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## Formal learning spaces in Higher Education – a systematic review

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### ABSTRACT

Over the past ten years, there has been an increasing focus on physical learning spaces in higher education. By now, what do we really know about the relation between space and student learning? What does the research landscape look like, and how has it developed? A systematic review of peer-reviewed 108 articles on the physical learning space for the period 2009–2019 was performed. A broad and fragmented field emerged that is to some extent under-researched and under-theorized. Few articles contain theory sections, and very few authors refer to each other's work in their articles. On the other hand, a diversity of themes, methods and perspectives can be seen. Overall, the review can contribute to an overview of what we know – and what we do not know – about the complex relationship between student learning and learning spaces.

### ARTICLE HISTORY



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### KEYWORDS

Systematic review; higher education; formal learning spaces; teaching; learning

## Introduction

This review aims to contribute to an overview of what we know – and what we do not know – about the relationship between student learning and learning spaces and thus increase awareness of how we can exploit the potential of the, hopefully imminent, return to physical learning spaces. Let us begin by looking at two former reviews of the field by Temple (2008) and Ellis and Goodyear (2016). Temple (2008) identified learning spaces in HE as an under-researched area, and his statement was based on a literature review from 2007 (Temple and Fillippakou 2007) to inform the future design of learning spaces. The review covered a wide range of literature, not only research articles, with a broad spectrum of topics from the maintenance of buildings to theoretical perspectives on space. Temple (2008) presented a conceptual model of how a university could be understood as, 'the campus, the university in the city, a community space, individual buildings, spaces intended for teaching and learning (including libraries), and other spaces' (28). The results showed a lack of studies on: the relation between spaces

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and interaction in teaching and learning processes; the social aspects of the university environments and what role spaces could have in community building. Furthermore, Temple detected a rather optimistic discourse based on anecdotal evidence on how spaces could support learning (2008).

Less than ten years later, Ellis and Goodyear (2016) presented a literature review on learning spaces in HE with the intention 'to synthesize relevant literature and to help repair the conceptual fracturing in the field' (150). In their review, which focused on main contributions to the research field from 1995 and onwards, Ellis and Goodyear reached a similar conclusion as Temple (2008), as they found that space in HE was still both under-researched and under-theorized. They identified three broad areas in the field: 'pedagogy and curricula and their association to learning space; learning space and design; and the development of software tools that create virtual spaces in which students could learn' (164). Like Temple, Ellis and Goodyear were critical towards generalizations and the poor conceptualization of space in the literature.

Finally, we would like to add a review conducted within the Australian-based research project Innovative Learning Environments & Teacher Change (ILETC) (Byers et al. 2018). This systematic review had the aim to 'identify quantitative studies with valid methodologies that isolate the variable of different learning environment type/s (blended, ILEs, open-plan and traditional) and analyse their impact on reliable measures of student academic achievement' (9). The search for strong evidence on student academic success resulted in the inclusion of only 21 studies from a selection of 5,521. Of these 21, only a few presented robust evidence on how space could affect student learning in all types of school settings. The authors highlighted the need for more longitudinal research on the effect of how different learning environments can impact student results.

To sum up, these comprehensive reviews represent different perspectives of a growing field. Furthermore, all three reviews point towards the fact that learning spaces in HE is a field that is under-researched, under-theorized and with little robust evidence of the relation between space and student learning. Is this still the case? We present two motives for our review:

- (1) We have a rapidly changing learning landscape in higher education, and an important post-pandemic question is what education on campus will look like in the future? In the ongoing discussion, campus spaces are regarded to be indispensable places for learning, even if we move towards blended and hybrid solutions (Gaebel et al. 2021). This means that 'universities will have to rethink what a campus space can be to ensure that HE remains an embodied and communal experience' (Eringfeld 2021, 1). To support that re-thinking, we argue that we can learn much from pre-pandemic knowledge production on teaching and learning in campus spaces. But what does that knowledge production look like? This leads us to our second motive.
- (2) With a focus on formal spaces and teaching and learning, combined with a bird's eye perspective provided by our review, we think that we can contribute with a deepened understanding of the field.

Hence, we systematically review how the research field has developed between 2009 and 2019, with a clear focus on scholarly articles on formal learning spaces in HE and

research that in some way relates to learning processes and teaching. In that sense, this review has a narrower focus than the Temple and Ellis and Goodyear reviews. However, to relate learning to interaction and teaching, we need a more generous view on evidence than in the ILETC-review; scholarly articles from a wide evidence-informed perspective, both quantitative and qualitative, are therefore included.

## **Aim and research questions**

The overall aim of this systematic literature review is to map and discuss the field of research results on formal learning spaces in HE between 2009 and 2019 with a focus on the following research questions: What research has been published where and when? What themes can be detected in the research field? The article is organized as follows: the method used for the review is introduced, followed by the presentation of the results. The results section is divided into two parts: a quantitative map of the field and a thematic analysis of the field. Finally, we discuss synthesis of the results.

## **Method**

### ***Scope of the review***

This article uses a mixed-method approach and combines quantitative and qualitative methods inspired by the systematic quantitative literature review SQLR-method (Pickering and Byrne 2014) and a reflexive qualitative approach (Braun and Clarke 2006). The systematic quantitative literature review is an approach that offers a means of identifying not only what is known in a field but also indicates where there are gaps (Grant and Booth 2009; Pickering and Byrne 2014). The reflexive qualitative approach serves to thematically analyse the findings and to identify themes within the material. The combination of these approaches results in a semi-systematic review with the aim of attaining an overview of the research area and a synthesis of the state of knowledge in the field (Snyder 2019; Ward, House, and Hamer 2009).

