A LEARNING SPACE ODYSSEY

RONALD BECKERS

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Exploring the alignment of learning space in universities of applied sciences with the developments in higher education learning and teaching

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PREFACE

It was February 2006, when I started as a lecturer at the HAN University of Applied Sciences (HAN). I noticed that not much had changed since the early 1990s, when I was a student in Eindhoven myself. Many classrooms were still equipped with chalkboards and I used an overhead projector with transparent sheets during my lessons. Occasionally, I requested for a beamer that together with a computer had to be delivered on a trolley so I could roll it into the classroom to install it. Students took notes with a pen on paper. Most of them already owned a mobile phone. Only a happy few could afford a laptop computer at that time, or even an advanced personal digital assistant (PDA), such as a Blackberry, which was released in 2003. The introduction of the first iPhone took another four years till 2007, and the iPad would arrive even three years after that; at the beginning of the year 2010. From that moment on, students took the outside world into the classroom with their mobile devices. As a lecturer I had to deal with students using MSN, email, Facebook, WhatsApp, YouTube, Web shops, Web logs, et cetera. The digitisation meant new opportunities for my lectures as well, e.g., using Digi boards, offering students Web lectures, and sharing information in virtual learning environments.

To put it briefly, five years after my first experiences as a lecturer in higher education, I noticed that higher education had changed and that this was only the beginning. As a lecturer and a father of two young children, I realised that traditional instructions in classrooms would come to an end. My role as a teacher was changing from 'the master' to 'the coach' and the role of the student changed from 'consumer' to

'prosumer'. As a facility professional, I was curious about how these changing roles and the evolving changes in the interaction between student and lecturer would influence the design of learning facilities and higher education buildings. Could we teach our future students in today's or even in yesterday's educational buildings? Were corporate real estate managers aware of the rapid changes in education, and how did they act in order to be prepared for these changes? Numerous questions popped up in my head; an ideal starting point for a PhD research!

I took up the challenge and in 2010 I started writing my proposition. Now, six years later, I look back satisfied and grateful for the opportunities I have had, all the skills I have learned, and the interesting people I have been able to work with. This is the place and the moment to express my appreciation and to mention the people to whom I owe finishing this PhD trajectory.

Of course in the first place I owe Karin, who has always been 'guide on the side'. You were there to support me, to listen, and to ask me the relevant questions that were needed for every next step in my research. I thank and love you for your patience and for being the anchor at home for me and the girls, especially at the end of my project when I was busy writing during the weekends and the holidays. Besides that, you have had a tremendous contribution to the design of my dissertation!

Next, I would like to thank Geert and Theo for being my supervisors. You guided my renewed acquaintance with the academic world after almost twenty years. Geert, from the very beginning you were confident that I would succeed in obtaining my PhD and you played an important role in my academic development. Even as a visiting professor at Stanford and as a dean at the University of Twente, you took the time to discuss my research and stimulated me to keep an eye on the big picture of my project. You enabled me to make my own choices and you supported my personal goals as an external and part-time PhD candidate. Thank you for that.

Theo, you really were my academic mentor. With you I discussed my dilemmas, uncertainties, doubts, struggles, and frustrations about rejected papers. With a lot of patience, you encouraged me, helped me, and taught me to develop myself as a researcher. I really enjoyed our meetings, your keen eye, your modesty, and your unremitting energy to support my journey. I am truly honoured to be the last PhD student of your academic career.

Next, I would like to thank the HAN University of Applied Sciences, for the opportunity and the support they gave me to do my PhD, besides

my job as a lecturer. Special thanks to Lilian who, as the then director of my department, persuaded me to start doing my PhD and who always expressed her faith at a successful result. Furthermore, I have to mention Marie-Elise and Nicole, who not only edited my English texts but above all helped me to improve my English writing skills! Also, I owe Sascha for introducing me into the wondrous world of statistics, and all my other HAN colleagues that empathised with me over the past few years.

Having supervisors at two universities was not always easy. Every other week I travelled to Enschede or Delft. Nevertheless, both places introduced me to many interesting academic colleagues, who I thank for the fruitful conversations about doing research and for their company during international conferences. Being a PhD candidate also led to valuable contacts with researchers at other *hogescholen* and with practitioners in the field of education, facility management, and corporate real estate management. Thank you all.

At the end of my research, I would like to acknowledge all the respondents in the several studies, such as the real estate managers and facility managers of the *hogescholen* who I interviewed at the beginning of my research, the students who filled in the logbooks, and the students who participated in the survey. I also express my gratitude to the students Aniek and Jill for their help with the data collection and the data entry of the almost 700 questionnaires. And I thank the Dutch Facility Management Association (FMN), who supported the deployment of Aniek and Jill.

Moreover, I need to thank my parents, Karin's parents, my brother Marcel and Maud. You followed my research with great interest and empathised with me in good times and in bad times. *Dank jullie wel voor jullie steun tijdens mijn promotieonderzoek de afgelopen paar jaar, maar vooral voor alle jaren ervoor die me gebracht hebben tot waar ik nu ben.*

My final thanks go to our two girls, Berit and Bente. *Meiden, vaak was ik die vader die boven in zijn kamertje zat te werken aan zijn promotieonderzoek. Natuurlijk was dat belangrijk voor mij, maar jullie zijn echt het allerbelangrijkste! Ik wens jullie veel geluk met jullie eigen zoektochten in het leven. Waar die ook mogen uitkomen; ik hou van jullie!*

Ronald Beckers
May 2016

SUMMARY

BACKGROUND, OBJECTIVES, AND RESEARCH QUESTIONS

This dissertation addresses the alignment of learning space with higher education learning and teaching. Significant changes in higher education the past decades, such as increased information and communication technology (ICT) and new learning theories have resulted in the dilemma whether higher education institutions can facilitate tomorrow's learning and teaching in today's or even yesterday's school buildings. In practice, this results in the managerial question: 'How can higher education institutions align the physical learning environment with the developments in learning and teaching?'.

Answering this question requires a focus on two perspectives: product and process. The process is related to the intangible aspects of the topic, such as corporate real estate management (CREM) processes that are pursued to achieve alignment. The product is concerned with the material side of the topic, namely: the physical learning environment itself.

Literature and practice show that there still is a lack of understanding of both the alignment process, and the product that results from this process in terms of the design of learning environments and learning environment typologies that fit user requirements and support new pedagogical approaches. Therefore, the main objective of this dissertation is twofold. First, it explores the alignment of higher education accommodation with higher education learning and teaching

developments. Second, it supports CREM decision-making to align learning spaces with the requirements that result from the developments in higher education. The main research question of this thesis is: 'Which aspects influence the alignment of learning space with developments in higher education learning and teaching?'. In order to address this question, five sub-questions were formulated (RQ1-RQ5). To answer each sub-question, five studies have been conducted resulting in five research papers. This chapter presents the key findings of the five studies and the overall conclusions of the research.

STUDY 1

Study 1 (chapter 2) aimed to answer RQ1: 'What are the spatial implications of the developments in higher education learning and teaching?'. The purpose of this study was to explore the spatial implications of new learning theories and the use of ICT in higher education. This chapter builds upon findings from different disciplines: education, didactics, CREM, and facility management. Based on a review of the literature, a theoretical framework was developed that visualises the spatial implications of developments in higher education. To further explore the spatial configurations that support changes in education, a comparative floor plan analysis was conducted at four Dutch Universities of Applied Sciences (UAS). Also, document analyses of annual reports and building walkthroughs were part of the study. The main findings show that traditional classroom space is progressively being replaced by a variety of learning settings to support contemporary learning activities. The research findings contribute to a better understanding of the alignment of learning space to the evolving needs from new ways of learning supported by advanced ICT, and can be used to support space planning in higher education.

STUDY 2

Based on the knowledge of the first study, the next step was to get in touch with the managers who are responsible for higher educational buildings and ask them for their view on the physical learning environment in relation to the developments in higher education institutions. Study 2 (chapter 3) aimed to answer RQ2: 'How are corporate real estate strategies and corporate real estate operating solutions aligned with the corporate strategies of higher education institutions?'. The substantial changes in higher education lead to evolving corporate strategies. Study 2 aimed to explore how CRE managers of higher education institutions formulate CRE strategies

and CRE operating decisions in order to align CRE with the corporate strategies of these organisations. An analytical alignment framework was developed, which was used to study the connections between CRE and corporate goals at 13 large Dutch UAS. The data collection included a content analysis of the strategic plans of these universities and interviews with CRE managers. The results of the study show various differences between the alignment of corporate strategies with the CRE strategies in the documents and CRE strategies that are applied in practice. It appears that the CRE strategies in-use are more clearly aligned with the corporate strategies than the espoused CRE strategies. Supporting user activities and cost control seem to be the main goals of the CRE strategies and the CRE operating decisions.

STUDY 3

The results of study 2 showed that the CRE managers of higher education institutions particularly apply CRE strategies and operating decisions in practice that are in line with the corporate strategies. An evolving question was, what do they do to achieve that? So, how do they manage the alignment of the accommodation with the needs of the organisation and its end users in practice. Study 3 (chapter 4) aimed to answer RQ3: 'Which management strategies do corporate real estate managers apply to align higher education accommodation with the user needs?'. The study first outlined the theoretical issues of CRE alignment processes and the management of accommodation needs. It therefore combined insights from disciplines, such as management and organisation as well as information technology with insights from CREM theory. Chapter 4 presents the findings of a multiple case study in 14 Dutch UAS from the perspective of the CRE manager. The empirical study was based on interviews and a questionnaire. The theory in this chapter shows three key process activities in managing the alignment of CRE with the organisation and the needs of the end users: coordination, communication, and decision-making. These three process activities result in two opposite management approaches or strategies that can be characterised by the level of user involvement and control orientation. The two management strategies can be used by CRE managers to reconsider the current process of aligning CRE with the needs and requirements of clients, customers, and end users. This may help to improve the match between demand and supply in order to define future-proof accommodation solutions.

STUDY 4

Apparently, supporting user needs is an important goal for CRE managers. However, study 3 showed that the largest group of users, students, is hardly involved in CREM issues. This may result in limited knowledge of CRE managers about students' needs and requirements. Study 4 (chapter 5) was conducted to answer RQ4: 'Which factors influence higher education students' actual learning space use?'. For this study a diary research method was adopted, in which 52 business management students of a Dutch UAS participated. The students reported which learning activities they worked on during a week, where, and why there. The diary format built on the literature from various disciplines and was used in combination with a questionnaire and interviews. The findings show that students' learning space use is particularly connected with their study activities. Students use different learning spaces for different activities. They mainly conduct individual learning activities at home and besides for scheduled instructions, students go to school to work in small groups with other students and for social activities. For these learning activities they mainly use learning spaces in open areas, corridors, hallways, atria, and lounges. Next to that, learning space use is related to aspects such as comfort preferences, personal control over the environment and the social influence of peers. Surprisingly, the students' living situation and the travel time to school are not correlated with the choice of where to study. Student characteristics, such as gender, age, and study year, are only to some extent related to differences in learning space use. The correlation of third places and ICT developments with learning space use is limited too.

STUDY 5

The actual learning space use depends on the availability of learning settings. Settings that are missing, cannot be used to support learning activities. Therefore, the final study of this dissertation explored which learning spaces students would use when they could choose from a set of available settings. Study 5 (chapter 6) aimed to answer RQ5: 'Which aspects influence the learning space preferences of higher education students?'. To answer this question, a quantitative study was conducted, based on a self-administered questionnaire that was filled in by 697 business management students at a Dutch UAS. The study focussed on individual study activities that require concentration, and on collaborative study activities with peers that require communication. The results show that students consider their physical learning environment to be relevant. In their perception it contributes to the results of their study activities. Students particularly link their learning

space preferences to their learning activities and their goal pursuit at that moment. These results endourse the findings of the diary study that showed a strong link between learning space use and students' learning acticities. For individual activities students prefer learning space at home. However, collaborative study activities with peers are preferably conducted at school. Irrespective of the two given study activities, students prefer quiet, closed learning spaces where they can retreat as an individual or as a small group. Public spaces are not popular for study activities. The findings show that behavioural aspects such as the preferred privacy, interaction, and autonomy, or characteristics of the physical environment (comfort of settings, aesthetics, technical resources and layout) are only to a certain extent significantly correlated with learning space preferences. Student characteristics, such as gender, age, study year, and living situation, have a significant, but limited influence on learning space preferences. The results of study 5 lead to the discussion for how students value their physical learning environment. Do educational buildings actually contribute positively to students' motivation, or is the physical learning environment mainly a commodity or a hygiene factor that may frustrate students when the environment is not satisfactory?

CONCLUSIONS

Chapter 7 of this dissertation presents the general conclusion and a discussion involving the practical and scientific contribution, based on the five conducted studies. The findings of the five studies in the dissertation contribute to a large diversity of insights in order to answer the main question of this dissertation. This concerned the aspects that influence the relationship between learning spaces and the developments in learning and teaching as well as the evolving requirements of the users in a broad perspective. As a general conclusion of the overall research, the results of the studies are summarised in three alignment mechanisms (indicated as I, II and III), which are presented in figure 1.

The first alignment mechanism (I) concerns the alignment process, referring to management approaches for how to align CRE with the perspectives of the organisation and its end users. Mechanism I involves the process activities of bringing demand and supply together, using different conceptions of the role of the user in alignment issues by focussing on coordination, communication, and decision-making. Depending on how coordination, communication, and decision-making are applied, several management approaches for the alignment process reveal, namely: a control-oriented approach, an involvement-oriented approach, or a combination of both approaches.

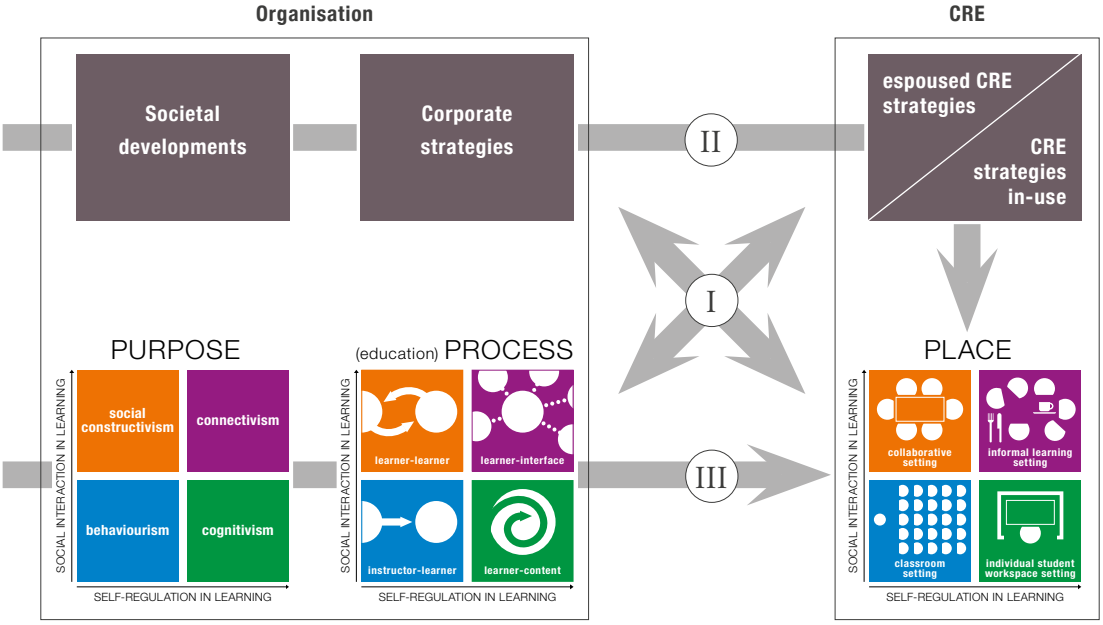

Figure 1

Learning space alignment model with three alignment mechanisms

The other mechanisms (II and III) can be seen as the result (product) of the alignment process activities of mechanism I. Based on the process activities of alignment mechanism I, CRE managers formulate their CRE strategies that are in line with the corporate strategies, which is presented as alignment mechanism II. In this alignment mechanism, CRE strategies show up as espoused strategies and strategies in-use. Differences between both types of strategies can disturb the alignment of CRE with corporate strategies. Also, these differences can lead to misalignment of CRE strategies with CRE operating decisions. The CRE strategies aim at creating a physical learning environment with learning spaces that fit the educational processes related to teaching and learning. The latter is shown in figure 1 as alignment mechanism III.

According to alignment mechanism III alignment occurs when the physical setting matches the educational process, which result from a specific learning theory. The alignment of learning space with the student needs is a relevant part of alignment mechanism III as well. Alignment particularly occurs when learning spaces match the learning activities of students.

CONTRIBUTION OF THE RESEARCH

This dissertation contributes in several ways to the literature. One of the main contributions of this research is that it not only builds upon different scientific disciplines, such as education, didactics, facility management, corporate real estate management, and learning space design, but also connects them by integrating them in several frameworks. Further research can build on these frameworks. Second, the research contributes to insights into the physical learning environment from an end-user perspective. Third, the research emphasises the differences between espoused CRE strategies and CRE strategies in-use. Also, it shows new insights in the processes that CRE managers can apply for involving the representatives of the demand side at several levels in CRE alignment issues. Finally, the research contributes to the literature through the combination of research instruments that are applied in the several studies, such as a comparative floorplan analysis, diary research, traditional interviews, and surveys.

RECOMMENDATIONS

The thesis presents practical recommendations for aligning learning spaces with learning and teaching developments in two main ways. The first is concerned with learning space planning, such as learning space design, flexibility of learning spaces, layout of education buildings, and spatial concepts for learning spaces. The recommendations can be summarised as:

- Create a learning environment that meets the increased variety in didactical approaches in higher education teaching supported by ICT.
- Create dedicated areas for learning communities. These include student areas, teaching staff areas, and areas for ad-hoc interaction and programmed instructions.
- Create therefore mixed zones with informal meeting space for contact between students and staff, as well as among staff or students for educational goals as well as for social purposes.
- Distinguish areas that particularly support study activities or social activities in educational buildings.
- Create activity-based learning environments for students that support concentration, routine work, and communication; not: 'one-size-fits-all'.
- Separate learning spaces for students from circulation areas, such as corridors; do not create learning spaces in corridors.
- Meeting space is close to circulation areas to stimulate encounters by chance.
- Experiment with hybrid instruction areas or intelligent classrooms that support new learning and teaching approaches where the teacher

is the ‘guide on the side’ for self-regulated students who work together in small groups supported by ICT-facilities.

The second category of recommendations is related to improving learning space management. This includes formulating appropriate CRE strategies, learning space use, and user involvement. Higher education institutions are recommended to organise user involvement not only when user information is needed for building adaptations or construction projects, but as an ongoing process. A next recommendation is to not only involve policy makers and course managers in CRE alignment issues, but also lecturers and especially students, which represent the largest user population in educational buildings. When formulating CRE strategies, CRE managers preferably focus on a balanced combination of CRE aspects related to effectiveness, efficiency, and experience. The focus depends on the purposes of the several stakeholders on the demand and supply side that are involved in CRE alignment issues. This requires mutual understanding and the development of a common ‘language’ regarding the alignment of CRE with educational purposes. Finally, CREM professionals would rather be involved in educational developments in an earlier stage for a better understanding of the requirements that result from changes in the core business. On the other hand, this may lead to a better understanding of policy makers, course managers, lecturers, and students of the added value of the physical learning environment for learning and teaching.

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INTRODUCTION

DEVELOPMENTS IN HIGHER EDUCATION LEARNING AND TEACHING 1.1

1.1.1 INTRODUCTION

This dissertation addresses the alignment of learning space in higher education with learning and teaching. Higher education has gone through substantial changes in the past decades (Johnson, Smith, Willis, Levine & Haywood, 2011; Robinson, 2010; Collis & Van der Wende, 2002). Today's schools should prepare young people for tomorrow's knowledge economy by teaching them 21st century skills (Voogt & Pareja Roblin, 2012; Robinson, 2010; Ananiadou & Claro, 2009). This demands a new scope on learning and teaching processes that build upon traditional behaviourist, cognitivist, and social constructivist learning and teaching approaches (Marais, 2011; Foster, 2008). These new ways of learning can be characterised as a shift from a supply-driven approach of learning to more customised and demand oriented ways of learning (Van Aalst & Kok, 2004). In 1995, Bar & Tagg foresaw that schools should change from a place of instruction to a place that produces learning (Barr & Tagg, 1995), where learning for students should be a co-production with their peers and their teachers, instead of simply consuming knowledge and instructions in a classroom. This requires self-directed students who take responsibility for their own learning process, and learn how to build and use networks, cooperate with others, and make use of information and communication technology (ICT) as a tool to find resources that can help them to achieve their learning goals. Twenty years later, in so-called flipped

classroom concepts (Abeysekera & Dawson, 2015), students use the Internet for watching web lectures at home or in other places and come to school to meet for social reasons, for working together on assignments, and for face-to-face contact with their tutors.

The changing context of higher education leads to reconsidering the physical learning environment and to studying how new learning spaces can be used to support an effective pedagogical transition (Marmot, 2012). There is much research available about new learning and teaching approaches in higher education, but the link with the physical learning environment is still an under-researched topic (Boddington & Boys, 2011; Temple, 2008). The research described in this dissertation aims to contribute to a better understanding of how higher education institutions align their school buildings and learning spaces with the developments in learning and teaching.

This introduction first explores the developments in higher education learning and teaching as well as the alignment of learning space with these developments. Then, it will elucidate the research objective and the research context. The introduction concludes with the research design and the outline of the dissertation.

1.1.2. NEW WAYS OF LEARNING

In the past century, educational approaches were dominated by traditional psychological theories such as behaviourism, cognitivism, and constructivism (Merriam, Caffarella & Baumgartner, 2007). In behaviourism, learning is basically linked to objective, observable changes in behaviour (Zimbaro, Johnson & McCann, 2009; Ashworth, Brennan, Egan Hamilton & Sáenz, 2004). This assumption is well-known by the stimulus-response experiments of Pavlov in the 1920s and Skinner's use of reinforcement to strengthen behaviour by operant conditioning in the 1950s (Zimbaro et al., 2009). In education, the behaviourist approach aimed at the reproduction of learned knowledge to show that learning had occurred. Techniques of rewards and punishments were used to stimulate learning behaviour. The behaviourist learning theory has long been, and still is, widely used in higher education classrooms. Shreeve (2008, p. 24) mentions lecture based learning as a "method of teaching [that] promotes superficial learning and utilises assessment methods that reward student reproduction of facts". Due to the results of increased research about knowledge processing in the brain, the behaviourist paradigm shifted to a cognitivist philosophy after World War II. Cognitivists such as Piaget, Vygotsky and Bruner believed that learning is a mental process, which is not necessarily observable in changed behaviour (Zimbardo et al., 2009; Illeris, 2007). Cognitivists focus on learning as a process of

meta-cognition in which concepts such as perception, memory, problem solving, creativity, and thinking are important (Ashworth et al., 2004). The ideas about cognitivism further evolved into the constructivist theory. This theory describes how learning happens and is derived from the idea that learners construct knowledge based on their experiences (Foster, 2008; Volman, 2006; Van Aalst & Kok, 2004; Shuell, 1988). Learners link new information to existing knowledge so every person constructs its own unique interpretation of reality. Constructivist theorists extended the traditional focus on individual learning to address the collaborative and the social dimensions of learning (Ashworth et al., 2004). This social constructivist approach supposes that learning results from social interaction and that knowledge and understanding are constructed when individuals engage socially and communicate with each other, through shared problems and tasks (Foster, 2008). An example of social constructivism in current higher education is problem based learning (PBL) (Shreeve, 2008; Kayzel, 2004), in which "[students work] in small learning groups, discuss and explore individual knowledge and research findings to arrive at a group solution or course of action" (Shreeve, 2008, p. 24). These and other social constructivist approaches require a different role of the teacher. According to Martin, Katz, Morris and Kilgallon (2007, p. 13), the role of the teacher needs to change from "the sage on the stage" to "the guide on the side". Leland and Kasten (2002) showed similar trends by comparing a traditional industrial model with a new inquiry model. The industrial model was devised after the factories at the end of the 19th century and the inquiry model resulted from developments in learning and teaching (table 1.1).

THE INDUSTRIAL MODEL VERSUS THE INQUIRY MODEL IN EDUCATION (DERIVED FROM LELAND & KASTEN, 2002) TABLE 1.1

	Industrial Model	**Inquiry Model**
Learning model	Behaviourism	Social constructivism
Purpose of education	Conformity, obedience	Critical thinking, creativity
	Prepare learner for factory job	Prepare learner for information/ technology
Structure	Classes graded by age	Multi-age classes
	Homogenous groups	Heterogeneous groups
Curriculum	Fact based, traditional skills	Problem solving, 21st century skills
Instruction	Text-based, transmission	Multiple sources, transaction
Assessment	Uniform, standardised	Authentic, diverse
Role of the student	Passive, receive knowledge	Active, construct knowledge
Role of the Teacher	Foreman, clerk	Co-learner, facilitator

The inquiry model of table 1.1 lays, just like PBL and other modern didactic approaches, the foundation for 'new learning' or 'new ways of learning'. New learning refers to new kinds of learning processes and

new instructional methods, which occur because society requires new learning outcomes (Simons, Van der Linden & Duffy, 2000). New ways of learning are a response to the perception that the traditional transfer model of knowledge in education is not satisfactory (Volman, 2006). This causes a shift in education from a supply-driven approach to a more demand-driven policy (Ashworth et al., 2004; Van Aalst & Kok, 2004). According to new learning approaches, students have to be active and self-regulative in their learning process. New ways of learning are linked to real issues and occur in real learning contexts. This comes to the fore in the concepts of authentic learning (Volman, 2006) and context-rich learning (Simons et al., 2000), which resulted into the development of communities of learning and practice (McLaughlin & Mills, 2008; Smith & Bath, 2006).

1.1.3 TECHNOLOGY IN EDUCATION

An additional driver for change is the availability of information and communication technology (ICT) in society and in education, enabling new ways of learning and teaching (Collis & Van der Wende, 2002; Prensky, 2001). The traditional learning theories such as behaviourism, cognitivism, and social constructivism existed without computer technology in education (Van der Zanden, 2009). The development of ICT in the classroom led to a new learning theory called connectivism (Marais, 2011; Siemens, 2005). Connectivism is an answer to the debate about changing learning theories due to alternative ways of information storage, processing, and recall through devices and through networked connections. Connectivism, like social constructivism, builds on interaction too, but goes further than the interaction between persons (Siemens, 2005). According to Siemens (2005), constructivists would likely see the network solely as a social medium for interaction, while a connectivist additionally sees the network itself (referring to all available information sources) as an extension of the human mind. So, not only learning from others, but also learning in as well as from social, digital or virtual networks. In connectivism, know-how and know-what are supplemented with know-where, which refers to the understanding of where to find knowledge that is needed (Siemens, 2005). As such, connectivism fulfils the need for teaching current students 21st century skills where learners move beyond content consumption and into stages of critical thinking, collaboration, and content creation (Downes, 2007). Also, connectivism is aware of globalisation in education as presented by Miller, Shapiro and Hilding-Hamann (2008). Connectivism shows opportunities in learning, which were impossible without ICT. This makes connectivism a learning theory for the digital age (Siemens, 2005).

A connectivist way of thinking matches the current generation students in higher education. These modern students differ in their use of

technology in daily life. Literature indicates this generation, born between 1985 and 2000, as screenagers (Bontekoning, 2008), generation Einstein (Boschma & Groen, 2007), the net generation (Oblinger & Oblinger, 2005) or digital natives (Prensky, 2001). They can always be online and can have access to the whole world for both social ends and educational needs. By bringing their devices into the classroom, this generation of students is a trigger for change in education (Veen & Vrakking, 2006). The increase of ICT in education makes it easier for students to have access to a huge source of data. The lecturer no longer has the exclusive rights on knowledge supply (Van Aalst & Kok, 2004). He or she has become one of the many sources in the students' network, which can be consulted for educational goals.

1.1.4 SIMILARITIES WITH NEW WAYS OF WORKING

The developments in the education sector are reminiscent of the changing needs of knowledge workers in the early 1990s, known as new ways of working (Vergunst, 2011). Literature and practice show a persistent attention for workplace innovations and new workplace design (Van Meel, 2012; Greene & Myerson, 2011; Maarleveld, Volker & Van der Voordt, 2010; Becker, 2004). In new offices, work is characterised by a high need for autonomy and interaction of the knowledge worker (Duffy, 2000). The developments in ICT make it possible to work 'anytime, anyhow and anywhere'. New ways of working have resulted in a shift in the design of workspaces. In new offices, space is designed to stimulate meeting. Office buildings progressively look like grand cafés, restaurants, and trendy clubs combined with flexible non-assigned activity-based places for concentration work, formal and informal meetings, and all kinds of information-processing activities.

Research concerning workplace design does not only focus on the physical office environment. From the beginning, publications like 'Workplace by design' of Becker & Steele (1995) and 'The New Office' of Duffy (2000) tried to picture a holistic view of workplace design by linking place to people and process, and discussing the subject in relation to developments in ICT, work processes, and individual preferences of office users. An important characteristic of new ways of working is that developments in ICT changed the time - place nexus, resulting in a concept of hybrid spaces where knowledge workers have the choice for synchronous and asynchronous interaction on different times and at different places (Kojo, Nenonen & Rasila, 2011). New ways of working are associated with several 'space' dimensions, like physical, virtual, social, emotional, and mental space. In essence there are four focus points in terms of new ways of working, represented by two opposite values (Beckers & Van der Voordt, 2013):

an organisational focus ↔ a focus on the individual knowledge worker
the physical workplace ↔ the virtual world

These four focus points lead to four basic principles of new ways of working, underpinned by literature (table 1.2). The organisational focus is concerned with the changing roles and the shifting relationship between managers and employees. Knowledge workers have to be managed based on results (output-oriented leadership). The individual focus refers to knowledge workers that are self-directed and have varying needs for autonomy and interaction in their activities.

The virtual world is the enabler of working anytime and at any place and makes free and unlimited access to information possible. The physical workplace has to be tuned to knowledge workers being able to work anytime and anywhere. The office workplace supports the need for meeting others and also the need to do concentrated work. Concerning the four focus points (organisational/individual and physical/virtual), literature shows many similarities between new ways of working and new ways of learning (table 1.2).

1.2 ALIGNING LEARNING SPACES WITH LEARNING AND TEACHING IN HIGHER EDUCATION

Table 1.2 shows that just as in new ways of working, new ways of learning and the increased use of ICT in education have influenced the relationship between students and teachers, the relationship among students, and the way these relationships are supported by learning spaces (Long & Holeton, 2009; McLaughlin & Mills, 2008; Jamieson et al, 2000). Originally, Oblinger (2005, p. 15) defined learning spaces in higher education as "regularly scheduled physical locations designed for face-to-face meetings of instructors and students". Due to the new trends in learning and teaching, other studies used the term learning spaces in a broader context as the facilities where learning takes place (JISC, 2006, Marmot, 2006). According to Brown (2005, p. 12.4). "[l]earning spaces encompass the full range of places in which learning occurs […]". The relationship between learning and teaching and the environment in which learning and teaching takes place has been widely studied (Higgins, Hall, Wall, Woolner & McCaughey, 2005). Higgins et al. (2005) studied more than 200 academic references, which show that particularly basic variables of the physical environment such as air quality, temperature, noise, and several design features influence educational processes and student performance. However, according to Fisher (2005, 2001), the real impact of school buildings on learning and

BASIC ASSUMPTIONS OF NEW WAYS OF WORKING AND NEW WAYS OF LEARNING - COMPARISON FROM LITERATURE (ADAPTED FROM BECKERS & VAN DER VOORDT, 2013)

TABLE 1.2

	New ways of working	New ways of learning
Organisational	Changing roles and relationships between managers and employees (Baane et al., 2010). Output-oriented leadership: knowledge workers are managed on results (Baane et al., 2010).	The teacher does not have the monopoly on knowledge. This leads to new didactical forms and a shift in the relation teacher – student. The role of the teacher is changing from 'the sage on the stage to the guide on the side' (Martin et al., 2007).
Individual	Distinction of different types of knowledge workers (Green & Myerson, 2011). Individualisation of the employee: not one size fits all, but one size fits me (Baane et al., 2010).	Characterisation of new learners with different needs and preferences: – homo zappiens (Veen & Vrakking, 2006) – net generation (Oblinger & Oblinger, 2005) – digital natives (Prensky, 2001) Individualisation of the student. From one size fits all towards individual learning routes (Veen & Vrakking, 2006).
Virtual	The virtual organisation (Sotto, 1997). Development of the virtual world in knowledge work like Skype, video conferencing, E-business; groups and networks in the cloud (Kojo et al., 2011).	The development of the virtual world in the classroom like the flipped classroom, blended learning, E-learning, distance learning, web lectures; social media used in education; digital learning environments; groups and networks in the cloud (Abeysekera & Dawson, 2015; Veen & Vrakking, 2006; Oblinger & Oblinger, 2005; Jamieson et al., 2000).
Physical	Diversity of spaces that support the need for autonomy and interaction (Duffy, 2000). The new office (Van Meel, 2012). An increasing use of public places (Fruianu et al., 2011; Oldenburg, 2001). The increase of elements from the experience economy (Pine & Gilmore, 1996) in office environments (Jensen et al., 2013)	Traditional classroom space is being replaced by a variety of learning settings in school buildings and at campuses (Beckers et al., 2015a; Marmot, 2006; JISC, 2006; Fisher, 2005). Increasing fun elements in school buildings, such as grand cafés, restaurants, lounge seats, experience centres (Beckers et al., 2015b).

teaching is mainly theoretical rather than empirically proven. In practice there are many intervening variables that obscure the relationship between learning spaces and learning activities of students (Gislason, 2010). It is likely that a good teacher in a bad building will lead to better results than a poor teacher in a very well utilised building. Nevertheless, the past decades even more studies have addressed alignment of learning space characteristics and learning and teaching approaches in higher education.

Alignment can be described as bringing into harmony things that differ or could differ. Regarding to buildings, there are two perspectives that are relevant for aligning the properties a building should have with its intended use (Szigeti & Davis, 2005; Spekkink & Jasuja, 2005). On the one hand, there is the demand perspective that refers to the requirements of the organisation and its end users. On the other, there is the supply perspective that refers to the characteristics of the physical environment (figure 1.1). According to the philosophy of performance-based building, Szigeti and Davis (2005) argue that representatives of the organisation and the end users (demand side) should formulate why they require a built facility and what their requirements are, in terms of the expected results of the core processes. In other words, the demand side is supposed to think about what a building facility is required to do for the organisation and the end users, and not what it should look like (Szigeti & Davis, 2005). The know-how about which building solutions are needed to meet the formulated requirements is situated at the supply side. However, the alignment between demand and supply that is needed to compare and match requirements and possible solutions is a joined responsibility.

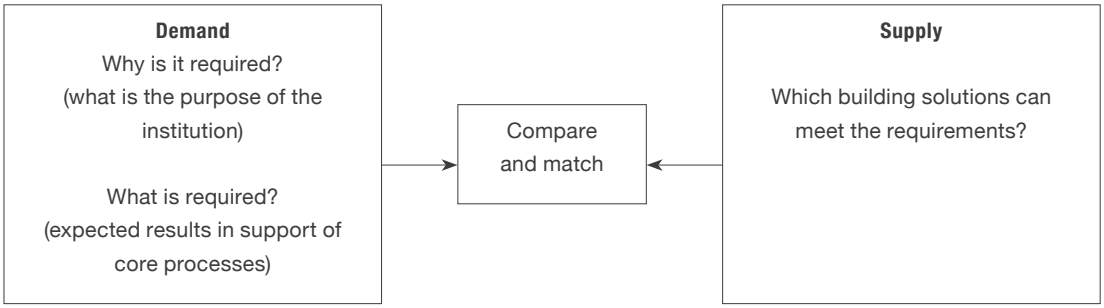

Figure 1.1
Performance based building (derived from: Szigeti & Davis, 2005)

The perspectives of figure 1.1 show up in studies into learning spaces as well. Based on an extended literature review, Temple (2007) concludes that literature is related to either the use of learning space in higher education (demand side) or to managerial and design issues related to learning space, such as providing learning space, real estate development, and campus facilities (supply side). Comparing and matching demand and supply is quite a challenge (Szigeti & Davis, 2005), and is not widely studied in higher education environments (Temple, 2007). Szigeti and Davis (2005) mention that the demand and the supply side use different languages. Long and Holeton (2009) plea for a common language to establish mutual understanding among the involved parties from both sides. Nevertheless, several studies have attempted to define principles to show how learning spaces could be developed integrally with special interest for students, pedagogy, school building,

and technology (Beckers & Van der Voordt, 2013; Harrop & Turpin, 2013; Riddle & Souter, 2012; JISC, 2006; Oblinger, 2005; Jamieson et al., 2000). Yet, the different perspectives and interests of the demand side and the supply side, make the alignment of learning space with the developments in higher education complex.

