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Connecting Physical and Virtual Spaces in a HyFlex Pedagogic Model with a Focus on Teacher Interaction

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This article highlights interaction within physical and virtual spaces in a higher education HyFlex learning environment with live streamed lectures and seminars. What kinds of learning spaces do we shape when we connect physical and virtual spaces? How does a group of teachers interact in these spaces and how do the HyFlex spaces affect the interaction? The perspective of 'designs for learning' theoretically frames the study. The result shows that several different spaces are shaped: physical space, representational space, interactional space, and liminal space. The results also imply that a HyFlex model requires an increased didactic awareness of designing for learning.

Introduction

This article highlights the interaction within physical and virtual spaces in a higher education HyFlex learning environment. HyFlex (hybrid and flexible) course design is a blended form of teaching that combines physical spaces, virtual spaces, and face-to-face interaction with online learning (see Bower et al. 2015). In this study, the lectures/seminars were streamed live, with one lecturer and another teacher in the room acting as the streaming facilitator. Space in higher education is essential when it comes to the framing of and the conditions for learning, but space is also a significant part of the interaction and communication during the learning process (Leijon 2016). What happens when we move towards more blended learning spaces? Blended learning spaces tend to be the new normal in higher education (Owston 2013), but how can we understand these learning spaces? What kinds of learning spaces do we shape when we connect physical and virtual spaces? How does a group of teachers interact in these spaces, and how do the HyFlex spaces affect the interaction?

Background and aim

Research on blended/HyFlex learning environments in higher education examines several aspects, such as course design and student choices. McGee and Reis (2012) discuss how design and support, course alignment, moderation of interactivity, expectations, and technology are all crucial aspects of blended learning environment conception. Abdelmalak (2014) identifies encouraging student control, differentiating instruction, and increasing access to course content as important themes to consider in HyFlex design. Other studies explore student choices (see Lakhal et al. 2014). This form of learning gives access to students who would otherwise not be able to attend classes; it also allows the possibility for an enhanced sense of community between online and campus students (Szeto & Cheng 2016). However, Inglis et al. (2011) show that although students are offered different resources in a blended/HyFlex environment, they tend to stick to one choice; that is, if they start by attending online, they continue attending online.

Furthermore, in their study, online students had lower attainment than those who often attended the learning activities on campus. Students found this pedagogical form satisfying and engaging; they like the option to choose (Beatty 2007), but what about the teachers? Wright (2016) highlights how teachers adjust both the curriculum design and teaching strategies in this pedagogic form, which requires a robust infrastructure and support system.

This article focuses on a HyFlex design that combines physical spaces, virtual spaces, and face-to-face interaction with online learning and live streaming. This area, with its emphasis on higher education and teacher interaction, in particular, is somewhat under-researched. However, in a rather similar setting (video conferencing in a campus space), McNaughton et al. (2014) found that the teachers experienced a conflict between the design of the physical learning spaces and their pedagogical goals. When the teacher moved around in the space only one-third of the room was used consistently; furthermore, the teacher felt disconnected from the remote students. That is, the design of the space and the framing of a video conference affected the interaction in both the campus space and online. This connects to the purpose of our study, which aims to investigate the interplay between space, and in particular,

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teacher interaction in a higher education HyFlex learning environment. The following research questions were asked: What kinds of spaces are connected in a HyFlex model? How do the participants, with a particular focus on the lecturing teachers, design their interaction in the different spaces?

Conceptual framework

Our point of departure is that space and place act as social products (see De Certeau 1984; Dourish 2006; Tuan 1977); that is, when we interact in space, we fill it with emotions and value, thus, space becomes a place. Spaces affect the way we interact, but spaces can also be perceived as negotiable and designed in interaction with the participants in the space (see Jewitt 2005; Leijon 2016). In this study, learning spaces are looked upon as social, negotiable, and an essential part of the interaction between teachers and students. The research also draws upon a multimodal design-oriented perspective called *Designs for Learning* (Selander, 2008; Selander and Kress, 2010) and makes use of two aspects of design in a Hyflex learning environment: designs for learning and designs in learning.