### ***Inclusion and exclusion criteria***

In our literature search, we targeted peer-reviewed journal articles, and based on our language skills, we limited our search to literature written in English, Swedish, Danish and Norwegian published 2009 and 2019. The year 2020 and 2021 are excluded since we focus on learning spaces not affected by the pandemic. Criteria for inclusion were that the articles should cover physical spaces in HE with a focus on learning, teaching and teachers and/or students. We used one of the clusters suggested by Ellis and Goodyear (2016) to frame our research: ‘Physical learning spaces in which the teacher and students are typically co-present and in which the activities are either teacher-centred or teacher-supervised’ (164), frequently referred to as ‘formal learning spaces’. Articles on online education, e-learning, informal learning environments and libraries (unless they also include some spaces for teaching) were excluded. Worthy of note is that the selection of research is framed by Western university traditions, with English as the dominant language.

## Search process

Three researchers were involved in screening articles and extracting data. A broad and thorough database search was conducted in Libsearch, a meta-database that includes for example, Ebsco, Eric, ERC, Pro quest, Cinahl 125, Medline, Scopus and PsycINFO. The initial search resulted in 153 peer-reviewed articles (Figure 1). These articles were exported to a screening database (Rayyan QCRI), where all four researchers read abstracts and conducted a blind selection, resulting in the inclusion of 44 articles. Then, minor bibliographic cartography was conducted by screening the references in the 44 articles selected. This screening resulted in a further 75 interesting articles, and after screening, 21 of these articles remained. The empirical material now consisted of 65 articles in total. Finally, the publication pattern of the 65 articles included was analysed. Journals with a specific focus on learning spaces, HE and active learning were targeted, which resulted in a selection of eight scholarly journals. All issues between 2009 and 2019 were scanned for relevant articles. Forty-three new articles were included in the material and the literature search resulted in the inclusion of a total of 108 articles.

## Analysis

We adopted an interactive procedure where four researchers divided the 108 articles between them and mapped their content in a shared excel document with the main

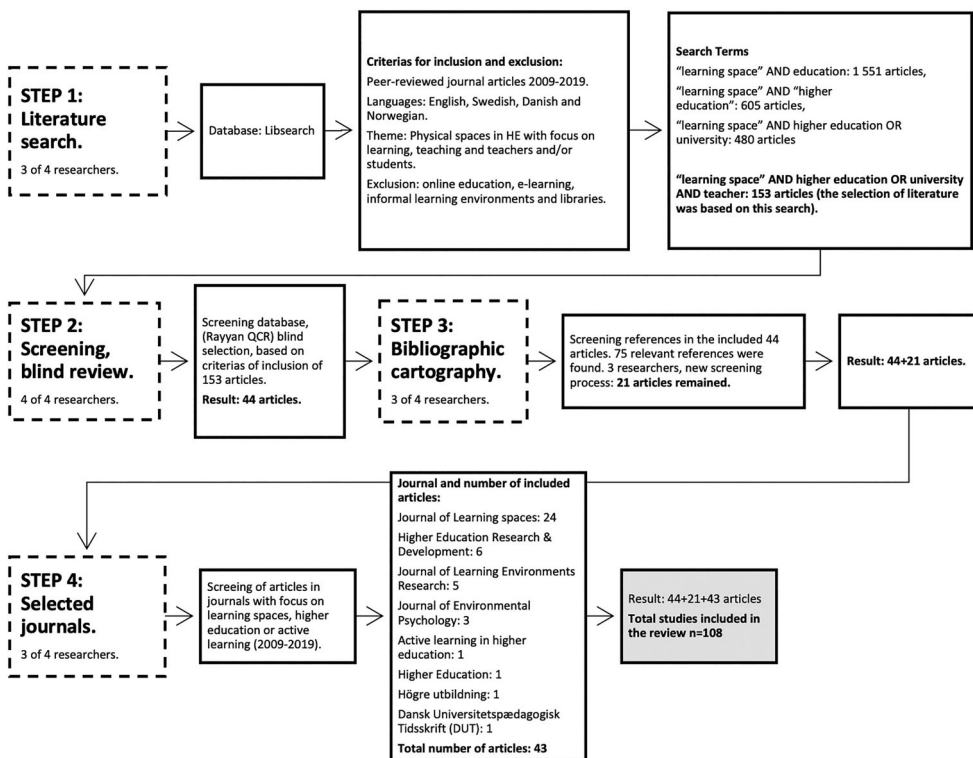


Figure 1. Illustration of the search process.

categories: publication year, where (country), title, authors, name of the journal, main research questions, subject/focus, method, theory, concept/definition of learning space and main points/findings. The excel document served as the starting point for answering the quantitative questions of what research has been published where and when, and for investigating the concept/definition of learning spaces used in the articles. During the qualitative analysis, all articles were divided among the researchers and read a number of times to obtain a general picture of the material, highlighting some overall features. Then, two of the researchers both read through the first 25 articles in chronological order and identified seven respective eight themes. Thereafter, the remaining articles (n83) were analysed by the same researchers to test the themes and in the last step, all four researchers critically discussed and agreed upon the six themes that are presented in the results section.

