. The students work on small exercises and the results from the exercises are projected on the screens for everybody to see. The exercises are "*meant to be fun, not particularly difficult. This is straight out of high school, so there is a big knowledge gap. Some students are very strong in math and physics and others are very weak.*" The electronic equipment in the room makes it possible for Andrew and his students to coordinate and cooperate in their learning processes. Quite the opposite is true for Alan. He uses an OH projector with a camera that captures what he's writing and projects his problem

solving on to the screens on the wall. At too many occasions he has experienced that the electronic devices in the room didn't work and with too few whiteboards located where all students could see them, he has come up with the OH-solutions as a safe, dependable way of communicating. Alan is not comfortable in this room because of its electronic dependency and has actually asked to teach next semester's tutorials in another room with only whiteboards. Alan describes himself as "*not that reliant on electronics*" and prefers to teach in a room with no screens even though the room is considerably smaller – he will just have "*to stuff the students in*". The most important aspect of teaching to Alan is the ability to "*bond with the students*" so that they are encouraged to ask and answer questions. It seems that the electronic equipment of the given space somehow comes in the way for Alan to create that bond.

Again, the spatial conditions are not deterministic as to which learning processes take place. Andrew feels comfortable using all kinds of electronic aids to enhance the collaboration between the learners, Alan would rather teach in a smaller and darker room in order to get rid of the intimidating electronic equipment and be able to pursue interactive and bonding learning processes.

The open space

The open space in the back of the room is recognized by all four teachers as a significant part of the learning space but only used by two of the teachers. Kathryn uses the floor to do exercises where students must position themselves according to their beliefs and feelings towards e.g. sustainability. She includes games in her teaching to "*make it fun and surprising*". The same "fun factor" is also important to Andrew. The workshop Andrew teaches consists of two parts; a computer exercise part and a "*lab component*". In the second part of the workshop he and his teaching assistant will set up a little catapult and a target plate in one end of the room. The students have in groups been asked to model the process of a ball hitting the target plate using the catapult, and Andrew will set up the catapult according to the students' settings. The students "*get marked if they hit the target or not.*" The workshop is divided into two because "*it's kind of a long roll – if you keep asking questions they'll get bored.*" The lab component is simply more fun. And fun is important "*to keep them motivated.*" At the time of the observation the students

either stand around the catapult watching the process or sitting by their computers to prepare or refine their model used in the catapult exercise. Students who have come up with answers to the model exercise quickly, start by the catapult while other students still work on the modelling at their computer. In this way, the space and the exercise that make students stand up and move to other parts of the space lend itself to an informal and unofficial assessment; by noticing which group of students changing position in the room you can de-code which students understand/learned the theoretical concepts connected to the exercise and which students don't (yet). Andrew needs the floor space – not just for the catapult experiment but also for other experiments during the semester that require floor space (Lego robots following masking tape tracks). The two remaining teachers acknowledge the open space but do not use it. Daniel is aware of the space he is teaching in but mostly as an awareness of the possibilities that the space provides that he as a teacher doesn't take advantage of; *"We're not using the room's full potential; we're doing a standard tutorial workshop and this room is not designed for that."* What it is the space is designed for, he´s not sure, he just "*knows that something's missing.*"

Both Andrew and Kathryn use the open space to create variation in their teaching methods and hence also in the learning processes involved. Exercises and hands-on experiments in the open space require movement and the students to be physical active and thereby boost motivation and concentration. The open space being such a prominent element of the learning space without being able to take advantage of it frustrates both Daniel and Alan. The very flexible learning space points to new and different ways of learning, but Daniel and Alan has lost their sense of ownership of the space. This lead them to plan and conduct teaching in this *new* learning spaces on the grounds of learning views more relevant for teaching in *traditional* spaces. Or like Daniel puts it: "*We teach with old paradigms in new learning spaces*". In this way space in itself becomes a hindrance for learning.

Discussion – views on space as views on learning?

In the above, the spatial practices of learning are described through exploring how teachers act in and perceive the impact of space on learning. The third part of the methodological framework was to explore

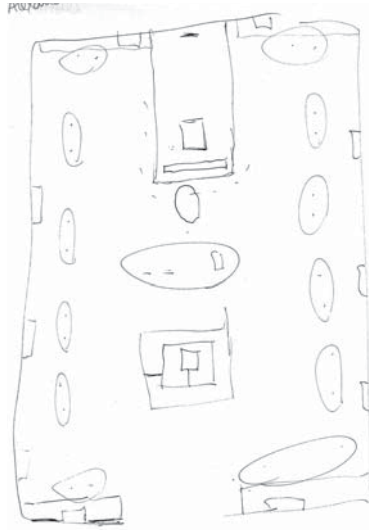Fig. 4. Daniel's sketch of the learning space. Numbers indicate the order in which elements are drawn.