RESEARCH OBJECTIVE 1.3

As outlined in the foregoing sections, learning and teaching in higher education have undergone substantial changes. These developments in education are expected to have consequences for the alignment of higher education accommodation with learning and teaching. For higher education institutions, the main challenge for the future is how they can facilitate tomorrow's learning and teaching in today's or even yesterday's school buildings. In practice, this results in the managerial question: 'How can higher education institutions align the physical learning environment with the developments in learning and teaching?'. Supporting higher education institutions with recommendations requires insights in the 'product' that is needed for alignment with educational developments, such as the design of learning environments and how these learning environments are experienced and used, as well knowledge about requirements of the organisation and the end users for learning environments. It also demands knowledge about appropriate methods and tools for applying corporate real estate management (CREM) processes that are pursued to achieve the alignment of physical learning environments with developments in higher education institutions.

There is still a lack of understanding in how to align the physical learning environment with the requirements that result from developments in higher education learning and teaching. Therefore, the objective of the research in this dissertation is twofold. First, it explores the alignment of higher education accommodation with higher education learning and teaching developments. Second, it supports CREM decision-making to align learning spaces with the requirements that result from the developments in higher education.

Based on these two objectives, the main research question of this thesis is: 'Which aspects influence the alignment of learning space with developments in higher education learning and teaching?'

To address this main research question, the following sub-questions will be answered in this dissertation:

RQ1: What are the spatial implications of the developments in higher education learning and teaching?

RQ2: How are corporate real estate (CRE) strategies and corporate real estate operating solutions aligned with the corporate strategies of higher education institutions?
RQ3: Which management strategies do corporate real estate managers apply to align higher education accommodation with the user needs?
RQ4: Which factors influence higher education students' actual learning space use?
RQ5: Which aspects influence the learning space preferences of higher education students?

These sub-questions fit relevant alignment issues in order to connect the demand and the supply side of higher education buildings. RQ1 aims to explore how higher education buildings match the developments in higher education learning and teaching. Next, RQ2 and RQ3 refer to identifying how managers, who are responsible for the supply side, act in line with these developments. The key aspect of RQ2 concerns the content of CRE strategies that are formulated to match corporate strategies. The key aspect of RQ3 is concerned with the process of managing alignment of supply with demand. Finally, RQ4 and RQ5 focus on investigating the alignment of higher education buildings specifically from the perspective of students as an important user group. RQ4 aims at the actual use of learning spaces by students, where RQ5 aims to study the students' preferences for their physical learning environment.

1.4 RESEARCH CONTEXT

1.4.1 DUTCH HIGHER EDUCATION

The studies in this thesis have been conducted within the context of Dutch higher education. Dutch higher education has a binary system, which means that a distinction is made between research-oriented education [wetenschappelijk onderwijs – WO] at universities and higher professional education [hoger beroepsonderwijs – HBO] at Universities of Applied Sciences (UAS) [hogescholen] (EP-Nuffic, 2015a). This distinction has continued after the introduction of the bachelor's-master's degree structure according to the Bologna declaration (1999). Both types of higher education have its own admission requirements, programme duration, and titles (EP-Nuffic, 2015a). The total number of students in higher education is approximately 700 thousand (in 2014). Approximately 35% of this number is enrolled at one of the fourteen research-oriented universities (253,482 students) (VSNU, s.d.) and 65% at various UAS (434,509 students) (Vereniging hogescholen, s.d.).

To accommodate all these students the total higher education sector (research universities and UAS) together uses 4.4 Million square meters gross floor area (Van Elp & Zuidema, 2013).

1.4.2 DUTCH UNIVERSITIES OF APPLIED SCIENCES

The research scope of the present thesis is focussed on Dutch UAS. In 1983, there were 375 UAS (at that time called institutions of higher professional education) in the Netherlands with 200,090 students (Van Bemmel, 2014). Currently, the number of government-funded UAS is reduced to 37 mainly large institutions that educate 5% of the total number of pupils and students in the Dutch education system[1] (Vereniging hogescholen, s.d.). Additionally, there are 62 commercial institutes that offer higher education courses (CHOI, 2015). These institutes are mainly focussed on adult education and both the institutes and their students cannot rely on financial support of the government. Due to the heterogeneity of the studied objects, this dissertation focusses on the government-funded UAS only. The 37 funded UAS offer bachelor education in seven sectors or domains, namely: Economics, Social sciences, Health, Arts, Agricultural, Education, and Engineering technology. The Economics domain is with 41.4% the largest sector (in 2014). The Agricultural domain has the lowest percentage of students in higher professional education (2.4%). The number of students per domain is shown in table 1.3.

[1] The position of the UAS in the Dutch education system is illustrated in appendix A of this dissertation.

NUMBER OF (BACHELOR) STUDENTS IN DUTCH UAS PER SECTOR (VERENIGING HOGESCHOLEN, S.D.)

TABLE 1.3

Sector	1975	1985	1995	2005	2010	2011	2012	2013	2014	% (2014)
Economics	7,100	31,800	75,800	125.700	166,908	171,503	170,404	177,548	179,814	41.4%
Social sciences	20,800	26,500	73,100	49.500	50,738	52,366	52,517	54,321	54,170	12.5%
Health	11,300	22,200	21,800	30.500	36,805	38,370	39,941	43,389	43,279	10.0%
Arts	14,800	19,900	18,300	19.500	19,099	18,696	18,087	17,838	17,383	4.0%
Agricultural	3,000	6,500	9,200	7.900	8,889	9,090	9,265	9,907	10,392	2.4%
Education	99,200	51,900	52,400	69.100	54,940	53,499	50,534	51,459	51,539	11.9%
Technology	30,800	40,500	54,800	57.700	65,976	68,230	69,837	74,245	77,932	17.9%
Total	**187,000**	**199,300**	**305,400**	**359.900**	**403,355**	**411,754**	**410,585**	**428,707**	**434,509**	**100.0%**

Table 1.3 shows a steep increase of the number of students in Dutch UAS over the past 40 years. The development of the student population from 2000/01 is shown in figure 1.2 (OC&W, 2015).

Figure 1.2 also shows a forecast for the student population till 2030/31. The expectation is that the student population for Dutch UAS will still increase the next few years till 2020. After 2021, the population is expected to decrease, due to the demographic developments.

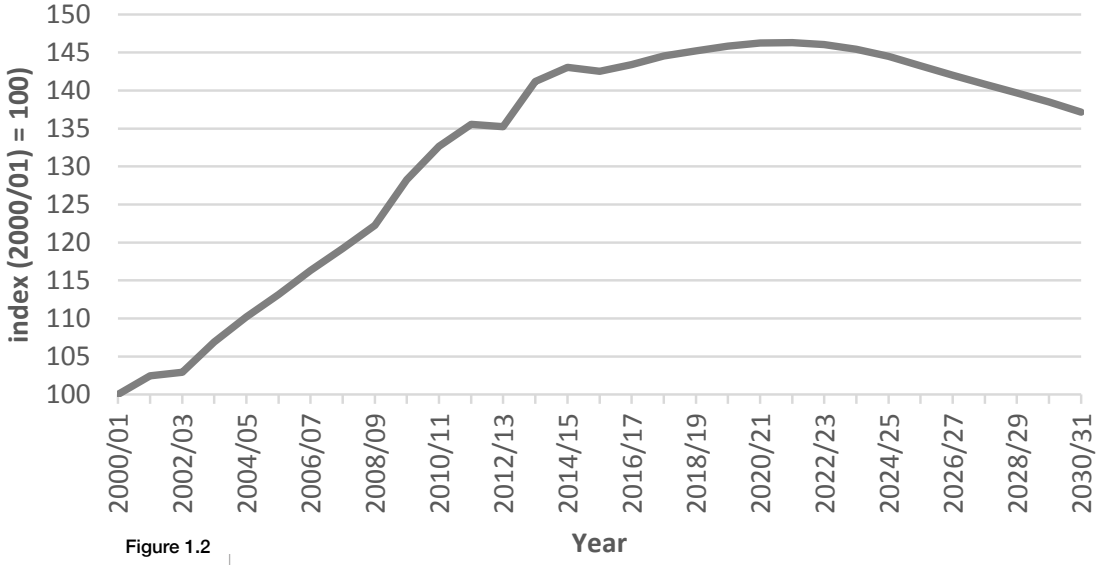

Figure 1.2
Development and trend in UAS student population (derived from OC&W, 2015)

Table 1.4 shows the number of enrolled students for all 37 Dutch UAS. The size of the organisations varies strongly, from a very small school with 440 students (Iselinge Hogeschool) to a large institution with 47,581 students (Hogeschool van Amsterdam). Table 1.4 also shows that the UAS can be divided into multi-sector institutions and single-sector institutions. The latter mainly occurs in the sectors of Education, Agriculture, and Arts. Many of the UAS in table 1.4 offer (professional) master courses as well. Compared with the enrolled number of students in the fourteen research-oriented universities in the Netherlands, the number of master students in UAS is low. This is because most of the master tracks in UAS are commercial activities and not government-funded.

The Dutch UAS are autonomous in the allocation of their revenues. Table 1.5 gives an overview of the allocation of the financial resources of all Dutch UAS (Vereniging hogescholen, 2013). Table 1.5 shows that, mostly due to the increased number of students, the total revenues of Dutch UAS have increased in the last years. More students result in more personnel and thus more personnel costs. According to the last figures from 2012, the Dutch UAS employ 43,549 people (teachers and staff). This is an increase of 5.8% regarding to the year 2009. The costs for real estate are approximately 6% of the total costs and have been more or less stable during the last years. Yet, compared to 15 years ago the costs for real estate have been reduced to half of the percentage in 1997. Then, the real estate costs added up to 12% of the total costs (De Vries, 2007).

DUTCH UAS (VERENIGING HOGESCHOLEN, S.D.) TABLE 1.4

	University of Applied Sciences (hogeschool)	Multi sector	Single sector	Bachelor students (2014)		Master students (2014)	
1	Amsterdamse Hogeschool voor de kunsten		Arts	2,298	0.5%	612	5.1%
2	Artez Hogeschool voor de kunsten		Arts	2,660	0.6%	263	2.2%
3	Avans Hogeschool	x		28,432	6.5%	53	0.4%
4	Chr. Hogeschool Ede	x		4,107	0.9%	17	0.1%
5	Chr. Hogeschool Windesheim	x		18,750	4.3%	1,158	9.6%
6	Codarts, Hogeschool voor de kunsten		Arts	846	0.2%	179	1.5%
7	Design academy Eindhoven		Arts	603	0.1%	109	0.9%
8	Driestar educatief		Education	1,313	0.3%	53	0.4%
9	Fontys Hogeschool	x		41,703	9.6%	2,613	21.6%
10	Gerrit rietveld academie		Arts	667	0.2%	159	1.3%
11	Haagse Hogeschool (HHS)	x		25,324	5.8%		0.0%
12	Hanzehogeschool Groningen	x		26,247	6.0%	356	2.9%
13	HAS Hogeschool		Agricultural	2,797	0.6%		0.0%
14	Hotelschool Den Haag		Hotel	2,167	0.5%		0.0%
15	Hogeschool de Kempel		Education	781	0.2%		0.0%
16	Hogeschool der kunsten Den Haag		Arts	1,222	0.3%	305	2.5%
17	Hogeschool Inholland	x		28,283	6.5%	272	2.3%
18	Hogeschool Ipabo		Education	911	0.2%		0.0%
19	Hogeschool Leiden	x		9,227	2.1%	95	0.8%
20	Hogeschool Rotterdam	x		33,467	7.7%	479	4.0%
21	Hogeschool Utrecht	x		33,554	7.7%	2,895	24.0%
22	Hogeschool van Amsterdam	x		47,581	11.0%	529	4.4%
23	Hogeschool van Arnhem en Nijmegen	x		31,821	7.3%	573	4.7%
24	Hogeschool voor de kunsten Utrecht		Arts	3,746	0.9%	190	1.6%
25	HZ university of applied sciences	x		4,823	1.1%		0.0%
26	Iselinge Hogeschool		Education	440	0.1%		0.0%
27	kath. pabo Zwolle		Education	705	0.2%		0.0%
28	Marnix academie		Education	1,423	0.3%	194	1.6%
29	NHL Hogeschool	x		11,719	2.7%	417	3.5%
30	Nhtv internationale Hogeschool Breda	x		7,444	1.7%	40	0.3%
31	Saxion Hogeschool	x		25,190	5.8%	170	1.4%
32	Stenden Hogeschool	x		10,839	2.5%	62	0.5%
33	Thomas More Hogeschool		Education	589	0.1%		0.0%
34	Van Hall Larenstein		Agricultural	4,193	1.0%		0.0%
35	Viaa		Education	1,692	0.4%		0.0%
36	Vilentum Hogeschool		Agricultural	2,741	0.6%	73	0.6%
37	Zuyd Hogeschool	x		14,204	3.3%	212	1.8%
	Total			**434,509**	**100.0%**	**12,078**	**100.0%**

Two reasons for the decreasing real estate costs are the growing awareness of the substantial contribution of real estate to the financial result of higher education institutions and the focus on efficiency in the management of real estate (De Vries, 2007). This resulted in a decline of the number of square meters per student.

TABLE 1.5 FINANCIAL OVERVIEW OF DUTCH UAS (VERENIGING HOGESCHOLEN, 2013)

Financial overview (x 1,000 euro)	**2009**	**2010**	**2011**	**2012**	**2013**
Total revenues	3,300,863	3,528,454	3,656,169	3,685,206	3,827,204
Personnel costs	2,354,171	2,463,581	2,618,406	2,703,447	2,781,753
Real estate costs	216,582	223,359	223,892	226,527	230,411
Other costs	682,993	707,444	717,268	694,421	707,281
Total costs	3,253,746	3,394,384	3,559,566	3,624,394	3,719,445
Result	47,116	134,071	96,603	60,812	107,759
% of total cost					
Personal	72.4%	72.6%	73.6%	74.6%	74.8%
Real estate	6.7%	6.6%	6.3%	6.3%	6.2%
Other	21.0%	20.8%	20.2%	19.2%	19.0%
	100%	100%	100%	100%	100%

TABLE 1.6 RESEARCH METHODS AND TECHNIQUES FOR EACH STUDY AND THE LINK WITH THE RESEARCH QUESTIONS

Research questions	**Research methods and techniques**
RQ1: What are the spatial implications of the developments in higher education learning and teaching?	Study 1: literature study, comparative floor plan analysis of school buildings, document analysis, and building walkthroughs (N=4).
RQ2: How are corporate real estate strategies and corporate real estate operating solutions aligned with the corporate strategies of higher education institutions? → content of CRE strategies.	Study 2: literature study, document analysis, and interviews with CRE managers (N=13).
RQ3: Which management strategies do corporate real estate managers apply to align higher education accommodation with the user needs? → process of CRE management.	Study 3: literature study, document analysis and interviews with CRE managers (N=13) (same data as in study 2) and additional questionnaires filled in by CRE managers (N=13).
RQ4: Which factors influence higher education students' actual learning space use? → which space do students actually use.	Study 4: literature study, questionnaires filled in by students (N=52), students' diaries/logbooks (N=52), and interviews with students (N=8) in small groups.
RQ5: Which aspects influence the learning space preferences of higher education students? → which space would students prefer.	Study 5: additional literature study and a survey based on questionnaires filled in by students (N=697).

RESEARCH DESIGN

1.5.1 RESEARCH METHODS AND TECHNIQUES

To answer the research questions, five studies have been conducted for which several different research methods and techniques have been applied (table 1.6). All studies have been submitted to or published in double blind refereed scientific journals (chapter 2-6). In this section, the methods, techniques and research procedures will be further elucidated in detail for each study.

Study 1

The first study had its starting point in the developments in learning and teaching in higher education. Based on theories from several fields, such as education, didactics, CREM, and FM a framework was developed that connects traditional and new learning theories to higher education processes, and relates these to learning and teaching settings. Based on the literature, it is expected that higher education learning and teaching is shifting towards a combination of more self-regulation and more social interaction of students in their learning process. Consequently, it is expected that this will be represented in new higher education buildings. Therefore, an empirical study was conducted to analyse the floor plans of four higher education buildings. Three relatively recent buildings were compared with an older, more traditional education building. The buildings accommodated comparable higher education courses. To get informed about the accommodated UAS, their strategic plans and annual plans were studied and used as context information. The floor plans with the spatial functions and the number of square meters of each room were provided by the participating UAS. Before studying the floor plans, all four buildings were studied by a building walkthrough. Pictures were taken of learning spaces to identify spatial settings that corresponded with the settings in the conceptual framework. Next, the floor plans were studied and analysed based on the four particular spatial settings of the conceptual framework. Finally, we made an overview of the amount of space dedicated to a specific learning setting, to see the changes over time.

Study 2

The second study had its focus on the CRE/FM managers who are responsible for higher education buildings. We were curious about three topics: which changes in higher education learning and teaching do these managers perceive, how are they dealing with these potential changes in terms of CRE strategies and CREM processes, and which concrete measures did they take to align the physical learning

TABLE 1.7 INTERVIEWS AT 13 DUTCH UAS

Date of interview	Participating UAS	Respondent
October 11, 2011	Hogeschool van Arnhem en Nijmegen	FM manager
October 24, 2011	Christelijke Hogeschool Ede	FM manager
October 25, 2011	Hogeschool van Rotterdam	Accommodation manager
November 3, 2011	Fontys, Eindhoven	CRE manager
November 17, 2011	Avans Hogeschool, Breda	Accommodation manager
November 18, 2011	Inholland, Hoofddorp	Accommodation manager
November 24, 2011	NHTV, Breda	FM manager
November 30, 2011	Hogeschool van Amsterdam	FM manager and CRE manager
December 21, 2011	Haagse Hogeschool, Den Haag	FM manager
February 3, 2012	Hanze Hogeschool, Groningen	CRE manager
February 3, 2012	Saxion Hogeschool, Deventer	CRE manager
February 7, 2012	Zuyd Hogeschool, Heerlen	Accommodation manager
February 13, 2012	Hogeschool Windesheim, Zwolle	CRE manager

environment to these changes? Therefore, the CRE/FM manager of the 17 largest Dutch multi-sector UAS were asked to participate in an interview, of which 13 agreed. The open interviews were semi structured, based on the three above mentioned topics. The dates of the interviews and the participating UAS are shown in table 1.7.

The interviews varied in length from 1 hour to 1.5 hours. All interviews were tape recorded and transcribed in Word. In advance of the interviews, the strategic plans and/or annual reports of the participating Dutch UAS were collected and studied.

After collecting the data, the interviews and the information of the corporate plans were inserted in Atlas.ti for further analysis. The data from the interviews and the plans were coded based on two theoretical frameworks. First, a framework with ten CRE strategies that evolved from the literature. The data of the interviews and the strategic plan were labelled in Atlas.ti by the author of this dissertation. The CRE strategies that evolved from the interviews in the UAS were linked to the ten CRE strategies from the literature. The corporate strategies that evolved from the strategic plans were linked to these ten CRE strategies from the literature too, just like the CRE operating decisions that were mentioned in the interviews. Second, a framework that distinguishes four types of alignment between the corporate strategy, CRE strategies, and CRE operating decisions, was used to further analyse the interview data and the data from the strategic plans. The data analyses were conducted by the author of this dissertation as well.

To obviate potential bias in the coding and analysis of the data, the interpretations of the researcher were discussed many times during the

study with the two supervisors of this PhD research. The analysed data from the interviews and the plans were used to study the four types of alignment between organisational strategies and real estate strategies.

Study 3

This study built on the interview data from study 2. Where study 2 focussed on the 'content' of the organisational strategies, CRE strategies, and operational decisions, study 3 aimed at exploring the management 'process'. Therefore, in study 3 another theoretical framework was used to analyse the data. The framework built on management literature and literature from building planning disciplines and CREM, and included three main activities in managing CREM processes: coordination, communication, and participation. Just like in study 2, the interview data were coded by the author of this dissertation, by using Atlas.ti, according to the three CREM process activities from the framework and the developments in Dutch higher education. After analysing the interview data, the author of this dissertation was invited for a meeting with CRE/FM managers of Dutch higher education institutions in Wageningen (May 23, 2014). The managers who attended the meeting were asked to fill in a questionnaire to get more detailed information about their opinions and management approaches regarding the developments in higher education and the three activities for managing CREM processes. Not all the UAS that had participated in the interviews were also present at the management meeting. The non-attenders received the questionnaire directly after the meeting by email with the request to fill it in. Finally, the managers of 13 UAS participated. Seven of them were also interviewed before in the period of October 2011 till February 2012. Because some of the managers switched jobs, their successors or another representative filled in the questionnaire. The questionnaires were filled in manually and the data were inserted in SPSS by the researcher. SPSS was used for the descriptive statistics. The data from the interviews and the questionnaires were analysed, compared, and used to explore similarities and dissimilarities in managing the alignment of higher education buildings with educational changes. Like in study 2, the coding and analyses were discussed during the study with the two supervisors of this PhD research.

Study 4

The fourth study started with an exploration of the literature on learning activities, learning and teaching spaces, and learning space use. The literature was used to build a diary format. The research involved students of the HAN UAS, who were enrolled in four business management courses in Nijmegen. The students were randomly selected

with an announcement on the Facebook page of one of the courses and with an appeal by tutors of the four courses, who requested students during their classes to participate. The 56 students, who applied for participation in this diary research, were invited for a brief introduction meeting of 45 minutes in small groups of 8 to 10 students. 54 students attended one of these meetings. During the meetings the students filled in a questionnaire with personal questions about gender, age, study year, living situation, traveling time to the university, and work commitments next to their study. Furthermore, the researcher (the author of this dissertation) introduced the purpose of the study and the diary format in a short presentation. The diary format had been pretested with 10 students, who filled in the format for one morning or afternoon to check for faults and comprehensibility of the answering categories. The students who pretested the format did not participate in the diary study itself. It came to the fore that some of the learning activities needed further explanation and some of the motivations had to be rephrased for clarity. During the introduction meeting the students were asked to fill in the diary format with the activities that they had applied during that day, to get familiar with the format and to give them the opportunity to ask questions. At the end of the meeting the students received a printed diary logbook. To encourage them to fill in the format daily, the students were told that two gift vouchers of € 100,- would put up for raffle among all students who participated in the kick-off meeting and who would return a completed diary.

Finally, the students were asked to fill in the diary format for one school week in the period from Monday till Friday from 12-24 May 2014. Both the digital and the printed logbook started with a short introduction with the purpose of the study and information how to fill in the pages of the logbooks. The logbook pages contained a table per day. The students were asked to fill in the date and their name before starting to fill in the table. They could also choose to fill in the diary logbook in an Excel format, which they had received by email. The participants had to report a number for each study related activity (what), a letter for the location of that activity (where) and also a letter related to the reason for especially using that location for that activity (why). For each location the respondents could give a maximum of two reasons to motivate the use of that location. If necessary, a respondent could supplement the categories with other possibilities than the prescribed items. The diary format itself is presented in chapter 5 of this dissertation. Every student got a specific week in which they were asked to fill in their diary. During that week, these students received an email at the start of each day, with a picture or a cartoon, to encourage them to think about their diary logbook that day. At the end of the period, the students received a personal email to thank him or her for filling in the format en to ask

them to return the filled in logbook to the researchers mailbox. Only 2 students did not return their logbooks. The digital format was used by 17 students. The other 35 used the printed logbook.

All the logbooks were inserted in an SPSS format for descriptive statistics and correlational analyses. After analysing the questionnaires and the diary logbooks, in December 2014 all 54 participants were invited by email for a feedback session, to inform them about the results of the diary study and to further explore the motivations the students had had for their learning space choices. Due to internships and for other reasons only 8 students were able to attend the feedback session. The session was organised in small groups of two and three students and the researcher, and took approximately 45 minutes per session. The sessions were tape recorded, transcribed and analysed by using open coding of the transcripts in Word. The results of these sessions were added to the analyses of the logbook data and are presented in chapter 5.

Study 5

The final study of this dissertation aimed to further investigate the motivations that students expressed for their learning space use in study 4. First, a literature study was conducted to build a conceptual model that is presented in chapter 6, showing the hypothesised impact of various social and physical dimensions of learning settings and student characteristics on preferred study places for individual and collaborative learning activities. The empirical study concerned a survey that focussed on business management students too. The survey questionnaire is presented and illustrated in section 6.4.2 of this dissertation.

The sample of 697 respondents was selected from a population of 985 undergraduate students in the first three study years at the HAN UAS in Nijmegen. The members of the research team (the author of this dissertation and two assistants) visited the classrooms to ask the students to volunteer in filling in a questionnaire at the start of a lecture. The participating students were treated appropriately with respect to the ethical principles of the university. There were no student names or student numbers on the questionnaires, and there was no relation between the lecture and the questionnaire, such as filling in the questionnaire being a course requirement or an opportunity for extra credits. The cover of the questionnaire included a brief introduction of the purpose of the study. The questionnaire had been pretested twice with two small groups of randomly selected students (N=10 and N=11). The main purpose of the tests was to check for clarity of the questions and the answering categories, as well as testing the required time to fill in the questionnaire. The students who pretested the questionnaire

did not participate in the diary study itself. After the first pretest, the initial 7-point Likert scale was reduced to a 5-point scale, because the respondents found it difficult to gain a clear view of too many answering categories, and because it made the fill in time longer than the set 5 minutes. Furthermore, the feedback of the students after the pretests led to several textual improvements in questions and answering categories. After the second pretest, the average time to complete the questionnaire met the expected 5 minutes. The data from the questionnaires were inserted in an SPSS format manually by the members of the research team for further analysis. The SPSS format had been tested in the pretest as well.

1.5.2 RESEARCH PHILOSOPHY

Scientific research aims to develop new knowledge or to test existing theories and hypotheses. According to Gibbons et al. (1994) and Gibbons (2000), in knowledge production two modes can be distinguished. Mode 1 is based on traditional, mostly mono-disciplinary scientific research. Mode 2 is characterised by its transdisciplinary scope within the context of application (Hessels & Van Lente, 2008). Gibbons et al. (1994) motivated the need for this heterogeneous knowledge production as an expanded view on mode 1. Mode 1 and mode 2 are complementary, so mode 2 is not meant to replace mode 1, but rather to supplement it (Hessels & Van Lente, 2008). The research in this dissertation can be typified as mode 2 knowledge production. Its interdisciplinary character aims to bridge the gaps between education theory, CREM, facility management, interior design, and builds on other disciplines such as ICT as well as management and organisation. Furthermore, the current research aims to contribute to the applied knowledge requirements of managers who are responsible for accommodating higher education institutions and to contribute to practical solutions and decision support.

Related to the knowledge production, researchers have to discern their epistemological beliefs of the nature and the scope of the knowledge. Various methodological textbooks such as Saunders, Lewis and Thornhill (2009), Groat and Wang (2002) describe the positivist and interpretivist (also indicated as naturalist by Groat and Wang) approaches as competing research philosophies. Positivist researchers rely on objective observations, using research instruments that collect hard and preferably quantitative data that are perceived as facts and the truth, where interpretivists often use qualitative research methods to collect data. For studies in the built environment, several researchers apply a combination of the positivist and the interpretivist perspective. Van Meel (2000) argued that the positivist perspective was difficult to apply in his study into office designs and that the interpretivist research

philosophy was more appropriate. The interpretivist philosophy offers the possibility to "studying phenomena in their natural environment" and corresponds to "the importance of qualitative factors such as shared norms and values, culture and common languages between actors" (Van Meel, 2000, p. 16). These arguments, to use an interpretivist paradigm, also came to the fore in research into the management of buildings and corporate real estate (Riratanaphong, 2013; Den Heijer, 2011; Van der Schaaf, 2000). The research in this thesis also primarily builds on the interpretivist research philosophy, by conducting a comparative floor plan analysis of higher education buildings, qualitative studies into CRE strategies, and CREM management approaches. Other parts of this dissertation are based on quantitative research methods such as diaries and questionnaires, which fit more the positivist research philosophy.

1.5.3 RESEARCH STRATEGY

An important aspect of the interpretivist philosophy is that the researcher aims to understand the research context from the perspective of the studied objects (Saunders et al., 2009). The interpretivist philosophy is often linked to a qualitative research approach and inductive reasoning (Saunders et al., 2009). The inductive process of inquiry aims to theory building based on clarification of multiple critical factors affecting the studied phenomenon (Groat & Wang, 2002). The opposite approach is deductive reasoning that aims at theory building by exploring and testing hypothesis and seeking for cause-and-effect explanations (Groat & Wang, 2002), which fits more the positivist research philosophy. Where deduction stands for a top-down approach, induction matches a bottom-up procedure. This dichotomy between induction and deduction can be misleading (Groat & Wang, 2002). Both approaches can be used in combination (Folkestad, 2008; Miles & Huberman, 1994), which has been applied in the present research. Miles and Huberman (1994) and Folkestad (2008) see it as legitimate and useful to start with conceptual analytical categories, which is deductive, or to gradually develop them, which is inductive.

The present research builds on the previous arguments and on Folkestad (2008) referring to Ryen (2002) who stated that testing preliminary theories by deduction can follow inductive identification of a theme, and vice versa. The chosen research strategies vary per research question and the aim of the related study. All five studies start with a review of the literature and an analysis of concepts and theories that are used for that specific study. The evolving research findings are used to build conceptual frameworks as input to new empirical studies, which implies deduction. Then, often also an inductive strategy is applied by using the empirical data to further explore current theories or to develop new insights.

1.6 OUTLINE OF THE THESIS

The next chapters (two to six) present the five research studies. All studies have been published or submitted as peer-reviewed papers in scientific journals. The thesis ends with general conclusions, a discussion, and practical and scientific implications (chapter seven). The overall structure of the research and the mutual relationship between all studies is presented in figure 1.3.

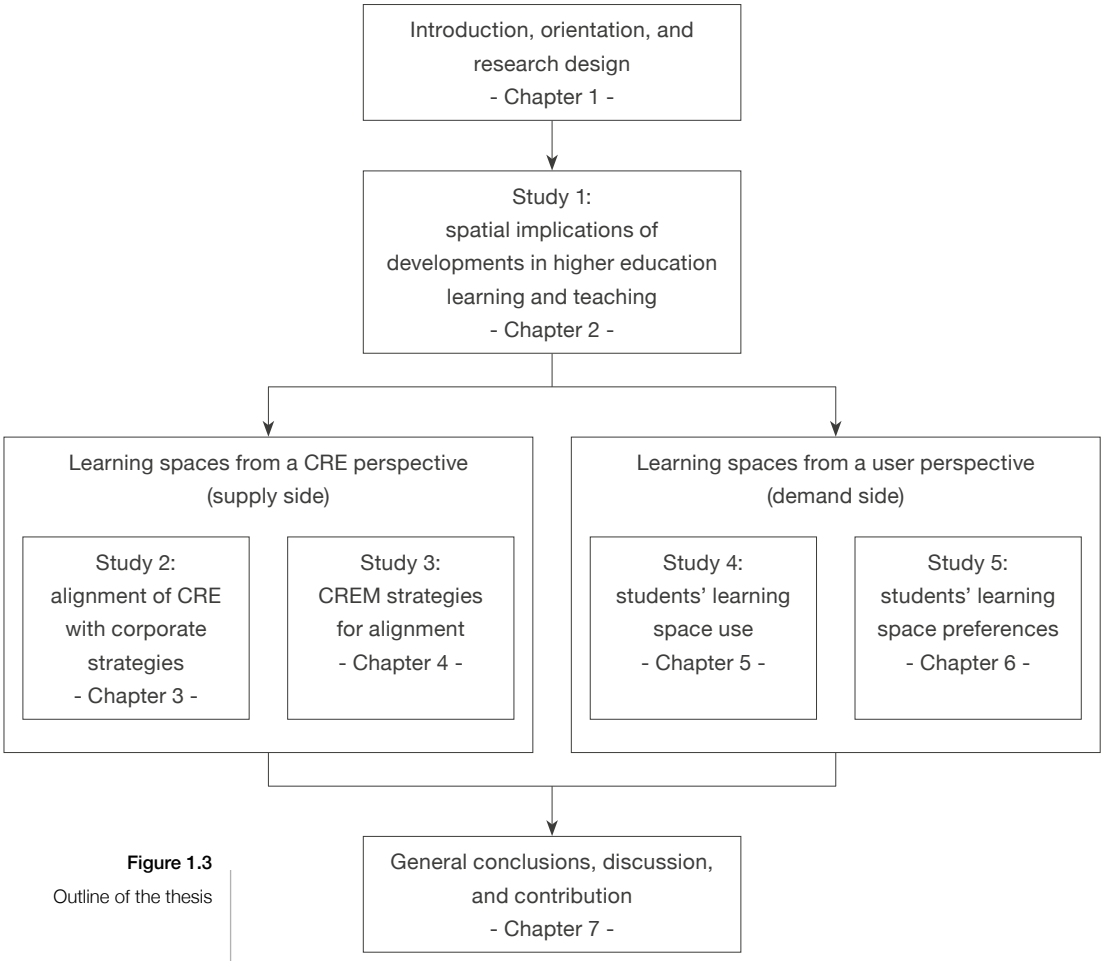

Figure 1.3
Outline of the thesis

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A CONCEPTUAL FRAMEWORK TO IDENTIFY SPATIAL IMPLICATIONS OF NEW WAYS OF LEARNING IN HIGHER EDUCATION

Citation - Beckers, R., Van der Voordt, T., & Dewulf, G. (2015). A conceptual framework to identify spatial implications of new ways of learning in higher education. *Facilities*, 33(1/2), 2-19.

INTRODUCTION

2.1

In the literature and the practice of facility management, there has been an increasing interest in the educational sector (Dunyar, 2011; Kok, Mobach & Omta, 2011; Price, Matzdorf, Smith & Agahi, 2003; Amaratunga & Baldry, 2000). In the past few decades, the educational sector has undergone substantial changes (Johnson, Smith, Willis, Levine & Haywood, 2011; Collis & Van der Wende, 2002). Developments in learning, educational theories and information and communication technologies (ICT) have resulted in new ways of teaching and learning – anytime, anyhow, and anywhere (Beckers & Van der Voordt, 2013; Punie, 2007; Simons, Van der Linden & Duffy, 2000). Despite the growing attention for the educational sector, Temple (2007) draws attention to the limited research investigating the relationship between teaching, learning, and physical space in higher education. Learning spaces in higher education remain an under-researched topic (Boddington & Boys, 2011; Temple, 2008, 2007). Marmot (2012) highlights that there is a need to understand how new learning spaces are used to support an effective pedagogical transition.

Boddington and Boys (2011, p. xviii) conclude that there should be a shift in the way we think about learning spaces "from solution to illumination". "We need both better conceptual frameworks and more appropriate methods and tools that reveal, assist and inform rather than dictate and fix the management and construction of learning spaces, whether physical, digital or intellectual". (Boddington & Boys, 2011, p. xviii).

This present research aims to contribute to the understanding of the alignment of learning space to the changing educational context. The paper first outlines a conceptual framework, which links learning space to learning theories and educational processes. This framework builds on the 'purpose-process-place' framework of Duffy, Craig & Gillen (2011), which was developed to analyse the interaction between organisations and the use of the physical environment (figure 2.1). Purpose-process-place refers to 'why, how and where' in a specific context of 'what'. Duffy et al. (2011) used case studies to explore the framework in office environments. They concluded that spatial arrangements and adjacencies ('place') have to be deployed in such a way that working practices ('processes') can contribute to enhance the goals of the organisation ('purpose'; figure 2.1).

Figure 2.1
The purpose-process-place framework (visualised after Duffy et al., 2011)

After the theoretical elaboration of the purpose-process-place framework in the context of higher education, an empirical study will be presented to explore whether shifts in ways of learning are represented in new buildings in Dutch higher education. Finally, the findings will be discussed in connection to practical implications.

2.2 PURPOSE, PROCESS, AND PLACE IN HIGHER EDUCATION

2.2.1 PURPOSE

According to Merriam-Websters dictionary, a school can be defined as a place of instruction and teaching. This traditional perception fits the purpose of schools as formulated by the American educational reformer Dewey at the start of the 20th century. Dewey's vision on the purpose of schools was to transfer knowledge and prepare young people to participate in America's democratic society (Rodgers, 2002). In the 20th century, the ideas about knowledge transfer in education were mainly

based on traditional learning theories such as behaviourism, cognitive theory, and constructivism (Merriam, Caffarella & Baumgartner, 2007). The application of behaviourism in education was focussed on predicting and controlling behaviour (Ashworth, Brennan, Egan, Hamilthon & Sáenz, 2004). Learning was manifested by a change in behaviour, with an emphasis on a connection between a stimulus and a response. In the middle of the 20th century, the emerging knowledge about processing and storage of information in someone's brain led to the cognitive learning theory. Cognitivism is concerned with how learners learn: how information is received, organised, stored, and retrieved by the mind (Illeris, 2007; Merriam et al, 2007). For education, this meant that the emphasis moved from the reproduction of learning to meta-cognition (Ashworth et al, 2004).