## Results

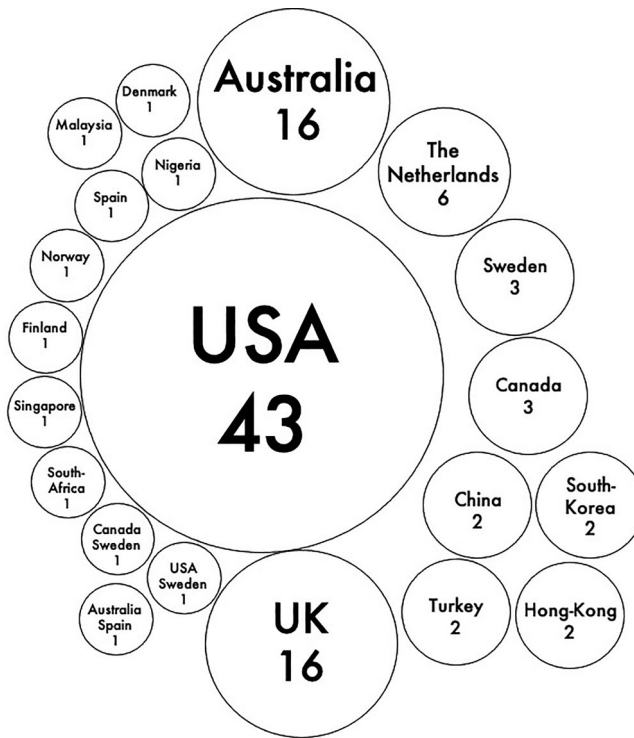
This section is divided into two parts: a quantitative map of the field and a thematic analysis of the field. We start by presenting the results from the quantitative analysis with a focus on: what research has been published and when; in what journals; and how is learning space defined? Then we move on to the results from the qualitative analysis where we present a thematic view of the field.

### *A quantitative view on learning space research*

The illustrations below (Figures 2 and 3) highlight a growing number of articles over the years, reaching a peak in 2016, followed by a fairly steady number over recent years. The field is clearly dominated by research from the USA, followed by the UK and Australia. This could be explained by the movement towards Active Learning Classrooms in the US and articles published in relation to that. In the UK there has been a focus on more varied learning spaces, while a special interest in innovative learning environments has been the focus in Australia.

The Journal of Learning Spaces dominates the field and much of the early research from the USA has been published there, although recently, the journal has become more international. As seen in Figure 4, the other journals illustrate that researchers either publish with a focus on teaching and learning in HE or from a disciplinary perspective, where Medical Teacher and Journal of Interprofessional Care serve as examples. Naturally, this result can be discussed from the perspective that the articles included are based on the authors' language competency and with a broader inclusion, other countries and journals may be more prominent.

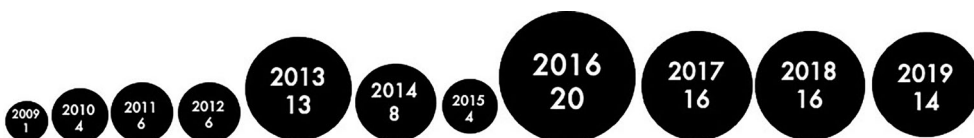
There is a confusing array of nomenclature in the literature used to define the 'formal rooms where learning takes place'. The term *space* is by far the most dominant term used to describe the rooms where learning takes place (n85). The term is frequently used together with learning (n52) and several articles (n37) refer to specific spaces (Figure 5). Terms such as learning environment (n13) and learning landscape (n5) can either represent a broader design perspective or connect a classroom to a wider campus context. A third route is to understand environments as the physical, social and pedagogical context in which learning is intended to occur, as in the definition of an Innovative



**Figure 2.** The illustration shows the number of published studies in different countries and depicts how the USA, followed by Australia and the UK dominate the research field on formal learning spaces in HE.

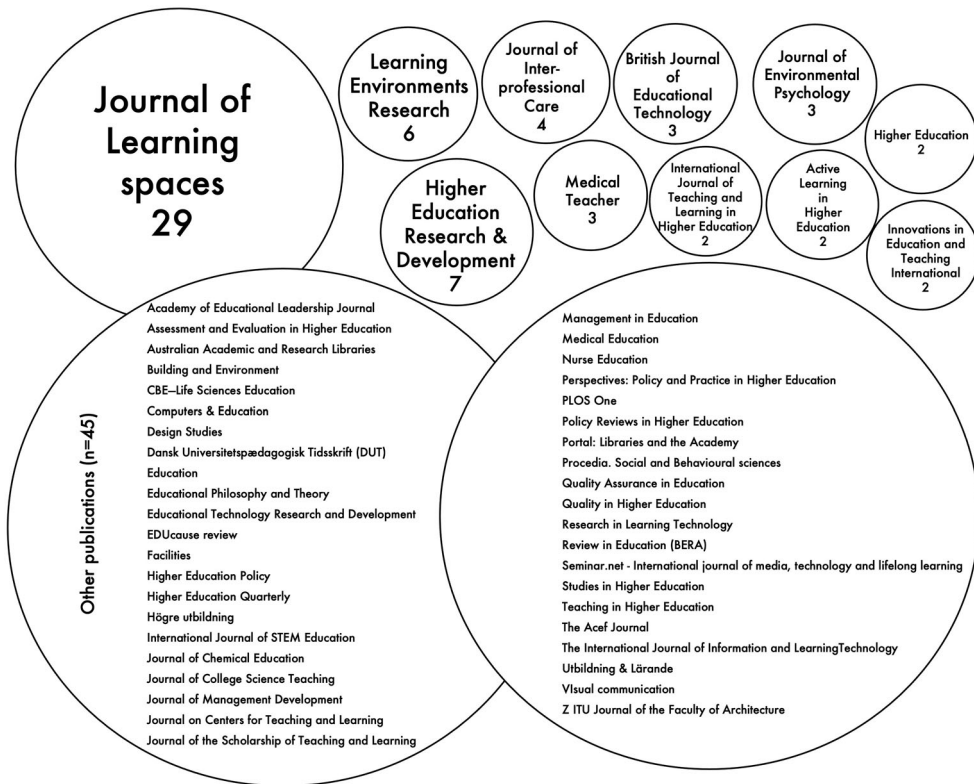
Learning Environment (ILE). Within the material, there are a few articles that use both space and environment (n4) and some discuss the relation of space to place (n5), often connected to materiality and relational perspectives. Finally, in the material, there are attempts to address the specific flexible hybrid learning spaces (HyFlex) encompassing physical and virtual learning spaces simultaneously (Figure 6).