Designs for Learning deals with the conditions for learning, such as institutional patterns, norms, governing documents, and settings – all of which affect how activity in a learning space is designed. Thus, concerning space, designs for learning helps us to understand how space, as a part of the setting, constitutes an essential element in communication. Here, the teacher often has a significant role through his or her didactic design based on an idea of how teaching can be designed and implemented in a specific space. In this didactic design, physical space represents a valuable resource. In a HyFlex learning environment, design for learning helps us understand how different physical and virtual spaces constitute essential elements in communication and interaction.

Designs in learning concerns how a teacher and students act in, and in this case, use the space as a resource during a learning process. They could use resources like a whiteboard, computer, furniture, movement in a room, speech, or gestures to shape their interaction as a part of the learning process (Selander, 2008; Selander and Kress, 2010). So, with designs in learning, we could deepen our understanding of how a HyFlex learning space become a resource in a learning process, here, with a particular focus on teacher interaction with students. *Designs for Learning* can help us understand and unpack not only the HyFlex space concerning the framing part, but also the activities in the space, designs in learning (Leijon 2010; Leijon & Lindstrand 2012). What happens in *Designs for Learning* influences designs in learning and thus affects the teacher interaction in the learning space.

We also draw on a model presented by Cuthell et al. (2011). Those authors investigated how members of a professional organization interact in different physical and virtual spaces across different settings, locations, and time zones to create a model that describes how the physical space, the online space and the representational space all create a new liminal space; that is, liminal in the sense of dislocation and uncertainty – a kind of in-betweenness. In our aim to understand and unpack the spaces that are created in a HyFlex setting, we elaborate on the concepts presented by Cuthell et al. as well as add and extend the model. We do not use liminality as the point of departure for understanding the space but instead use the idea of liminality to unpack and label the different spaces; thus, liminality plays a possible minor role in our model.

Methodology

This section presents methodology and tools for analysis and will describe: setting and participants; data collection, analysis, and ethical considerations.

Setting

This study had an ethnography-inspired design and was conducted in a teacher-education setting in Sweden. Mixed methods were used and drew data sources in combining streamed filmed material from lectures together with interviews. Three lectures/seminars were streamed live, with one lecturer and another teacher in the room acting as streaming facilitator. Students could choose to participate at the campus and be present in the room or to participate online. Since the sessions were recorded and published on the course platform, students could choose to only watch the recorded material after the sessions. The facilitator communicated with online students via text chat and forwarded comments to participants in the room. The sessions were recorded; the streamed filmed material constitutes part of the data, together with interviews with the three teachers.

Participants

The study has a particular focus on how the lecturing teachers design their interaction in the different spaces. Three teachers agreed to share their views on teaching in the HyFlex setting in interviews. The three sessions were chosen by convenience; they were merely the upcoming live streamed seminars that the participating teachers were about to conduct. The sessions had different aims, different forms and were conducted in different types of physical learning spaces. They had in common that they were live streaming and that the teachers, although all experienced, were relatively new to this way of teaching. One of them

had done a couple of previous sessions; two of them had no previous experience.

The participant teachers (one male, two females) were chosen in a way that was convenient, as the researchers had close access to the setting. The closeness to the setting and the conveniently chosen sample may be problematic in relation to bias and generalization (Bryman, 2016). As this study has an explorative point of departure, namely, trying to understand and unpack a new learning space, we find that the closeness to the field and the participants to be an asset. Both authors have experience in the setting and are able to gain a deeper understanding of the research subject as an inquiry from the inside in our intent to understand the learning spaces and the teacher interaction within them (Rossman & Rallis 2003).