Based on Vygotsky's work at the end of the 20th century, the understanding of learning shifted from a quite inactive role of the student, to learning as constructing knowledge and understanding in interaction with the social environment (Ashworth et al, 2004). This social constructivist theory of learning stresses the need for collaboration and social interaction between learners, in contrast to traditional competitive approaches (Foster, 2008). Education shifts from an industrial model of transmission to an inquiry model of transaction and from a purpose of conformity to the purpose of critical thinking (Leland & Kasten, 2002).

In the past two decades, the growing opportunities of ICT in the educational context (Marmot, 2006; Collis & Van der Wende, 2002) have led to a new learning theory: connectivism (Marais, 2011; Kop & Hill, 2008; Siemens, 2005). Connectivism argues that knowledge is distributed across a network of connections, and that learning consists of the ability to construct and traverse those networks (Downes, 2007). Developments in ICT have prepared a paradigm shift by anticipating opportunities to learn in ways that were not possible without ICT facilities (Siemens, 2005).

To conclude, the purpose of teaching and learning has shifted from 'school' as a place of instruction in the 19th century to a place to produce learning in the late 20th century (Barr & Tagg, 1995) and to a place to construct knowledge in the 21st century (Siemens, 2008). However, the above-mentioned learning theories all have their own merits. Ashworth et al. (2004, p. 10) emphasise that "[…] it would be more advantageous for educators of the future to take a more eclectic approach where learning theory is concerned, as more than one theory could accommodate the needs of the self-directed, experimental and lifelong learners of the future".

2.2.2 PROCESS

The four described learning theories are reflected in different educational processes with a different power distribution between student and teacher. Trigwell, Prosser & Waterhouse (1999) formulated three approaches founded on two extremities of the student-teacher spectrum: a teacher-focussed strategy, a student-focussed strategy, and a teacher-student interaction strategy in between. Illeris (2007) mentions three similar interactions between students and teachers and calls these 'teaching directions' from a teacher perspective, teaching directions from a student's perspective and a teaching direction in which both teachers and students are involved.

The traditional teacher-centred way of teaching is based on behaviourism (Freiberg & Lamb, 2009). The behaviourist learning theory has had a substantial influence on education, for example, leading to programmed instructional approaches (Jones & Brader-Araje, 2002). Behaviourism in schools placed the responsibility for learning directly on the shoulders of the teachers (Jones & Brader-Araje, 2002) and was based on fixed rewards for positive student behaviour (Freiberg & Lamb, 2009). Shreeve (2008) described this didactic form as lecture-based learning, where learning is derived from the instructor imparting what is known about a subject and, thus, hopefully resulting in knowledge transfer. According to Ashworth et al. (2004, p. 7), "Cognitivism meant a shift away from teacher-centred methods of course delivery and more freedom for students to choose the type of learning that suits them best". Such students have to be self-regulated learners. "They personally initiate and direct their own efforts to acquire knowledge and skills rather than relying on teachers, parents, or other agents of instruction." (Zimmerman, 1989, p. 329).

The impact of social constructivist theories in education can be seen in the focus on working in small groups (Jones & Brader-Araje, 2002). The emphasis is on having students working together, while sharing ideas and challenging each other's perspectives. "Crucial to social constructivism is the idea that knowledge and understanding are constructed when individuals engage socially and communicate with each other, through shared problems and tasks. Most social constructivist models, therefore, stress the need for collaboration among learners" (Foster, 2008, p. 93). Social constructivist literature mentions different didactic forms, like problem-based learning, collaborative learning, and cooperative learning (Foster, 2008). A characteristic of all educational processes that fit the social constructivist theory is the shift in the teacher's role from "the sage on the stage to the guide on the side" (Martin, Katz, Morris & Kilgallon, 2007, p. 13).

New learning processes in connectivism are based on network learning (McLaughlin & Mills, 2008). In network learning, everyone is a node in a collaborative learning process. According to Siemens (2008), the difference between connectivism and the previously mentioned social constructivism is that constructivists suppose that knowledge transfer occurs by socialisation, and connectivists are connecting nodes involving both people and other sources. Hence, while a constructivist would likely see the network solely as a social medium for interaction, a connectivist additionally sees the network as an extension of the mind (Siemens, 2005). Wang (2008) described the learner-interface interaction as an important component of a technology-based interactive learning environment. This has led to virtual education, which can be characterised as a form of asynchronous tuition (Shabha, 2004). "Learners might move away from classroom groups and a tutor to online networks and important nodes on these networks", and the role of the teacher will further decrease (Kop & Hill, 2008, p. 9).

2.2.3 PLACE

Traditional school environments focus on accommodating the transmission of knowledge rather than on learning objectives and learning outcomes, which can be achieved in different ways (Punie, 2007). "The design of classrooms optimises instructor transmission. In the traditional classroom floor plan, students receive content packaged and presented with a 'one-size-fits-all' approach, regardless of the learners' unique needs or styles" (Brown & Long, 2006, p. 9.3).

The increase of self-regulated learning in education implies a shift in the role of the physical learning environment. "In order to self-regulate, learners must be able to control their attention. Often this process entails clearing the mind of distracting thoughts, as well as seeking suitable environments that are conductive to learning (e.g., quiet areas without substantial noise)" (Winne, 1995 as cited in Zumbrunn, Tradlock & Roberts, 2011, p. 11).

Influenced by social constructivist theories in education, formal teaching spaces for large groups, like traditional classrooms, are becoming less common than smaller, less formal settings where students can learn from one another as well as from their appointed teachers (Marmot, 2006). This leads to the need for project rooms and small group settings which support project-based learning and other forms of active learning (Fisher, 2005a).

For new ways of learning, students need more informal areas where they can meet face-to-face and have contact with their virtual network sources (Foster, 2008). Watson (2007) mentions 'third places' as a

striking development in new university buildings. Originally, third places were public settings where people gathered to meet, such as coffee houses, cafés, restaurants, public outdoor spaces, and virtual spaces ('cyberspace') (Oldenburg, 2001). Based on the idea of third places, Oldenburg defined the social learning space as a physical and/or virtual area that is not predominantly identified with either social or work/study perspectives, but transcends both (Oldenburg, 1991 as cited in Wiliamson & Nodder, 2002). New university buildings have progressively shown such environments, for instance, Techno Cafés (Foster, 2008), which include high-quality services and technology to facilitate individual and group work.

To conclude, the relation between the physical learning environment and learning activities had been explained in frameworks before (Beard & Wilson, 2006). Developments in learning theories generate opportunities to give students more freedom to decide 'what' they are supposed to learn, when they want to learn, 'how' they learn and 'with whom' (Rudd, Gifford, Morrison & Facer, 2006). Schools have to facilitate the needs of the students regarding these choices by offering the right spaces, so students can also decide 'where' to learn. In their Learning Combination Lock (LCL), Beard and Wilson (2006) show those principles by defining several learning environments as the 'where' of learning and linking these to learning activities as the 'what' of learning. Frameworks like the LCL illustrate that learning spaces should not focus exclusively on the reproduction of knowledge. They should also be sufficient flexible to facilitate different learning modes and styles, depending on the learning object, the learner, the teacher, the environment, etc. "In some cases, the learning mode could be more traditional […] and in others, it could be more personalised […]. Then again, it could be group work […] or face-to-face (bilateral) interactions" (Punie, 2007, p. 193).

2.3 CONCEPTUAL FRAMEWORK

The development of the above-mentioned four learning theories can be characterised by two shifts in ways of learning. First, the development from behaviourism to cognitivism implies an increase of self-regulation in learning (Chen, 2002; Zimmerman, 1989). "Self-regulated learning emphasises autonomy and control by the individual who monitors, directs, and regulates actions towards goals of information acquisition, expanding expertise, and self-improvement" (Paris & Paris, 2001, p. 89). Second, in contrast to behaviourism and cognitivism, social constructivism and connectivism emphasise social interaction (Van der Zanden, 2010; Siemens, 2005). Where social constructivism is,

to some extent, associated with self-regulation (Paris & Paris, 2001), connectivism is strongly related to self-regulated learning (Türker & Zingel, 2008) and the learner's autonomy (Kop & Hill, 2008). The four learning theories can be placed in a two-by-two matrix with 'self-regulation in learning' on the horizontal axis and 'social interaction in learning' on the vertical axis (see the left box of figure 2.2).

The impact of the four described learning theories on educational processes can also be mapped in a matrix with the same axes (see the middle box of figure 2.2). The designations of the four process quadrants in the matrix are derived from Wang (2008) and Moore (1989). The conventional behaviourist educational instruction model was described by Moore (1989) as a relationship between the instructor and the learner. He characterised the self-regulated (cognitive) learner in relation to the content and the social constructivist learner in relation to other learners. In connection to ICT developments in education, Wang (2008) added the relation between the learner and the interface. The four fields are not mutually exclusive. They are all valuable and complementary, and a curriculum is usually composed from a palette of different teaching and learning processes (Kolb, 1984).

The right hand box of figure 2.2 represents the physical learning environment. Here the matrix builds on relevant learning space classifications in literature (e.g., Beard & Wilson, 2007; Watson, 2007; Marmot, 2006; Fisher, 2005b, 2003). Fisher (2003) presented a 'learning environments matrix', showing a clear overview of learning settings with different levels of self-regulated spaces and/or collaborative spaces. He distinguished four edges of the learning space spectrum: the classroom setting, project space, personal study space, and the Internet café. The four edges correspond with Fisher's typology of four learning settings from 2005. Analogous to Fisher's work, we also defined four categories of learning spaces in the right hand box of the conceptual framework, using the same axes as in the other two matrices (figure 2.2):

1) Classroom setting: types of spaces that support large groups for the benefit of presentations and lectures.
2) Collaborative setting: types of spaces that support small groups for the benefit of face-to-face collaborative and cooperative learning activities.
3) Individual study setting: types of spaces that support individuals for the benefit of self-study activities.
4) Informal learning setting: types of spaces - scattered across the campus or building in corridors, atria or cafeteria and restaurants - that support individuals and small groups for the benefit of either social or study activities, both in the real world and in the virtual world.

This completes the conceptual purpose-process-place framework for education, as shown in figure 2.2.

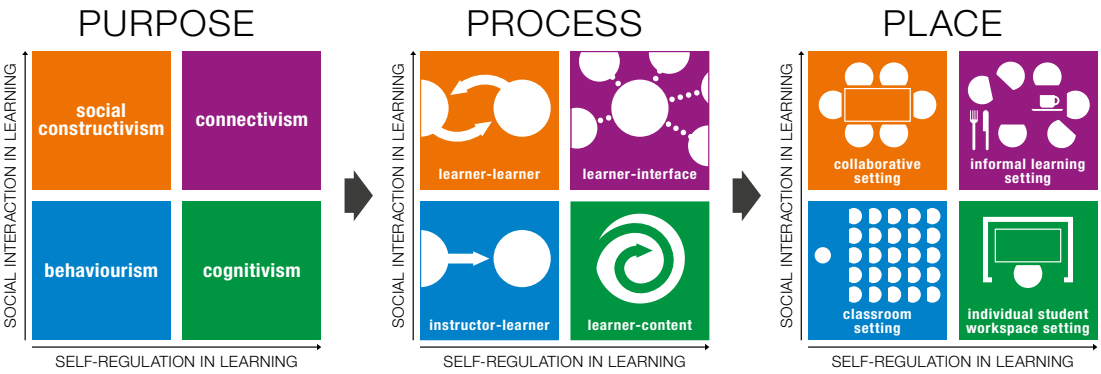

Figure 2.2
Purpose-process-place framework for education

2.4 AN EXPLORATIVE STUDY AT DUTCH HIGHER EDUCATION INSTITUTES

According to the framework of figure 2.2, it is expected that changes in the purpose and process of learning (i.e., the shift towards new learning theories and a growing use of ICT), will be reflected in the learning space design in practice. More particularly, that a shift might be expected to occur in the ratio between different types of learning settings, with less traditional classroom space and more space for interaction and informal learning. To test this proposition, a comparative floor plan analysis (CFA) was conducted at four buildings of Dutch higher (professional) education institutes (HEIs), also indicated as Universities of Applied Sciences (UAS). The Netherlands has 39 of such institutes with a total number of 421,560 students (2012). The ten largest institutes together represent 73% of all students. In the period 2010-2011, six of these ten institutes constructed new school buildings. To explore spatial reflections of developments in learning and teaching, three new buildings were selected and compared with an older school building.

2.4.1 RESEARCH METHOD

For this study, a three-tier analysis procedure was followed. First, the study compared a building in Arnhem (building A) of the economics faculty of the HAN University of Applied Sciences (HAN) built 14 years ago (1998) with a new economics faculty building in Nijmegen from 2011 (building B), also part of the HAN. Both buildings

accommodate the same kind of students and nearly identical educational processes, and as such, the comparison provides a good insight into changes in learning space design over time. Second, the new building B in Nijmegen was compared with a new building of Windesheim University of Applied Sciences in Zwolle from 2010 (building C) and a new building of HU University of Applied Sciences (HU) in Amersfoort from 2010 (building D), to look for similarities and differences regarding the way new school buildings facilitate educational processes of the 21st century. Buildings C and D also accommodate economics educational disciplines and are in that respect comparable with the target group of the buildings A and B. Third, all buildings (i.e., A, B, C and D) were compared.

Based on Yin (2009), the four cases were selected partly for homogeneity and partly for heterogeneity regarding age of the building and type of academy. The characteristics are shown in table 2.1.

CASE CHARACTERISTICS TABLE 2.1

Homogeneity of the cases	Heterogeneity of the cases
All school buildings for Dutch HEIs	Three different Dutch HEIs
New building B, C and D (2010-2011)	An older building A (1998)
All buildings are used by economics students	
Two buildings (A and B) of the same Economics Faculty	

To compare the four buildings, the CFA method has been used (Van Hoogdalem, Van der Voordt & Van Wegen, 1985; Van der Voordt, Vrielink & Van Wegen, 1997). On the one hand, CFA studies search for similarities and differences between floor plans of the same organisation over time, and of different organisations in the same period. On the other hand, CFA studies explain different spatial-functional configurations. A similar method was used by Fisher (2005b), who linked pedagogy and space in several case studies in Australian school floor plans. Besides the analysis of floor plans, document analysis of annual reports (2010/2011) and building walk-throughs were included in the research design as well.

RESULTS 2.5

2.5.1 BUILDING A (1998), ARNHEM

Building A has 16,360 m2 gross floor area on five floors and accommodates 4,544 students of the faculty of economics. A particular characteristic of the building is the narrow, 150 m long central atrium, surrounded by classrooms and offices. At the time building A in Arnhem

was built (1998), educational processes were still mainly based on the transfer learning model, supplemented by emerging interactive learning based on social-constructivism, in which students work together on assignments. ICT had not yet been incorporated in education in 1998. Figure 2.3 shows the plan of the first floor of building A. The labels in the figure refer to the type of learning space based on the framework of figure 2.2. The floor plan is characterised by a large proportion of classrooms. There are hardly any collaborative settings/project rooms in the building. Most small rooms on the plan are staff offices. The main places that support group work or individual study activities are the study landscape situated in the library or the canteen on the ground floor (figure 2.4).

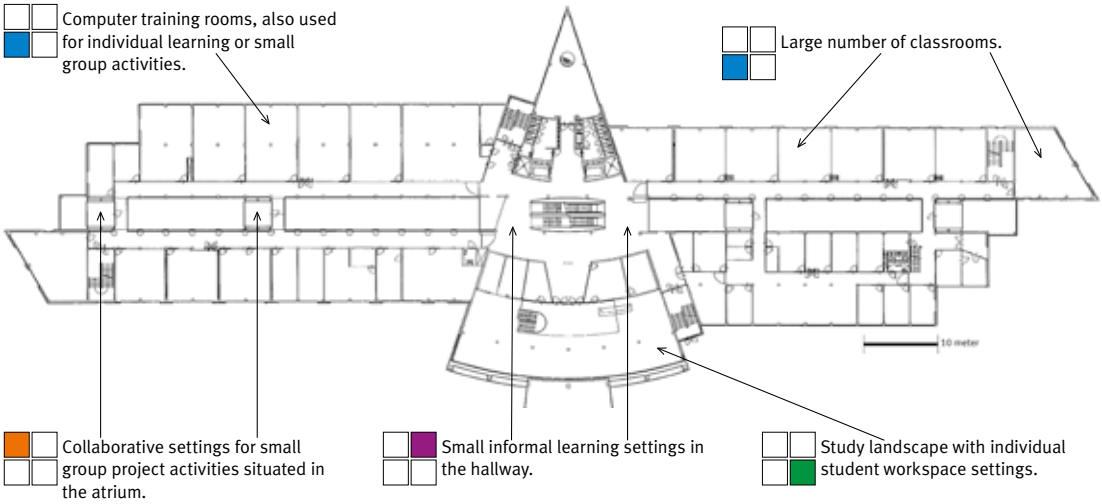

Figure 2.3
Floor plan of building A


Long corridors, no informal learning space.


Canteen used as an informal learning space.


Project rooms situated in the atrium.

Figure 2.4
Pictures of building A

2.5.2 BUILDING B (2011), NIJMEGEN

Building B has 13,998 m2 gross floor area, divided over three floors, and accommodates 3,794 students of the faculty of economics. The floor plan reflects the educational concept of the HAN, which was changed to competency-based learning and teaching in 2005. The main principles of this concept are: stimulating vocational orientation, autonomy in learning, and creating opportunities for a personal interpretation of the education by the student. All activities are supported by a digital learning environment called Scholar that provides students with an online access to teaching materials and project data. Figure 2.5 shows the first floor of the building that is typical because it has two atria. Despite the developments in education, there are still many classrooms that still facilitate a traditional teaching approach. In the building, many informal and collaborative settings are scattered across the wide corridors, in and around the atria. Central in the building, on the ground floor, a large restaurant is situated that is also used for informal learning (figure 2.6).

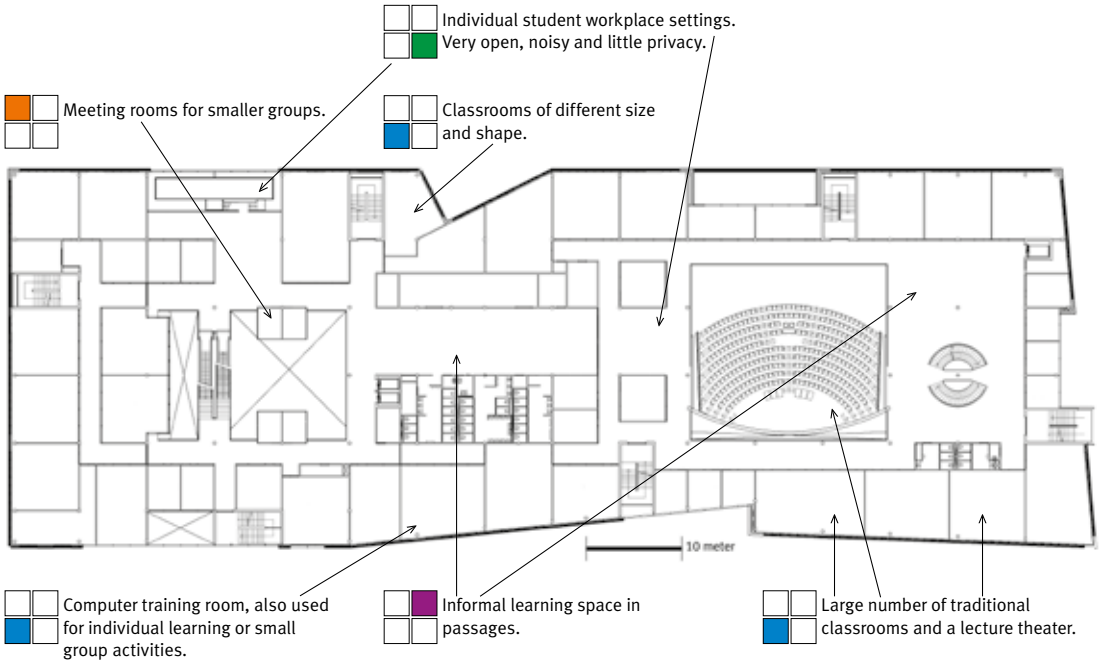

Figure 2.5
Floor plan of building B

Individual student workspace.

Cafetaria with informal learning space.

Restaurant used as informal learning space.

Figure 2.6
Pictures of building B

2.5.3 BUILDING C (2010), ZWOLLE

Building C of Windesheim University of Applied Sciences in Zwolle was finished in 2010. It accommodates 4,602 students of the School of Business and Economics, and the School of Media on 11 floors with a total of 16,852 m2 gross floor area. The educational process of Windesheim is characterised by competence-based learning in which students work together in projects. Classroom learning is shifting to demand-driven learning with more attention to the individual student and a digital learning environment, which makes learning flexible. The change in education methods is visible in the building, which includes many informal learning spaces and study landscapes. Figure 2.7 illustrates this concept on the eighth and ninth floor. The interior of the building is characterised by a large atrium that divides the building into two parts with split level floors on both sides (figure 2.8). On each floor, learning settings are mixed to stimulate circulation of students and teachers in the building, so they can easily meet. Catering facilities are concentrated on the ground floor in a large restaurant.

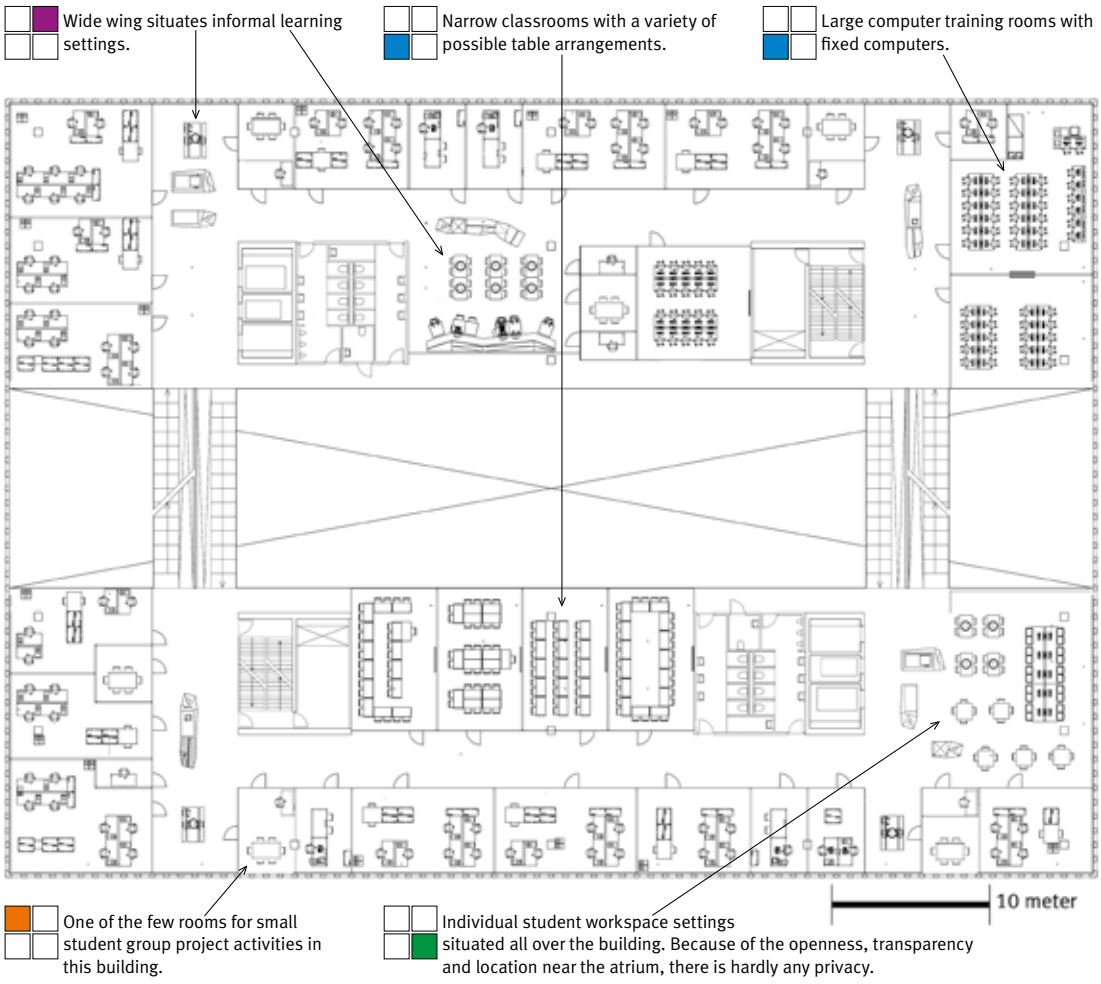

Figure 2.7
Floor plan of building C

Narrow class rooms.

Large atrium with informal learning space.

Few individual learning settings in quiet spots of the building.

Figure 2.8
Pictures of building C

2.5.4 BUILDING D (2010), AMERSFOORT

Building D of HU University of Applied Sciences (HU) is located in Amersfoort and has 14,000 m2 gross floor area on 7 floors. It has a total length of 151 meters and consists of a short and a long wing. The building has been occupied since 2010 and accommodates 4,000 students of the Faculties of Economics and Management, Education, and Society and Law. The educational process is aimed at creating learning communities to stimulate students to meet face-to-face as much as possible because for HU, 'learning is meeting'. The accommodation concept is meant to support meeting, connecting, and knowledge sharing. The building is characterised by large voids inside and open spaces. A mix of learning settings is present on each floor. A large part of the ground floor accommodates the restaurant and meeting space. Figure 2.9 shows the second floor which gives a good picture of the way learning space is arranged throughout the building. The pictures of figure 2.10 illustrate several learning settings in the building.

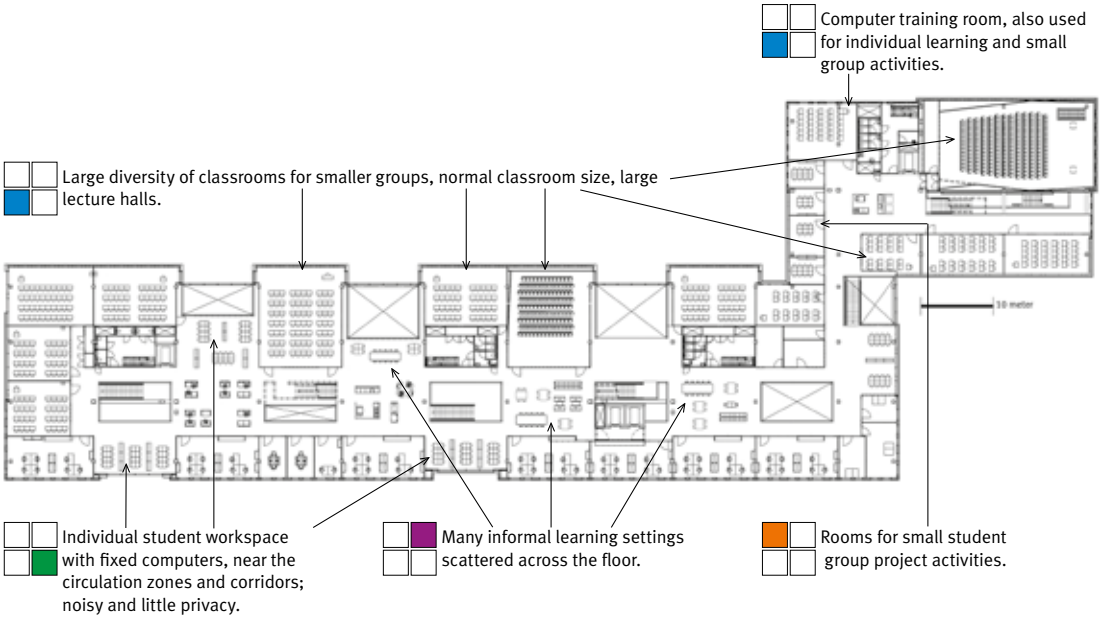

Figure 2.9
Floor plan of building D

Individual learning settings near corridors.

Small cockpits for concentrated individual learning.

Informal learning settings.

Figure 2.10
Pictures of building D

2.5.5 COMPARISON OF THE FOUR BUILDINGS

The floor plans were analysed using the typology of learning settings in the conceptual framework of figure 2.2. Table 2.2 shows the ratio of various learning settings in percentages of total square meters gross floor area learning space for each building.

COMPARISON OF LEARNING SETTINGS IN PERCENTAGES OF TOTAL SQUARE METERS GROSS FLOOR AREA

TABLE 2.2

LEARNING SETTINGS	Building A Arnhem	Building B Nijmegen	Building C Zwolle	Building D Amersfoort
Classroom setting (incl computer training rooms)	70.8%	61.8%	54.5%	50.1%
Individual study setting	4.9%	10.7%	13.9%	13.7%
Collaborative setting (project rooms)	5.0%	11.8%	1.7%	9.6%
Informal learning setting (general)	1.1%	3.9%	12.6%	23.5%
Informal learning setting (restaurant)	18.2%	11.8%	17.2%	3.1%
Total	100%	100%	100%	100%

The comparison of the four buildings shows a shift from a high proportion of classroom space in the 15-year-old building A, towards less classroom space and a growing percentage of individual workspaces for students, and informal learning space in the new buildings B, C, and D. In these buildings, informal learning space is much more scattered throughout the whole building and, especially, designed for the purpose of informal learning using ICT. The new buildings have wide corridor areas, which are also used as meeting spaces and for informal learning activities. The older Arnhem building (A) is characterised by

long, narrow corridors that only serve circulation. All four buildings are primarily designed to support the transfer learning approach.

Other remarkable findings are the limited percentage of collaborative learning spaces in building C (1.7%), the low percentage of informal learning spaces in combination with lunch facilities in building D (3.1%), and the relatively low percentage of informal learning spaces in building B (3.9%). Walkthrough observations in the four buildings showed that students use informal learning spaces like restaurants and cafeterias for project activities too. The older building A does not contain deliberately designed informal learning spaces. However, because of the wireless network, students nowadays use the large canteen for informal learning activities too. Individual study spaces, like in libraries, are used for project activities. Using informal learning spaces for collaborative activities fits to the connectivist philosophy, but using individual learning spaces for project group activities is interfering with peacefulness and quietness of individual use of these workspaces. As the study did not involve an analysis of the curricula of the education in the buildings, it is difficult to conclude that the shift in learning settings can be fully attributed to developments in educational purpose and processes. Yet, it is interesting to see that the ratios between learning settings in building B of the HAN in Nijmegen exactly correspond with the ratios formulated for first-year student learning activities in the annual report 2011 of the HAN. The HAN indicates that the preferred ratio between instruction and students activities without supervision of a teacher (self-study and project work) for first-year students is 62 to 38 percent.

2.6 DISCUSSION

The present study shows that in modern school buildings, developments in education are expressed in a lower proportion of classroom space and a higher proportion of space for informal learning, self-study, and collaborative learning in small groups. This finding is consistent with experiences from The Saltire Centre case (Watson, 2007) and other research in HEIs in the UK that concluded that institutions need to remodel their existing space to cope with new teaching and learning methods, the use of new technologies, and new social expectations (Space Management Group [SMG], 2006). Our study shows that despite the apparent shift in learning settings, the floor plans of the new school buildings in Dutch higher education are still characterised by a large number of classrooms. The development towards modern learning centres, as presented in the guide for 21st century learning space design (Joint Information Systems Committee [JISC], (2006), in the design patterns

of Nair and Fielding (2005), and the visions on learning environments of Marmot (2006), go well beyond the studied higher education buildings. A justified question is what is needed for further developments in learning space design. Jessop, Gubby and Smith (2012) state that the push to make fundamentally or radically different choices concerning learning and teaching spaces in universities have to come from students.

Our study shows that HEIs with new school buildings can anticipate on developments in education. Yet, the change in education is much faster than the buildings can accommodate. Buildings are a long term investment, and most universities have to learn to live with their architectural legacies (Temple, 2007). Diverse studies argue for flexible learning environments (JISC, 2006; Marmot, 2006; Jamieson, Fisher, Gilding, Taylor & Trevitt, 2000). Adaptable furniture and equipment, movable walls and flexibility in building technology make it easier to deal with that legacy and facilitate multi-functional use of space by different users and for different purposes.

The cross-case comparison confirmed the expected changes in the floor plans of new school buildings in Dutch higher education. However, the number of studied buildings is limited. Besides, the empirical study only focused on a CFA. A systematical post-occupancy evaluation and data-collection on the use of space were not included. The presented conceptual framework, showing a typology of four learning theories, four learning processes, and four types of learning space may suggest that each type of learning is exclusively associated with one particular type of space. In practice, much space is used in a more flexible and multi-functional way to stimulate efficient use of space. The implementation of ICT in education makes it possible to arrange contact 'anytime, anywhere', independent of time and location (Punie, 2007; Jamieson et al., 2000). In addition to measures to support technical spatial adaptability, the opportunity to have access to information and networks always and everywhere, leads to space that can and will be used in more flexible ways (JISC, 2006). The walkthrough observations indicate that students progressively work on projects in informal learning settings, coffee corners, and restaurant settings. Watson (2007, p. 258) noticed a similar situation in The Saltire Centre-case: "for the student, finding a place to undertake interactive group work is not straightforward […] many students end up working in the refectory". Students also use classrooms that are not scheduled for classes, for small project group work, or even for one-on-one peer feedback sessions with a tutor. As a consequence, the conceptual framework should be used as a discussion tool to deliver conceptual input to the planning of learning spaces, like Duffy (2000) did in the framework for the planning of new ways of working in offices.

2.7 CONCLUDING REMARKS

The purpose-process-place framework was shown to be useful for linking learning settings to learning theories and educational processes, and the CFA was shown to be a useful method to explore the relationship between purpose, process, and place. The combination of the conceptual framework and CFA contributes to a better understanding of how different learning theories may influence the physical learning setting, but does not yet explain completely the use of those spaces to a full length. Other research methods are needed as well to understand the motivations of students to use certain types of space.

The studied floor plans of the new school buildings in Dutch higher education show a trend towards less classroom space and an increasing proportion of other learning settings. Yet, the studied buildings are quite conservative in learning space developments. Developments in learning and teaching apparently do not go at such pace that one might speak of a revolutionary change in learning space design. In current Dutch higher education, all four types of learning settings are still needed to support learning processes. They are complementary and not mutually exclusive. The total demise of the formal lecture and the classroom as a learning setting that has been suggested in literature, will not be reality in the foreseeable future of Dutch higher education.

Of course, a selection of four cases is too limited to generalise these conclusions to all institutes of higher education. Further research is needed to test if the established trends are visible in other new school buildings as well. Another topic for further research is the quantification of the most desired ratios between different types of learning settings, and how this knowledge is or could be incorporated in decision-making on the design and the management of learning spaces.

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ALIGNING CORPORATE REAL ESTATE WITH THE CORPORATE STRATEGIES OF HIGHER EDUCATION INSTITUTIONS

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INTRODUCTION

3.1

In the literature and the practice of facility management, there has been an ongoing interest on how corporate real estate (CRE) can contribute to higher education (Beckers, Van der Voordt & Dewulf, 2015; Vidalakis, Sun & Papa, 2013; De Vries, De Jonge & Van der Voordt, 2008; Amaratunga & Baldry, 2000; Housely, 1997). Since the past decennia, higher education has experienced substantial changes, such as the increased use of information technology in higher education (Johnson et al., 2013; Collis & Van der Wende, 2002), new learning approaches (Marais, 2011; Siemens, 2005), the development of learning communities (McLaughlin & Mills, 2008), changes in student behaviour (Veen & Vrakking, 2006; Prensky, 2001), changes in student expectations (Beckers & Van der Voordt, 2013), and a changing policy concerning internationalisation and educational quality (CPOO, 2008). These developments lead to changing strategies of higher education institutions. To support these evolving strategies, the CRE of higher education institutions should be be aligned with these evolving organisational strategies.

Actualisation of this alignment is the responsibility of CRE management (CREM). According to Krumm, Dewulf and De Jonge (2000, p. 32), CREM can be defined as "[…] the management of a corporation's real estate portfolio by aligning the portfolio and services to the needs of the core business (processes), in order to obtain maximum added value for the business and to contribute optimally to the overall performance of the corporation". Several studies indicate the relevance of CREM in accommodating the changes in higher education. A study of the Society for College and University Planning in the USA shows that 53% of their members think that changing pedagogy will be an important drive for developments in changing accommodation needs (Grummon, 2008). This is endorsed by Den Heijer (2011), who studied developments in university campuses in the Netherlands and found twelve strategic choices that universities are faced related to evolving corporate strategies. A study of the impact of real estate interventions on the performance of higher education institutions showed that many educational buildings were not sufficiently prepared to meet educational developments (De Vries et al., 2008). As early as the 1990s, Housely (1997) studied the role of CRE in aiding the success and profitability of higher education institutions. He concluded a gap between the strategic management and CREM. According to Housley (1997, p. 81), one of the problems causing this gap was "the apparent mis-alignment between the understanding by the academic departments and the estates department of the aims and objectives of the institution". Based on an extensive literature study, Temple (2007) concluded that there is still a lack of knowledge about and research into managerial decision-making about educational buildings in relation to educational goals and purposes. Also, Boddington and Boys (2011) indicated a need for appropriate methods and tools for the management of buildings for higher education.