The quantitative map reveals a pattern of research dominance from Anglophone core countries, but a note of caution is due here since we apply a limited selection criteria based on language. In our material, there is a lack of international exchange, enhanced by the dominance of one journal. However, we trace a disciplinary openness within the field, where scholars from different disciplines show an interest in physical learning spaces. This openness could result in a varied conceptual and theoretical underpinning – something we return to in the next session.



**Figure 3.** The illustration shows the number of articles by year of publication that have been published over the selected period.





**Figure 4.** The illustration shows in what journals the articles have been published.

### ***A thematic view of learning space research***

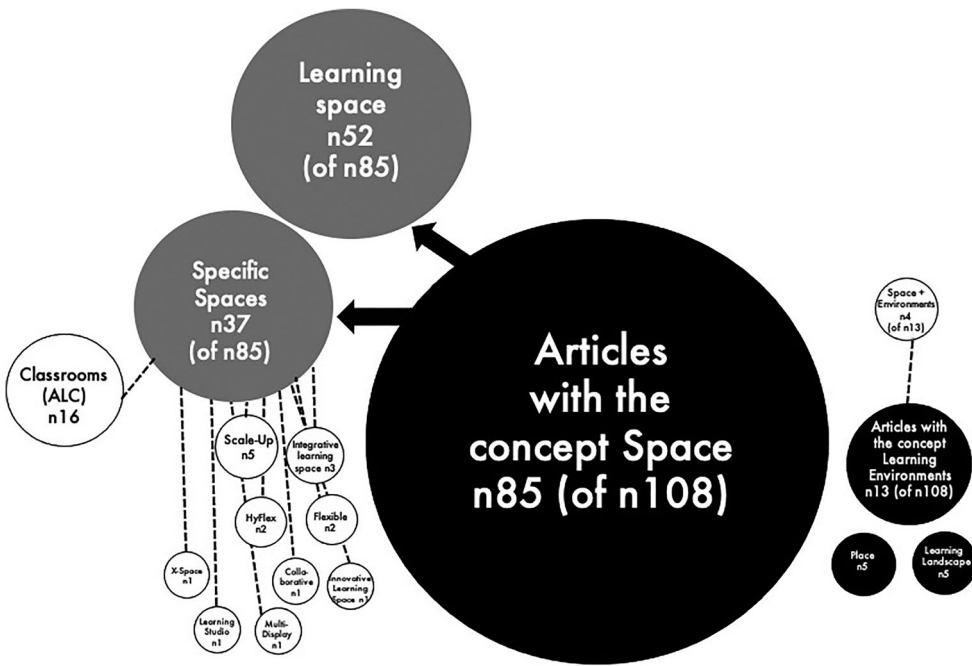
In this section we will expand on the six themes that were detected:

- Relations between design, learning activities and learning.
- How students and teachers perceive learning space.
- Focus on design principles and processes.
- Methods, tools and language to assess relations between learning spaces and learning.
- Support of teachers' educational development/use of learning spaces
- Theoretical focus

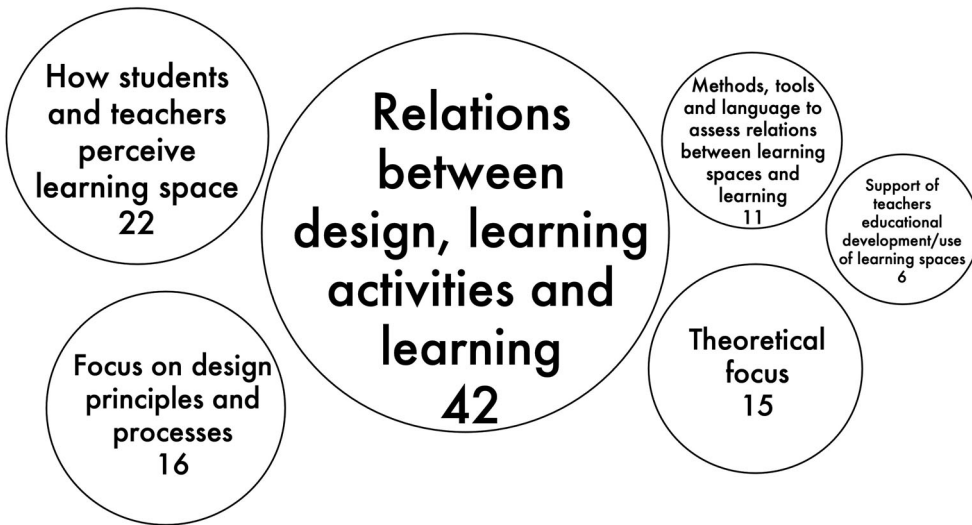
### ***Relations between design, learning activities and learning results***

The most frequent theme (42 articles) highlights interaction in a variety of learning spaces as well as the search for relationships between space and learning. A majority of the 42 articles compare interaction in traditional spaces with innovative, flexible spaces or active learning classrooms (ALCs) (Bligh and Lorenz 2010; Brooks 2011, 2012; Henshaw, Edwards, and Bagley 2011; Hunley and Schaller 2009; Jessop, Gubby, and Smith 2012; Salter et al. 2013; Walczak and Van Wylen 2014). They all point towards the importance of teaching philosophy and teacher moderation of