Fig. 5. Andrew's sketch of the learning space. Numbers indicate the order in which elements are drawn.

the conceived space, that is to have teachers sketch their perception of the learning space as the method enables other expressions of meaning than talking or writing about learning spaces (Mavers, 2011). It is interesting to note that the four teachers sketch the same space in different ways and the components of the space in different orders. Andrew draws masking tape on the floor in his sketch of the space (fig. 5), but Daniel doesn't (fig. 4). The conceived space is thereby a visualisation of the components in the space that is important in the planning of learning processes – Daniel doesn't use the masking tape, so he doesn't draw it. Likewise, the teachers differ by the order in which they draw components of the space. Alan starts by drawing the windows and the teacher's desk (fig. 7), but Kathryn starts by drawing where the students are placed (fig. 6) which could be indications of teacher-focused and student-centred approaches to learning, respectively. In this way the sketches of learning spaces triangulates the data from the interviews and observations.

Bringing information together from how teachers use learning spaces, how they sketch the learning space and how they describe their intentional use of a learning space in a Lefebvrian sense the production

Fig. 6. Kathryn's sketch of the learning space. Numbers indicate the order in which elements are drawn.

Fig. 7. Alan's sketch of the learning space. Numbers indicate the order in which elements are drawn.

of a mental learning space comes to life which mimics the production of the physical learning space. By exploring the spatial practices of learning in this threefold way we might add to our knowledge of the kinds of learning taking place – at least from a teacher's perspective. A next step would be to apply the method on students; ask students to sketch and describe their learning space together with observations on the actual use of the learning space.

Taking the results on the interplay between space and learning further on to the didactical implications, the results show teachers including considerations on space in their planning and conducting of teaching as they consider (and try out) possible and impossible teaching methods in the given space. The four teachers interpret, however, the possibilities and limitations of the same space in very different ways. Some focus on the distribution between floor space and tables in the learning space while others focus on the space's technical devices as opposed to its whiteboards. Some teachers focus on how colours, light and non-hierarchical furnishing in the space create an informal and safe atmosphere, while electronic equipment in the space creates a scary and unsafe atmosphere for other teachers. Seen through the lens

of the didactical relation model (Hiim & Hippe 2007), space is a framing factor in understanding what happens in a teaching situation and why. Framing factors are given conditions that either limit teaching or make teaching possible and can be rules and regulations, time of day, number of students – or the physical space in which teaching takes place. As with all framing factors, space as a didactical category is related to the prerequisites of the students, the learning objectives, the content, the learning process and the evaluation. In this project it is clear that teachers' perceptions of space are related to their former experiences and views of learning. Alan has had experiences of electronic equipment breaking down and hence prefers a space without technical solutions even if it means less room for the students and for him as a teacher to act out his teaching philosophy of creating relationships with the students as a prerequisite for learning. Kathryn describes the space with its group tables and no obvious place for the teacher to stand as underpinning her teaching philosophy of learning as a social practice. Hence, the physical space either inhibits or enhances the didactical space of action for the teachers to plan and conduct activities that produces student learning.

The findings also point to recommendations of creating ownership for teachers and students of a learning space and its resources in order to enhance teaching that uses the full potential of a given learning space. The need for ownership is seen as crucial for teachers to accept and embrace (new) learning spaces (Melhuish 2010; Pearshouse et al. 2009) and recommendations are to include teachers in the design process of new learning spaces (Grummon 2009; Lippincott 2009). One might argue that the lack of ownership leads to an annulment of the interplay between space and learning. In this project, the learning space in question is not a *new* learning space, where teachers have had (or haven't had) the opportunity to get involved in the design process. Even so, the cases of Daniel and Alan show that ownership perhaps also can be established by providing teachers with instructions on how to use the space through courses, hands-on workshops, videos or pamphlets.

Conclusion

This small-scale project has strived at exploring ways of investigating learning from a spatial perspective. By using a threefold method

consisting of investigations of how teachers act in, conceive and perceive the impact of space on learning our understanding of the spatial practices of learning can be enriched. The method, however, does not only have the potential to enrich our/researchers' understanding of the impact of space on learning. Sketching and describing your learning space could also support the individual teacher in his/her reflection on views on and use of space and thereby expand teachers' didactical space for action. The results from the project indicate that teachers include space as a didactical category in their planning and conducting of learning activities, but that it is important for the teachers to feel some kind of ownership of the learning space in order not to teach despite of space. In a time where many learning spaces at university are rebuilt, renovated and redesigned this is an important point. Moving from traditional spaces, like the lecture theatre, recognisable to most teachers to more flexible learning spaces, like the space in this project, which point to new and different ways of learning, many teachers might become uncertain and lose their sense of ownership of the space. This might lead to teachers planning and conducting teaching in new learning spaces on the grounds of learning views more relevant for teaching in traditional spaces. In this way space in itself becomes a hindrance for good teaching and learning.

This chapter aimed at investigating the relationship between space and its occupants. Even though not traditionally acknowledged in higher education, space do play a role in teaching and learning, and the interplay between space and learning becomes clearer as learning spaces in higher education change. To rephrase Churchill, if we re-shape the buildings, then how do we shape up?

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