The present research investigates the alignment between institutional strategies and CRE strategies in higher education. The question that this paper addresses is how CRE managers of Universities of Applied Sciences (UAS) formulate their CRE strategies and CRE operating decisions in order to align CRE with the evolving corporate strategies of these organisations. First, an analytical framework will be presented consisting of four different types of alignment, which is based on the CRE management literature and the business management literature. Then, the results of a multiple case study at 13 Dutch UAS will be discussed. The paper ends with theoretical and practical implications and concluding remarks.

ANALYTICAL FRAMEWORK 3.2

CREM is a relatively new profession. It goes back to approximately 25 years ago (Heywood, Kenley & Waddell, 2009). According to Brackertz and Kenley (2002), the current awareness that CREM can contribute to organisational performance started with the work of Roulac (1986) at the end of the 1980s, and gained prominence in the early 1990s with the publications of Nourse and Roulac (1993), and Joroff, Louargand, Lambert and Becker (1993). Nourse and Roulac set a standard by defining CRE strategies and linking them to business strategies (Heywood, 2011; Appel-Meulenbroek et al., 2010). According to Nourse and Roulac (1993, p. 476), "[…] the specification of the scope of products and markets provides a basis for considering what physical facilities are needed to support the organisation's strategy, and therefore the real estate strategy that is needed to support the organisation's strategy". Joroff et al. (1993) called CRE the fifth resource in addition to the traditional resources i.e., people, technology, information, and capital. Joroff's vision superseded the former perspective of CRE as a necessary burden, a bunch of bricks and stones, or an undesired cost factor (Krumm et al., 2000). The theory and practice of CREM have been developed and professionalised since, and CRE has progressively been perceived to be an essential instrument to support the performance of an organisation and to add value for its stakeholders (Jensen, Sarasoja, Van der Voordt & Coenen, 2013; Lindholm, Gibler & Leväinen, 2006; De Jonge, 1996). Currently, CREM is a field of management that aims to align the CRE strategies and CRE operating decisions and activities with the strategic goals at the corporate level (Heywood & Kenley, 2007). Whereas Nourse and Roulac focused on real estate in a business environment, several studies show that CRE strategies are also important in other contexts such as universities (Den Heijer, 2011; De Vries et al., 2008) and hospitals (Van der Voordt & Van der Zwart, 2011). Table 3.1 summarises CRE strategies with reference to the various studies: Nourse and Roulac, 1993 is indicated with letter (a) in table 3.1, De Jonge, 1996 with (b); Lindholm et al., 2006 with (c); De Vries et al., 2008 with (d); Jensen, 2010 with (e); Den Heijer, 2011 with (f); Van der Voordt and Van der Zwart, 2011 with (g); and Den Heijer and De Jonge, 2012 with (h).

Connecting CRE strategies and corporate strategies is a typical example of the alignment of support functions with the core business of an organisation. Based on their Balanced Scorecard approach, Kaplan and Norton (2006) show that this alignment is an important way for support functions to create value and to contribute to strategic goals of the organisation. Regarding the alignment between CRE strategies and corporate strategies, Heywood (2011) noted that, though CRE executives may think that there is alignment, there can be a gap between

TABLE 3.1 CRE STRATEGIES FOUND IN THE LITERATURE

CRE strategies to		Source:
1.	Increase user satisfaction by offering an attractive and comfortable physical environment that meets user expectations	a, c, d, e, f, g, h
2.	Support innovation by supporting knowledge development	a, c, d, f, g, h
3.	Support corporate image with recognizable buildings and environments that contribute to a positive perception of the organisation	a, b, c, f, g, h
4.	Support culture with a physical environment that contributes to a sense of community within the organisation	b, c, e, f, g, h
5.	Support environmental responsibility with buildings that contribute to reducing the carbon footprint	e, h
6.	Stimulate collaboration with buildings that perform as a hub where people from inside and outside the organisation can meet	f, h
7.	Support change by increasing building flexibility and building adaptability	a, b, c, d, e, f, g, h
8.	Support user activities with buildings to increase production and productivity	a, b, c, d, e, f, g, h
9.	Control real estate costs by maintaining an optimal balance between building investments and life cycle costs, and efficient use of space	a, b, c, d, e, f, g, h
10.	Control physical risk with reliable and safe buildings	b, c, e, f, g, h

the strategies described in strategic reports and the implementation of those strategies in CRE practice. Management literature refers to this as a lack of managerial consensus between strategies of the functional management disciplines and the corporate strategy (Ambrosini & Bowman, 2003). Besides, the literature mentions a distinction between the espoused strategy and the strategy in-use (Brown, 2010; Clemons, Row & Thatcher, 1995; Argyris & Schön, 1974). "The espoused strategy is publicly held and publicly acknowledged and often coincides with organisational objectives, ideals or mission statements" whereas "the strategy in-use is the interpretation of the espoused strategy by the personnel within the organisation" (Clemons et al., 1995, p. 14). Clemons et al. (1995) argue that in a stable business environment, both strategies are likely to exhibit considerable agreement. According to Heywood (2011), differences between espoused CRE strategies and CRE strategies in-use might have consequences for the alignment of CRE operating decisions with CRE strategies. Kaplan and Norton (2006) showed that, to achieve alignment at a strategic level, it is relevant to "close the loop" (Kaplan & Norton, 2006, p. 121) and to formulate functional requirements at an operational level as well. Nourse and Roulac (1993) incorporated CRE operating decisions in their alignment framework e.g., the choice of the location, building size, building character, mechanical systems, risk management. Many other authors confirmed the need of alignment between CRE strategies and CRE operating decisions, and based their frameworks on Nourse and Roulac (Den Heijer, 2011; De Vries et al., 2008; Appel-Meulenbroek & Feijts, 2007; Lindholm et al., 2006). The current research also builds on

the framework of Nourse and Roulac (1993) to describe the alignment between corporate strategy, CRE strategy, and CRE operating decisions and incorporates the distinction between espoused CRE strategies, as written in strategic documents, and the CRE strategies in-use. Yet, the CRE alignment framework of this present study shows four types of alignment, as seen in figure 3.1:

- Two types of alignment between corporate strategy and CRE strategy: the alignment of the espoused CRE strategy with the corporate strategy (type A) and the alignment of the CRE strategy in-use with the corporate strategy (type B).
- Two types of alignment within the CRE domain: the alignment of CRE operating decisions with the espoused CRE strategy (type C) and the alignment of CRE operating decisions with the CRE strategy in-use (type D).

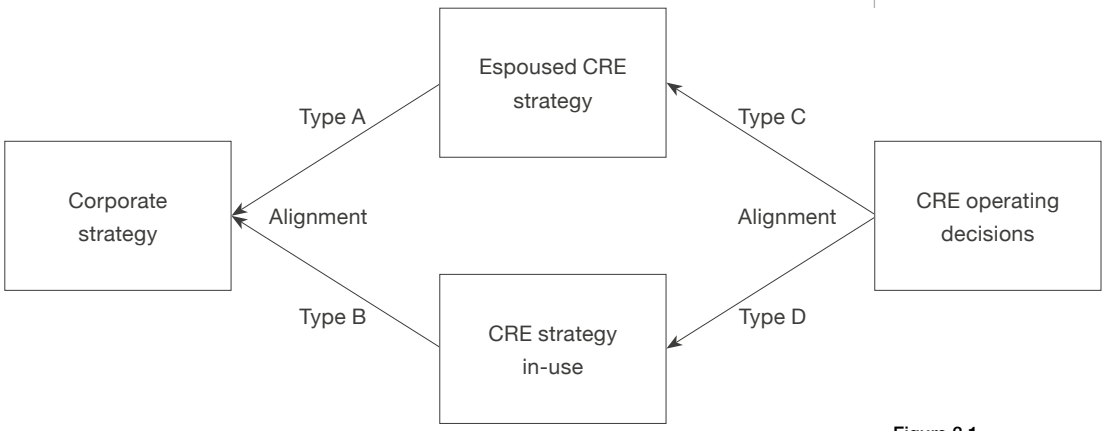


Figure 3.1
Analytical CRE alignment framework with four types of alignment

The next section of this paper presents a multiple case study that explores these different types of alignment in practice.

3.3 MULTIPLE CASE STUDY AT DUTCH UAS

CRE alignment is strongly related to a specific organisational context (Osgood, 2004). The present research aimed at studying CRE alignment in the context of higher education. The study was conducted at Dutch UAS. The Netherlands has 39 of these UAS, with a total number of 423,776 students and 41,429 employees in 2011/2012 (Vereniging Hogescholen, s.d.). In 2011, Dutch UAS spend € 216 million on their CRE (OC&W, 2013). That is 6.3% of the total expenses (€ 3.4 billion) for higher professional education.

The UAS, which participated in the study, were selected for their size and diversity in education, because these institutions are responsible for the alignment of a substantial gross floor area with a variety of corporate goals. The 17 largest multi-sector UAS were approached for the study; finally, 13 UAS participated. With a total market share of 75% of all students, this sample is representative for Dutch higher professional education. At the time of the research, the 13 UAS together used 145 buildings for education and staff, with a total number of approximately 1.5 million square meters gross floor area. An overview of the statistics per UAS is shown in table 3.2.

TABLE 3.2 STATISTICS OF THE DUTCH UAS INVOLVED IN THE RESEARCH

	Dutch UAS	No. of students (2011/2012)	Market share of students (2011/2012)	No. of employees (2011/2012)	No. of buildings (2010)	Gross floor area in m2 (x 1,000) (2010)
1	Hogeschool van Amsterdam	45,171	10.7%	3,352	13	150 - 175
2	Fontys	40,194	9.5%	3,916	32	> 200
3	Hogeschool Inholland	31,328	7.4%	2,800	8	150 - 175
4	Hogeschool van Arnhem en Nijmegen	30,685	7.2%	3,061	23	150 - 175
5	Hogeschool Rotterdam	30,354	7.2%	3,281	11	125 - 150
6	Hanzehogeschool	25,416	6.0%	2,704	18	125 - 150
7	Avans Hogeschool	25,273	6.0%	2,148	6	125 - 150
8	Saxion	22,428	5.3%	2,225	3	100 - 125
9	Haagse Hogeschool	22,206	5.2%	1,851	4	100 - 125
10	Windesheim	21,167	5.0%	1,868	14	100 - 125
11	Zuyd Hogeschool	15,020	3.5%	1,767	3	75 - 100
12	NHTV	7,203	1.7%	665	8	< 50
13	Christelijke Hogeschool Ede	4,039	1.0%	521	2	< 25
		320,484	75.6%	30,159	145	1,500 - 1,600

Due to the complex relationships between the mission, vision, and strategy of an organisation and the strategic and operating decisions regarding real estate, this study used an interpretivist and qualitative research approach. Interpretivism originally fits an inductive research method (Saunders, Lewis & Thornhill, 2008). Because various studies are often available, Miles and Huberman (1994) argue for a combination of deduction and induction. Yet, the present research had a deductive starting point in the analytical CRE alignment framework of figure 3.1 and the CRE strategies found in the literature. Second, the empirical research investigated the particular field of higher education also based on induction.

For the study, two data collection methods were used. The first set of data was collected from a document analysis of the institutional Web sites, annual reports, and strategic plans (2010/2011) of all the 13 UAS.

A total of 47 documents were studied. The purpose of the document analysis was to collect information on the corporate strategies and the espoused CRE strategies. The second set of data was derived from semi-structured, in-depth-interviews with managers who are responsible for the educational buildings. The interviews were conducted to study the CRE strategies in-use that show up in practice at Dutch UAS, and how these institutions translate their CRE strategies to concrete CRE operating decisions. The interviews were conducted in the period of October 2011 till February 2012 and varied in length from 1 hour to 1.5 hours. All interviews were tape recorded. For coding and analysis of the interviews and the studied documents, Atlas.ti and Excel were used.

RESEARCH FINDINGS

3.4

This section will first present the espoused CRE strategies and CRE strategies in-use of the studied Dutch UAS. Second, it will discuss the alignment between these CRE strategies and corporate strategies (type A and B alignment in figure 3.1). Next, the alignment of CRE operating decisions with both types of CRE strategies will be discussed (type C and D alignment in figure 3.1). Finally, the relation between the four types of alignment will be discussed.

3.4.1 CRE STRATEGIES OF DUTCH UAS: ESPOUSED AND IN-USE

The study of the strategic documents of the Dutch UAS resulted in 125 text fragments that referred to espoused CRE strategies. The text fragments were clustered based on the 10 CRE strategies found in the literature. Out of these ten possible strategies, two CRE strategies did not show up in the studied documents: 'support innovation' and 'control physical risk' (see the second column of table 3.3). The analysis of the documents showed that the plans at the corporate level (e.g., annual reports), scantly mention CRE strategies. The figure between brackets in table 3.3 refers to the number of cases in which a CRE strategy showed up in the documents.

In the interviews, the respondents referred to nine CRE strategies in-use in 284 quotations (see the third column of table 3.3). Similar to the findings from the documents, the CRE strategy related to 'support innovation' was not found in the interviews. In addition, table 3.3 shows notable differences between the espoused CRE strategies found in the documents and the CRE strategies in-use found in the interviews. In practice, there are many more UAS respondents that refer to a CRE strategy, which aims to 'support culture', than to the CRE strategies found in the documented espoused CRE strategy (all 13 cases versus

2 cases). A similar difference was found regarding the CRE strategy to 'support user activities' (all 13 UAS mention that CRE strategy in the interviews, whereas 4 UAS mention the CRE strategy in their strategic plans).

TABLE 3.3 ESPOUSED CRE STRATEGIES AND CRE STRATEGIES IN-USE FOUND IN THE 13 DUTCH UAS

Possible CRE strategies (found in the literature and summarised)	**Espoused CRE strategies** (presented in strategic plans, with the number of cases that formulated this particular strategy between brackets)	**CRE strategies in-use** (mentioned in the interviews, with the number of cases that applied this particular strategy between brackets)
1. Increase user satisfaction	Offer an inspiring learning, teaching, and research environment (7 cases)	Offer buildings that meet user's expectations, which refer to the increasing importance of positive experiences (12 cases)
2. Support innovation	-	-
3. Support corporate image	Make corporate identity and image tangible with buildings and the campus environment (6 cases)	Make corporate identity and image tangible with buildings and the campus environment (8 cases)
4. Support culture	Offer group identification at a small environmental scale (2 cases)	Offer a recognisable home base for students and staff at small scale (13 cases)
5. Support environmental responsibility	Realise sustainable buildings (5 cases)	Environmental awareness in CRE (e.g., fitting buildings to the surrounding built environment and attention for sustainability) (6 cases)
6. Stimulate collaboration	Facilitate meeting and collaboration in learning and teaching with buildings and the campus environment (7 cases)	Stimulate meeting and collaboration in learning and teaching with buildings and campus, for all internal and external stakeholders and share CRE with partners (10 cases)
7. Support change	Increase CRE flexibility with long term CRE plans, anticipate on virtual campus developments and endorse changing student profiles (11 cases)	Increase building flexibility to be prepared for educational developments and even initiate changes in education with CRE (10 cases)
8. Support user activities	Support learning, teaching, and research activities with CRE (4 cases)	Support learning, teaching, and research activities by offering sufficient m2 and a functional education environment, which is more than just classrooms (13 cases)
9. Control real estate costs	Look after efficient use of learning and teaching space (8 cases)	Efficient use of learning and teaching space reducing m2 per student and staff (12 cases)
10. Control physical risk	-	Take care of a safe and secure work and study environment (e.g., minimal building quality) (5 cases)

3.4.2 ALIGNMENT BETWEEN CRE STRATEGIES AND CORPORATE STRATEGIES

The alignment between the found CRE strategies and the corporate strategies (type A and B of the analytical framework in figure 3.1) refers to if and how espoused and in-use CRE strategies fit the corporate strategies. Therefore, the corporate strategies were first retrieved from a total of 394 text fragments in the strategic plans. These text fragments were grouped in 14 corporate strategies. Second, these 14 corporate strategies were linked to 10 possible CRE strategies found in the literature, as shown in table 3.4. Table 3.4 shows that most CRE strategies match one specific corporate strategy. Two CRE strategies support more corporate strategies:

1) The CRE strategy that aims to stimulate collaboration is related to two corporate strategies concerning a learning community, and realising regional partnerships.
2) The CRE strategy that aims to support user activities is related to four corporate strategies regarding education and developments in learning and teaching (i.e., realise a high quality of education, recognise individualisation in education, realise the shift from a 'school' towards a knowledge institution, and develop new didactical procedures).

For one corporate strategy (international focus), there is no specific CRE strategy to match it. And for one CRE strategy (control of physical risk in buildings) no related corporate strategy was found in the strategic plans and documents.

The number of UAS in which alignment was found between CRE strategies (espoused and in-use) and the corporate strategies from table 3.6 is presented in the histograms of figure 3.2. Four possible linkages have been distinguished:

I. Alignment: this occurs when the CRE strategy is in agreement with the corporate strategy (Heywood, 2011) (i.e., when the corporate strategy is applied in that UAS and the related CRE strategy is also present).
II. No alignment: when the corporate strategy is applied, but no related CRE strategy was found in documents or mentioned in the interviews.
III. No alignment: when the CRE strategy was found in documents or mentioned in interviews, but no related corporate strategy was found.
IV. Alignment not applicable: when neither the corporate strategy nor the CRE-related strategy is present.

The black bars (I) in figure 3.2 show that, in general the CRE strategies in-use are more often aligned with the corporate strategies than the espoused CRE strategies written down in the strategic plans. The striped bars (II) show that a number of corporate strategies are not covered by

TABLE 3.4

CONNECTIONS BETWEEN CRE STRATEGIES FOUND IN THE LITERATURE, AND CORPORATE STRATEGIES FOUND AT 13 DUTCH UAS

Possible CRE strategies (found in the literature and summarised)	**Corporate strategies** derived from strategic plans and documents (the number of cases in which that corporate strategy occurs between brackets)
1. Increase user satisfaction	Offer inspiring education and teaching (4 cases)
2. Support innovation	Contribute to innovation and to the development of the knowledge economy (8 cases)
3. Support corporate image	Exhibit the corporate identity by carrying out core values like reliability, involvement, transparency, informality, etc. (13 cases)
4. Support culture	Deliver education at small scale so students and staff can identify themselves with their own group in a large institution (9 cases)
5. Support environmental responsibility	Act with attention to sustainability and social responsibility (10 cases)
6A. Stimulate collaboration	Increase collaboration and meeting in a learning community (12 cases)
6B. Stimulate collaboration	Realise regional partnerships by increased collaboration with companies and organisations in the surrounding area (10 cases)
7. Support change	Act future-oriented by focusing on demographic developments, educational developments and anticipating on developments in the use of ICT in learning/teaching (11 cases)
8A. Support user activities	Realise a high quality of education and teaching (13 cases)
8B. Support user activities	Recognise individualisation of education by attention to increased diversity of student profiles and learning preferences (13 cases)
8C. Support user activities	Realise the shift from 'school' towards a knowledge institution (12 cases)
8D. Support user activities	Develop new didactical procedures, aimed at vocational orientation in education e.g., competence-based learning and teaching, with links to cases in practice (10 cases)
9. Control real estate costs	Focus on efficiency with efficient allocation of financial resources (13 cases)
10. Control physical risk	-
-	Focus on international developments by global acting and thinking (10 cases)

any CRE strategy. In some occasions, UAS have CRE strategies without any corporate strategy to match (the grey bars: III). For example, the first bar of alignment goal 1 indicates that:

- Three UAS have a corporate strategy concerning inspiring education and teaching and support that strategy with an espoused CRE strategy;
- One UAS has a corporate strategy on this subject, but do not mention any CRE strategy in their documents to match;
- Four UAS respondents mention an espoused CRE strategy, but there is no corporate strategy to match; and
- Five UAS mention neither a corporate strategy nor an espoused CRE strategy on inspiring education in relation to CRE.

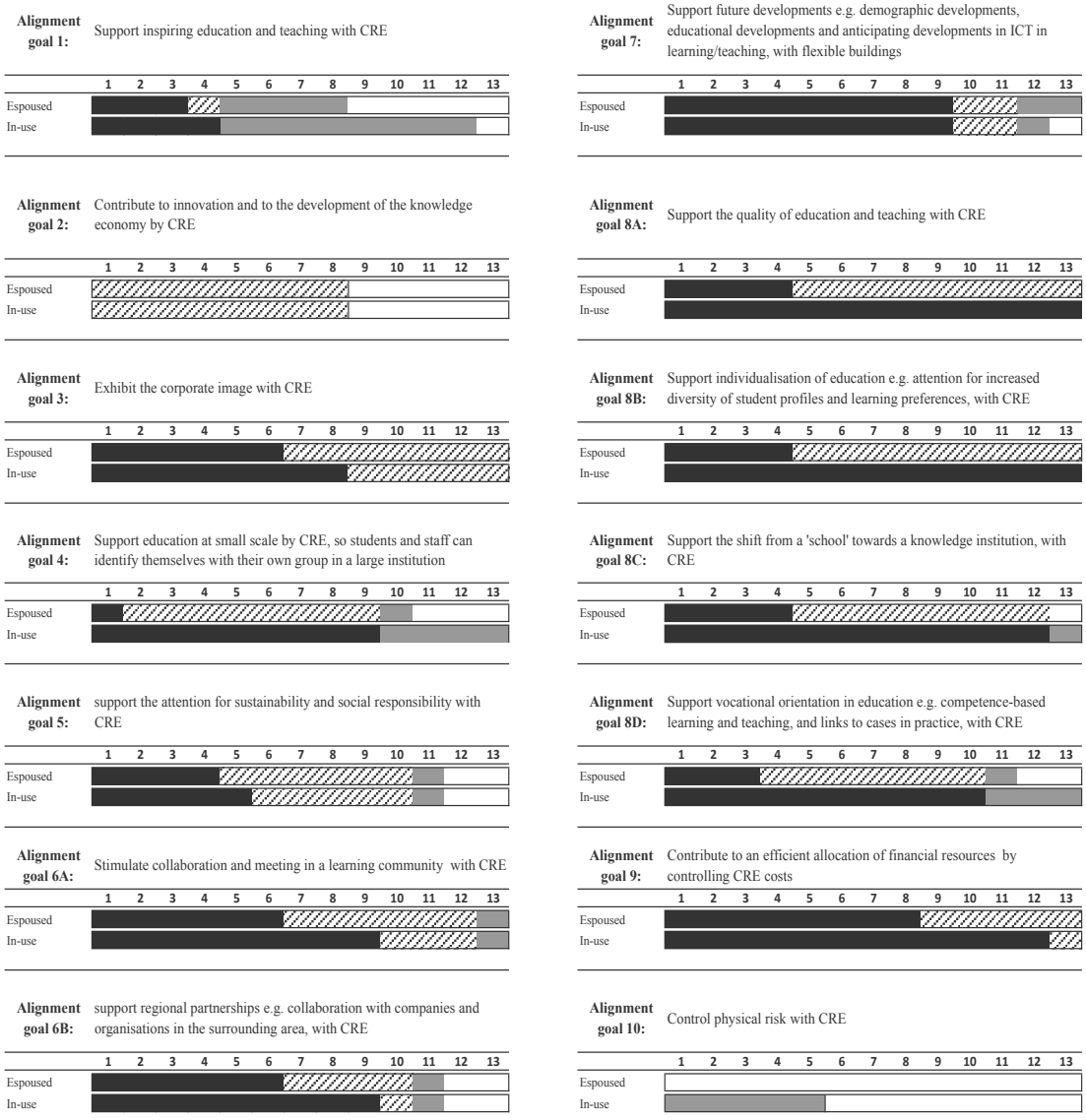


Figure 3.2
Alignment between applied CRE strategies (espoused and in-use) and corporate strategies in the 13 Dutch UAS (alignment type A and B)

TABLE 3.5 CONNECTIONS BETWEEN CRE STRATEGIES FOUND IN THE LITERATURE AND CRE OPERATING DECISIONS MENTIONED IN THE INTERVIEWS

Possible CRE strategies (found in the literature and summarised)	**CRE operating decisions** mentioned in the interviews (the number of cases in which these CRE operating decisions occurred between brackets)
1. Increase user satisfaction	Create an inspiring educational environment, like attractive architecture, green campus appearance, attractive facilities (8 cases)
2. Support innovation	Fit the aim to support innovation with CRE (0 cases)
3. Support corporate image	Exhibit the corporate image of the institution, e.g., new buildings, special architecture, etc. (3 cases)
4. Support culture	Create a recognisable home base for students/staff, e.g., dedicated buildings or dedicated areas in buildings for a specific degree program, recognisability through signing, use of colors, materials, etc. (12 cases)
5. Support environmental responsibility	Fit the aim to support corporate responsibility and sustainability with CRE (2 cases)
6. Stimulate collaboration	Create meeting spaces supported by restorative facilities for students/staff, realise project rooms and collaborative space for students, create transparency in buildings by using glass walls, stimulate mobility in and between buildings, accommodate teaching activities at companies in the region (12 cases)
7. Support change	Create flexibility, e.g., flexible building systems (walls, ceiling, floors), create generic space measures (like classrooms without any specific identity), choose flexible furniture (10 cases)
8. Support user activities	Support learning, teaching, and research activities, e.g., offering a variety of learning settings for students, increase informal learning space, introduce new ways of working for staff, offer sufficient wireless ICT facilities for students (12 cases)
9. Control real estate costs	Reduce costs, e.g., reducing 'dedicated space for specific end-users' and creating generic space measures, reducing the m2 per student, clustering facilities (like lunch facilities, libraries, etc) (13 cases)
10. Control physical risk	Realise a safe work and study environment, e.g., optimising fire safety and indoor climate facilities (3 cases)

3.4.3 ALIGNMENT BETWEEN CRE STRATEGIES AND CRE OPERATING DECISIONS

To study the alignment between the CRE strategies and the CRE operating decisions, text fragments were coded in the interviews that refer to the CRE operating decisions. In total, 211 text fragments were found. These text fragments were then classified according to the ten possible CRE strategies that were found in the literature. Table 3.5 shows the number of cases in which these CRE operating decisions were mentioned.

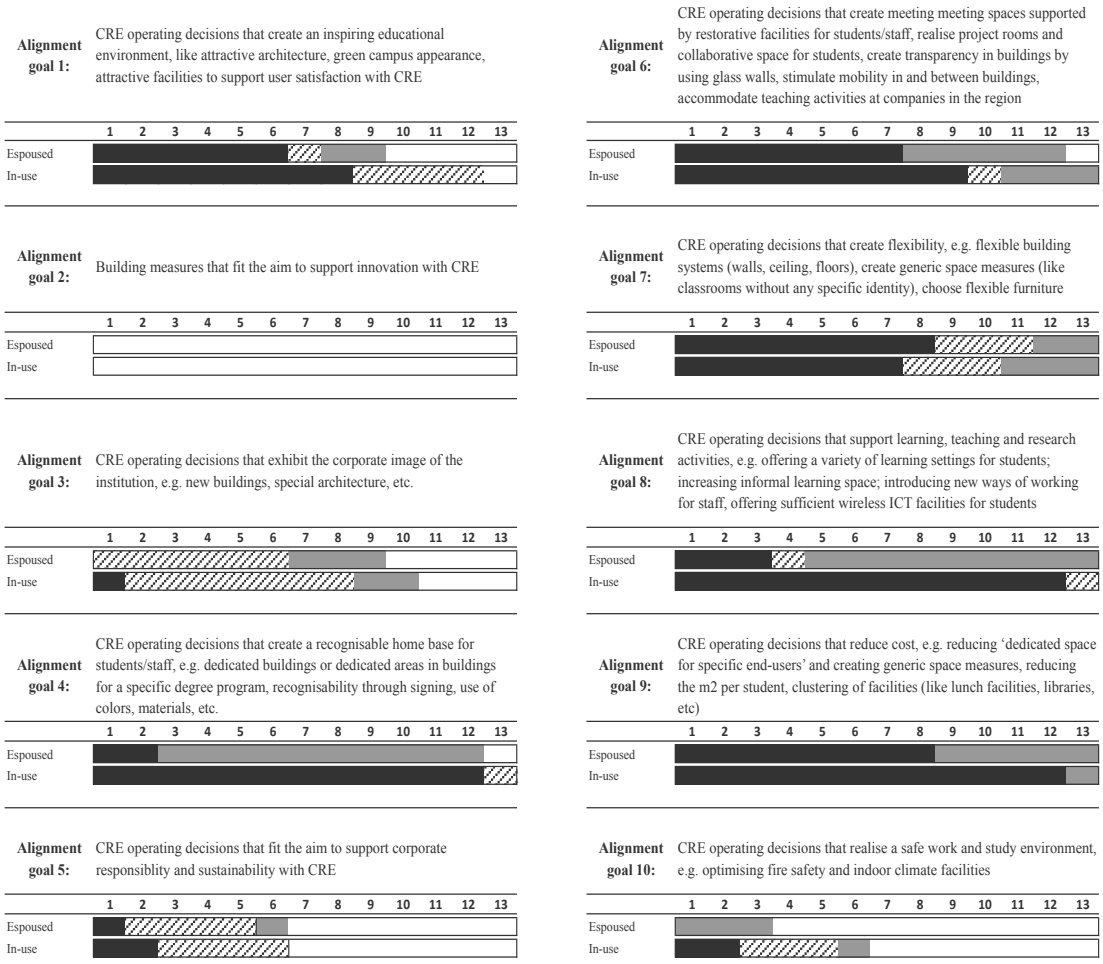


Figure 3.3
Alignment between applied CRE strategies and CRE operating decisions in the 13 Dutch UAS (alignment type C and D)

Not all 10 possible CRE strategies were covered by CRE operating decisions. Furthermore, no CRE decisions were mentioned in relation to 'support innovation', and remarkably, despite the incorporation of this issue in both espoused and in-use CRE strategies, no CRE operating decisions were mentioned concerning sustainability. The realisation of new educational buildings to support the corporate image was only mentioned in 3 UAS. The same holds true for CRE operating decisions that that focus on creating safe building circumstances. CRE operating decisions that aim to reduce CRE costs were mentioned in all interviews. Next, the alignment between CRE strategies and CRE operating decisions (type C and D of the analytical framework of figure

3.1) is examined for every single UAS. Figure 3.3 shows how these CRE strategies (espoused and in-use) show up in the CRE operating decisions (e.g., concrete building measures).

Figure 3.3 shows that the CRE operating decisions fit the CRE strategies in-use more often than the espoused CRE strategies. There is one exception: CRE operating decisions that create (building) flexibility. The histograms show that CRE decisions often occur without referring to any CRE strategy (the dark grey parts of the bars, type III). Histogram 3 shows the opposite regarding supporting corporate image. Both the strategic documents and the interviews suggest that CRE should contribute to the corporate image of the institution. Yet, there are only a few CRE operating decisions mentioned that exhibit this CRE strategy in practice. Building measures concerning safe and secure buildings are only mentioned in a few UAS and usually fit the CRE strategy in-use of the CRE manager. At a corporate level, there is no such CRE strategy present in the documents.

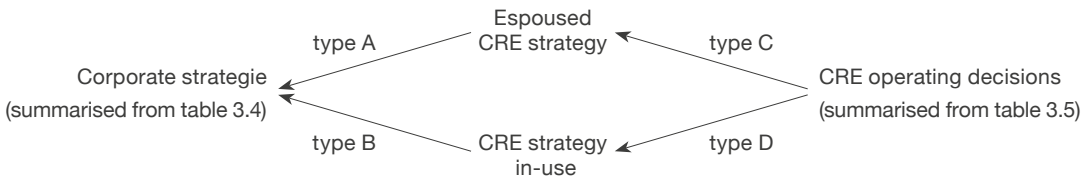
3.4.4 ALIGNMENT BETWEEN CRE OPERATING DECISIONS AND CORPORATE STRATEGY

The former sections have shown how the four alignment types A, B, C, and D of the analytical framework of figure 3.1 show up in practice. The histograms of figure 3.2 and 3.3 do not make clear to what extent the concrete CRE operating decisions as mentioned in the interviews support the corporate strategies as found in the strategic documents. Table 3.6 shows for each studied UAS whether the alignment between espoused/in-use CRE strategies and corporate strategy (concerning type A and B) is elaborated in the alignment between CRE strategies and CRE operating decisions (type C and D). For example, the numbers 3 and 2 in the second row of table 3.6 refer to three UAS with an alignment between the espoused CRE strategy and the corporate strategy (in accordance to the histograms of figure 3.2) from which, two UAS mention CRE operating decisions that are in line with that CRE strategy.

Table 3.6 shows that most CRE strategies that are aligned with corporate strategies show up as concrete CRE operating decisions in practice. Only one corporate strategy – 'contribute to innovation' - was not found in any related CRE strategies or CRE operating decisions that were mentioned in the interviews. Conversely, the CRE operating decision 'to create a safe work and study environment' was not traced in any corporate strategy document.

NUMBER OF CASES WITH ALIGNMENT TYPES A / C AND TYPES B / D ACCORDING TO THE ANALYTICAL FRAMEWORK OF FIGURE 3.1

TABLE 3.6

		
1. Offer inspiring education and teaching (4 cases)	3 2 4 2	Create an inspiring educational environment
2. Contribute to innovation (8 cases)	- - - -	-
3. Exhibit the corporate identity (13 cases)	6 - 8 1	Exhibit the corporate image of the institution
4. Deliver education at small scale (9 cases)	1 1 9 8	Exhibit the corporate image of the institution
5. Act with attention for sustainability and social responsibility (10 cases)	4 1 5 2	Sustainable building solutions
6A. Increase collaboration and meeting in a learning community (12 cases)	6 6 9 8	Create meeting space
6B Realise regional partnerships (10 cases)	6 6 9 9	Accommodate teaching activities at companies in the region, etc
7. Act future-oriented (11 cases)	9 7 9 7	Create flexibility
8A. Realise a high quality of education and teaching (13 cases)	4 3 13 12	Support learning, teaching, and research activities
8B. Recognise individualisation of education (13 cases)	4 3 13 12	Support learning, teaching, and research activities
8C. Realise the shift from 'school' towards a knowledge institution (12 cases)	4 3 12 11	Support learning, teaching, and research activities
8D. Develop new didactical procedures aimed at vocational orientation (10 cases)	3 2 10 9	Support learning, teaching, and research activities
9. Focus on efficiency and efficient allocation of financial resources (13 cases)	8 8 12 11	Reduce costs
10. Control physical risk (0 cases)	- - - -	Realise a safe work and study environment

Finally, the ratio between the number of cases with a particular CRE strategy and related CRE operating decisions is quite similar for espoused and an in-use CRE strategies; despite the fact that CRE strategies in-use are more frequently mentioned than espoused strategies.

3.5 DISCUSSION AND IMPLICATIONS

The literature stresses the importance of the alignment between CRE and the core business (Heywood, 2011; Jensen, 2010; Lindholm et al., 2006; Osgood, 2004). According to Krumm et al. (2000), this alignment is important in order to obtain maximum added value for the organisation as a whole. Porter's (1985) value chain also showed that besides primary activities, support activities like CREM are of importance for an organisation's performance. Building on Porter (1985) and other management literature (e.g., Zeithaml, 1988; Kaplan & Norton, 1996, 2006), a distinction can be made between two ways in which CREM can add value to the organisation (i.e., by cost reduction and by value creation) (Jensen et al., 2013; De Vries et al., 2008; Lindholm et al., 2006). Both ways were detected in the Dutch UAS study. Cost-controlling strategies were both found in the strategic documents and were mentioned in the interviews. CRE operating decisions aimed at cost reduction were mentioned in the interviews with CRE managers as well. Value creation was found in terms of CRE strategies 'to support future developments', 'to increase user satisfaction', 'to support culture', and 'to support user activities'. These results are consistent with the findings of Housley (1997), who found that the key CRE strategies contributing to success of the organisation were 'reduction of occupancy costs' and 'providing humane work environment'.

The CRE strategies that were found in the studied Dutch UAS correspond quite well with the ten CRE strategies that were retrieved from the literature. This is in contrast to Rondinelli, Rosen and Drori (2001, p. 414) who state that "alignment […] has consistently been advocated in theory but has often been disregarded in practice". Nevertheless, in the present study some gaps were found between the 'paper truth' and the 'real truth' (i.e., the CRE strategies that are written down in strategic plans and the CRE strategies that are applied in-use). This is comparable with findings of Clemons et al. (1995), who also showed significant discrepancies between the two. In their research, the espoused strategy was often better aligned with the corporate business strategy than the strategy in-use. Remarkably, in the Dutch UAS cases, the CRE strategies in-use seemed to align better with corporate strategies than the espoused CRE strategies.