The authors took on somewhat different approaches. The second author participated as a facilitator and conducted the live stream. This led to understanding the researcher role as one of a participant observer. As a facilitator, the second author directed the live stream, maintained contact with the online students, and verbally transformed questions from the live chat. No notes were taken. Instead, the participation served as background and immersed knowledge of the activity, that is, an insider research approach with backstage access to the field. To the participants the researcher´s role as both a facilitator and researcher was well defined and overt (Rossman & Rallis 2003).

The first author did not participate in the sessions, but solely analyzed the filmed material from the live streams. This meant, in a sense, that the first author acted somewhat as an online student by using the same afforded resources, exclusive of participation in the chat forum. This combination of participant and spectator roles provided both closeness and distance to the field.

Data collection

Streamed and recorded film material

The streamed film material comprises three recorded lectures conducted by three teachers. The duration of the first lecture was 1 hour 26 minutes 29 seconds. The second lecture was divided into parts: the first lasted 1 hour 6 seconds and the second was 1 hour 12 minutes 37 seconds. The third lecture was 1 hour 26 minutes 2 seconds long. In total, the filmed material runs just over 5 hours. We look upon the filmed material, not as a neutral medium for representing reality at the lectures (Pink 2007) but rather as a form of fiction, as the facilitator who took on the role of director conducted the live stream and thus made certain decisions concerning angles, frames, et cetera.

Interviews

The interview can be understood as a construction created by the researcher and the interviewee, it contains a hierarchical relationship with the researcher often setting the agenda for the interview (Kvale 2006). Both researchers were present at the interview, which presented a risk of dominating the conversation. Therefore, to reduce the researcher monopoly of interpretation and as a way to share the new findings with the participants, the interviews were designed as a discussion of the recorded filmed material. This approach is inspired by the idea of stimulated recall (Haglund 2003; Kagan 1984). During the interviews, excerpts were watched and discussed, with a focus on the teacher interaction within the rooms. The teachers were asked questions like: What do you think about live streamed lectures or seminars? How do you prepare? How does a lived streamed session affect your teaching? Any opportunities or challenges? Can you describe what you do in this transcript? The interviews lasted approximately 52, 50 and 46 minutes. All interviews were audio recorded and transcribed.

Analysis

The recorded material from the sessions was analyzed by the first author from a multimodal perspective (Kress & van Leeuwen 2001), with a focus on both visual and auditory information as well as the teachers' use of both physical and virtual space as a resource in their communication. The filmed material was partly transcribed in a table format, with a particular focus on how the teacher interacted at the start, during, and at the end of the lecture. The entire recorded film was watched as a way to search for focal episodes where the teachers were using different aspects of the space as a resource in their interactions. Examples include: movement in the room, using a whiteboard, body language towards the camera and so on. Focus was placed particularly on how the teacher interacted with students in the room and with the students online. As a result, only some of the interactions in the room were highlighted in the transcripts, while other parts were excluded. Thus, the transcript was designed by us as researchers to represent specific foregrounded actions that stand as being more significant than others. (Halliday 1978; Hasan 1989[1985]; Ravelli 2000). These highlighted actions served as a ground for the interviews. A way of verifying the accuracy of the analysis of the recorded filmed material was the interviews. The material was discussed and the participating teachers had a possibility to verify as well as develop the understanding of the findings or correct the interpretation made by the researchers (Bryman, 2016). The search for patterns in the interviews connected to the interaction in the filmed material helped to acquire a

deeper understanding of the teachers' views. Both researchers conducted a final analysis of the material to establish an agreement concerning the interpretation as a way to test the internal reliability (Bryman, 2016).

Ethical considerations

Careful ethical considerations were made to ensure that the participants consented; the participants were informed of the purpose and the implementation of the study both verbally and in writing. Further, they signed their participation (written consent) with the knowledge that they could cancel at any time with no further explanation necessary. The participants were informed in advance of the decisions about how the material was going to be represented and they were told that their faces would be cropped and/or blurred to hinder identification (Pink 2007).