**Figure 5.** A concept map of how to define the formal rooms where learning takes place.



**Figure 6.** The circles indicate thematic size distribution. Many articles had a dominant focus in one theme and a minor focus in another theme. In those cases, we categorized the article according to the more dominant theme. A few articles had a more equal focus on more than one theme and thus were categorized into two or into three themes, hence the total number of 115 in this figure.

activities (King et al. 2015; McArthur 2011, 2015; Sawers et al. 2016; Zimmermann et al. 2018) thus, simply moving into a new space does not change teaching behavior (Beery et al. 2013; Fisher and Newton 2014). Significant for this theme is how a connection

between space, pedagogy and technology becomes visible (Duvivier 2019; Wilson and Randall 2012). Other studies explore this relationship on a deeper level as they focus on the reciprocal relationship between people and space (Hawick, Cleland, and Kitto 2018; King 2016; Leijon and Lundgren 2019; Parsons 2016). Smith (2017) reveals how spatial arrangements affect the sense of ownership and agency among students and teachers and thus has an impact on interaction. The fact that students and teachers read a space and shape their interaction in relation to that reading, while also using the layout and resources in space to shape a place for learning, is presented by Leijon (2016a, 2016b). In other words, space, people and interaction are entangled, and activities are shaped both by space and the people who are active in the space (Acton 2018).

Nearly half of the 42 articles relate space to learning in different ways. This ranges from merely concluding that interaction and learning are different in different environments and thus affect student learning in different ways (Bolden et al. 2019; Lamb and Shraiky 2013; Mui et al. 2019) to measuring how specific resources in a space such as sound, light or air quality can also affect student learning (Marchand et al. 2014). Some studies focus on time spent seated (Baepler, Walker, and Driessen 2014) or student positions in space – such as the result that students sitting at the back of a lecture hall get lower course grades than students sitting in the front or middle of a space (Shernoff et al. 2017; Yuan, Yunqi, and Feng-Kuang 2017). There is growing evidence that changes in the design of a space, together with changes in pedagogy makes a difference in the students' learning process (Baepler et al. 2014; Chiu and Cheng 2017; Cotner et al. 2013; Hacisalihoglu et al. 2018; Stoltzfus and Libarkin 2016; Stover and Ziswiler 2017; Thomas et al. 2019). In contrast, some studies present no significant difference in student results when comparing teaching and learning in different settings (Muthyala and Wei 2013; Vercellotti 2018).

To conclude, there is still a search for evidence on how space affects learning. Even if the research cannot isolate space as a single cause to positive learning outcomes, one conclusion to make is that well-designed learning spaces support changes in pedagogy towards active learning methods that could enable students to develop a deeper understanding of a subject. Thus it is space, resources, people and pedagogy that together affects learning (Lundahl et al. 2017). Furthermore, we see a movement over the years from the acknowledgement of an existing relationship between space and learning towards a more developed understanding of how people, spaces and objects are intertwined.

### ***How students and teachers perceive learning space***

Closely connected to the previous theme on interaction and learning is the notion of how students and teachers perceive a formal learning space (22 articles). What difference does a learning space make to the learning experience, according to students and teachers? When researchers compare student perception of flexible or active learning spaces to traditional spaces, they get a positive reaction in favor of the more innovative choices. Active learning classrooms are perceived by students as being better suited for collaborative learning and engagement than more traditional classrooms (Adedokun et al. 2017; Benoit 2017; Clinton and Wilson 2019; Dag, Şumuer, and Durdu 2019). Even an upgrade or re-design of a learning space has a positive impact on both student and

teacher satisfaction (Hill and Epps 2010; Perks, Orr, and Al-Omari 2016). Perceptions of learning environments, both negative and positive, are affected by both the physical space and the teaching process (Cox 2011; Han et al. 2018; Møller and Bonde 2019; Oluwatayo, Aderonmu, and Aduwo 2015). Some studies show that students do not rank spaces as relevant for improving their learning processes (Jones et al. 2016; Ovbiagbonhia, Kollöffel, and den Brok 2019). Nevertheless, when asked what kind of space on campus is the most important for satisfaction, both students and teachers rank classrooms highly (Kärnä and Julin 2015). In order to foreground how space affects interaction and learning, teachers need support to develop their pedagogy for teaching in different kinds of learning spaces (McDavid et al. 2018).

This theme also covers studies on seating choices, the impact of movable furniture and the lighting of the space on students perception of their learning experience (Beckers, van der Voordt, and Dewulf 2016b; Castilla et al. 2018; Harvey and Kenyon 2013; Henshaw and Reubens 2014). For example, Park and Choi (2014) presents the front area in a traditional classroom as a golden zone and the back area as a least preferred shadow zone. In an Active Learning Classroom, no such zones exist, according to the authors. So, if students can choose, what types of learning environments do they prefer? Students want a mix of learning spaces on campus that are flexible (McLaughlin and Faulkner 2012) and quiet study places (Lee et al. 2018). The need for informal learning spaces is seen to grow in relation to increased student active learning processes (Beckers, van der Voordt, and Dewulf 2016a).

The research shows that students and teachers have a positive attitude towards flexible and innovative spaces, especially regarding collaboration and active learning. Perceptions of learning environments, both negative and positive, are affected by physical space and pedagogy. Space is not the first thing students highlight when they are asked about their learning but seems to be a crucial aspect when students experience changes in pedagogy as positive. Furthermore, space is closely connected to emotions, and as an example, students develop strategies for seating choices to have some degree of control over their environment.