A key dilemma of the alignment between CRE and the organisation is the difference between the time horizon of the real estate strategy and the corporate strategy. The studied strategic corporate plans of Dutch UAS mostly concern a planning horizon of four years, whereas the strategic planning horizon of CRE decisions can span 50 years or even longer (Brand, 1994). Gibler, Black and Moon (2002, p. 245) discussed this issue and the consequences as: "[…] the strategic planning horizon for most companies remains five years or less, with many using only a two- or three-year planning horizon […] Such a short-term view limits the company's ability to approach a long-term commitment such as real estate in a strategic manner." Nevertheless, Gibler et al. (2002, p. 236) conclude that "in many organisations the corporate real estate manager is not involved in the company's strategic planning process". The current research in Dutch UAS partly confirms this issue and stresses the importance of involving CRE managers in decision-making to strengthen the connections between business management and CRE management. It is expected that the effectiveness of CRE strategies and CRE operating solutions will be increased if CRE managers are aware of how these strategies and solutions might support the organisational goals. By showing the potential and actual alignment between CRE and the organisation, the findings of this present research can support CRE managers to make the right choices for CRE strategies in line with the corporate purposes and in prioritising CRE operating decisions.

Another practical implication is the relevance of the involvement of end users in formulating CRE operating solutions. This because 'supporting user activities' and 'increasing user satisfaction' showed to be two of the main CRE strategies. Further research into the alignment processes between demand and supply can be helpful to improve our understanding of which CRE operating solutions support end-user needs in terms of efficiency, effectiveness, and satisfaction.

Although the 13 studied cases represent a large percentage of the total student population in the Netherlands, the limited number of interviews and the limited duration of the interviews (1 – 1.5 hours) did not allow for studying all types of alignment in depth and longitudinally. It appeared to be difficult to get a full insight in all applied functional strategies and operating decisions and actual connections with the corporate strategies in one interview. As a consequence, the findings are not fully conclusive yet, but merely an evidence-based indication of how higher education organisations apply CRE strategies and operational decisions in practice. Additional data is needed to validate the alignment framework, both empirically and regarding managerial applicability. Future work should focus on extending the number of cases and the number of interviews. It would also be productive to involve corporate

management in interviews or focus groups as well to find out what their understanding is of the impact of CRE on the delivery of the corporate mission.

3.6 CONCLUSION

Due to the rapid and complex developments in higher education, the challenge of the present research was to shed more light on how CRE managers try to develop CRE strategies and take CRE operating decisions in order to align CRE with the evolving corporate strategies of Dutch UAS. The results show differences between the alignment of the corporate strategies with espoused CRE strategies and with CRE strategies in-use. The alignment of espoused CRE strategies showed a number of gaps, which might refer to a limited understanding of the possible added value of CRE for the organisation and the end users. On the other hand, CRE strategies in-use seem to be aligned quite well with the corporate goals. This suggests that CRE managers are aware that CRE can be more than just a support function or a necessity, and how CRE can add value to serve the corporate interest. The CRE managers mainly steer on CRE alignment with corporate goals by formulating CRE strategies that support user activities and that control CRE costs. Beside these two added values of CRE, aligning CRE operating decisions are also related to supporting the organisational culture. The analytical alignment framework presented in this paper showed to be useful for the exploration of the different types of alignment between corporate strategies, CRE strategies, and CRE operating decisions. The combination of the document analysis and the interviews with CRE managers showed to be appropriate to detect similarities and dissimilarities between the alignment of corporate strategies with espoused CRE strategies and CRE strategies in-use in the field of higher education. The findings contribute to the recognition of the growing importance of aligning CRE with corporate goals as an added value for organisational performance.

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MANAGEMENT STRATEGIES FOR ALIGNING HIGHER EDUCATION ACCOMMODATION WITH THE USER NEEDS

This paper has been selected by the journal's editorial team as a Highly Commended Paper in the 2016 Emerald Literati Network Awards for Excellence.

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4.1 INTRODUCTION

In the field of corporate real estate management (CREM), there is ongoing interest in how organisations align their corporate real estate (CRE) with the goals of the organisation and its core business (Haynes, 2012; Appel-Meulenbroek & Feijts, 2007; Lindholm, Gibler & Leväinen, 2006; Scheffer, Singer & Van Meerwijk, 2006; Osgood, 2004; Nourse & Roulac, 1993). Many CRE alignment studies focus on addressing CRE strategies that match the corporate strategy, and on indicating which CRE operating decisions create a building or a built environment that fits the corporate goals best (Beckers, Van der Voordt & Dewulf, 2015b; Heywood, 2011; Appel-Meulenbroek, Brown & Ramakers, 2010). According to the 'strategy alignment model' of Osgood (2004), CRE alignment requires a continuous process of matching the building supply of an organisation in its own business with specific trends and developments.

A business that has been facing substantial changes is higher education (Johnson, Smith, Willis, Levine & Haywood, 2011; Robinson, 2010). In the past decades, there has been a shift from a supply-driven approach of traditional teaching and learning to new, more customised and demand-oriented ways of teaching and learning (Simons, Van der Linden & Duffy, 2000). The role of school has changed from a place of instruction to a place for producing learning (Barr & Tagg, 1995). Barr and Tagg deliberately use the verb produce, to emphasise that learning for students has become a co-production with the school, instead of simply a case of consuming instructions in a classroom. These changes in education have been affecting the accommodation of learning and teaching (Beckers, Van der Voordt & Dewulf, 2015a; Johnson et al., 2011). Yet, literature shows that many buildings of Dutch higher education institutes are not sufficiently prepared for future needs and demands (De Vries, Van der Voordt & De Jonge, 2008). De Vries et al. attribute this to limited understanding of the alignment of educational buildings with changes in learning and teaching. Based on an extensive literature study, Temple (2007, p. 8) concludes that "the literature throws almost no light on managerial decision-making about space issues affecting students or staff: this is a topic where further work would be useful." This is endorsed by Boddington and Boys (2011), who indicate that there is a need for more appropriate methods and tools for the management and construction of learning spaces in higher education. Yet, CRE managers need a better understanding of how to align educational buildings with the developments in higher education. To contribute to this understanding, a study has been conducted to determine the current management approaches for aligning CRE with the needs and requirements of higher education institutes. The present paper first outlines the theoretical issues of CRE alignment processes and the

management of accommodation needs. Next, it presents the results of an empirical study based on a series of interviews with CRE managers or facility management (FM) managers of Dutch Universities of Applied Sciences (UAS) and an additional questionnaire. The paper ends with theoretical and practical implications and concluding remarks.

THEORETICAL BACKGROUND 4.2

Traditionally, CREM theory shows four alignment perspectives of CRE with the core business (Manning & Roulac, 2001; figure 4.1). Two perspectives are related to the institution (demand side) and two to CRE (supply side). Within these perspectives, a distinction is made between the strategic and the operational level (Den Heijer, 2011; Krumm, Dewulf & De Jonge, 2000).

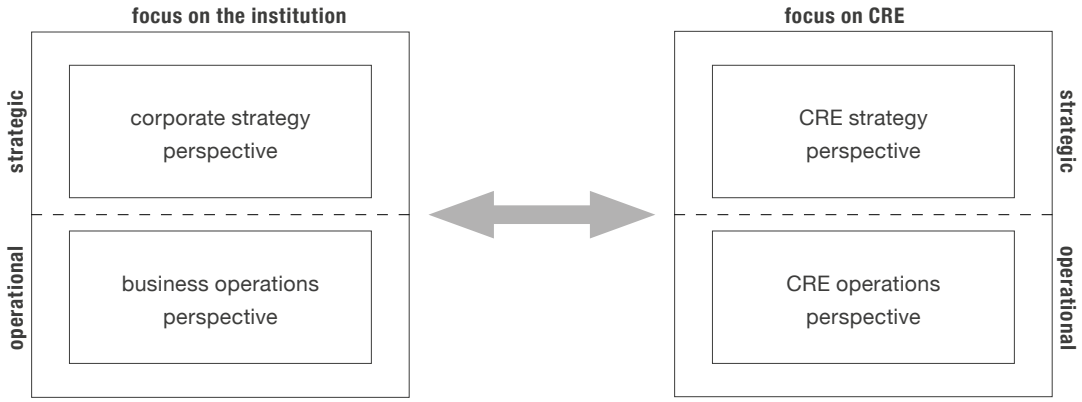

Figure 4.1
Four CREM perspectives

The arrow between the demand and the supply side in figure 4.1 represents the process of aligning CRE with the organisation and the end users. That process aims at analysing the corporate goals and the day-to-day operating activities to determine the right CRE strategy and the matching CRE operating solutions. Yu, Chan, Chan, Lamb and Tang (2010) use the term 'requirements management' for this process. Their research points out that requirements management is crucial for the delivery of appropriate CRE solutions, and that "there is a lack of identification, management and traceability of the requirements" (Yu, Shen & Chan, 2010, p. 372). Yu et al. (2010a) identified a number of potential problems in understanding the requirements based on a several studies. The formulated requirements are often incomplete and inconsistent. Decision-makers misunderstand and misinterpret the requirements, and there is often a lack of involvement of the end users.

Omar and Heywood (2014) confirm that there is still a gap between CREM executives and the building users. One of their solutions to close that gap is to pay more attention to the relationship with these users. Relationship management can also be considered an instrument to help the CREM department to "learn […] the language of the business" (Fisher, 2009 referring to Roper, 2001). McCarthy, Hunt and Truhan (2006) describe several aspects of relationship management in CREM such as: the need to know the core business, open communication with the users, access to strategic business information, and the user's involvement in decision-making. According to Arnstein (1969), there are three levels of user involvement, which can be divided into eight rungs on a ladder of participation. The bottom rungs of the ladder describe two ways of non-participation (manipulation and therapy). The middle tree rungs progress to levels of "tokenism that allow the have-nots to hear and to have a voice" (Arnstein, 1969, p. 219), namely: informing, consultation, and placation. The upper part of the ladder refers to three levels of user power with increasing degrees of involvement in decision making: partnership, delegated power, and full control. Arnstein's ladder considered the participation of citizens related to city planning. Concerning participation in the context of CREM, Horgen, Joroff, Porter and Schön (1999), and Dewulf and Van Meel (2002) formulated a shorter ladder with three ways of involving building users in CREM issues:

1) Informing: the CREM department only informs the building users.
2) Participation: building users participate by giving input for CREM issues.
3) Co-creation or co-design: the users are not only given possibilities to express their opinions and ideas, but also have decision-taking powers.

There are several levels at which building users can operate. This paper adopts the tripartition of CEN (2006) with the client who represents the building user at the strategic level, the customer such as heads of departments at the tactical level, and the end user at the operational level. Different ways of managing the involvement of the client, customers, and end users can be found in the literature of business organisation and business process management (Llewellyn & Armistead, 2000; Garvin, 1998). They distinguish two main dimensions: a structural dimension and a behavioural dimension. The structural dimension is related to the coordination of the people you reach and the ways of reaching them (Llewellyn & Armistead, 2000) and to activities such as budgeting and planning (Garvin, 1998). The behavioural dimension is related to the organisation's way of acting and interacting, such as communication and decision-making (Garvin, 1998). The foregoing leads to an analytical framework for the management of the CRE alignment process, which is presented in table 4.1.

ANALYTICAL FRAMEWORK FOR MANAGING THE CRE ALIGNMENT PROCESS (DERIVED FROM: LLEWELLYN & ARMISTEAD, 2000; GARVIN, 1998). TABLE 4.1

Context (developments in the business of the organisation)

Process dimensions	Key process activities	Management perspectives for the key process activities
Structural dimension	Coordination	Related to whom you reach and how you reach them, and preconditions like planning and finances
Behavioural dimension	Communication	Related to correct information that is relevant for aligning CRE with the needs of clients, customers, and end users
	Decision-making	Related to the levels of influence in CREM issues of the clients, customers, end users, and the CREM department

In the next sections, this paper explores the analytical framework of table 4.1 in the context of UAS in order to compare theory with practice and to explore which lessons can be learned from this comparison.

EMPIRICAL STUDY: METHODOLOGY 4.3

The empirical part of this research was conducted at 14 large Dutch UAS. The Netherlands has 37 UAS (in 2013) with a total number of 440,235 students (in 2013) and 43,549 employees (in 2012) (Vereniging hogescholen, s.d.). The 14 institutions involved in the research together represent 38% of all Dutch UAS and 84.5% of all students in Dutch UAS (in 2013). At the start of the research (in 2011), the UAS that were involved in the study used 157 buildings for education and staff, with a total number of approximately 1.65 million square meters gross floor area.

The first part of the study concerned interviews with the CRE or FM managers who were responsible for the management of the accommodation (Beckers & Van der Voordt, 2014). The interviews were conducted in the period of October 2011 till February 2012. The main purpose of the interviews was to study the management approaches for aligning CRE with the accommodation needs. All interviews were tape recorded and transcribed for subsequent analysis in Atlas.ti and Excel. The linkage of the quotations from the interviews to the key process activities in the framework of table 4.1 was based on open coding (Corbin & Strauss, 2008).

Second, during a meeting in May 2014 with CRE directors of Dutch UAS, they were asked to fill in a questionnaire to get more detailed information about their opinions and management approaches regarding the topics that came up in the interviews. It was aimed to involve the same UAS that participated in the interviews also in the questionnaire. Indeed, seven of the interviewed managers in 2011/2012 also filled in the questionnaire in 2014. In the other UAS, the manager who filled in the questionnaire in 2014 differed from the manager who was interviewed in 2011/2012. One of the interviewed UAS was not available for filling in the questionnaire. There also was a UAS that did fill in the questionnaire, but that had not participated in the interviews. Table 4.2 shows an overview of which UAS participated in the interviews and which UAS filled in the questionnaire.

TABLE 4.2 FIGURES OF THE DUTCH UAS INVOLVED IN THE RESEARCH

Case no.	No. of students (ref date 2013)	Market share (ref date 2013) (%)	No. of employees (ref date 2012)	Participation in the interviews (2011/2012)	Participation in the questionnaire (2014)	Same manager in interview and questionnaire	Buildings (ref date 2010)	Gross floor area indication (x 1,000) (ref date 2009/2010)
1	48,207	11.0%	3,558	yes	yes	yes	13	150 - 175
2	42,484	9.7%	3,662	yes	yes	yes	32	> 200
3	36,454	8.3%	3,608	no	yes	no	12	150 - 175
4	32,443	7.4%	3,321	yes	yes	no	11	125 - 150
5	31,921	7.3%	3,170	yes	yes	yes	23	150 - 175
6	30,138	6.8%	2,423	yes	yes	no	8	150 - 175
7	27,705	6.3%	2,275	yes	yes	yes	6	125 - 150
8	26,223	6.0%	2,784	yes	yes	no	18	125 - 150
9	25,336	5.8%	2,369	yes	yes	no	3	100 - 125
10	24,783	5.6%	2,021	yes	yes	yes	4	100 - 125
11	20,112	4.6%	2,009	yes	yes	yes	14	100 - 125
12	14,675	3.3%	1,573	yes	yes	no	3	75 - 100
13	7,171	1.6%	662	yes	yes	yes	8	< 50
14	4,195	1.0%	523	yes	no	no	2	< 25
	371,847	**84.5%**	**33,958**				**157**	**1,600 - 1,700**

RESEARCH FINDINGS

4.4

The interviews with the CREM/FM managers have resulted in 550 quotations that refer to the management perspectives for the CRE alignment process, as shown in the framework of table 4.1. Table 4.3 shows per case how many quotations refer to the key process activities of table 4.1. In the next paragraphs, the results of the interviews will be presented in combination with the results of the questionnaires.

NUMBER OF QUOTATIONS THAT ARE RELATED TO THE KEY PROCESS ACTIVITIES OF TABLE 4.1

TABLE 4.3

Key activities of the management of the CRE alignment process	Cases in Dutch UAS														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**total**
Contextual developments	20	11	-	12	9	8	4	1	2	8	14	13	6	5	**113**
Coordination	19	17	-	12	11	20	22	11	9	6	22	15	5	14	**183**
Communication	10	10	-	8	8	7	12	12	7	13	11	15	2	2	**117**
Decision-making	12	17	-	19	13	5	23	6	7	3	14	4	6	8	**137**
	61	**55**	**-**	**51**	**41**	**40**	**61**	**30**	**25**	**30**	**61**	**47**	**19**	**29**	**550**

4.4.1 CONTEXTUAL DEVELOPMENTS IN HIGHER EDUCATION AND DUTCH UAS

In the interviews, the CRE/FM managers mentioned several developments and changes in the context of Dutch UAS, of which they think that these might influence the CRE, such as:

- Fast information technology (IT) developments in society like social media and in education, for example, e-learning, blended learning - which is a mixture of e-learning and face-to-face meetings at school - or the concept of the flipped class room, where students watch Web-lectures at home and come to school to work together on assignments in class.
- Educational developments, like the shift from teaching in classrooms with one teacher talking and thirty students listening, to students that progressively work together in small groups. These developments become apparent in 'a shift from a cognitive focus on education to a social focus', 'an increasing need to meet', 'increasing flexibility in educational processes', and an abandonment of 'one size fits all'.
- The financial crisis that led to cuts of the Dutch government to the education budget and to the resources for supporting activities, buildings, and facilities.
- The social debate in the Netherlands about the improvement of the quality of higher education and increased attention for 'the student'.
- The growing impact of the 'experience factor': school must be fun and education must be attractive to the students.

– Demographical developments land the expectation that the number of students will decrease after 2020.
– The current demand for valorisation of knowledge of higher professional education leads to the need for increased cooperation of these institutions with public and private companies in 'the outside world'.

In the follow up questionnaire, the respondents were asked to mark how strongly they thought these developments would influence the accommodation needs of their institution on a five-point scale, from (1) = definitely not to (5) = very much. Table 4.4 shows that IT developments in education and changing didactics in education are the main drivers for the changing needs for the accommodation, directly followed by the increasing expectations of students in higher education.

TABLE 4.4 INFLUENCE OF DEVELOPMENTS ON THE HIGHER EDUCATION ACCOMMODATION

How do these aspects influence the accommodation needs?	Definitely not (1)	Not (2)	Perhaps (3)	Much (4)	Very much (5)	Total N	Mean	SD	Median
IT developments in education	0	1	0	6	6	13	4.31	0.85	4.00
Educational developments	0	0	3	6	4	13	4.08	0.76	4.00
Financial cuts to the education budget	0	1	6	6	0	13	3.38	0.65	3.00
Quality improvements in higher education	0	2	8	2	1	13	3.15	0.80	3.00
Demographical developments	0	1	5	6	1	13	3.54	0.78	4.00
Increasing expectations of students	0	0	1	12	0	13	3.92	0.28	4.00
Need for cooperation with 'the outside world'	0	0	3	9	1	13	3.85	0.55	4.00

The interviews showed four possible consequences for the accommodation of these developments:

1) A decreasing need for square meters in educational buildings. *Interviewee (case number 14): "The influence of IT in education will result in a reduction of traditional learning space such as large lecture rooms."*
2) The need for other learning space settings, such as more informal learning settings instead of traditional class room space. *Interviewee (case number 5): "Both inside school buildings and outside on the campus, I think that there will be more creative spaces that support the need to meet."*
3) Quality improvements of the actual square meters in the building.

Interviewee (case number 4): "Because of the experience economy in our society we refurbished the entrance and created this well-designed meeting area."

4) The possibility that there will be no or hardly any consequences for accommodation.

The questionnaires show that most respondents think that developments in higher education will lead to the need for other kinds of learning settings and a higher quality of these settings. The CRE/FM managers are ambiguous about the consequences for the quantity of learning space (table 4.5).

CONSEQUENCES FOR THE ACCOMMODATION TABLE 4.5

What are the consequences for the accommodation?	Definitely not (1)	Disagree (2)	Don't know (3)	Agree (4)	Definitely (5)	Total N	Mean	SD	Median
Other functional needs in learning settings?	0	0	1	6	6	13	4.38	0.65	4.00
Quality improvements of the actual square meters?	0	0	3	6	4	13	4.08	0.76	4.00
Less need for square meters?	0	1	5	3	4	13	3.77	1.01	4.00
No or hardly any consequences?	7	6	0	0	0	13	1.46	0.52	1.00

4.4.2 COORDINATION

In the first place, coordination activities concern the structural aspects of managing the CRE alignment process. The interviews show two aspects. First, coordination 'with whom?' The interviews especially focused on the internal stakeholders related to learning and teaching. CRE managers distinguish four categories of internal stakeholders:

1) Executive board: top management;
2) Middle management: academy directors, institute directors, program directors;
3) Teachers and non-teaching staff; and
4) Students.

The executive board and educational managers are defined as the client and the customers respectively. The teachers, non-teaching staff, and students are considered the end users.

Interviewee (case number 4): "Facility managers in a building are responsible for their own customer relations and account management, with questions such as: who is the customer and end user, what are their requirements, are building adjustments needed, et cetera."

The second one is 'how?', which aims at figuring out the needs and requirements of education takes place by asking (like account management), by measuring ex post whether people are satisfied with the accommodation solutions (for example, with a customer satisfaction survey), and by occasional conversations with the client, customers, and end users to survey possible complaints.

Account management is a frequently-used and planned way to stay in tune with building users, but not always clearly structured; it mostly depends on coincidence.
Interviewee (case number 7): "Another way we get informed about user requirements is through the monitoring of complaints via the service desk."

It is remarkable that investigating the accommodation needs is mainly based on traditional approaches. Only one of the UAS mentioned the use of social media (specifically Twitter) to communicate with end users.

The next coordination aspect concerns the organisation of the preconditions. The most powerful precondition that was mentioned in the interviews was the allocation of the financial resources. The financial resources are decreasing and the volume is often obscure. Two different ways for allocating the financial resources concerning CRE did show up in the interviews. First, the financial resources are allocated on a strategic level by the executive board or by the CRE executive. Most other building users do not have a clear idea of CRE costs and cannot make decisions about which financial resources are available for the accommodation. For a sincere allocation of the financial resources, the CREM department uses standards for space use, such as a number of square meters per enrolled student.
Interviewee (case number 11): "Financial incentives only work at a certain organisational level, let's say at a management level […] but teachers care less."

Second, the financial resources are delegated by the executive board and allocated to lower organisational levels of the institution (managers of academies, faculties, course directors). These organisational units pay for the use of their accommodation, often per square meter.
Interviewee (case number 5): "On behalf of the executive board, we are the (delegated) owner of the buildings. Faculties are the tenants of a building. They pay for the square meters of space they use."

In some cases these units are even the owners of CRE. This way of allocating financial resources may lead to obvious differences between the way academies, faculties, and courses, are accommodated (such as a different number of square meters per student and different quality of the finish of buildings).

4.4.3 COMMUNICATION

Concerning the communication with the client, customers, and end users, the CRE managers are quite critical about the way these internal stakeholders define their accommodation needs. From the interviews, three key aspects came to the fore, which were supported by the findings of the questionnaires:

1) Needs and requirements often arise from dissatisfaction with the current situation. Representatives of education are quite conscious about what they do not want but do not really know what they do want or need and how to formulate their real needs.
   Interviewee (case number 9): "If I ask teachers how they see future education, then it falls painstakingly silent."
   In the questionnaire, twelve of the CRE/FM managers agreed that course managers also find it difficult to define their accommodation needs and requirements.
2) Needs and requirements are often formulated in operational terms and solutions (such as moving walls or replacing doors) and not in the desired outcome or aimed performance in terms of: what are our processes, which are our intended goals and results, how can CRE support our needs.
   Interviewee (case number 4): "Requirements are mostly formulated in terms of 'we need this separation wall removed', and 'I would like to have a glass door for this classroom'."
   Twelve of the respondents indicated in the questionnaire that course managers indeed formulate their accommodation needs in operational terms instead of the desired outcome.
3) Needs and requirements are often formulated in terms of familiar solutions and what is known from the past, such as: 'we want more of what we already have, but then refreshed and new'. Also, the needs and requirements are mostly ad hoc or short term and not focused on the long term. Strategic plans of Dutch UAS have a time scope of only four years ahead. Most clients, customers, and end users find it difficult to think 'out of the box'.
   Interviewee (case number 7): "Academies think about the here and now and not about what they want to do in the future and that what they need to achieve that."

The questionnaire shows that eleven CRE/FM managers agree with this statement.

Because of the lack of strategic, long-term information in the communication of the internal stakeholders about education, CRE managers have to cope with the dilemma of having a time horizon with their property that goes far beyond that of education. CREM requires long-term thinking, which is not always in line with the

dynamics of education especially when CRE managers are faced with new construction projects, large building renovations or long-term lease contracts. CRE managers often have to deal with an enormous number of square meters of the current stock as an inheritance of the past, which hinders their ability to cope with, for instance, the growing need for efficiency, cost reduction, sustainability, and flexibility. Ten of the CRE/FM managers feel that they 'often lag behind the facts'. Three of them are ambiguous about that statement.

4.4.4 DECISION-MAKING

Decision-making is strongly related to the power distribution between those involved in CREM issues. In the interviews, the CRE/FM managers mentioned that decision-making about CREM issues is often not clear and transparent. Besides, the involvement of the internal stakeholders shows a huge variety. Sometimes the executive board leads in decision-making, but in other cases, UAS decisions are made by lower management echelons or by the CREM department.
In the questionnaire, the CRE/FM managers were asked to specify the power of the client, customers, and end users for three CREM situations:

1) construction project activities with a clear scope, for example, new construction projects or large renovations;
2) CRE alignment activities regarding going concern accommodation management, like smaller mutations of buildings, changes concerning the layout of buildings and relocations; and
3) maintenance.

According to the literature, a distinction was made between those who are only informed about CREM issues, those who participate in CREM issues and those who have the full power to make decisions about CREM issues. Table 4.6 shows an overview of the answers, with the most given answer out of the total 13 respondents between brackets (the modus).

TABLE 4.6 INVOLVEMENT OF INTERNAL STAKEHOLDERS IN DECISION MAKING ABOUT CREM ISSUES

Internal stakeholders for CREM	Construction projects	Accommodation management	Maintenance
CLIENT			
The executive board	Decide (12)	Decide (11)	Participate (7)
CUSTOMERS			
Course management	Participate (9)	Participate (8)	Inform (8)
END USERS			
Teaching and non teaching staff	Participate (10)	Participate (10)	Inform (9)
Students	Participate (9)	Inform (8)	Inform (10)

Regarding the role of the CREM department itself, the interviewees mentioned several ways of how they operate in decision-making regarding CREM issues. Two opposite perspectives were mentioned:

1) Reactive or proactive: The reactive CREM department reacts to concrete demands from the client, customers, or end users. The proactive CREM department anticipates on educational and societal developments, in order to come up with proposals to accommodate those developments.
   Interviewee (case number 2): "We are responsible for the availability of facilities and accommodation. Therefore we have to take the lead in the development of these facilities and accommodation. So we can't wait until an academy express their requirements. We should always be a step ahead."
2) Advisory or directive: The CREM department may play the role of the consultant who helps the client with the translation of needs into CRE operating solutions. The client (executive board) finally decides.
   Interviewee (case number 5): "What if education wants to change their teaching processes? As a facility professional and partner of the core business, we can help them with the possible consequences for the physical environment."
   In the other role the CREM department is more directive.
   The customer (course management) can request mutations in the accommodation, but the CREM department decides whether that request will be granted (supported by the client of course).
   Interviewee (case number 7): "We play an important role in the decision whether building adaptations occur or not. […] Requests have to be submitted to the CREM department. We translate these into business cases with an advice for the executive board. Finally they decide, we get the resources and are responsible for the realisation."

4.4.5 EIGHT PERSPECTIVES FOR MANAGING CRE ALIGNMENT

The interviews of the explorative study in Dutch higher education show eight opposite management perspectives to how CRE/FM managers cope with coordination, communication, and decision-making to align CRE to the accommodation needs and requirements of the client, customers, and end users (table 4.7). The interviews did not specifically reveal how the individual CRE/FM managers act related to these opposite perspectives. In the questionnaire of May 2014, the respondents indicated the way they would situate their organisation based on a five-point scale. The results are shown in figure 4.2.

TABLE 4.7

OPPOSITE MANAGEMENT PERSPECTIVES FOR ALIGNING CRE TO INTERNAL STAKEHOLDER NEEDS

Coordination			
1	The internal stakeholders form a homogeneous group with comparable needs.	versus	The internal stakeholders form a heterogeneous group with diverse needs.
2	Structured interaction between CREM department and client, customers, end users.	versus	Ad hoc and occasional interaction between CREM department and client, customers, end users.
3	The CREM department has a relevant influence on the financial resources.	versus	The CREM department has a marginal influence on the financial resources.
4	Cost focus on operational excellence and CRE standardisation.	versus	Focus on customer intimacy and custom made CRE solutions.
Communication			
5	CRE decisions are based on strategic information and a long term focus on CRE.	versus	CRE decisions are based on operational information and a short term focus on CRE.
Decision-making			
6	The CREM department is proactive.	versus	The CREM department is reactive.
7	CREM decision-making is top down.	versus	CREM decision-making is bottom up.
8	The CREM department has a directive role in CREM decision-making.	versus	The CREM department has an advisory and operating role in CREM decision-making.

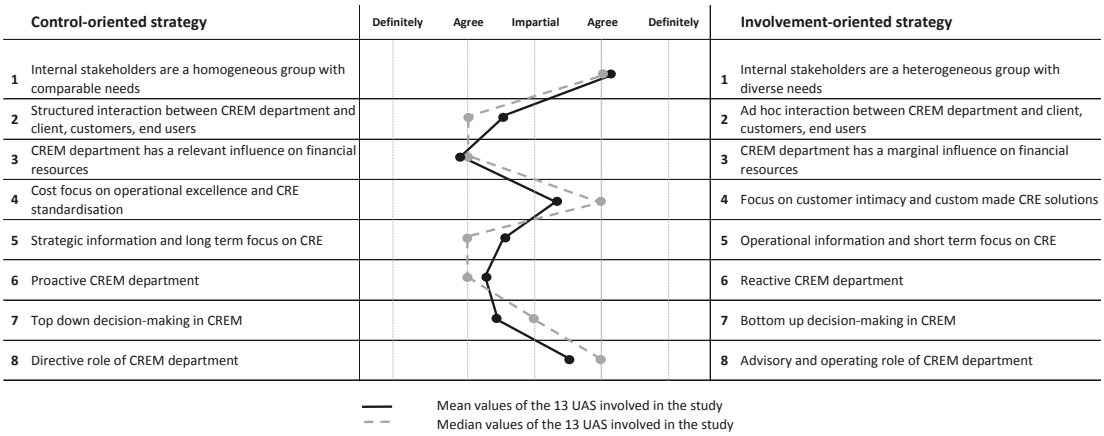

Figure 4.2

Eight opposite CREM perspectives to align CRE to internal stakeholder needs

DISCUSSION

4.5

The eight management perspectives as presented in figure 4.2 can be interpreted as two opposite strategies for the CREM department to manage the CRE alignment process. The two strategies that show up in the Dutch UAS cases correspond with the distinction between control-oriented and involvement-oriented management strategies (Lawler, 1992; Meyer, 1991). The control-oriented strategy (A) is represented by the eight perspectives in the left-hand column of figure 4.2. In this strategy approach, the responsibilities, power and often also the financial resources are allocated to the strategic CREM level. The corporate strategies are translated into CRE strategies, which are the starting point for operating solutions. The middle management submits, demands, and requests from the core processes to the executive board. Communication between demand and supply is mainly organised at a strategic level. The involvement-oriented strategy (B) is represented by the eight perspectives in the right-hand column of figure 4.2. Here, the responsibilities, power, and often also the financial resources are allocated to lower levels in the organisation. The CRE operating solutions are directly derived from the operational processes and activities, resulting in a bottom-up approach in which communication with end users is key. Thus, the CREM department mainly organises communication at that level. The two opposite strategies can be linked to the four alignment perspectives of CREM (figure 4.3). Both strategies start at the corporate strategic level at the upper left hand side of figure 4.3, and result in CRE operating decisions at the lower right side of figure 4.3.

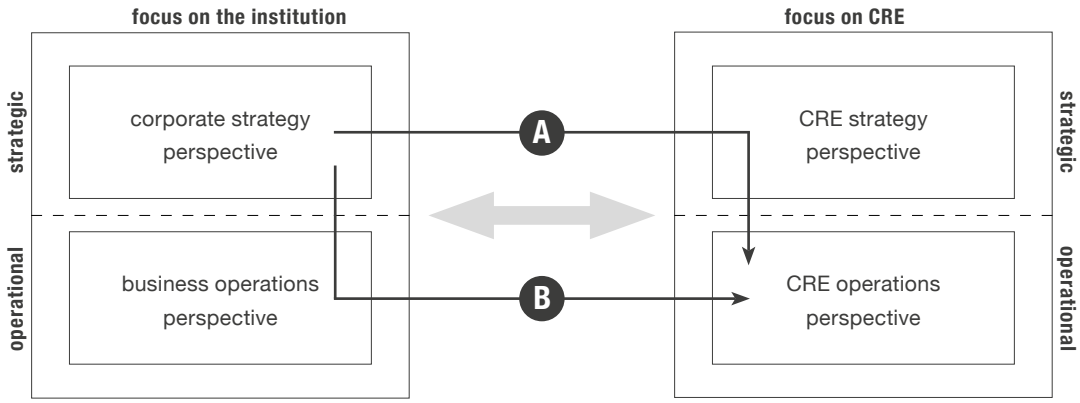

Figure 4.3
Two opposite strategies for managing the CRE alignment process

However, strategy A and B result in a different implementation of alignment between business and CRE and as such in a different elaboration of the large arrow in figure 4.3. The visualisation of these two strategies resembles the strategic alignment perspectives in the IT industry in the 1990s, based on Henderson and Venkatraman's Strategic Alignment Model (Coleman & Papp, 2006; Englert, 2001; Henderson & Venkatraman, 1990). Henderson and Venkatraman (1990) formulated two comparable ways of how the business strategy may lead to operating (IT) solutions. Besides the combined perspective of the arrows as presented in figure 4.3, they also formulated strategies in a reverse way, where changes in the supply of IT, or changed IT strategies can contribute to changes in the core business. Later, Coleman and Papp (2006) described a total of four possible combined perspectives based on Henderson and Venkatraman's model where each perspective has an anchor or starting point and an impact area. Figure 4.3 only shows the perspective where the corporate strategy is the anchor and CRE is the impact area. It would be interesting to explore all four perspectives in a CREM context in future research.

4.6 CONCLUSION AND IMPLICATIONS

The present study showed three key activities for managing CRE alignment with the needs of the client, customers, and end users: coordination, communication, and decision-making. The way in which organisations manage these key activities in practice can be represented by eight opposite management perspectives and two opposite strategies for CREM departments: a control-oriented strategy and an involvement-oriented strategy. The results of the empirical study do not show explicit preferences of the case organisations for one of the two strategies. However, the mean values suggest that the organisations tend to adopt a more control-oriented strategy, combined with an eye for the end users. In practice, that means that end users mainly participate in CREM issues or are informed about these issues by the CREM department. End users are much less involved in decision-making than the executive board and middle managers.

A significant practical implication of the current research is that the eight management perspectives that result from the empirical study and the two distinguished management strategies help to raise awareness of different possibilities how to manage CRE alignment. It also may help practitioners to align coordination, communication, and decision-making mechanisms in a more efficient and effective way. That brings the demand side and the CREM department closer together. Based on a more integral approach, practitioners are able to define a well-considered

and appropriate CRE alignment management strategy. This study shows that organisations tend to choose a combination of a little more control-oriented and a little less involvement-oriented CRE alignment strategy. Further research is needed to investigate if this is the best possible solution or whether it is better to find a different balance or to choose either one or the other strategy and why. Beforehand, it is assumed that the optimal choice depends on the organisational context such as the organisational culture and the shared values and probably also on the external context such as the societal attitude towards user involvement and pressure of end users. The proposed further research could also contribute to the development of a common language between the demand and supply side, to explore new ways for managing the alignment of CRE with the needs of policy-makers and end users, and to translate these needs into future-proof accommodation solutions.

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WHY DO THEY STUDY THERE? DIARY RESEARCH INTO STUDENTS' LEARNING SPACE CHOICES IN HIGHER EDUCATION

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INTRODUCTION

5.1

Research into higher education shows an increasing interest in the physical learning environment (Fisher & Newton, 2014; Salter, Thomson, Fox & Lam, 2013; Jessop, Gubby & Smith, 2012; Matthews, Andrews & Adams, 2011). In the past two decades, such developments as the increasing use of information and communication technology (ICT) in higher education (Collis & Van der Wende, 2002; Prensky, 2001), new social constructivist learning approaches (Marais, 2011; Foster, 2008), and the phenomenon of learning communities (Smith & Bath, 2006), have led to new ideas about the university in the third millennium. These developments have resulted in many experiments with new physical learning environments, such as Social Learning Spaces (SLS) (Matthews et al., 2011), technology-rich experimental learning and teaching environments (Salter et al., 2013), Technology Enabled Active Learning (TEAL) environments (Fisher & Newton, 2014), and Active Learning Classrooms (ALC) (Park & Choi, 2014).