Results

This section presents the primary themes and findings from the study. In the first part we will describe the different spaces we have found in the material: physical space, representational space, and interactional space. Then we will present three different teacher strategies concerning how to design interaction in different spaces; the first is called online and room-oriented, the second is called room-oriented, and the third is room-oriented and online on demand.

The first research question was: What kinds of different spaces are connected in a HyFlex model? In a HyFlex learning environment with live streamed lectures and seminars, several different spaces are shaped. We have unpacked and labeled four different spaces, although there may be more. With inspiration from Cuthell et al. (2011), we have found and will elaborate on the following spaces: physical space, representational space, interactional space, and a fourth possible space that we call a liminal space. The analysis will also be framed by the concepts designs for and in learning.

Physical space

First is the physical setting on campus; it could be a seminar room or a lecture hall. The students who choose to attend on campus enter a room designed to be functional for the live-streaming session. This means that both the students and the teacher have to consider how their interaction in the learning sequence – *Designs for Learning* – in the physical room is affected by the technical resources for streaming, namely, the camera and microphone, as a part for the designs for learning. They also have reflected on the knowledge that all their interactions are being filmed and live-streamed. Maybe the designs for learning somewhat constrain their possibilities to interact and design their way in learning? Does increasing flexibility online mean decreased flexibility in the campus space? Our observations highlight a transformation of the campus space to a relatively traditional lecture space with a limited stage for the teacher and the students. The physical space includes remote students' spaces. In a HyFlex environment the physical campus space is connected with several different spaces off campus. The remote students can attend the sessions while sitting at a café in another part of the world or at home in their kitchen. How does this mix of spaces affect interaction? The teacher has no idea what spaces he or she is connected to during the session, and thus loses a critical aspect of both designs for and in learning.

Representational space

One aspect of the representational space is that which the teacher designs while conducting the lecture, that is *Designs for Learning*. The teacher has power over how to stage, present, and perform in front of the students within the room. The same goes for representation of the content, in this case, in slide format and through verbal interaction. However, in the next stage, the teacher loses control over the representational space. This is the space designed by facilitator for streaming. By making choices about things like camera angles and clips, the facilitator designs the representation of the interaction in the physical space for the remote students. The facilitator is the only person with a connection to this second space, constructed of a blend of both campus and virtual spaces. In this case, four different representations were detected. For the lecturing teacher, this means losing control or, at least, handing over control of parts of the representational space to the teacher conducting the live stream. The same goes for the students in the campus room; they have no idea how they are represented online unless they follow the streaming in real time using their laptops or mobile phones while attending class in the campus space – an aspect that we will return to later. How does this affect their designs in learning? The third representational space is the chat space that the remote students have the agency to design in the same parallel process as the campus discussion. We have observed a student discussion which moved between technical questions, comments on the lecture, and elaborations on the presented topic. The lecturing teacher had no direct access to this chat. Also, a virtual space exists where the remote students would meet when they connected with their laptops. This space is out of reach for the teachers, as it was designed by the other teacher in the campus room who facilitates the live streaming. Neither the

performing teacher nor the students have access to how they are represented online.

Interactional space

The physical and the representational spaces construct a ground for sophisticated and versatile interactional spaces.