### ***Focus on design principles and processes***

Of the 16 studies in this theme, three studies investigate how educational principles can be translated into design principles and 13 studies investigate different parts of the complex design and building process. The three studies with design principles try to establish an interesting middle ground that can connect educational principles with the many different types and forms of actual built learning places. There is, however, hardly any overlap in the use of concepts between these three attempts. Finkelstein et al. (2016) describe an approach to design carried out at McGill University in Canada, where five pedagogical principles for student engagement developed from the North American National Survey of Student Engagement are translated into design principles for lay-out, furniture, technologies, acoustics and lighting/colour. Carnell (2017) identifies how the six dimensions of the connected curriculum framework that express the overall institutional educational goals of University College London, are aligned with four design principles. Beckers et al. (2015) offer a conceptual framework connecting learning theories, learning situations and spatial lay-outs, and then use this framework

for a comparative floor plan analysis of four educational buildings in the Netherlands, investigating the alignment between space and new ways of learning.

The remaining 13 studies in this theme investigate different parts of the complex design and building process, from the early stages of conceptualizing which spaces are needed (Nordquist, Sundberg, and Laing 2016), through the different stages of designing, furnishing and equipping learning spaces (e.g. Alstete and Beutell 2018; McNamara 2012; Pates and Sumner 2016; Wanless 2016), to experiences in the use and post-occupancy evaluations (Kuntz, Petrovic and Ginocchio 2012; Manahasa and Özsoy 2016). A general focus and finding across several of these studies is the importance of and challenges in getting students and academics involved and engaged in the design process. Several studies report on using different participatory approaches to enhance such engagement and to improve communication and reduce tension between stakeholders (Casanova and Mitchell 2017; Han, Leong, and Nair 2014; Kanyal 2014; Lee and Tan 2013). Neary and Saunders (2011) investigated how tension and conflicting interests between different stakeholders was managed in 12 university building projects and suggested ways to get academics more involved to increase the representation of their perspectives. Finding common language between designers, managers and users is part of the challenge and Legerton (2013) gives us an interesting glimpse into an architect's perspective when describing the specific design moves involved in transforming an existing library into a student-centric interactive learning environment.

Taken together, the studies in this theme give an account of the complexity and many challenges in the process of conceptualizing, designing and evaluating new learning spaces. If there is one conclusion to highlight, it must be to involve all users at an early stage in the process.

### ***Methods or models to evaluate relations between learning spaces and learning***

The aim of the majority of articles (11) in this theme is to develop methods or models to evaluate the very complex relationship between learning spaces and learning. Present in the material are, however, also a few articles on evaluations of teaching where spatial issues are part of the evaluation questions (Han et al. 2018; Lei 2010). We will in the following focus on the articles in the material whose main objective is the evaluation of learning spaces.

The recurring conclusion regarding methods and models to evaluate learning spaces, in general, is that generic evaluation tools are inappropriate because of the diverse purposes and designs of the spaces and uses (Cleveland and Fisher 2014). Consequently, evaluation tools are required that can easily be modified to accommodate the specific physical settings within which they are to be applied (Spencer and Watstein 2017). Some suggestions for evaluation methods that are generic yet adaptable are the models described by Kvan (2013) and Leonard et al. (2017), which both draw on evaluation methods from other areas such as teacher training programs and quality processes.

It seems easier to create evaluation tools if the purpose and design of the learning space are fixed, like in the specific spaces ALCs (Active Learning Classrooms) and SCALE-UP. Here, specific outcomes of teaching in the space are evaluated both in terms of students' learning outcome (Walker and Baepler 2017, 2018) and in terms of teachers' use of the space (Birdwell et al. 2016; McNeil and Borg 2018). Another kind

of specific space is the creative space, where Thoring et al. (2018) identify five different types of creative spaces and relate them to spatial qualities to evaluate to what extent the space is suited for creative processes.

In this (small) sample of the articles, there is no interconnectedness or progression in terms of methods. The SCALE survey is the only method or model to evaluate the relation between learning space and learning that is mentioned more than once, which perhaps can be explained by the fact that the two articles are written by the same authors (Walker and Baepler 2017, 2018). In this sense, the field has not come to an agreement on how the effects of space on learning might be rigorously evaluated, as hoped for by Temple and Fillippakou (2007).

### ***Support of teachers' educational development/use of learning spaces***

This theme draws attention to the fact that teachers very often are unfamiliar with redesigned or new learning spaces. Access to optimal learning spaces is not enough to ensure good teaching or good learning. It also takes sufficient time and other kinds of support for the teachers to use the new room's full potential (Lundahl et al. 2017; Birdwell and Uttamchandani 2019). There are many ways of offering that support to teachers; formal training, shadowing or informal training by which instructors can become familiar with the learning space (Knaub et al. 2016) or formal cooperation with faculty staff once a course is selected to be taught in a new space (Cogswell and Goudzwaard 2018). Other kinds of support are more reflective, like the two approaches described by Ramsay et al. (2017), Flashbacks and Re-Captures, by which the teacher can reflect on their experience in the classroom and hence become more aware of how to use the space in the future, and the Active Learning Classroom Observation Tool, which is a tool to be used during a classroom observation to guide reflection on the ways that a given teacher employs the capabilities of the space (Birdwell et al. 2016).

As evident from the above, only a few articles in the material (6) are concerned with this theme, they all stem from the last four years (2016–2019), and they are mainly descriptive of what can be done to support teachers in using new learning spaces. We don't see any right way to support teachers nor any right time. They all, however, highlight the need to 'create conversations around spaces in addition to creating the spaces themselves' (Birdwell and Uttamchandani 2019, 26).