On the topic of how educational futures should be configured and how learning spaces should be designed, Rudd, Gifford, Morrison and Facer (2006) stated that it is essential to understand the links between what students learn, how they learn, with whom they learn, when they learn and the requirements of the places where they learn. Oblinger (2005) raised similar questions such as: Where does learning take place on the campus? Do students use classrooms outside class times? Is learning taking place in small groups in the library or in a coffee bar? When is space used? To answer these questions, the students' experiences should be a key aspect of research into learning spaces. According to Jessop et al. (2012), the students' voice is still missing too often in research into this topic. Therefore, the purpose of the present study was to investigate the interaction between learning activities in higher education and the physical environment from a student perspective, focusing on: what, where and why. 'What' refers to the learning activities of students in higher education. 'Where' concerns the physical learning spaces which these students choose to perform these activities. 'Why' is related to the reasons behind the use of these spaces. What, where, and why are studied by using a diary research design.

5.2 DIARY RESEARCH DESIGN

A conclusive argument for using diaries or logbooks is that they provide the opportunity to examine regular activities in the participants' daily environment (Iida, Shrout, Laurenceau & Bolger, 2012). Using diaries gives a researcher more influence on the completeness of the reported information than using surveys would (Appel-Meulenbroek, 2014). The diaries in the current research focus on data that link learning activities and learning space choices. According to several sources, the heterogeneity of student characteristics regarding gender, study experience, work commitments, and residence, can influence the decision to go to school for attending lessons and other learning activities or to stay at home (Sawon et al., 2012; Gomis Porqueras & Rodrigues-Neto, 2010). For example, according to Gomis Porqueras and Rodrigues-Neto (2010), senior students appear to attend fewer classes than junior students. Therefore, the students participating in the diary study were asked to attend one out of eight kick-off sessions at the start of the study to fill in a questionnaire with their personal characteristics. These sessions were also used to inform the participants about the diary method. Next, these students kept a diary for one week. The questionnaires and the data from the diaries were analysed using SPSS and Excel. The findings of the data analysis have been discussed in interviews in small groups with students who kept a diary. The aim of the interviews was to reflect on the findings and to get additional

information about why the students chose particular learning spaces for specific study activities. The interviews were tape recorded, transcribed and analysed based on open coding. The overall research design is presented in figure 5.1.

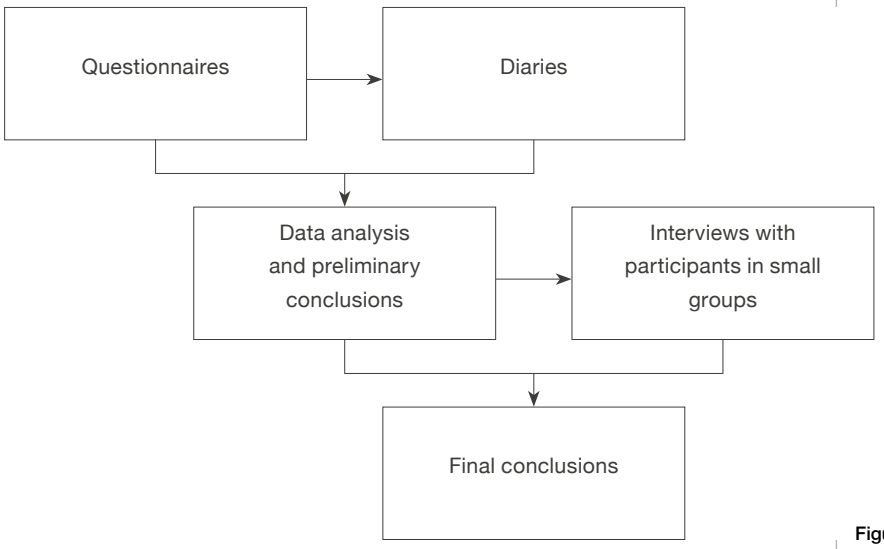

Figure 5.1
Overall research design of the empirical study

In the next sections, the theoretical background that has been used to define the diary format for studying 'what', 'where' and 'why' is described first. Then, the results of the empirical part of the study at a Dutch higher education institution are presented. Finally, the findings are discussed and linked to practical implications.

5.3 BUILDING THE DIARY FORMAT ON WHAT, WHERE AND WHY

5.3.1 WHAT: LEARNING ACTIVITIES

The literature shows a long tradition of research into learning objectives and learning activities (Moseley et al., 2004). More than half a century ago, Bloom, Engelhart, Furst, Hill and Krathwohl (1956) developed their taxonomy of educational objectives. Nowadays, the elements of this taxonomy are still recognisable in studies on learning skills (Binckley et al., 2010; Redecker, Ala-Mutka, Bacigalupo, Ferrari & Punie, 2009). New studies added 21st century skills related to ICT developments in education, and skills regarding working together, innovation, and responsibility. To show how student competencies, like critical thinking, communicating, self-organising, and collaborating can be recognised in students' daily activities, Fisher (2005) used five pedagogical processes:

delivering, applying, creating, communicating, and decision making. These processes build on three main educational approaches: a teacher-led approach, a student-led approach and an interaction-led approach (Illeris, 2007; Fisher, 2005; Trigwell, Prosser & Waterhouse, 1999). Earlier, Moore (1989) introduced the interaction between the individual learner and the content. Wang (2008) added the relation between the learner and the interface. In line with the latter, Beckers, Van der Voordt and Dewulf (2015) defined four key learning configurations in higher education, namely: autonomous learning, programmed instructional learning, interactive/small group learning between students, and network learning. These four learning configurations were used to define the 'what' part of the diary format. Nine learning activities of students, derived from several literature sources were selected, sometimes rephrased and linked to the four learning configurations (table 5.1).

TABLE 5.1 FOUR LEARNING CONFIGURATIONS AND NINE LEARNING ACTIVITIES (DERIVED FROM: A = NAIR & FIELDING, 2005; B = FOSTER, 2008; C = POOLE & WHEAL, 2011; D = GENSLER, 2012; E = FISHER, 2005)

Learning configurations (Beckers et al., 2015)	**Learning activities** (The letters in brackets refer to the used sources)
Autonomous learning; relation between the learner and the content	1. Independent study for knowledge accumulation and critical thinking (A, C, D, E) 2. Autonomous working on assignments for applying knowledge outside scheduled lessons (C, E) 3. Routine activities – organising (E)
Programmed instructional learning; relation between the instructor and the learner	4. Attending classes and lectures (A, D, E) 5. Cooperative learning activities, students working in small groups led by a teacher (B, D, E) 6. Tutorial consultation (B, E)
Interactive/small group learning; relation between the learner and other learners	7. Collaborative learning activities, students working in small groups on project assignments without a teacher involved (B, C, D, E) 8. Social learning activities (face-to-face) with other students - communicating (A, C, D, E)
Network learning; relation between the learner and the interface	9. Wireless networking with peers, teachers, digital learning environments and other digital sources (A, C, D)

5.3.2 WHERE: TEACHING AND LEARNING SPACES

According to Oblinger (2005, p. 15), learning spaces are "regularly scheduled, physical locations designed for face-to-face meetings of instructors and students". However, particularly the ICT developments of the past ten years have shed a different light on this definition. In the UK, the Higher Education Space Management Project (Barnett &

Temple, 2006) distinguished space for teaching and space for learning. Teaching space is the traditional timetabled classroom, whereas learning space refers to settings for individual learning or small group activities. Teaching and learning space has been the subject of many studies (Souter et al., 2011; JISC, 2006; Marmot, 2006; Fisher, 2005). These studies endorse the development of higher education institutions "providing more space for unstructured/ad hoc self-directed learning and peer-teaching among students" (Barnett & Temple, 2006, p. 13). Besides specific spaces for vocational education, four main types of learning space are applied to support self-regulation and social interaction in learning by higher education students (Beckers et al., 2015). First is classroom space, which supports large groups for the benefit of presentations and lectures. Second are collaborative spaces, such as project rooms, that support small groups for face-to-face collaborative and cooperative learning activities. Third are individual study spaces to support self-study activities. Fourth are informal learning spaces that are scattered across the campus or buildings, in corridors, atria or coffee bars and restaurants. These informal learning spaces support individuals and small groups for study activities and social activities in the real world and in the virtual world. Nowadays, in this virtual world students can have access to study resources from anywhere, which means learning space is not limited to a school building. Analogous to the "city is the office" (Harrison, 2002, p. 248), every square meter of the built environment has the potential to support the learning activities of a student, from home to the classroom and all kinds of other settings in between, such as a coffee house, café, restaurant, bar, museum, library and public spaces, such as streets, parks or public transport (Radcliffe et al., 2008; Oldenburg, 2001). This perspective on higher education learning spaces is shown in the framework of figure 5.2 and has been used to design the 'where' part of the diary format.

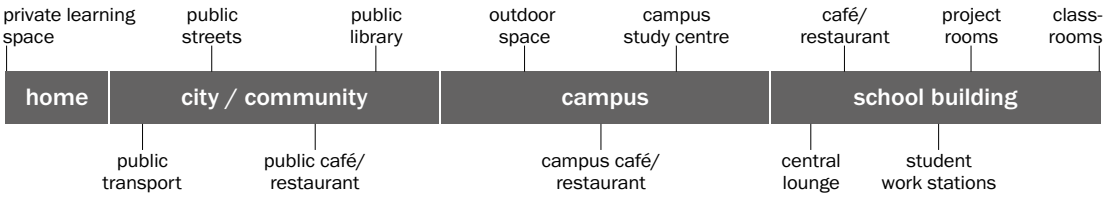

Figure 5.2
Higher education learning space framework

5.3.3 WHY: CONSIDERATIONS TO CHOOSE PARTICULAR LEARNING SPACES

To study the students' reasons for choosing particular learning spaces, lessons can be learned from the research into workspace choices in office environments. Both are human decision-making processes, which are influenced by psychological needs and non-psychological variables. Appel-Meulenbroek, Groenen and Janssen (2011) developed a framework with seven variables that may influence the choice of workspaces that fit the working activities of office workers and/or their personal preferences best. This framework includes psychological needs, such as (1) the preferred levels of privacy/concentration, (2) the preferred social interaction/communication and (3) the need to personally control one's choice of space. Next, it contains various characteristics of the physical environment, such as (4) functional characteristics related to equipment, furniture and technology, (5) comfort characteristics regarding light, colour, and the finishing of the environment, (6) layout characteristics such as the location of the workspace and its spatial position towards other workspaces, and finally, (7), the framework includes variables concerning the availability of workspaces.

Most of the variables of this framework for workspaces are also elaborated in studies into higher education learning environments. According to Jamieson (2003), layout, fit-out, comfort, and aesthetics are elements of the learning environment that should meet students' individual requirements. Comparable aspects were mentioned by Matthews et al. (2011), who studied Social Learning Spaces (SLS) and identified which aspects students perceived to be important for a welcoming atmosphere, such as comfortable furniture, controlled temperature, and catering services. The availability of catering services was mentioned by Brett and Nagra (2005) too as an important reason for choosing particular learning space for 82.5% of the students in their study. Harrop and Turpin (2013) showed that successful higher education informal learning spaces should meet students' behavioural needs, such as interaction, conversation, community, and the need for retreat.

The seven variables of the framework of Appel-Meulenbroek et al. (2011) were used to formulate the considerations behind the student's learning space choices in the 'why' part of the diary format. Due to the mentioned importance of catering services as an additional consideration to choose learning spaces for study activities, these services were included in the diary format as well. In addition to consciously considered choices of learning spaces, the psychological literature shows that in peoples' decision making unconscious decisions also come to the fore (Dijksterhuis, Bos, Nordgren & Van Baaren, 2006). Therefore,

'habit' and 'unaware of the reason' were included in the 'why' part of the diary format too.

5.3.4 THE DIARY FORMAT

The foregoing leads to figure 5.3, which shows the diary format with the three main categories 'what', 'where' and 'why', referring to the learning activities in higher education, the learning spaces and the considerations for choosing particular spaces, respectively. A short list with prescribed items was used to make a quantitative analysis of the data possible and because long and complex diary formats may reduce participant compliance (Iida et al., 2012). The diary format was tested in a small pilot study with students before the diary study was conducted.

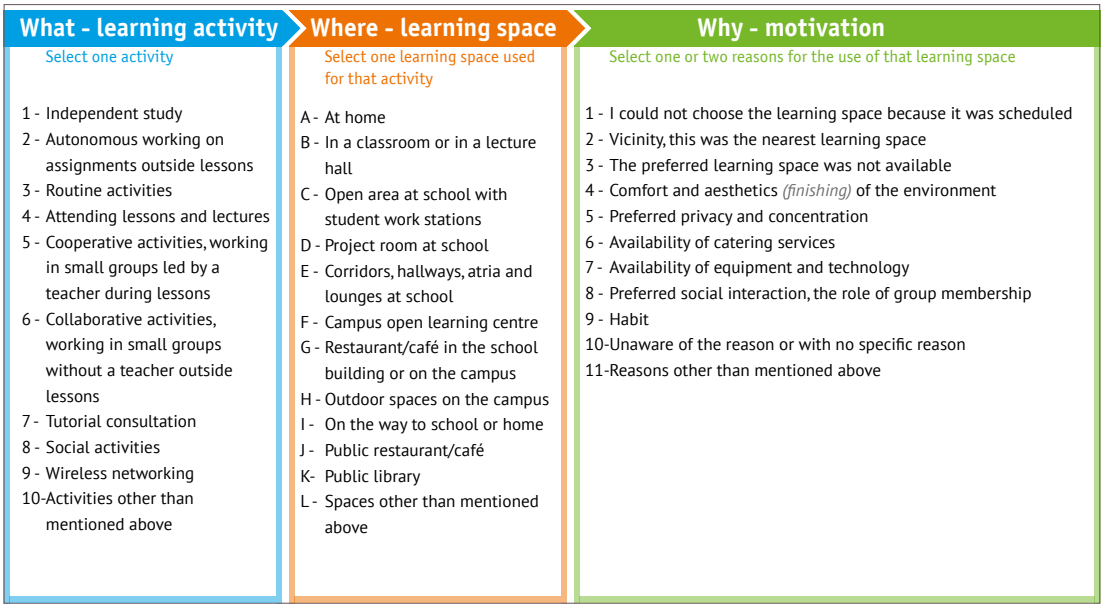

Figure 5.3
The diary format with three categories derived from the literature

The diary format was filled in by the students from Monday till Friday, in one out of two regular school weeks in the period from 12-24 May 2014. The participants reported the start and the finish time of each learning activity, the corresponding number of the activity itself (what), the letter for the learning space for that specific activity (where) and finally the letter related to the motivation for using that space for that activity (why) (figure 5.4). Per activity, the respondents could mark two reasons maximally for why they chose the learning space. If necessary, the student could add items themselves in addition to the items in the diary format.

DAY 1 : *date* NAME : *student*

start and finish	What - learning activity	Where - learning space	Why - motivation
8.20 - 8.50	*1*	*I*	*10*
8.50 - 9.00	*8*	*E*	*2 and 9*
9.00 - 9.30	*6*	*C*	*7 and 9*
9.30 - 10.15	*4*	*B*	*1*
10.15 - 10.30	*8*	*G*	*6 and 8*
10.30 - 11.15	*4*	*B*	*1*

Figure 5.4
An example of one page of the filled in diary format

TABLE 5.2 NUMBERS AND PERCENTAGES OF THE PARTICIPANTS (N=52)

Variable	Number	Percentage	Variable	Number	Percentage
Gender			**Living situation**		
Male	13	25%	with parents	29	56%
Female	39	75%	students' house/dormitory	23	44%
Age			**Traveling time from home to the campus**		
17 years old	1	2%	< 15 minutes	16	31%
18 years old	6	12%	≥ 15 and < 45 minutes	12	23%
19 years old	18	35%	≥ 45 minutes	24	46%
20 years old	10	19%	**Work commitments**		
21 years old	7	13%	none	3	6%
22 years old	3	6%	< 8 hours per week	15	29%
23 years old	3	6%	≥ 8 and < 16 hours per week	30	58%
>23 years old	4	8%	≥ 16 hours per week	4	8%
Study year			**Average scheduled time (hours:minutes)**		
first year	21	40%	first-year students	18:51	
second year	22	42%	second-year students	15:33	
third year	9	17%	third-year students	9:00	
fourth year	0	0%	weighted average overall	15:44	

RESEARCH FINDINGS

5.4

5.4.1 PARTICIPANTS

The empirical study was conducted at the HAN University of Applied Sciences (UAS) in the Netherlands and was carried out with 52 business management students in Nijmegen. The students were invited to participate with an announcement on Facebook and with an appeal by tutors during classes. The personal characteristics of the 52 students as retrieved from the questionnaires are presented in table 5.2.

5.4.2 WHAT AND WHERE

The 52 students reported a total number of 1836 learning activities in connection to the chosen learning spaces in their diaries, as presented in table 5.3. The average time spent on each activity-space combination is given in table 5.3 as well. To test statistically significant correlations between learning space choices and learning activities, several learning activities and several learning spaces in table 5.3 had to be clustered.

THE REPORTED COMBINATIONS OF LEARNING ACTIVITIES AND USED LEARNING SPACES IN THE DIARIES

TABLE 5.3

		Learning Spaces							
Learning Activity (LA)		**A *)**	**B**	**C / E / F**	**D**	**G**	**H**	**I / J / K / L**	**TOTAL**
LA1: Independent study	count	107	5	10	2	0	1	56	**181**
	percentage	59.1%	2.8%	5.5%	1.1%	0.0%	0.6%	30.9%	100.0%
	average time	2:48:57	0:06:32	0:09:54	0:02:53	0:00:00	0:00:35	1:05:12	4:14:02
LA2: Autonomous working on assignments outside lessons	count	186	26	38	23	3	1	15	**292**
	percentage	63.7%	8.9%	13.0%	7.9%	1.0%	0.3%	5.1%	100.0%
	average time	4:22:13	0:39:48	0:47:57	0:38:10	0:03:39	0:00:35	0:16:09	6:48:31
LA4 / LA5 / LA7: Programmed instructional learning activities	count	0	429	8	13	0	10	2	**462**
	percentage	0.0%	92.9%	1.7%	2.8%	0.0%	2.2%	0.4%	100.0%
	average time	0:00:00	10:30:28	0:05:23	0:05:40	0:00:00	0:08:05	0:02:01	10:51:37
LA6: Collaborative learning activities outside lessons	count	4	7	59	27	1	0	4	**102**
	percentage	3.9%	6.9%	57.8%	26.5%	1.0%	0.0%	3.9%	100.0%
	average time	0:11:27	0:05:52	1:02:59	0:39:25	0:01:44	0:00:00	0:09:14	2:10:40
LA8: Social student activities	count	11	40	78	5	33	49	64	**280**
	percentage	3.9%	14.3%	27.9%	1.8%	11.8%	17.5%	22.9%	100.0%
	average time	0:09:21	0:12:28	0:35:58	0:05:06	0:17:12	0:15:17	0:55:01	2:30:22
LA9: Wireless networking	count	220	12	10	2	1	3	63	**311**
	percentage	70.7%	3.9%	3.2%	0.6%	0.3%	1.0%	20.3%	100.0%
	average time	0:59:46	0:04:31	0:02:14	0:00:17	0:00:06	0:00:23	0:14:55	1:22:13
LA3 / LA10: Miscellaneous learning activities	count	135	11	14	2	0	0	46	**208**
	percentage	64.9%	5.3%	6.7%	1.0%	0.0%	0.0%	22.1%	100.0%
	average time	0:37:29	0:12:01	0:04:47	0:02:53	0:00:00	0:00:00	0:37:25	1:34:36
TOTAL	count	**663**	**530**	**217**	**74**	**38**	**64**	**250**	**1836**
	percentage	36.1%	28.9%	11.8%	4.0%	2.1%	3.5%	13.6%	100.0%
	average time	9:09:12	11:51:40	2:49:12	1:34:25	0:22:40	0:24:54	3:19:58	29:32:01

Home		School		Elsewhere	
A	At home	B	In a classroom or lecture hall	I	On the way to school or home
		C	Open area with student work stations	J	Public restaurant/café
		D	Project room at school	K	Public library
		E	Open space in corridors, hallways, atria, lounges at school	L	Other spaces
		F	Campus open learning centre		
		G	Restaurant/café in the school building or on the campus		
		H	Outdoor spaces on the campus		

***)** the students reported 107 independent study activities (LA1) at home (A) during the week that they kept their diary, which implies 59.12% of all independent study activities. These activities took an average time of 2 hours and 48 minutes during that week.

The test showed a significant relationship between learning activities and chosen learning space, based on a Pearson chi square test ($\chi^2(36, N=1836) = 2375.231$, p=.000). Cramer's *V* was used to assess the

strength of the relationship between the two variables. Cramer's *V* is 0.46 (p=.000), which shows a relatively strong association between students' learning space choice and their activities. Individual learning activities are mainly conducted at home, whereas collaborative learning activities and social interaction mostly take place at school. At school, students mainly use learning spaces in open areas such as corridors, hallways, atria and lounges. Virtual contact with peers and with school mostly occurs at home. Notably, students hardly use public spaces for learning activities. Where public space is used, it mainly concerns public transport.

5.4.3 WHERE AND WHY

The 52 students indicated 2200 reasons to motivate their learning space choices in the diaries. Only twice no motivation was reported for the choice of a learning space and 366 times two motivations were mentioned. The overall picture of the motivations for why students chose particular learning spaces is presented in table 5.4.

TABLE 5.4 MOTIVATIONS FOR CHOOSING LEARNING SPACES, AT HOME, AT SCHOOL/CAMPUS OR ELSEWHERE

		MOTIVATIONS FOR CHOOSING LEARNING SPACES											
LEARNING SPACE		**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**	Total
at home (A)	count	1	290	4	208	71	4	37	7	86	168	5	**881**
													40.0%
	percentage	0.1%	32.9%	0.5%	23.6%	8.1%	0.5%	4.2%	0.8%	9.8%	19.1%	0.6%	100.0%
at school (B, C, D, E, F, G, H)	count	489	116	21	78	61	9	28	125	63	36	15	**1041**
													47.3%
	percentage	47.0%	11.1%	2.0%	7.5%	5.9%	0.9%	2.7%	12.0%	6.1%	3.5%	1.4%	100.0%
elsewhere (I, J, K, L)	count	1	66	1	9	11	5	2	12	7	127	37	**278**
													12.6%
	percentage	0.4%	23.7%	0.4%	3.2%	4.0%	1.8%	0.7%	4.3%	2.5%	45.7%	13.3%	100.0%
Total	Count	**491**	**472**	**26**	**295**	**143**	**18**	**67**	**144**	**156**	**331**	**57**	**2200**
													100.0%
	percentage	22.3%	21.5%	1.2%	13.4%	6.5%	0.8%	3.0%	6.5%	7.1%	15.0%	2.6%	100.0%

M1	The learning space was scheduled	M7	The availability of equipment and technology
M2	Vicinity, this was the nearest learning space	M8	The preferred social interaction and the role of group membership
M3	The preferred learning space was not available	M9	Habit
M4	Comfort and aesthetics (finishing) of the learning space	M10	Unaware of the reason (no specific reason)
M5	Preferred privacy and concentration	M11	Reasons other than mentioned above
M6	The availability of catering services		

The differences in motivation per type of learning space were shown to be statistically significant according to a Pearson chi square test ($\chi^2(20, N=2200) = 1324.85$, p=.000). Cramer's *V* is 0.55 (p=.000), which shows a strong, significant association between motivations and chosen learning spaces. So, students had different motivations for studying at home, at school/campus or elsewhere. The main reasons for students to conduct learning activities at home were related to (M2) vicinity (32.9%), to (M4) comfort (23.6%), to (M9) habit (9.8%), and to (M10) no specific reason (19.1%). Learning space at school was often chosen because it was scheduled (mainly classrooms) by the institution (47%)

or due to social aspects (12%). For choosing learning space at school/campus, comfort (M4), available equipment/technology (M6), and catering services (M7) seemed to be minor motivations.

5.4.4 IMPACT OF PERSONAL CHARACTERISTICS

Learning space choices are also correlated with personal characteristics. A Pearson chi square test showed that the chosen learning spaces are significantly associated with gender. Females studied more at home and male students more at school (χ^2(2, N=1836) = 12,834, p=.002). Cramer's V = 0.084 (p=.002). Significant differences between the age of the students showed up in the Pearson chi square test as well (χ^2(20, N=1836) = 45,889, p=.001; Cramer's V = 0.112 (p=.001). Yet, the results do not clearly show why age is correlated with learning space use. Additional analyses showed that second-year students chose learning spaces at school significantly more often than first- and third-year students, whereas third-year students studied significantly more often at home (χ^2(4, N=1836) = 10,215, p=.037); Cramer's V = 0.053 (p=.037). The living situation, the travelling time between home and school, and work commitments next to study activities, did not show any significant correlations with the choice of learning space at home, at school or elsewhere. The low Cramer's V values refer to very weak associations between the tested variables. The overall correlations between the variables from the questionnaires and the diaries are presented in figure 5.5.

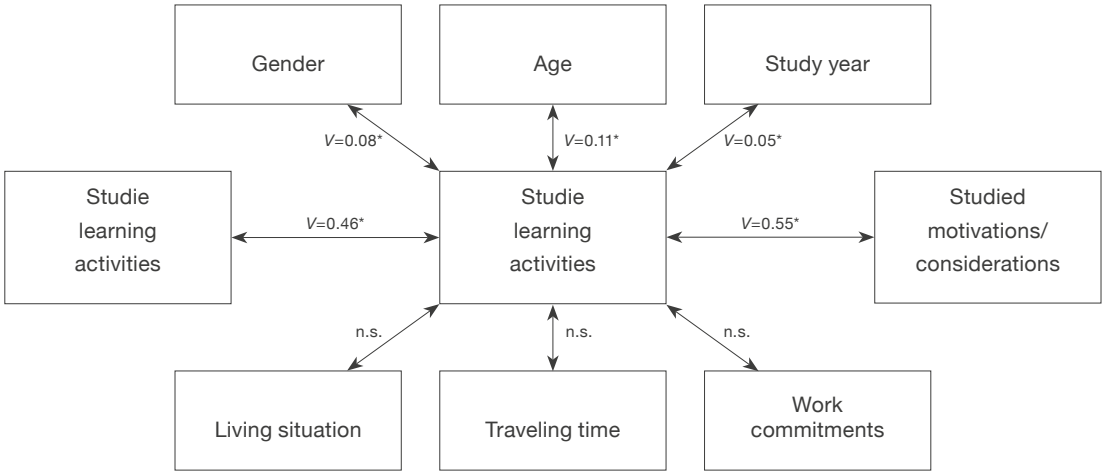

Figure 5.5
The main Cramer's V associations between the what, when and why (*p <.05, n.s. = not significant).

Zooming in on the choice of learning spaces at school, apart from classrooms, significant differences were found in the use of learning spaces at school between first- and elder-year students (χ^2(2, N=267) = 16,535, p=.000). Second- and third-year students chose enclosed project rooms significantly more often than first-year students, whereas first-

year students more often chose open learning spaces in corridors and catering areas. However, Cramer's *V* is 0.249 (p=.000), which refers to a significant but a weak association between the choice of learning space at school and the study phase. The other variables from the questionnaires do not show any significant associations with the choice of different learning spaces inside the school building.

5.4.5 INTERVIEWS

In December 2014, eight students who filled in a diary logbook participated in one of the interviews in small groups of two or three students. The eight students responded to an invitation for the interviews through email. The interviews aimed to inform the students about the main results and to further explore the motivations the students had had for their learning space choices. These students emphasised the significant relationship between learning activities and learning spaces, for instance: "You want learning spaces that are effective for your learning activities. I always choose the most suitable learning space for my learning activities". To determine the most suitable learning space, the students said that they make deliberate choices based on what they consider most valuable for their learning activities. A student: "I find the lounge seats in the restaurant very comfortable, but when there are no electrical power outlets for my laptop, or when it is crowded and noisy, I will not choose to sit there".

The diaries showed that most learning activities occur at home. Besides comfort, another important reason that emerged from the interviews for studying at home was the autonomy to do what you want to do at the moment that you want to do it. Student: "Home is the place where I can be alone. I hate it when everybody can see me doing things". Students find it important to listen to their own music and to have the possibility to turn it off when they want to, or to control the temperature in their room to feel comfortable. The combination of activities, like doing the laundry or eating and drinking whenever one wants, while doing school work, makes home a preferred learning space.

Studying at school often occurs because of group dynamics. A student: "I go to school for working together. When I work alone, I stay at home". Working together online was not widely endorsed by the students who participated in the interviews. The general opinion of the interviewed students is that the output of face-to-face communication is higher than that when using digital media. Yet, students told that a digital medium like WhatsApp is very popular for short messages related to project group work or mutual questions during self-study activities at home. A student: "Perhaps WhatsApp is so obvious that students do not even notice that they use it all the time to communicate about their

learning activities". That shows that WhatsApp might be considered as a kind of virtual learning space.

5.5 DISCUSSION, IMPLICATIONS, AND NEXT STEPS

The literature suggests that the campus of the future and the city will increasingly merge and that students are going to use public spaces to conduct their learning activities more often. However, the findings from the present diary study show a different picture. Students mainly conduct their learning activities at school or at home. Apart from public transport, and sometimes a public library, 'the city as the campus' does not seem to be close at hand yet. However, higher education buildings contain a growing diversity of learning spaces with similar characteristics to public spaces (Souter et al., 2011; Marmot, 2006; Fisher, 2005). Traditional classroom space is being replaced by a variety of informal learning spaces to support contemporary learning activities (Beckers et al., 2015). These informal learning spaces support interaction of students with their peers and their teachers outside the classroom (Matthews et al., 2011). Park and Choi (2014) argue that the combination of traditional classrooms and new learning spaces will facilitate developments in education best. The findings of the current diary study support this statement. Many of the lecturer-driven learning activities still occur in traditional learning environments. When students work together outside classes, or conduct solitary learning activities, they mainly use informal learning spaces in open areas within the school building. Research by Matthews et al. (2011, p. 114) showed that students appreciate these spaces because they "can make noise, talk, eat and socialise". The disadvantage is that this makes these kinds of learning spaces very busy. The interviews in the present study emphasise that students additionally need learning spaces where they can concentrate and work individually or in small groups. Many higher educational buildings particularly focus on facilitating collaborative and social activities but lack sufficient learning spaces for retreat. As a consequence, students stay at home for solitary learning activities. If the shift from a teacher-led approach to a student-led approach continues, this will lead to an increasing need for quiet informal learning spaces in higher education buildings. The future challenge for higher education institutions will be to permanently align learning space at school with learning activities and take into account the increasing diversity of students' preferences, regarding how and where to learn and, the required physical and social characteristics of learning spaces. Because school attendance has been shown to be of great importance for students' learning results (Sawon et al., 2012; Gomis Porqueras &

Rodrigues-Neto, 2010), it is important that both informal open areas and quiet learning spaces for individuals and small groups are provided in combination with traditional classrooms. New learning space designs have to match new ways of learning and teaching (Fisher & Newton, 2014; Beckers & Van der Voordt, 2013). On the one hand, new learning environments with continuing traditional learning and teaching approaches can frustrate students and teachers. On the other hand, new pedagogical practices in a yesterday's learning environments will also lead to a misfit between educational practice and learning space. Appropriate learning space requires an integral approach in which space planners, teachers, staff and students cooperate to align the physical learning environment with educational developments and end-user needs.

The present study allows us to reflect on the value of using diaries for data-collection. According to Whiteside and Fitzgerald (2009, p. 5), the diary method meets the need to supplement traditional research methods with innovative tools: "New approaches such as student logs […] may provide data that better and more completely answer researchers' questions, leading to evidence-based solutions". Fisher and Newton (2014) argue that both quantitative and qualitative methods should be used to study the usability of learning spaces in order to collect data that support the development of new learning environments. A common limitation of diary research methods is that they mainly produce correlational data and hardly establish causal mechanisms (Iida et al, 2012). Yet, by not only asking 'what' and 'where' but also 'why' for the period of a week the present diary study provided insight into cause and effect relationships as well. The study showed that students deliberately choose their learning space based on their study activities. The present study did not show if and how the chosen learning settings contribute to students' performance though and which settings suit to acquire new knowledge and skills best. To explore the impact of learning spaces on learning performance in depth, additional research is needed. A particular point of attention too is how students share social spaces such as atria, espresso bars and restaurants, and how these spaces can be considered real learning spaces for working informally in groups or how these fulfil the need for silence and concentration. Besides, the current study had its focus on students from one case in the Netherlands. However, there are many similarities between Dutch higher education and other contexts such as the UK studied by, for example, Foster (2008), Barnett and Temple (2006), Marmot (2006), and the Australasian region with work from, for example, Park and Choi (2014), Matthews et al. (2011) and Souter et al. (2011). Although it is always questionable to extrapolate and generalise the findings of a specific study, the similarities indicate that the results may apply for other

universities and countries as well. Extension of the current research with students from different institutions, other programmes and different countries could further endorse this statement and would therefore be the preferable next step. Expanding the number of diaries and collecting data from other periods during the year would add value to our study as well. A final suggestion for further research is to explore the factors that influence students' learning space preferences in connection to different learning activities in depth, by using additional research methods.

5.6 CONCLUSION

This research has shown significant correlations between the chosen learning spaces and learning activities of business management students, their psychological needs and the preferred characteristics of the physical learning environment. The study found that students mainly conduct individual learning activities at home because of the opportunity to personally control the environment regarding concentration and comfort and to enable combining learning with other activities such as listening to music. On days that students are not obliged to go to school it saves travel time as well. In addition to teacher-led learning activities, students go to school to work in small groups with other students and for social activities. For these learning activities they mainly use learning spaces in open areas, corridors, hallways, atria and lounges. Besides public transport, students hardly use public spaces outside school for their learning activities. The choice of learning spaces has been shown to be influenced significantly by student characteristics such as gender, age and study year. Surprisingly, the students' living situation and the travel time to school are not correlated to the choice of where to study. Also, the research did not support the idea that network learning activities are replacing face-to-face meetings or classical lessons. For students virtual contact is mainly used additional to face-to-face meetings. The view that students' learning activities mainly consist of surfing on the Internet to learn from anywhere at any time is not (yet) confirmed.

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LEARNING SPACE PREFERENCES OF HIGHER EDUCATION STUDENTS

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INTRODUCTION

6.1

This paper presents the results of a study into learning space preferences of higher education students and the factors that influence these preferences. The research builds on the growing number of studies about the relation between the physical learning environment and student behaviour in primary education (Barret, Davies, Zhang & Barret, 2015), secondary education (Marcouyeux & Fleury-Bahi, 2011), and higher education (Yang, Becerik-Gerber & Mino, 2013; Felsten, 2008).

In recent decades, various changes occurred in the higher education system. Traditionally, higher education was designed as an industrial oriented system that treats students like an assembly line similar to a learning factory (Robinson, 2010; Leland & Kasten, 2002). Today's higher education institutions should prepare young people for tomorrow's knowledge economy and 21st century skills (Voogt & Roblin, 2012; Robinson, 2010; Ananiadou & Claro, 2009). Modern students are supposed to be self-directed learners, who take responsibility for their own learning process, learn how to build and use networks, cooperate with others, and use information and communication

technology (ICT) to find appropriate information (Marais, 2011). New learning objectives, the increased use of ICT facilities in education, and changed instructional methods, currently stressed in psychological and educational theory, are indicated as new ways of learning (Simons, Van der Linden & Duffy, 2000).

New ways of learning are expected to require changes in the physical environment (Beckers, Van der Voordt & Dewulf, 2015). In 2008, Webb, Schaller and Hunley (p. 408) concluded that "there is a growing awareness that learning happens all over the campus, not just in classrooms and labs". Modern ICT facilitates new ways of learning and gives students the opportunity to study anytime, anyhow, and anywhere. Abeysekera and Dawson (2015, p. 1) argue that "The information-transmission component of a traditional face-to-face lecture […] is moved out of class time". Nowadays, study activities are increasingly taking place outside the traditional school buildings (Abeysekera & Dawson, 2015). So-called flipped classroom concepts combine class attendance with watching web lectures at home or anywhere else, such as on public transport, in cafés or outside in the park. In these concepts, the main reason to visit a building for higher education is to meet other students and to collaboratively work on assignments with tutors and peers. Higher education institutions therefore provide attractive and appealing informal learning spaces with high quality interior designs that resembles grand cafés, restaurants and Starbucks coffee bars (Beckers & Van der Voordt, 2013; Foster, 2008; Watson, 2007). It is expected that higher education institutions have to offer their students more of these alternative learning spaces (Fisher & Newton, 2014; Kuntz, Petrovic & Ginocchio, 2012; Matthews, Andrews & Adams, 2011; Souter, Riddle, Sellers & Keppel, 2011).