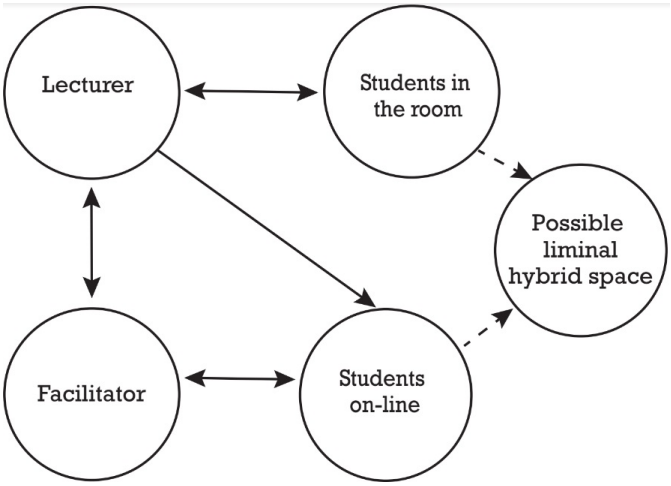

Figure 1. **Interactional space.**

There are several possibilities for interaction. The lecturer and the facilitator conducting the live stream can interact. The students in the campus room can communicate with the lecturer and with the facilitator (although they do not). The lecture has access to the students in the room, and also indirectly (via the camera) with the students online. The online students can interact and have discussions in the chat forum where they can pose questions that can be verbally transformed by the facilitator in the physical room.

Also, we have identified a possible space which we call liminal. It can be liminal in the way that it represents a threshold, a form of in-betweenness (van Genepp 1960), as the participants here can interact in a new (at least in a learning context) way. The liminal space includes a time aspect, as the students can connect to the live stream while being present in the campus room. The live stream has a short time delay, so the students experience the lecture in different modes: first in person in the room, then with a time delay in the online space. By connecting to the online space, they also have access to the discussion in the chat forum. We point out that this is a possible space that we unpack in our model, but in this study, we do not investigate if any or how many of the students in the campus choose to connect online. From a teacher perspective, this possible space creates a further complicated and complex learning situation to. It could be the case that the students in the campus space have access to the most spaces, while the lecturing teacher is the person with the least access. This is a temporary new learning space that we know little of, hence, the 'liminal' label.

Three teacher strategies

This leads us to our next research question: How do the participants, with a particular focus on the lecturing teachers, design their interaction in the different spaces? The analysis of the filmed material and the interviews show how three teachers use different strategies to design their interaction in this complex and versatile space. The first strategy we have called online and room-oriented, the second is called room-oriented, and the third is room-oriented and online on demand. In the following section, we elaborate on these strategies.

The first teacher (online and room-oriented) had a well-developed strategy of how to interact with students in the room and students in the online space. He introduced the session by looking straight into the camera, focusing on the online public, and speaking directly to them; then he changed focus to connect with the people in the physical room. This interplay continued throughout the lecture; when he asked students in the room questions, he also posed questions to the online participants. When the facilitator raised questions from the chat, the teacher listened and then looked into the camera while answering. Summing up and closing the session, this alternating rhythm was repeated, and both audiences were invited to participate by the lecturer. However, the teacher movement in the physical room was constrained to the area in the front, as the teacher had to handle the computer and the whiteboard as well as interact with the camera. In the interview, the teacher stated that he made no special preparation for the live-stream session; the interaction and the alternation come automatically, he said. However, he mentioned the feeling of being hindered in moving around in the room as he wanted. He also raised issues about the fear of losing contact with the students in the room while paying attention to the online students:

> *I am somewhat afraid of when I look into the camera, that I will leave the group in the room /…/ I kind of start to discuss with someone not present, and the students in the room are supposed to be passive – they are listening, of course, but I still find this a bit problematic. You feel it as a teacher. (T1)*

The second teacher (room-oriented) started in the same way, directing herself towards both the students online and in the physical room. Then the physical room took over, and all her attention lied there. This meant that she also moved around a lot in the physical room, walking towards the students and initiating group discussions without

involving the online group. She used the physical room to design the interaction with the participating students. This focus on the physical attendees meant that there was no interaction in the online chat space. Hence she did not have to interact verbally with the facilitator. In the interview, she expressed an initial awareness of the camera and the online students but stated that the interaction with the students in the room required all her attention, and she lost her focus on the online students:

> *No, I think I do not care about it [the camera] after a while, at least if it is a lecture where you get the response [from the audience in the room]… then you are so engaged that you do not think about the camera anymore. /…/ [When asking questions] I did not think so much about those who were online, even though I knew they [the questions] reached them too, and they had the possibility to write in the chat […]. I think I did not expect them to answer. I could have done that, but I suppose it is because you do not have the [same type of] direct response from them. (T2)*

The third teacher (room-oriented and online on demand) was a mix of the first two. She started the lecture in the same way as the other two by turning to both audiences, but then she somewhat lost the online focus, only to connect again when the facilitator posed questions from the chat flow. Facing the facilitator, the teacher listened to the question and answered by talking directly to the facilitator. The online students were mentioned indirectly in the third person. Also, her movement in the physical space was a mix of standing in the front and moving a step closer to the students in the room. However, she never entirely left the front, as she was aware of the camera and the risk of leaving the frame. In the interview, she explains this fear:

> *I was thinking, 'How can I move in the room?' I even asked you (the facilitator) about that /…/ 'Where can I stand? How shall I … how can I move? How big is my space?' so to say. (T3)*

To summarize, we have analysed teaching sessions of three teachers with three different strategies for designing their lectures in a complex and versatile HyFlex environment. In a more traditional setting, the lecturing teacher also interacts in various but less- and more controlled spaces (from a teacher perspective). A sketch of an interactional space for a teacher in a traditional setting might look like this:

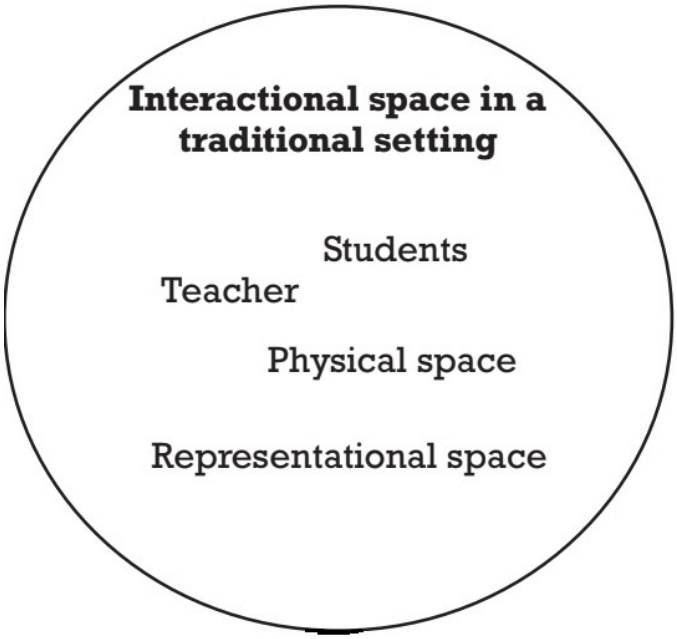

Figure 2. **Interactional space in a traditional setting.**

The teacher and students interact in the same physical space where the teacher has control and agency over the representational space; that is, how he or she represents him- or herself in front of the students. What kind of slides or other learning resources should be used, and how should the verbal interaction with the students be designed? In the HyFlex setting, from a teacher perspective, the interactional space might be depicted in this way:

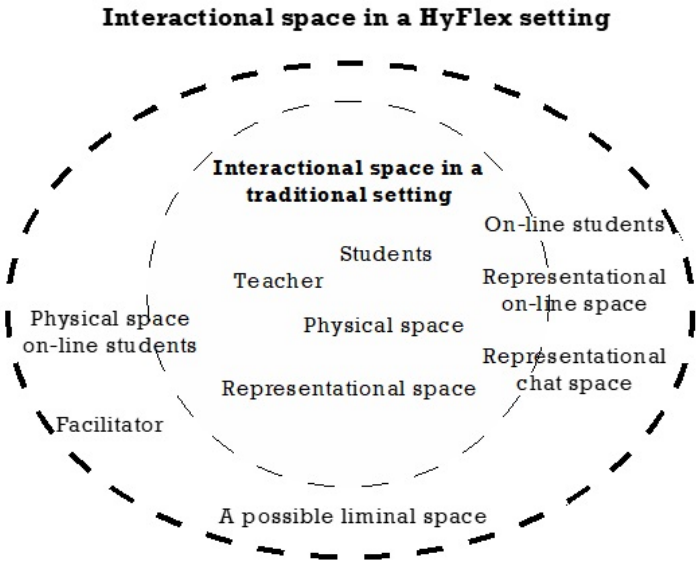

Figure 3. **Interactional space in a HyFlex setting**

The model illustrates how HyFlex spaces are multiple and versatile, connecting physical space with online space to shape complex interactional spaces. From a teacher perspective, the HyFlex setting affords an extended interactional space, where the teacher has a direct connection and control over some aspects but an indirect connection to and no control over other aspects. This means that, as a lecturing teacher in a HyFlex setting, one must interact with several learning spaces without having direct power to design the interaction.

Discussion and conclusion

In this article, we ask what kinds of spaces are connected in a HyFlex model; we found them to be: physical space, representational space, interactional space, and a fourth possible space that we call a liminal space. This is by no means a comprehensive understanding of the learning spaces in a HyFlex environment, as we have only just begun to unpack the complex settings that teachers and students have for interaction. Could the whole HyFlex space be understood as a liminal space, following Cuthell et al. (2011)? Maybe, this is a new teaching territory, unknown to many lecturers. On the other hand, teaching changes all the time. If a teacher is a designer (Selander & Kress, 2010, then teaching becomes a multifaceted profession of designing engaging and meaningful learning environments where teaching practice is informed by learning theories, subject knowledge, and didactic skills. Teaching is also informed by technological knowledge and experience. The changing learning environment is not new to teachers. Perhaps we can understand the complex learning environment as being partly well known, and partly liminal. By unpacking the different spaces in a HyFlex environment we suggest that some new aspects may add to the complexity of teaching. The loss of control in an interactional space is one example. Other examples include: the time aspect in the liminal space and the possibilities for students to experience the lecture in different modes: first in person in the room, then with a time delay in the online space. From a teacher perspective, this possible space creates a further complicated and complex learning situation. This adds new layers to the concept designs for learning; where the teacher in a HyFlex environment must prepare for the somewhat unknown learning spaces and interaction that are out of reach for his or her control and for the designs in learning.

So how do the teachers in our study design their interaction in these different spaces? We have discussed how HyFlex spaces are complex and versatile and that the teachers develop different strategies in designing their interactions. The results raise questions about who designs a HyFlex environment: the teacher, the students the facilitator or another person responsible for the technology in the room. The designer of the software used in the live stream? From a teacher perspective, our study shows that teachers only have agency and ownership of part of the *Designs for Learning*. This result implies that a HyFlex model requires an increased didactic awareness of designing for learning.

The complexity of a HyFlex model also affects the teacher's didactic design during the session – his or her design in learning. All three teachers in our study are new to the pedagogical model. In an educational development process, it is essential to understand how the complexity affects interaction and the choices that the teacher makes and is able to make. Regarding the teacher, the HyFlex setting requires the skill to communicate and simultaneously interact within the different spaces; it also raises questions about how to move in the space and how to feel secure in the space. The result also highlights that designing for online and live streaming might constrain the teacher's movements or other physical interactions within the campus room. Teaching in a HyFlex learning environment implies coping with complex learning spaces and letting go of control.

Limitations and further research

This study examined the approaches of only three teachers. Therefore, it is not known what would have occurred if a larger group of teachers with different pedagogical experiences had used the Hyflex setting. It would be beneficial to have additional studies in this area that would investigate student perspectives as well as students' level of success. Any further studies should consider involving more teachers and students from different contexts.

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