### ***Theoretical focus***

Fifteen of the articles have a theoretical ambition to explore the complex and dynamic connections between space, agency, and human activities. Before we look closer into these 15, we note that very few of the other 93 articles have a section titled *Theory*. Thus, authors use different theoretical perspectives as their point of departure in a more implicit way. This finding is interesting and echoes previous findings (Ellis and Goodyear 2016; Temple 2008), who claim that the field of understanding learning spaces is under-theorized. We find many references to learning theories (constructivist, socio-constructivist or socio-cultural), mostly used as arguments for the need to create more student active learning and for introducing new learning spaces to support such learning. However, authors seldom refer to spatial theories or theories about the

relationship between spaces and behavior. The implicit understanding for many authors seems to be that a change in design would or could give a change in behavior. Some researchers try to measure a possible correlation between learning space and learning behavior or learning results, struggling to isolate the spatial component from other components such as teachers' pedagogical beliefs or pedagogical practice. Other researchers refer to agency and thus give teachers and students a more active role in explaining the relationship between space and behavior.

In the 15 articles with a theoretical ambition, this relationship is further problematized and investigated, bringing in theoretical approaches and concepts from a variety of disciplines like philosophy, psychology, sociology, geography, biology, system theory and urban planning. Throughout these investigations, the relationship is seen as complex and dynamic, giving agency to both spaces and the constructors/users of the spaces and envisioning space, people and practices connected in a sort of assemblage or entanglement where they must be understood in relation to each other. Some refer to this as a socio-material perspective. In the following, we will briefly present these studies. Temple (2018) tries to summarize many different theories and positions on connections between space, agency, and human activities before arguing for using the concept of *place* rather than *space* and for bringing in perspectives from human capital theory in his approach to better understand this complex relationship.

Grellier (2013) takes a perspective building on 'philosopher Gilles Deleuze and psychoanalyst Félix Guattari's figuration of the rhizome [that] describes structures that are non-hierarchical and open-ended' (83) and states that the rhizome mapping is a strategy to give voice to marginal groups with little power in the commonly hierarchical structures of the university. Thomas (2010) offers a position where space and the learning taking place in that space is so integrated that they cannot be separated. He builds on theories of connectivism and principles of adaptive complex systems and claims that 'in this view, space and learning are inextricably linked, such that the space in which a particular type of learning takes place is an integral part of the definition of that particular kind of learning' (508). Acton (2017) argues for the use of a socio-material perspective on learning space to explore and understand a complex set of dynamic relationships. A socio-material perspective is also employed by Damşa, Nerland and Andreadakis (2019) in their contribution titled 'An ecological perspective on learner-constructed learning spaces'. These researchers understand space as being produced in an entanglement of people, social and material resources. Place-making is central to Swist and Kuswara (2016) when they combine it with activity system theory and the concept of affordance. Yeoman and Ashmore (2018) draws on 'Activity centred analysis and design (ACAD)' in their attempt to relate conceptual, social and material aspects when designing for learning. They claim that the ACAD framework conceptualizes learning activity as an emergent phenomenon that cannot be designed in advance but only indirectly influenced through design. Hawick, Cleland, and Kitto (2013) have a similar understanding of how space and place may affect and is affected by people, using the concepts of boundary objects, liminal space and Foucault's panopticon to provide a theoretical framework for their analysis. Beckers et al. (2015, 2016a, 2016b) build a conceptual model with a framework of 'Purpose-Process-Place' building among others, on Oldenburg's thinking about third spaces. Winks et al. (2019) refer to this framework when they analyze existing spaces in relation to creativity. In a series of articles (Kitto et



al. 2013; Nordquist 2016, 2015, 2016), a group of researchers develops the concept of learning landscape on four scales (classroom, building, campus and city) as a framework to explore a range of learning environments in the medical education curriculum.

Within our present systematic review, we have not attempted to thoroughly analyze and synthesize the wide variety of theoretical positions present in the articles above. It would be interesting and useful for this emerging field to have such an analysis. However, as this summary of the theoretical articles show, the field of learning spaces is in an ongoing attempt to broaden and deepen our theoretical understanding of the complex relationship between learning spaces and learning behavior. Furthermore, we see a movement towards an understanding of space as being produced in an entanglement of people, social and material resources.

## Discussion

The overall aim of this systematic literature review has been to map and discuss the field of research results on formal learning spaces in HE between 2009 and 2019. In the following section, we first discuss the results from a bird-eye's perspective on the field as such, including both our quantitative and qualitative analyses, and then we go into detail with the six existing themes, their extent and major points.

The 108 articles collected in this study show that the field of physical learning spaces is a wide-ranging field in at least three ways. One way is in terms of publication type. Articles on physical learning spaces in HE can be found in a variety of journals and accordingly, that learning spaces can be viewed from a variety of perspectives. In addition to the obvious journals such as the present journal and *Journal of Learning Spaces* we have found articles on physical learning spaces in journals with aims and scopes covering, for example, visual communication, environmental psychology, active learning and educational technology. Furthermore, when we investigate the selection of articles inside each theme, we find that these articles are also published in different journals. Consequently, even the theme on methods to evaluate learning spaces, for example, entails articles from journals with as different foci as learning spaces, quality in education, evaluation and assessment, design studies and disciplinary didactics. The second way is how wide-ranging the field is in the various definitions of what learning space means; from specific spaces such as Active Learning Classrooms (ALCs) and SCALE-UP with well-defined configurations and use to spaces that distinguish themselves from traditional spaces, so-called 'Innovative spaces' or 'Creative Hubs', to physical learning spaces in general, that is, any given physical space where formal learning takes place. Thus, the field encompasses both research of a more abstract nature on the relation between space and learning and very concrete attempts to argue for the effect of particular spatial settings. The third way is how the field is wide-ranging in its themes. In this regard, Ellis and Goodyear (2016) argue for three areas of research on learning spaces: pedagogy and curricula and their association to learning space; learning space and design; and the development of software tools that create virtual spaces in which students can learn. The third area is not represented here because of our focus on physical spaces. However, the six emerging themes in this review can be seen as elaborations and quantifications of Ellis and Goodyear's two other areas by mapping what we already know concerning relations, perceptions,



design processes and support to users, evaluation methods and theoretical considerations on space and learning.