In spite of the numerous experiments with new learning environments in higher education practice, there is still a lack of understanding of the student's preferences (Harrop & Turpin, 2013; Matthews et al., 2011). Therefore, more studies have to be conducted on learning space preferences (Harrop and Turpin, 2013). Moreover, research on required facilities and learning space preferences is often limited to the perspective of managers, lecturers or staff. There is a need to involve the student's voice in studying the physical learning environment (Fisher & Newton, 2014; Jessop, Gubby & Smith, 2012).

The current research responds to these demands with a survey among undergraduate students of a Dutch University of Applied Sciences. The study aims to answer the question: 'Which factors affect the learning space preferences of higher education students?'. The next section further explores the theoretical background regarding the characteristics of the

learning environment, resulting in a conceptual framework. Then, the result section presents the empirical part of the study. The final section discusses the contribution of the research to the literature and the practical implications of the findings for the design and management of physical learning environments, as well as topics for further research.

THEORETICAL BACKGROUND 6.2

Multiple studies have endorsed the connection between the learning environment and learning activities (e.g., Beckers et al., 2015; Taylor, 2009; Brown & Long, 2006; Beard & Wilson, 2006). Beard and Wilson (2006) developed the Learning Combination Lock (LCL) that stressed the importance of linking learning environments as the 'where' of learning to specific learning activities as the 'what' of learning. This 'what' in higher education learning is related to two basic activities: individual activities that require concentration and self-regulation, and collaborative activities that require communication and interaction (Beckers et al., 2015).

In former days, higher education learning took place in university buildings or at campuses. In the past two decades, traditional classroom space in buildings for higher education has been supplemented with a variety of learning spaces that support contemporary learning activities based on self-regulation and collaboration (Beckers et al., 2015; Fisher & Newton, 2014; Park & Choi, 2014; Souter et al., 2011; Watson, 2007; JISC, 2006). According to Watson (2007), these new learning spaces show a great resemblance with Oldenburg's (1999) third places. Oldenburg (1999) described third places as public settings where people gather to meet, such as coffee houses, cafés, restaurants, and public outdoor spaces. Due to the ICT developments, students can nowadays study anywhere, at any time. In line with this trend, every square meter of the built environment has the potential to support student's learning activities. Analogous to "the city is the office" (Harrison, 2002, p. 248), universities are univer-cities (Worthington, 2009), and third places are learning spaces.

The choice for a specific learning space is related to the actual and the perceived quality of the physical and social characteristics of a place in comparison to other places (Marcouyeux & Fleury-Bahi, 2011). Van Sprang, Groen and Van der Voordt (2013) used the terms physical dimension and the social dimension of the environment to address the dichotomy between the physical and social characteristics of the environment. This originates from studies in environmental psychology (Bitner, 1992; Mehrabian & Russell, 1974; Lewin, 1951) and from

research in office environments (Haynes, 2007). Building on Van Sprang et al. (2013), the next sections further explore the physical dimension and the social dimension of the learning environment.

6.2.1 THE PHYSICAL DIMENSION

Literature shows that poorly designed buildings can restrain students to come to the university (Kuntz et al., 2012), whereas well-designed buildings or campuses may help to attract students (Price, Matzdorf, Smith & Agahi, 2003). Many studies address the physical aspects of the learning environment that might influence learning and teaching (Yang et al., 2013; Harrop & Turpin, 2013; Walden, 2009; Woolner, Hall, Higgins, McCaughey & Wall, 2007; Jamieson, 2003; Schneider, 2002; Fisher, 2001; Earthman, 1998), in particular comfort and aesthetics. These aspects are linked to lighting, air quality, temperature, acoustics, furniture, and colour. Yang et al. (2013) showed that students' perception of attributes, such as air quality and temperature, are highly influenced by the design of classrooms. Students also perceive furniture to be important. Particularly for informal learning spaces, Harrop and Turpin (2013) found that students frequently described lighting and natural light as important. Temperature was only mentioned by a few students. Somerville and Collins (2008) endorsed the importance of comfortable, reconfigurable furniture in a functional, inspiring space. Jamieson's (2003) aesthetic aspects concerned interior design elements, such as colour schemes, quality and type of floor coverings, and decorative features. Other studies emphasised the importance of natural elements in learning environments for students' attachment to their learning environment, such as nature murals in indoor settings (Felsten, 2009), natural views (Benfield, Rainbolt, Bell & Donovan, 2015), and plants (Bakker & Van der Voordt, 2010). Another aspect of the physical learning environment is the layout (Jamieson, 2003), which encompasses the arrangements of settings and the space between these settings. Layout also refers to how the physical environment facilitates students to move through and between study areas and to work within an area, either individually or with others. Studies by Yang et al. (2013), Sommerville and Collins (2008), and Fisher (2001) noticed the relevance of the spatial layout in relation to students' learning. Sommerville and Collins (2008) found that students prefer open, unconfined learning environments. According to Yang et al. (2013), students' appraisal heavily relies on spatial attributes, especially visibility, ICT facilities, and other facilities that are provided. Concerning ICT facilities, access to these resources is important to the majority of learners (Sandberg Hanssen & Solvoll, 2015; Harrop & Turpin, 2013) and usually refers to PCs, printers, large screens, access to the Internet, and software.

Building on the above, the physical dimension in this study was operationalised in four characteristics: the perceived importance of comfort, aesthetics, ICT facilities, and layout.

6.2.2 THE SOCIAL DIMENSION

Several authors have studied aspects of the social dimension in office environments (Van Sprang et al, 2013; Appel-Meulenbroek, Groenen & Janssen, 2011; Oseland, 2009; Vischer, 2008; Haynes, 2007; Lee & Brand, 2005). According to Appel-Meulenbroek et al. (2011), the basic principles regarding the social dimension are the user requirements regarding privacy and concentration on the one hand, and communication and interaction on the other. These constructs have their origin in environmental psychology (Sundstrøm, 1986; Zeisel, 1981; Altman, 1975). Altman (1975) described privacy as the dynamic process to control the desired level of interaction, which varies according to individual differences and circumstances over time. In office environments, Van Sprang et al. (2013) and Haynes (2007) mentioned aspects like interruptions, crowding, and noise as attributes of distraction. In the context of learning spaces, Harrop and Turpin (2013) mentioned retreat as relevant aspect for learning spaces, which encompasses preferences for privacy and quiet study. They found that students with a general preference for privacy expressed the importance of having their own little space, without distractions, or spaces where others could not see them working (Harrop & Turpin, 2013). Various other learning environment studies endorse the former findings and show that noise and busyness often have a negative impact on student's behaviour (Matthews et al., 2011; Yau & Joy, 2010; Woolner et al., 2007; Higgins, Hall, Wall, Woolner & McCaughey, 2005; Gurung, 2005). Gurung (2005) showed that students who were distracted during studying for tests (e.g., by listening to music or having friends around) performed worse on their exams. Therefore, the majority of learners demonstrated clear self-awareness by expressing a preference for spaces where they could not be disturbed, nor disturb others. Nevertheless, some learners do prefer a more vibrant environment (Harrop & Turpin, 2013). Apart from the preferred privacy, learning spaces should support interpersonal communication from both a learning perspective as well as from a social perspective (Harrop & Turpin, 2013). Harrop and Turpin (2013) found that some students preferred spaces because it was likely that their friends would come to the same place. Sometimes, the preference for privacy and interaction goes hand in hand. Students who were working together in a group expressed a preference for using a meeting room because it offered more privacy (Harrop & Turpin, 2013). Appel-Meulenbroek et al. (2011) mentioned personal control as a third construct of the social dimension. Personal control refers to the degree of autonomy in deciding what to do, where, and when. A diary study into

higher education learning space use confirmed this desired autonomy, as students reported this aspect as one of the main reasons to study at home (Beckers, Van der Voordt & Dewulf, 2016). Because they could control the background noise and temperature, and listen to their own music if they liked, home was a more preferred learning space than university.

The degree of interaction, privacy, and autonomy are used to operationalise the social dimension of the environment in the empirical study.

6.3 CONCEPTUAL MODEL

The aspects mentioned above have been summarised in a conceptual model that is presented in figure 6.1. It is hypothesised that both the social dimension (the individual preferences for privacy, interaction, and autonomy) and the physical dimension (the perceived importance comfort, aesthetics, ICT facilities, and layout) influence the students' learning space preferences for either individual or collaborative study activities. Literature shows that sociodemographic characteristics, such as gender, age, study year, and living situation may influence learning space preferences as well. These aspects are mentioned in studies into student attendance by Sawon, Pembroke and Wille (2012), Gomis-Porqueras and Rodrigues-Neto (2010). According to Gomis-Porqueras and Rodrigues-Neto (2010), factors as college experience and residence influence the student's choice for attending lessons at the university. First- year students appear to attend more classes than seniors and students who live nearby have better attendance records. Sawon et al. (2012) attribute the latter to the student's cost-benefit behavior. A longer travelling distance requires a larger investment in time and money, which might result in less preference for learning spaces at the university and a higher preference for studying at home. On the other hand, students' perceptions of the study environment may influence their cost-benefit analysis of traveling long distances to the university as well, for instance by accepting longer travel distances in case of attractive and supportive learning places. Therefore, the conceptual model includes these four sociodemographic characteristics.

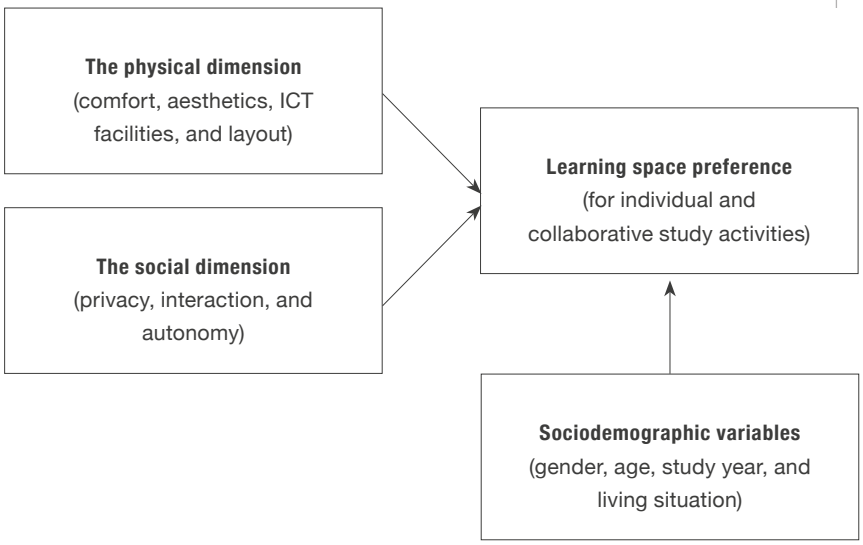

Figure 6.1
Conceptual model

RESEARCH METHODS 6.4

6.4.1 PROCEDURE

The empirical part of this study was conducted at the HAN University of Applied Sciences (UAS) in the Netherlands. The data were collected over a period of two weeks in March 2015. At that time, the UAS had 26,149 students enrolled. The sample was selected from a population of 985 business management students in Nijmegen. The study focused on undergraduate students in the first three study years. The participating students were treated appropriately with respect to the ethical principles of the university. The members of the research team visited the classrooms to ask the students to volunteer in filling in a questionnaire at the start of a lecture. There were no student names or student numbers on the questionnaires, and there was no relation between the lecture and the questionnaire, such as filling in the questionnaire being a course requirement or an opportunity for extra credits. The cover of the questionnaire included a brief introduction of the purpose of the study. The questionnaire had been pretested twice with two small groups of randomly selected students (N=10 and N=11). The main purpose of the tests was to check for clarity of the questions and the answering categories, as well as testing the required time to fill in the questionnaire. The students who pretested the questionnaire did not participate in the diary study itself. After the first pretest, the initial 7-point Likert scale was reduced to a 5-point scale, because the respondents found it difficult to gain a clear view of too many answering

categories and because it made the fill out time longer than the set 5 minutes. Furthermore, the feedback of the students after the pretests led to several textual improvements in questions and answering categories. After the second pretest, the average time to complete the questionnaire met the expected 5 minutes. The data from the questionnaires were inserted in an SPSS format manually by the members of the research team for further analysis. The SPSS format had been tested in the pretest as well.

Out of the 985 students, 697 respondents completed the questionnaire (response rate of 70.8%). From this group 48.2% were male and 51.8% female. The mean age was 19.92 years (SD = 1.86). Out of the 697 respondents, 45.3% were first-year students, 38.3% second year, 16.1% third year, 0.1% fourth year, and 0.1% were missing values. Of the students, 64.8% lived with their parents, 26.0% lived with other students in a students' dormitory, 7.5% lived alone or with a partner, 1.4% had another living situation, and 0.3% of the values were missing.

6.4.2 RESEARCH INSTRUMENT

Building upon the literature review, a questionnaire was developed with propositions to measure the social and the physical dimension of the learning environment (Appendix A). For the aspects of the social dimension (privacy, interaction, and autonomy), the students were asked to mark their opinion on a list of propositions, based on a five-point Likert scale from (1) = *I fully disagree* to (5) = *I fully agree*. Further, the respondents were asked to value characteristics of the physical environment from (1) = *very unimportant* to (5) = *very important*. Finally, the learning space preferences were measured for individual concentrated study activities and collaborative study activities with other students. For both activities, the respondents could indicate their preference for several prescribed learning spaces from (1) = *absolutely not preferred* to (5) = *definitely preferred*. The prescribed spatial settings build upon the distinction between home, settings at the university, and public settings in between home and the university. The settings at the university refer to three learning space types that support self-regulation and social interaction in learning by higher education students (Beckers et al., 2015):

- Collaborative spaces, such as project rooms that support small groups to conduct face-to-face collaborative and cooperative learning activities.
- Personal study space supporting self-study activities.
- Informal learning spaces that are scattered across university buildings, in corridors, atria or the entrance area.

Classrooms were not included in the questionnaire, because these are mostly scheduled for classes.

For the public places, two settings are distinguished:
- A quiet public setting, such as a public library.
- A busy public setting, such as a café in town.

RESEARCH FINDINGS 6.5

The data revealed that most of the students indicated learning spaces as important and perceived that learning spaces contribute to the results of their tests and their collaborative activities (table 6.1).

PERCEIVED RELEVANCE OF LEARNING SPACE TABLE 6.1

				95% CI	
What is your opinion about the next propositions?	***n***	***M***	***(SD)***	***LL***	***UL***
Learning spaces are important.	697	3.67	(0.80)	3.61	3.73
Learning spaces influence the result of my tests.	697	3.71	(0.98)	3.64	3.78
Learning spaces influence the outcome of collaboration with peers.	697	3.52	(0.97)	3.44	3.59

NOTE based on a 5-point Likert scale from 1 = I fully disagree to 5 = I fully agree.
CI = confidence interval; LL = lower limit, UL = upper limit.

6.5.1 ASPECTS OF THE PHYSICAL AND THE SOCIAL DIMENSION OF THE ENVIRONMENT

Table 6.2 and 6.3 show the Cronbach's Alpha's of the two dimensions and the factor loadings of the items, resulting from an exploratory factor analysis (EFA) with an Oblimin rotation, based on an Eigenvalue > 1. The analysis resulted into three factors for the social dimension of the environment: the general preference for privacy/retreat, for interaction/communication, and for autonomy/control (table 6.2). These factors explain 69.51% of the variance. The analysis resulted in four factors

FACTOR LOADINGS OF THE ITEMS OF THE SOCIAL DIMENSION OF THE ENVIRONMENT TABLE 6.2

	Privacy/ retreat	**Interaction/ communication**	**Autonomy/ control**
What is your opinion about the next propositions?	**α = .74**	**α = .56**	**α = .76**
I find it unpleasant when others can see what I do.	**.89**	-.00	.10
I find it unpleasant when others can hear what I say.	**.89**	.00	-.07
I enjoy being with others.	-.10	**.71**	.17
I enjoy working with others.	.02	**.79**	-.07
I go to school for company too.	.04	**.69**	-.05
I think it is important to decide for myself when I work on my study activities.	-.01	-.03	**.90**
I think it is important to decide for myself where I work on my study activities.	.03	.02	**.90**

NOTE Factor loadings > .30 are in boldface.
α refers to the Cronbach's Alpa.

for the physical dimension of the learning environment: the perceived relevance of comfort, aesthetics, ICT facilities, and layout (table 6.3). These factors explain 64.29% of the variance of that dimension. Table 6.4 presents the descriptive statistics of the seven factors that result from combining the underlying items.

TABLE 6.3 FACTOR LOADINGS OF THE ITEMS OF THE PHYSICAL DIMENSION OF THE ENVIRONMENT

What is your opinion about the next aspects of learning spaces in university buildings?	Comfort α = .73	Aesthetics α = .80	ICT facilities α = .60	Layout α = .67
The temperature of the learning environment.	**.78**	-.03	-.14	-.04
The presence of natural light.	**.75**	-.06	.02	-.01
The comfort of the furniture.	**.74**	.04	.10	-.05
The size of the working surface.	**.65**	.09	.10	.07
The finish in general and the decoration of the learning environment.	-.02	**.85**	.01	-.01
The finish of the floors in the building.	-.12	**.81**	.03	-.09
The presence of plants in the learning environment.	.02	**.77**	.06	.11
The use of color in the learning environment.	.17	**.66**	-.13	-.11
The presence of desktop computers in the learning environment.	-.06	.05	**.85**	-.03
The presence of printing facilities in the learning environment.	.12	-.04	**.81**	-.03
A central location of learning settings in the building.	-.03	-.02	.11	**-.87**
The transparancy/unconfinedness of the learning environment.	.04	.04	-.06	**-.84**

NOTE Factor loadings > .30 are in boldface.
α shows the Cronbach's Alpa.

TABLE 6.4 DESCRIPTIVE STATISTICS OF THE FACTORS RELATED TO THE PHYSICAL AND SOCIAL DIMENSION OF THE ENVIRONMENT

				95% CI	
Factor	***n***	***M***	***(SD)***	***LL***	***UL***
Privacy/retreat (2 items).	696	2.56	(0.81)	2.50	2.62
Interaction/communication (3 items).	697	3.80	(0.59)	3.76	3.85
Autonomy/control (2 items).	696	4.17	(0.66)	4.13	4.22
Comfort (4 items).	694	4.10	(0.52)	4.06	4.14
Aesthetics (4 items).	694	2.71	(0.74)	2.66	2.77
ICT facilities (2 items).	694	3.77	(0.82)	3.71	3.84
Layout (2 items).	694	3.32	(0.79)	3.26	3.38

NOTE CI = confidence interval; LL = lower limit, UL = upper limit.

6.5.2 LEARNING SPACE PREFERENCES

Besides learning space at home or in public areas, the questionnaire included learning settings in university buildings. These settings were reduced by using an EFA with an Oblimin rotation, based on an Eigenvalue > 1 (table 6.5). Table 6.5 shows that, to support individual study activities, six learning settings from the questionnaire could be reduced into two factors or learning settings. The first factor refers to open, busy spaces in university buildings, such as the entrance area with talking people, atria or corridors with others passing by, and catering areas, such as a restaurant or a grand café in the building (figure 6.2). The second factor includes a project room or a personal cockpit as quiet, closed settings in these buildings (figure 6.3). The two factors explain 64.89% of the variance in learning space preferences for individual study activities.

For the collaborative study activities, the questionnaire only included one quiet, closed setting. The internal consistency of the four busy, open learning settings to support collaborative study activities was determined with the Cronbach's Alpha (α = .75).

Table 6.6 presents further descriptive statistics of the learning space preferences. The mean values in table 6.6 show that students, for individual concentrated study activities, preferred home or quiet learning spaces in university buildings offering the possibility to retreat. For individual study activities, students did not prefer busy, open spaces in the university building and busy public places. For collaborative study activities with peers, they favoured particularly quiet, closed learning spaces at the university. All other learning spaces are less or much less preferred for collaborative study activities.

FACTOR LOADINGS OF THE ITEMS RELATED TO LEARNING SPACES IN THE UNIVERSITY BUILDING TO SUPPORT INDIVIDUAL STUDY ACTIVITIES TABLE 6.5

Preferred learning spaces	Busy, open area α = .76	Quiet, closed area α = .69
A catering area.	**.82**	.02
A café.	**.82**	.05
The entrance area.	**.73**	-.14
The corridors.	**.66**	.04
A project room.	.02	**.89**
A personal cockpit.	-.03	**.87**

Note Factor loadings > .30 are in boldface.
α shows the Cronbach's Alpa.

TABLE 6.6 DESCRIPTIVE STATISTICS OF THE LEARNING SPACE PREFERENCES

				95% CI	
Preferred learning spaces	***n***	***M***	***(SD)***	***LL***	***UL***
For individual study activities:					
At home (single item).	669	4.26	(0.92)	4.19	4.33
Busy, open area in the university building (4 items).	686	2.07	(0.66)	2.02	2.12
Quiet, closed area in the university building (2 items).	695	3.90	(0.84)	3.84	3.96
Busy public area (single item).	689	1.94	(0.89)	1.88	2.01
Quiet public area (single item).	687	3.36	(1.18)	3.27	3.45
For collaborative study activities:					
At home (single item).	654	3.16	(1.05)	3.08	3.24
Busy, open area in the university building (4 items).	686	2.51	(0.72)	2.46	2.57
Quiet, closed area in the university building (single item).	692	4.30	(0.75)	4.24	4.35
Busy public area (single item).	692	2.28	(1.03)	2.20	2.35

Note CI = confidence interval; LL = lower limit, UL = upper limit.

Figure 6.2
Learning space in a busy, open area

Figure 6.3
Learning space in a quiet, closed area

FURTHER DATA ANALYSIS

Table 6.7 and 6.8 present the correlations between the variables. The continuous variables were correlated based on a Pearson correlation. A Spearman's correlation was used to correlate the categorical sociodemographic variables. Table 6.8 shows only a few significant correlations. The preference for comfort and the preference for closed learning spaces when working collaboratively with peers showed a notable significant correlation ($r(589) = .30$, $p < .001$). There were no significant correlations between the level of preferred privacy and the preferences for any of the prescribed learning spaces. The sociodemographic variables, such as age and study year, hardly showed significant correlations with learning space preferences. For gender and living situation, some significant correlations occurred.

Next, a multiple linear regression analysis was conducted for each of the nine prescribed learning spaces (see table 6.9). The alpha for all measures was set on 5%. A Bonferroni correction was used to correct the significance value of .05 in order to protect for type I errors. The significance of the nine regressions was evaluated at the level of $\alpha = .006$ (.05/9). All nine regression models were significant at the .006 level and all regression analyses had no toleration levels lower than .80 and no VIF values higher than 1.20. This confirms that the potential multicollinearity concerns raised by the correlated predictor variables remained unjustified. Table 6.9 shows that the independent variables in general contribute more to the explained variance in learning space

CORRELATIONS BETWEEN THE ASPECTS OF THE PHYSICAL DIMENSION, THE SOCIAL DIMENSION, AND THE SOCIODEMOGRAPHIC VARIABLES

TABLE 6.7

	Variables	1	2	3	4	5	6	7	8	9	10	11
1	Gender[a,d]	1										
2	Age	.13***	1									
3	Study year[b,d]	.04	-.44***	1								
4	Living situation[c,d]	.03	-.37***	.15***	1							
5	Privacy	-.04	.04	-.07	-.01	1						
6	Interaction	-.05	-.07	.01	-.02	-.22***	1					
7	Autonomy	.01	-.01	-.01	-.04	-.03	.07	1				
8	Comfort	-.13***	.06	-.09*	-.02	-.02	.14***	.23***	1			
9	Aesthetics	-.03	.03	.02	.01	.07	-.01	.02	.23***	1		
10	ICT facilities	-.02	-.03	.02	.08*	-.05	.10**	.04	.20***	.15***	1	
11	Layout	-.09*	-.01	.01	.04	-.04	.10**	.01	.24***	.36***	.21***	1

NOTE *N* varies because blanc answers of the respondents were excluded from the analysis

[a] 1 = male, 0 = female. [b] 1 = first year, 0 = elder year. [c] 1 = with parents, 0 = other living situations

[d] correlations are based on the Spearman's rho, other values are based on the Pearson correlation

* Correlation is significant at the .05 level (two-tailed)

** Correlation is significant at the .01 level (two-tailed)

*** Correlation is significant at the .001 level (two-tailed)

TABLE 6.8

CORRELATIONS BETWEEN THE ASPECTS OF THE PHYSICAL AND THE SOCIAL DIMENSION, THE SOCIODEMOGRAPHIC VARIABLES, AND THE LEARNING SPACE PREFERENCES

	Variables	LSi1	LSi2	LSi3	LSi4	LSi5	LSc1	LSc2	LSc3	LSc4
1	Gender[a,d]	-.11**	.13***	-.13***	.03	-.03	.04	.04	-.15***	.08*
2	Age	-.05	.01	.01	.01	.03	.00	-.02	-.03	.03
3	Study year[b,d]	-.08*	.01	-.06	.02	.04	.05	-.02	-.05	.02
4	Living situation[c,d]	.14***	.02	.05	-.05	-.16***	-.08*	-.04	.06	-.07
5	Privacy	.03	.03	.01	-.02	-.07	-.08	-.06	-.06	-.06
6	Interaction	-.03	.06	-.06	.02	.04	.10*	.13***	.13***	.08*
7	Autonomy	.16***	-.06	.10**	-.05	.06	.05	-.01	.05	-.02
8	Comfort	.12**	-.09*	.13***	-.08*	.07	.02	-.03	.30***	.01
9	Aesthetics	-.03	.09*	-.08*	.14***	.06	-.03	.08*	-.07	.12**
10	ICT facilities	.02	.04	.11**	-.02	.04	.10*	.02	.07	.05
11	Layout	-.07	.10**	-.08*	.06	.03	-.02	.09*	-.01	.03

NOTE *N* varies because blanc answers of the respondents were excluded from the analysis
[a] 1 = male, 0 = female. [b] 1 = first year, 0 = elder year. [c] 1 = with parents, 0 = other living situations
[d] correlations are based on the Spearman's rho, other values are based on the Pearson correlation
LSi = learning space preferences for individual study activities
LSi1 = at home, LSi2 = busy, open area in a university building, LSi3 = quiet, closed area in a university building, LSi4 = busy public area, LSi5 = quiet public area
LSc = learning space preferences for collaborative study activities
LSc1 = at home, LSc2 = busy, open area in a university building, LSc3 = quiet, closed area in a university building, LSc4 = busy public area
* Significant at the .05 level (two-tailed)
** Significant at the .01 level (two-tailed)
*** Significant at the .001 level (two-tailed)

preferences than the sociodemographic variables. Although, in line with the weak significant correlations, the regression analysis showed low significant beta values for the variables that are assumed to predict learning space preferences of students, resulting in low R square values as well (R square max = 9%).

The low R square values in table 6.9 may lead to the assumption that learning space preferences hardly depend on the aspects of the physical dimension, aspects of the social dimension, or on the four sociodemographic variables in the conceptual model. That raises the question whether another possible explanation for the variance in learning space preferences could be given based on the collected data. By comparing the mean differences of the preferred learning spaces for individual tasks and for collaborative learning activities as shown in Table 6.6, statistically significant differences were found at the specified .025 level, after using a Bonferroni correction (.05/2). The preference to study at home is stronger for individual activities than for collaborative activities with peers ($t(645) = 21.76$, $p < .001$, $d = 1.11$, 95% CI [1.00, 1.21]). Regardless of the type of study activity, students highly favour quiet, closed areas (project rooms or individual cockpits). Nevertheless, for collaborative activities this preference is significantly greater than

MULTIPLE LINEAR REGRESSION ANALYSIS FOR PREDICTING THE LEARNING SPACE PREFERENCES

TABLE 6.9

Variables		LSi1	LSi2	LSi3	LSi4	LSi5	LSc1	LSc2	LSc3	LSc4
1	Gender[a,d]	-.14**	.13**	-.11**					-.12**	
2	Age									
3	Study year[b,d]									
4	Living situation[c,d]	.15***				-.15***				
5	Privacy									
6	Interaction							.11**	.10**	
7	Autonomy	.17***								
8	Comfort			.12**					.24***	
9	Aesthetics				.16***					.12**
10	ICT facilities			.11**						
11	Layout			-.13**						
R^2		.07	.04	.07	.03	.02	.03	.02	.09	.03
F		10.42***	7.26***	8.07***	9.21***	16.22***	5.42**	4.93**	23.59***	6.46***

NOTE *N* varies because blanc answers of the respondents were excluded from the analysis
[a] 1 = male, 0 = female. [b] 1 = first year, 0 = elder year. [c] 1 = with parents, 0 = other living situations
[d] correlations are based on the Spearman's rho, other values are based on the Pearson correlation
LSi = learning space preferences for individual study activities
LSi1 = at home, LSi2 = busy, open area in a university building, LSi3 = quiet, closed area in a university building, LSi4 = busy public area, LSi5 = quiet public area
LSc = learning space preferences for collaborative study activities
LSc1 = at home, LSc2 = busy, open area in a university building, LSc3 = quiet, closed area in a university building, LSc4 = busy public area
** $p < .01$ (significant after Bonferroni correction)
*** $p < .001$ (significant after Bonferroni correction)

for individual activities ($t(690) = -11.75$, $p < .001$, $d = 0.50$, 95% CI [-0.47, -0.33]). Whatever study activities students work on, they do not prefer busy, open learning spaces in a university building. However, the aversion to use these areas is significantly greater for individual activities than for collaborative activities ($t(677) = -16.59$, $p < .001$, $d = 0.64$, 95% CI [-0.50, -0.39]). Although the difference between individual and collaborative activities is small ($t(677) = -8.82$, $p < .001$, $d = 0.35$, 95% CI [-0.41, -0.26]), busy public areas are not preferred at all for study activities.

6.7 DISCUSSION AND CONCLUSIONS

The current study explored whether students perceive learning spaces to be relevant for their learning outcomes, how students value the importance of various characteristics of the physical and the social dimension of the learning environment, and what this means for their learning space preferences. The findings showed that students experienced privacy not as a very important aspect of the social dimension. This is in contrast with Harrop and Turpin (2013), who found a relationship between the preferred privacy of university students and the preference for a quiet learning space without any distractions. In their study, students reported selecting seats in out-of-the-way-corners for this purpose. The current research confirms the preference for quiet spaces, but did not find a significant correlation with the general preference for privacy. Instead of a preference for privacy, quietness seemed to be a key reason for the stated preference for places that support the possibility to retreat. This result endorses the findings in the study by Price et al. (2003) stating that quiet areas are one of the most relevant study facilities of universities. At the same time, they argue that opportunities for learning in an entrance area and in corridors or in combination with catering facilities seem to be important. In a study among 1,457 students at a Norwegian university, Sandberg Hanssen and Solvoll (2015) found that social areas even contributed most to the overall students' learning space satisfaction; social areas had a standardised β that was three times higher than the β for rooms for group work. Additionally, catering areas in university buildings are important for students' learning activities (Higgins et al., 2005). The relevance of these spaces is not confirmed by the results of the current study, since catering areas and informal learning spaces may be important to support social activities at the university, but are less preferred for both individual and collaborative study activities.

A result of the current study that confirms the findings of the Norwegian study, is that students valued aesthetical aspects of the physical dimension as not very important. This does not mean that aspects such as colour, finishing, and decoration of higher education buildings are irrelevant. Well-designed learning spaces are relevant, inter-alia due to the current experience economy (Pine & Gilmore, 1999) and increasing student expectations of higher education university buildings and facilities (Beckers & Van der Voordt, 2013). However, the current study shows that students' preferences regarding learning spaces are more influenced by their perceived effectiveness, such as being able to conduct the learning activities in an appropriate way, with a high level of autonomy, sound ICT facilities, sufficient comfort, and being able to working alone or together in a quiet environment. When it comes to learning activities, students seem to be mainly interested in

functionality. This confirms the findings by Jessop et al. (2012, p. 193), who stated that "[…] students appeared to be most concerned about the functional aspects of space. They presented themselves as not overly concerned about aesthetics […]".

The statistical analysis of this paper indicated that the learning space preferences of higher education students can only to a certain extent be attributed to the social dimension or to the physical dimension of the learning environment, as measured according to the characteristics in the conceptual model of this study. Learning space preferences are particularly related to whether students perform study activities individually or collaboratively. An explanation for the low contribution of the social and physical dimension of the learning environment combined with the higher impact of the type of learning activities (e.g., individual or collaborative), might be that current learning spaces already fulfill minimum standards. Once these are attained, the impact of place characteristics on preferred study places may be less significant (Higgins et al., 2005). Educational buildings and facilities may be considered commodities or, in terms of Herzberg's two-factor theory, hygiene factors (Herzberg, 2003). They can motivate students to a certain extent, but students are most aware of the environment when it is not satisfactory.

Student satisfaction is often related to study performances. According to a literature review by Temple (2007), empirical studies that link aspects of the physical environment to student satisfaction are often based on the assumption that satisfied students are better learners. However, the impact of education buildings on learning outcomes is hard to demonstrate. Although the results of the current study indicate that students prefer learning spaces that support their learning activities and confirm that learning spaces influence their learning outcomes, the study does not address the relationship between preferred learning spaces and learning performance. The impact of place characteristics on learning outcomes is very relevant, but it is difficult to show cause and effect relationships. Preferences should not be confounded with performances. Moreover, students do not appear to be the best evaluators of their own learning, as they might choose study strategies that do not necessarily emphasise actual learning (Gurung, Weidert & Jeske, 2010).

6.8 IMPLICATIONS FOR PRACTICE AND FURTHER RESEARCH

The findings of the current research may contribute to a better understanding of how students value learning spaces in university buildings, at home, and at other venues. The expectation is that future activities in higher education learning and teaching will be different from current activities. Traditional instructional approaches for larger groups will shift into more collaborative activities amongst small groups, in which students are self-directed learners. This shift in activities will have significant consequences for the requirements for higher education physical learning environments. As such, the findings of this research can be used to support managers and decision-makers, who are responsible for higher education buildings, in learning space planning issues and in learning space management, in order to support new ways of learning with suitable, future-proof learning environments. Furthermore, this study may be useful for researchers in different fields, such as environmental psychology, educational sciences, corporate real estate management, and facilities management.

The preferences that were found in the current study reflect the past and present ways of learning of Dutch students at a single UAS. Preferences may be different among other students and may change in time. Therefore, further research is necessary to extend this research to other students, from different universities, different educational programs, and different countries, to test the findings on their robustness. Furthermore, additional research is needed to explicit the low proportion of variance in learning space preferences explained by the two dimensions of the environment, for instance by using in depth narrative interview techniques. Longitudinal experiments, with new learning spaces for evolving learning activities, could be helpful as well. These experiments might also lead to insights into how study activities will change due to 21st century learning skills, new learning approaches supported by an increasing use of ICT in education, and how these changes might influence future learning space preferences.

APPENDIX A. PROPOSITIONS FROM THE QUESTIONNAIRE

6.9

Relevance of the learning environment

What is your opinion about the next propositions?

	I fully disagree				I fully agree
Learning spaces are important.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning spaces influence the results of my tests.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning spaces influence the outcome of collaboration with peers.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐

Social dimension of the learning environment

What is your opinion about the next propositions?

	I fully disagree				I fully agree
I find it unpleasant when others can see what I do.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
I find it unpleasant when others can hear what I say.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
I enjoy being with others.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
I enjoy working with others.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
I go to school for company too.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
I think it is important to decide for myself when I work on my study activities.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
I think it is important to decide for myself where I work on my study activities.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐

Physical dimension of the learning environment

What is your opinion about the next aspects of learning spaces in university buildings?

	Very unimportant				Very important
The presence of natural light.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The temperature of the environment.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The comfort of the furniture.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The size of the working surface.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The use of colour in the building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The finish of the floors in the building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The finish in general and the decoration of the learning environment.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The presence of plants in the learning environment.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The presence of desktop computers in the learning environment.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The presence of printing facilities in the learning environment.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
A central location of learning settings in the building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
The transparency/opennes of the learning environment.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐

Learning space preferences for individual study activities

Which learning space would you prefer for individual study activities that require concentration?

	Absolutely not preferred				Definitely preferred
Learning space at home.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in the entrance area of the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in the corridors of the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in the catering area of the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in the café in the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in a project room in the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in a personal cockpit in the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in busy public places, such as a café in town.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in a quiet public place, such as a library.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐

Learning space preferences for collaborative study activities

Which learning space would you prefer for collaborative study activities with other students?