With a wide-ranging field follows a risk of no cumulative development. The variety of perspectives, methods, and definitions of the core object may prevent us from learning from each other and moving the field onwards. In our review, the field is very fragmented; within the six themes described above, we do not find many crosslinks between articles. Even though more than 100 articles have been published since Temple's (2008) review, the accumulated knowledge in a very broad field is still thinly spread. The fragmentation can also be found in the lack of a time-related progression; the number of articles published has not become considerably larger over the years as one could have expected of an emerging field. On the other hand, bearing in mind the growing focus on online learning and thus a growing field of research on virtual learning spaces, one could have imagined that the number of articles on formal physical learning spaces may have decreased over the last ten years. However, this does not seem to be the case either. An obvious conclusion could be that the two tendencies in combination have leveled each other out. Ellis and Goodyear (2016) commented that for the combined field of physical and virtual learning spaces, fragmentation of a research field leads to slow progress (149), however, the same slow progress seems to be true for research on physical learning spaces alone. By using our mapping as a starting point for future research on, for example, how to engage academics in the design process or how students perceive their learning space, we hope to see more cross links and progression in the further development of the field.

This review echoes in many ways the conclusions of former reviews from five and ten years ago but also stands out from its predecessors in being a quantitative, systematic review on physical learning spaces alone. The systematic approach allows us to make conclusions on the research field per se in terms of six existing themes, their extent and major points:

- Most research is on relations between design, learning activities and learning results. Space cannot be isolated as a single cause to positive learning outcomes, but people, space, interaction and learning are intertwined.
- Closely connected is the theme on how space is perceived by teachers and students. Perception of space is emotional but also intertwined with the pedagogy used in the space.
- The research that covers different aspects of the design process, design principles and participatory design projects points at the need to involve users early in the design process.
- The literature on methods to evaluate the complex relationship between learning spaces and student learning is both scarce and fragmented.
- There are very few articles on how teachers are supported in their use of space. None of the articles look for evidence on the best way to support teachers, but highlight that support is needed.
- Most articles have no explicit theoretical perspective, but in the few that have we trace a movement towards an understanding of space as being produced in an entanglement of people, social and material resources and that many different theoretical perspectives are used to frame this understanding.

One overall tendency in the material is the search for evidence that space affects learning, and of ‘what works’. It is understandable, after all, as this is what we do on an everyday basis within higher education – trying to create the best possible learning environments for our students. Furthermore, there are numerous initiatives on the development of learning spaces where institutions are increasingly redesigning spaces or investing in new ones – hybrid spaces being the latest trend – and from an organizational perspective, those investments need to pay off. The search for ‘what works’ also resonates with a trend within educational research with a focus on evidence (Siegel and Biesta 2021). But is it a cul-de-sac? When it comes to learning spaces, the search for evidence seems to have a weak theoretical underpinning. Learning is complex, and what works one day in one setting, may not work another day – therefore, we need to acknowledge the complexity of learning. Here we draw on Illeris (2018), who states that all learning comprises dimensions of content, incentive and interaction. Thus, the movement in the field, towards a theoretical socio-material approach, is promising for how we can understand people, space and practices as entangled (Sørensen 2009; Mulcahy 2018).

When looking at the many different theoretical perspectives used to frame this understanding, we may wonder if the field really is under-theorized as previously claimed? Is the presence of so many different theories rather a sign of a field in the early stages of development, finding its way as a sort of peripheral participant in neighboring fields like educational science, architecture and geography?

A thorough philosophical investigation into the use of different theories in our field is welcomed. Future research could consider the development of the field in relation to its boundaries. What crossroads could be identified? What boundary objects are highlighted? Does the peripheral participation transform towards a more stable membership in certain theoretical fields? In this review, we have focused only on physical learning spaces, but is the division between physical and virtual still relevant? And how do we understand interaction and learning in hybrid learning spaces? In the light of the pandemic and aligned to post digital perspectives, there is a need for future research to focus on the reconceptualization of learning spaces in higher education. Furthermore, we can see a need for the development of new explorative research methodologies to critically investigate learning processes in our higher education spaces.

To sum up, mapping the landscape of research on the relation between learning and learning spaces shows the contours of a field, perhaps not in its infancy, as mentioned by Temple more than ten years ago, but then in its childhood. Certainly, the field has many exciting questions yet to be answered.

## Limitations

Restricting our review to strictly scholarly work with a focus on formal learning spaces in HE entailed limitations. However, our combined search strategies – database search, minor bibliographic cartography and search for publication patterns in eight journals – secured a broad selection of articles. Naturally, our decisions could have led to the exclusion of important research articles. We also acknowledge that our background, as researchers and educational developers with a special focus on learning spaces, can have affected, first and foremost, the thematic analysis. However, we view our

positionality as an asset for the study and strive for transparency throughout the review process to enhance the trustworthiness of our research.

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