	Absolutely not preferred				Definitely preferred
Learning space at home.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in the entrance area of the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in the corridors of the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in the catering area of the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in the café in the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in a project room in the university building.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
Learning space in busy public places, such as a café in town.	1. ☐	2. ☐	3. ☐	4. ☐	5. ☐

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CONCLUSION, DISCUSSION, AND CONTRIBUTION

INTRODUCTION 7.1

This thesis addressed the alignment of learning space with higher education learning and teaching. Alignment can be described as bringing into harmony things that differ or could differ. Significant changes in higher education learning and teaching approaches, due to developments in information and communication technology (ICT) and new learning theories, resulted in the need for reconsidering the design of the physical learning environment. In practice, the changing context of higher education leads to the managerial question: 'How can higher education institutions align the physical learning environment with the developments in higher education learning and teaching?'.

Answering this question requires insights into the layout and the design of learning settings in current educational buildings, how these settings are used, and what kind of learning environments fit end-user preferences and support new pedagogical approaches. It also requires knowledge about managing physical learning environments in higher education institutions, such as corporate real estate management (CREM) processes that are or can be applied to achieve alignment. Literature and practice show a lack of understanding on how to align the physical learning environment with the requirements that result from developments in higher education learning and teaching. Therefore, the main objective of the current dissertation was twofold. First, it aimed to explore the alignment of higher education accommodation with higher education learning and teaching developments. Second, it aimed to support CREM decision-making to align learning spaces

with the requirements from the developments in higher education and student's behaviour and preferences. The main research question of this thesis was: 'Which aspects influence the alignment of learning space with developments in higher education learning and teaching?'. In order to address this question, five sub-questions were formulated, which were answered in the foregoing chapters of this dissertation. The next sections first present three alignment mechanisms as an answer to the main research question. Then, the discussion section presents how this research contributes to literature and practice. Next, the limitations are discussed and recommendations for further research are presented. The chapter ends with the final conclusions.

7.2 ALIGNMENT MECHANISMS

7.2.1 INTRODUCTION

The findings of the five studies in this dissertation contribute to a large diversity of insights in order to answer the main question of this dissertation. As an answer to the main research question of this research, the results of the studies are summarised in three alignment mechanisms (indicated as I, II and III), which are presented in figure 7.1.

The first alignment mechanism (I) concerns the alignment process, referring to management approaches for how to align corporate real estate (CRE) with the perspectives of the organisation and its end users. Mechanism I involves the process activities for bringing demand and supply of CRE together, using different conceptions of the role of the user in alignment issues by focussing on coordination, communication, and decision-making. Depending on how coordination, communication, and decision-making are applied, two opposite management approaches for the alignment process can be distinguished based on control orientation or involvement orientation.

The other mechanisms (II and III) can be seen as the result (product) of the alignment process activities of mechanism I. Based on the process activities of alignment mechanism I, CRE managers formulate their CRE strategies in line with the corporate strategies, which is presented as alignment mechanism II. Also, they aim at creating a physical learning environment with learning spaces that result from these CRE strategies and that fit the educational processes related to teaching and learning. The latter is shown in figure 7.1 as alignment mechanism III.

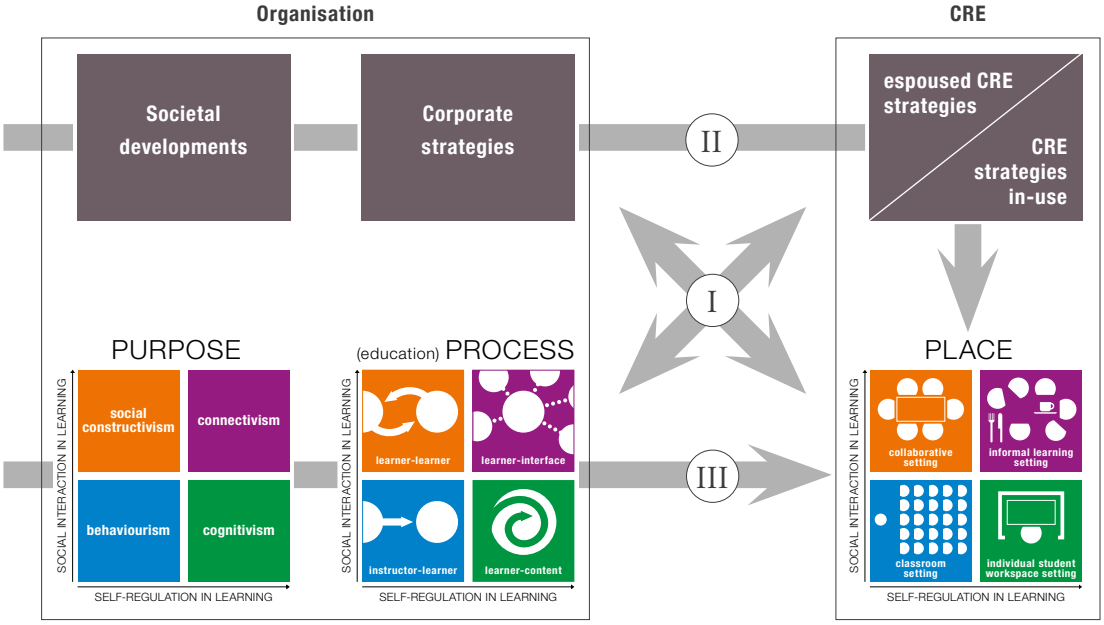

Figure 7.1
Learning space alignment model with three alignment mechanisms

7.2.2 ALIGNMENT MECHANISM I: MANAGING ALIGNMENT

The first alignment mechanism (I) regards the process of aligning the physical learning environment with demands from the organisation and its end users. The alignment process can be managed based on a control-oriented approach, an involvement-oriented approach, or a combination of both approaches. Both approaches result from different conceptions of the role of the representatives of the demand side in alignment issues. Three key process activities are applied, namely: communication (information exchange between demand and supply), coordination (managing stakeholders and preconditions) and decision-making. For these three activities, eight management perspectives result from the research, regarding: (1) the perceived differences between stakeholder groups, (2) how interaction with users is structured, (3) influence of CREM on financial resources, (4) value propositions of CREM, (5) the time horizon of CREM, (6) the extent to which CREM is proactive or reactive, (7) top-down or bottom-up approaches, and (8) the role of the CREM department in alignment issues. The results of the empirical study point out that the higher education institutions do not explicitly apply the eight management assumptions within the involvement-oriented approach or the control-oriented approach. In practice, a mixture of both alignment approaches is applied, with different accents on the eight management perspectives related to coordination, communication, and decision-making. How the eight perspectives

underlie communication, coordination, and decision-making, contributes to awareness of different possibilities how to manage alignment of CRE to the organisation, with involvement of management at the strategic level and the end-user at an operational level.

7.2.3 ALIGNMENT MECHANISM II: ALIGNMENT TO SOCIETAL DEVELOPMENTS AND CORPORATE STRATEGIES

Alignment mechanism II shows whether the CRE strategies and CRE operating solutions of higher education institutions are aligned with their corporate strategies and societal developments. Literature and practice have shown several key developments in society. One of the developments is the emerging knowledge economy for which schools have to prepare young people with 21st century skills, such as collaboration, critical thinking and problem solving, creativity and innovation, social responsibility, communication, personal management, and above all digital literacy (Voogt & Pareja Roblin, 2012). Due to the development of ICT in society and in education, the knowledge monopoly has been changing from the teacher as the main source of information to knowledge that is available always and anywhere. Schools are changing from a place of instruction to a place of knowledge sharing and knowledge development, which is co-created by students and teachers. Therefore, traditional teacher-led approaches of learning are shifting into more student-led approaches.

Students themselves are changing too. New generations are entering the classrooms with heterogeneous behaviour, needs, and expectations. The latter especially due to the growing impact of the experience economy, which is one of the main drivers of the increased attention for design issues of higher education buildings. Next to this, there is the need for valorisation, resulting in an increased collaboration of higher education institutions with the outside world (regionally, nationally, and internationally). Also, a decrease of the number of students after 2020 is expected as well as financial cuts in education budgets by the Dutch government. These societal developments can be recognised in the strategic plans of higher education institutions that particularly focus on the balance between the quality of higher education and costs. In their strategic plans, higher education institutions barely pay attention to CRE strategies to show how these support the corporate strategies. CRE strategies are hardly formulated in strategic plans of higher education institutions, which seems to represent a limited understanding at the strategic level of the organisation of the added value of CRE for the organisation and the end users. Whereas the espoused CRE strategies, which are mentioned in strategic plans, show various gaps in the alignment with the corporate strategies, formulated CRE strategies,

which are used in practice, seem to match corporate strategies well. This shows that CRE managers and CRE professionals in the organisation are actually aware that CRE can be more than just a support function or a necessity, and that CRE can add value to serve the corporate interests.

Alignment of the formulated CRE strategies with the corporate strategies of higher education institutions appears to focus on effectiveness of CRE by supporting user activities. In addition, CRE strategies are translated into CRE operating decisions aiming to create flexibility and efficiency of CRE by controlling CRE costs and efficient space use. Also, CRE operating decisions aim to contribute to experience aspects of CRE by increasing user satisfaction and contributing to the image of the organisation. The study did not reveal many substantive differences between the translation of espoused CRE strategies and CRE strategies in-use into CRE operating decisions.

7.2.4 ALIGNMENT MECHANISM III: ALIGNMENT TO EDUCATIONAL CHANGE AND STUDENTS' PREFERENCES

The third alignment mechanism (III) regards the alignment of the physical learning and teaching settings with learning and teaching approaches. Alignment occurs when the physical setting fits the appropriate educational process that depends on a specific learning theory. The developments towards 21st century skills result in increased self-regulation by students in combination with social interaction. The latter appears to be not only face-to-face, but due to the ICT developments more and more virtually as well. Students build virtual networks and use these to learn. Learning especially from a teacher (behaviourism), first shifted to self-directed learning (cognitivism), then to learning from each other (social constructivism), and finally to learning in virtual networks (connectivism).

Connectivism resulted in an increase of virtual education concepts in online networks that led to the development of asynchronous tuition methods, such as blended learning and flipped classroom concepts, which are a mixture of e-learning and face-to-face meetings at school. These new insights into learning, driven by ICT developments, result in new learning and teaching processes and in approaches with the teacher as a guide on the side. To support the learning and teaching processes, education buildings show four main types of learning space: classroom settings for large groups, collaborative settings for small groups, individual learning settings, and informal learning settings often combined with catering services. These learning spaces represent four edges of the learning space spectrum, in which learning settings from several literature sources are combined (e.g., Marmot, 2006; Fisher,

2005, 2003). Because a model is a simplification of reality, in practice, these learning spaces come to the fore in many different forms, such as learning labs, training rooms, lecture halls, grand cafés, libraries, learning centres, loose tables and chairs in corridors, project rooms, et cetera. Combining the four learning settings of chapter 2 with the four characteristics of the physical learning environment of chapter 6 (comfort, aesthetics, ICT facilities, and layout) enables to discern the learning settings by their design characteristics (see table 7.1).

Besides learning in school buildings, third places (public settings between home and school) show up to facilitate students' learning activities. Alignment initiatives of higher education institutions reveal in the shift from less classroom space to more informal learning spaces to support contemporary learning and teaching approaches.

Additionally, the expected developments from teacher-led educational approaches to more student-led approaches have led to specific attention to student needs within alignment mechanism III. Figure 7.1 shows that alignment is expected when learning settings match the learning activities of students. The specific relationship between students' learning activities and their space use is confirmed in the diary study of this dissertation. The results of the study show that students' learning space use is especially influenced by their current activities. Students use different learning spaces for different activities. Besides, learning space use is influenced by aspects, such as comfort preferences, personal control over the environment, and the social influence of peers. Student characteristics, such as gender, age, and study year, are only to some extent related to differences in learning space use. The correlation of third places and ICT developments with learning space use is limited too.

The actual learning space use depends on the availability of learning settings. Settings that are missing cannot be used for supporting learning activities. Therefore, the final study of this dissertation explored which learning spaces students would use when they could choose from a set of available settings. The results of the study show that students prefer quiet, closed settings for study activities, where the diary study showed that in practice they often use open, busy spaces. The study also shows that behavioural aspects such as the desired privacy, interaction, and autonomy, or characteristics of the physical environment, such as the importance of comfort, aesthetics, technical resources, and layout, have a significant but limited influence on learning space preferences. Student characteristics such as gender, age, study year, or living situation, do not have much influence on the learning space preferences of students too.

DESIGN CHARACTERISTICS OF FOUR MAIN LEARNING SPACE TYPES TABLE 7.1

Learning spaces	characteristics	
Classroom setting 	*Layout*	– Mostly closed rooms with 30 seats (50 m2) or more. Lecture halls up to 400 seats. – Seats face the lecturer in a front position in the room.
	Comfort	– Formal, functional and movable furniture (tables and chairs) or fixed chairs and tables in lecture halls. – Size of working surface is about 0.5 m2/seat. – Controlled temperature. – Natural lighting is usually limited.
	Aesthetics	– Finishing and decoration is functional and generic.
	ICT facilities	– Bring your own device and use WiFi. – Smartboard central in the room or decentral smaller presentation screens on the walls.
Collaborative setting for small groups 	*Layout*	– Open or closed settings, often scattered through the building. – Closed project rooms (10 m2) for retreat. – Open settings with movable tables and chairs in learning areas. – Preferably not situated directly in or near circulation areas.
	Comfort	– Setting with a large table and 4 to 8 seats. – Working surface is about 0.5 m2/seat. – Controlled temperature in closed project rooms; temperature difficult to control in open areas. – Often lack of natural light.
	Aesthetics	– Finishing and decoration in project rooms is functional and generic, in open areas more decorated and colourful.
	ICT facilities	– Bring your own device and use WiFi. – Presentation screen on the wall in project rooms.
Individual setting 	*Layout*	– Closed settings in personal cockpits (5 m2) or open settings in learning landscapes. – Preferably not situated directly in or near circulation areas.
	Comfort	– Functional furniture, comparable with office workspace (desk and chair). – Often lack of natural light. – Controlled temperature in personal cockpits; temperature difficult to control in open learning landscapes.
	Aesthetics	– Finishing and decoration in personal cockpits is functional and generic, in open areas more decorated and colourful.
	ICT facilities	– Bring your own device and use WiFi in combination with fixed desktop computers and printing facilities.
Informal learning setting 	*Layout*	– Open and transparent. – Combined with other functions, such as the entrance hall, corridors, atria, in or near a coffee corner or a catering area.
	Comfort	– Combination of formal and informal furniture. – Limited attention for the size of working surface. – Temperature is difficult to control, because of the layout and the size of these areas. – Usually limited natural lighting.
	Aesthetics	– Situated in colourful and decorated building areas.
	ICT facilities	– Bring your own device and use WiFi.

7.2.5 REFLECTION ON THE ALIGNMENT MECHANISMS

Differences in the scope of the alignment goals, especially between alignment mechanism II and III, but also within both mechanisms, may lead to some extent to conflicting situations. These conflicts of interest are often concerned with the balance between CRE effectiveness, efficiency, and experience. This can be illustrated with some examples. First, according to alignment mechanism III, higher education buildings contain a growing diversity of informal learning spaces, such as restaurants, cafés, and coffee bars. These spaces can be justified because of the development towards connectivism that resulted in more learner-interface interaction. Therefore, students can do study activities anywhere and anytime. With regard to alignment mechanism II, these learning spaces also correspond with the corporate strategies of higher education institutions for stimulating collaboration and the increased need to meet of students and teaching staff, and to build a knowledge institution rather than a teaching factory. When it comes to facilitating students' learning space preferences in alignment mechanism III, it lacks alignment between student preferences and informal learning spaces. Students do not prefer these spaces for supporting their individual study activities or for small group work.

Second, according to alignment mechanism II, the developments towards an experience economy result in fancy buildings with learning spaces that especially fit the idea that educational buildings contribute to students' experiences. Nevertheless, alignment mechanism III shows that the alignment of learning space with students' preferences depends more on the effectiveness of learning spaces, than on the experience value of learning spaces.

Third, alignment mechanism III shows that students consider their physical learning environment to be relevant. In their perception it contributes to the results of their study activities. Yet, according to the findings regarding alignment mechanism I, students are hardly involved in design issues of learning spaces. CRE managers often choose to only inform students about activities related to the physical learning environment. The students' voice is often lacking in learning space design decisions. Nevertheless, designing learning spaces requires a clear understanding of the link between student activities, where they conduct these activities and the reasons that underlie students' learning space choices and preferences.

DISCUSSION AND CONTRIBUTION

7.3

This research adds new insights about learning spaces to literature and practice in several ways. In this section, the scientific contribution and the practical implications are discussed. Furthermore, this section aims to reflect on the limitations that are inevitably connected to scientific research and make recommendations for further research.

7.3.1 CONTRIBUTION TO LITERATURE

The first contribution of this research to literature is that it links education to the physical learning environment. Much scientific literature focuses on the developments in higher education, such as new ways of learning, learning styles or new learning approaches (Voogt & Pareja Roblin, 2012; Marais, 2011; Foster, 2008; Downes, 2007; Coffield, Mosely, Hall & Ecclestone, 2004; Leland & Kasten, 2002; Simons, Van der Linden & Duffy, 2000) and on ICT developments in education (Abeysekera & Dawson, 2015; Johnson, Smith, Willis, Levine & Haywood, 2011; Collis & Van der Wende, 2002). Yet, less research has been conducted into the relationship between these developments and the physical learning environment (Boddington & Boys, 2011; Temple, 2008, 2007; De Vries, 2007). Especially, learning spaces in higher education are an under-researched topic (Temple, 2007). There is a need to understand how new learning spaces are used to support an effective pedagogical transition (Marmot, 2012). New conceptual frameworks are needed to understand the link between education and learning spaces better (Boddington & Boys, 2011). One of the main contributions of this research to literature is that it not only builds upon different scientific disciplines, such as education, didactics, facility management, corporate real estate management, and learning space design, but also connects them by integrating them in the purpose-process-place framework (chapter 2). That framework makes developments in higher education manifest and contributes to a better understanding of aligning learning space with the needs that result from new ways of learning, supported by advanced ICT. It can be used for further research into the relationship between education and the physical learning environment as well.

The second contribution is that the research in this dissertation studied the alignment between developments in higher education learning and the learning environment from an end-user perspective. Former research in higher education mainly studied alignment issues from the supply side by involving managers who are responsible for facilities, educational buildings or campus environments (Kok, 2015; Den Heijer, 2011; De Vries, 2007; Amaratunga & Baldry, 2000). If users are asked to participate in research, it mostly concerns educational staff, such as lecturers or non-teaching staff (Kok, 2015; Van Sprang, Groen &

Van der Voordt, 2013). There are studies that involve higher education students as well (Vidalakis, Sun & Papa, 2013; Jessop, Gubby & Smith, 2012; CABE, 2003; Price, Matzdorf, Smith & Agahi, 2003), but the students' voice is too often missing in studies into the physical learning environment. Therefore, there is still a lack of understanding about the students' needs and requirements for the physical learning environment that result from the developments in society and in education (Fisher & Newton, 2014; Harrop & Turpin, 2013; Matthews, Andrews & Adams, 2011). Besides, there is the need for insights into how learning spaces could be designed based on understanding about how students learn, where they learn, when they learn and what requirements students have for their learning spaces (Rudd, Gifford, Morrison & Facer, 2006; Oblinger, 2005). With the diary study and the survey into learning space preferences, this thesis contributes to the demand for involving students in research and to a focus on understanding students' activities, their actual space use, their preferred learning spaces, and the interrelationships between these topics.

The third contribution concerns new insights into CREM alignment. Traditionally, CREM literature shows four perspectives on alignment of CRE with the core business of organisations (Den Heijer, 2011; Manning & Roulac, 2001; Krumm, Dewulf & De Jonge, 2000). Two perspectives are related to the organisation (demand side) and two to CRE (supply side). Within these perspectives, a distinction is made between the strategic and the operational level. The current models lack insight into the mechanisms that occur in aligning demand and supply at a strategic and operational level. The research in this thesis adds three process activities that can be applied for creating alignment between CRE and the core business of an organisation (coordination, communication, and decision-making), which build upon the literature from general management disciplines (Llewellyn & Armistead, 2000; Garvin, 1998). Also, the two alignment approaches (involvement-oriented and control-oriented) and the underlying eight perspectives that result from the research add new insights to the literature concerning the alignment of CRE and the core business of organisations.

The fourth contribution concerns the need for more appropriate methods and tools that reveal, assist, and inform the management and construction of learning spaces in higher education (Boddington & Boys, 2011). According to Temple (2007), literature lacks insight into managerial decision-making about space issues related to higher education developments in learning and teaching approaches. CRE managers need a better understanding of what they can do to add value with educational buildings to higher education institutions as a whole and to its end users. Added value issues are much applied in CREM

literature (e.g., Jensen & Van der Voordt, 2015; Riratanaphong, 2013; Jensen, Van der Voordt & Coenen, 2012; Den Heijer, 2011; Van der Voordt & Van der Zwart, 2011; De Vries, De Jonge & Van der Voordt, 2008; Lindholm, Gibler & Leväinen, 2006; Nourse & Roulac, 1993). This thesis does not add new insights to the growing list of added values of CRE for organisations, but it shows quite clearly how the added values of CRE are linked to corporate strategies. This adds insights to the literature about alignment between strategies of functional management disciplines, such as human relations management (HRM), FM, CREM, information technology (IT), and corporate strategies (Ambrosini & Bowman, 2003). Further, the research adds the insight that the CRE strategies that occur in practice (strategies-in-use) are not always in concert with the CRE strategies in the strategic plans of institutions (espoused strategies). Studying the distinction between espoused strategies and strategies in-use in CREM is rare, but is well-known in other disciplines, such as in general management literature and in IT literature (Brown, 2010; Clemons, Row & Thatcher, 1995; Argyris & Schön, 1974).

The final contribution to literature is related to the methodology used in this research. Often, questionnaires, interviews or observations are applied to study people in their physical environment. According to Whiteside and Fitzgerald (2009), new approaches are necessary to provide data that better and more completely answer current questions about the learning environment. Some of the methods in this thesis build on traditional methods, but less common methods have been applied as well. In the first study of this dissertation, a comparative floorplan analysis (CFA) was used. A CFA aims to develop guidelines for the spatial organisation of activities (Van Hoogdalem, Van der Voordt & Van der Wegen, 1985). CFA studies have originally been applied in, for example, environmental psychology (Zeisel, 1981), in post occupancy evaluations (Van der Voordt, Vrielink & Van Wegen, 1997; Preiser, Rabinowitz & White, 1988; Van Hoogdalem et al., 1985), and in the development of patterns for the physical environment (Alexander, Ishikawa & Silverstein, 1977; Lynch, 1960). Especially, the combination of the conceptual purpose-process-place framework and the conducted CFA contributes to a better understanding of how different learning theories may influence physical learning spaces. Literature shows that learning and teaching processes are shifting from the traditional transaction model with the instructor that teaches the students, to more self-regulation and social interaction of students. The CFA in the four higher education buildings showed that this shift is recognisable in learning spaces too. With this, CFA complements former studies that focus on spatial-functional configurations in higher education buildings, to investigate how education processes are, and can be, supported by

learning space, such as Fisher (2005) or Nair and Fielding (2005). Another method was the use of diaries or logbooks, which is not widely applied in studies into learning spaces in higher education. A diary method provides more complete information than using questionnaires would (Appel-Meulenbroek, 2014) and the method gives researchers the opportunity to collect data of regular activities of students in relation to their physical learning environment (Iida, Shrout, Laurenceau & Bolger, 2012). The diary method in this thesis especially adds value because it was applied in combination with traditional methods, such as a questionnaire and interviews. This makes it possible to draw conclusions based on triangulation, which fit recent work by Fisher and Newton (2014), who argued for a mixture of qualitative and quantitative methods to study the usability of learning spaces.

7.3.2 CONTRIBUTIONS TO PRACTICE

The practical implications of the research in this dissertation aim to support decision-making on and management of aligning learning spaces with the developments in higher education learning and teaching. This section addresses two ways to accomplish this: learning space planning and learning space management.

Learning space planning

The design of the physical learning environment 'suffers' from its long-lasting history. In school buildings the same problems occur as with the railway system. Both concepts go back more than 100 years, which may frustrate innovation. According to Jessop et al. (2012), dominant models of teaching, such as teacher-centred approaches may have shaped the configurations of rooms. Therefore, space may place boundaries over developments in higher education learning and teaching, like new or alternative pedagogies. One of the main insights for practice of this dissertation is that the developments in education do not result in a revolutionary change of traditional learning settings, such as classrooms. The influence of developments in education on educational buildings will be closer to an evolution, rather than a revolution. Nevertheless, the research gives many insights for learning space planning that may lead to a better alignment of learning spaces with learning and teaching in the future.

The first recommendation for higher education institutions is to aim for creating activity based learning environments for students to support concentration, routine work, and communication. The purpose-process-place framework in this dissertation is a valuable conceptual tool that can contribute to learning space planning. Besides classrooms, the framework presents settings that support individual study activities and

settings that support communication. To sufficiently support the need of students for retreat, individual settings are preferably differentiated in closed settings for concentrated study and open space with workstations or laptop plug-ins for routine study activities and activities that do not specifically require concentration. The settings for communication are refined in three types. First, settings that support formal communication referring to collaboration. Second, settings for informal communication referring to meeting each other for routine activities. Third, settings that support activities that require concentration and retreat. This adds two closed settings to the three learning settings in the purpose-process-place framework, which leads to five settings to support learning activities (figure 7.2).

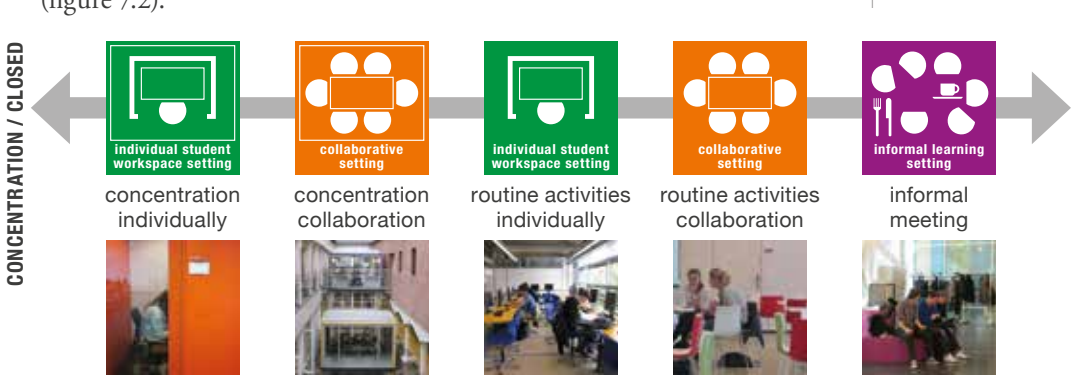

Figure 7.2
Settings for an activity based learning environment (classrooms excluded)

In current practice, the imbalance between the settings of figure 7.2 leads to misalignment. Besides traditional classrooms, higher education institutions mainly create informal meeting space in educational buildings, because the multi-functionality of these settings is highly overrated. To appropriately support study activities of students, higher education institutions could offer more closed learning spaces for retreat.

A second recommendation for higher education practice is to situate learning settings in relation to other spatial settings, such as instruction space, working space for teaching staff and circulation space, in an appropriate way. This supports the development towards communities of learning and practice (McLaughlin & Mills, 2008; Smith & Bath, 2006). Many higher education institutions focus on creating generic space for multi-use in terms of 'the campus as learning space'. Often, this is at the expense of students who want to identify themselves with a group and want to recognise that group in the building. The crux here is to find a balance between efficiency measures, such as generic space, and user preferences regarding dedicated areas for specific user groups. Figure 7.3 shows a learning space planning scheme that builds upon the next planning principles:

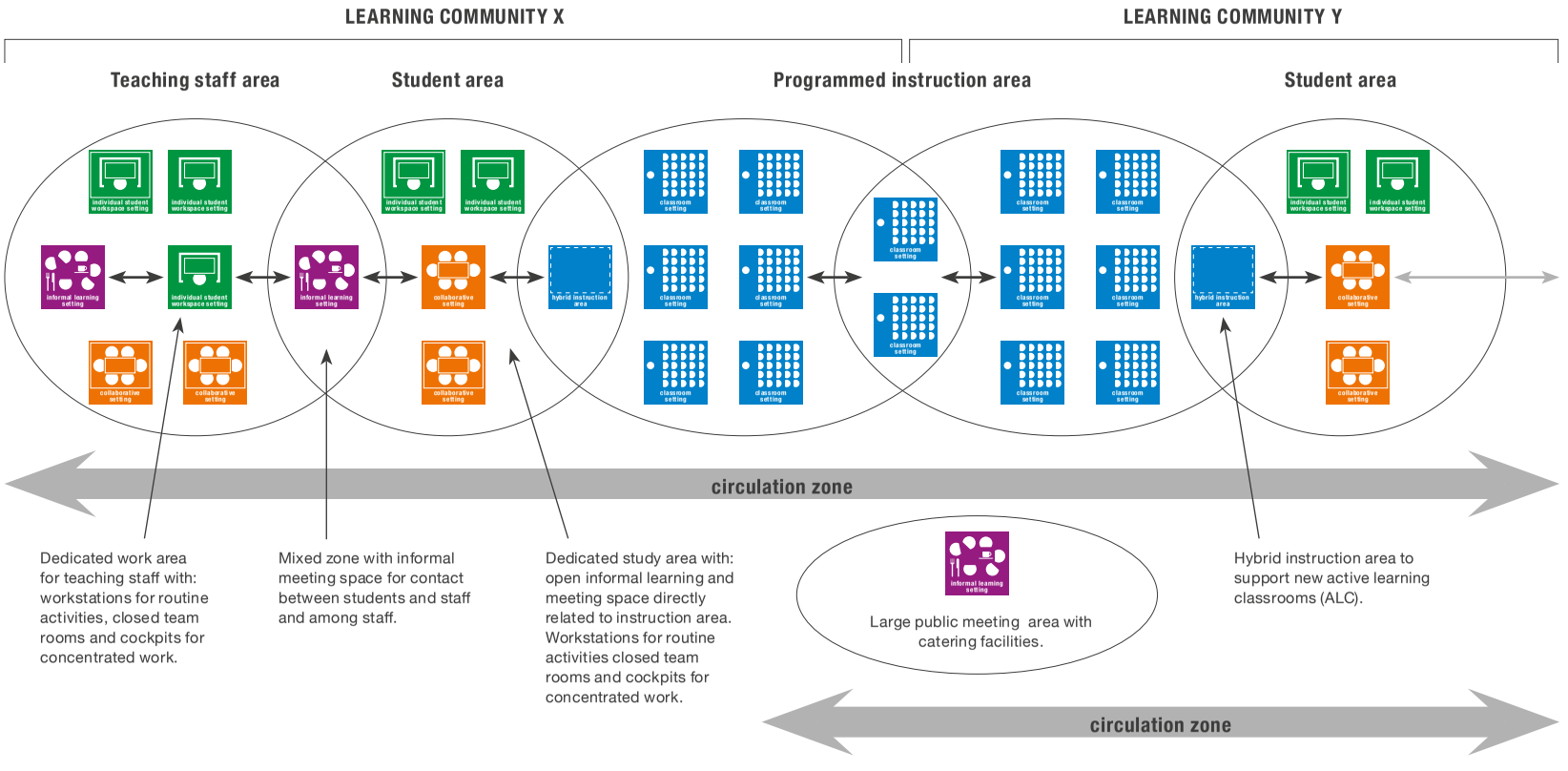

Figure 7.3
Learning space planning scheme

- Create dedicated areas for learning communities that include three key elements: a teaching staff area, a student area, and areas for programmed instruction rooms (still mostly traditional classrooms) and for ad-hoc interaction between students and staff.
- Create mixed zones with informal meeting space for contact between students and staff, and among staff or students. Decentral informal learning spaces are areas where students can eat and drink while doing their work. Catering services, other than basic hot drinks, are not necessarily present in these areas. Extensive catering areas are centrally situated in the building.
- Student areas and the staff areas contain a balanced mix of settings that support concentration, routine activities, and communication.
- Distinguish physical learning environments that particularly support study activities or social activities in educational buildings.
- Learning spaces for students are separated from circulation areas, such as corridors or the entrance area. Yet, meeting spaces are close to circulation areas to stimulate chance encounters.
- Create generic instruction areas in between two learning communities, which both can use, besides their dedicated instruction rooms.
- Situate student areas next to the instruction rooms. Due to new concepts such as blended learning and flipped classroom, the information-transmission component of face-to-face lectures is moving out of class time (Abeysekera & Dawson, 2015). Traditional instructional education, with the teacher as sage on the stage, is decreasing in favour of students doing assignments in small groups during programmed instructions, where the teacher is the guide on the side. These cooperative learning activities, where students are working in small groups led by a teacher, demand other spaces than the traditional classroom. Therefore, spaces for small group work are preferably nearby to the classrooms, to support the increasing flexibility in education processes. So, create a learning environment that meets the increased variety in didactical approaches in higher education teaching supported by ICT.
- Create flexibility in the learning environment (e.g., adaptable furniture and equipment, movable walls and flexibility in building technology). Other possibilities are flexibility in use, by using generic furniture, so that students and staff could use each other's space in mixed zones.

Finally, additionally to the former principles, higher education institutions could increase opportunities for experimenting on a small scale with spatial concepts for the classroom of the future, such as new technology enabled active learning environments (Fisher & Newton, 2014; Park & Choi, 2014). These are hybrid instruction areas or intelligent classrooms that combine ICT developments in education with

new didactical forms where students are not consumers of education, but active and self-regulative learners. Of course, new physical environments should match the learning and teaching approaches. But, according to Oblinger (2005), new learning spaces are themselves agents for change. By changing the environment, the users might be stimulated to think about adapting their activities to the environment.

Learning space management

Another way the findings and conclusions of this research can contribute to practice is by insights into how higher education institutions organise learning space management. The first lesson that these institutions can learn from the research is how they can involve users at all levels in aligning CRE with the core business of the organisation. CRE managers argue that they would like to involve end users in CRE alignment issues, but they often do not succeed in doing so. Sometimes this occurs because of the limited time that is available in construction projects or accommodation management. Also, CRE managers find it complicated to involve the end user in alignment issues. One cannot involve everyone and you never know whether involved end users are a good representation of their group. Students are difficult to reach, because they are like passers-by and in the perception of CRE managers they are often not interested in being involved in thinking about future learning space. So, in most cases educational managers formulate their idea of the student needs. What students really want or need is often kept implicit. Research by Kok (2015) into gaps between demand and supply in facility services design in Dutch higher education institutions showed that user involvement has to go far beyond just informing end users and organising end user feedback to be effective. Other research in construction management (Dewulf & Van Meel, 2002; Horgen, Joroff, Porter & Schön, 1999) shows that involving end users leads to a higher acceptance of decisions and to a higher user satisfaction about the result of construction projects. So, involving end users in alignment issues is a necessity and not involving them is a missed opportunity. However, user involvement requires comprehensive formal and informal structures (Kok, 2015). The studies in this dissertation contribute to this by elaborating on three key aspects for managing the interference with users: coordination, communication, and the way users are involved in decision-making. Insights about how these three key aspects and underlying eight management perspectives result in the two extreme approaches (involvement-oriented and control-oriented) can help higher education institutions make deliberate choices for organising user involvement. Higher education institutions are recommended to organise user involvement as an ongoing process. Often, users are asked to participate in giving information and feedback or in decision-making,

when a specific situation demands participation. Higher education institutions rather organise user involvement on a regular basis, for instance by asking end users as a sounding board group.

The various stakeholders that are involved often lack a 'common language' and they have different interests. That may disturb the alignment process and therefore the results of that process. When formulating CRE strategies, higher education institutions make choices for strategies aimed at creating an efficient physical learning environment, an effective environment and an experience rich learning environment. The studies in this dissertation have shown that students mainly value the physical environment for learning activities because of its effectiveness and functionality. With that knowledge, higher education institutions focus their CRE policy particularly on strategies, such as supporting user activities and to some extent on stimulating collaboration. The latter often results in increasing informal learning spaces and not in creating the quiet meeting rooms that students prefer for collaborative activities. A high experience value has been shown to be a topic in CRE strategies as well. This is not primarily to better align learning space with study activities, but to create an inspiring environment that aligns with corporate strategies that aim for increasing user satisfaction or supporting the image and culture of the organisation. The issue in general is that higher education institutions formulate and use appropriate CRE strategies for specific purposes. An entrance area, meeting space or restaurants could have accents on experience aspects though, and areas for learning preferably aim for supporting effectiveness of study activities.

A final recommendation for practice is to involve CREM professionals in education development projects. They could help lecturers, students, and course managers when they work on new experimental didactical approaches, to formulate requirements that are needed for a physical learning environment to contribute to preferred changes in education. Perhaps CREM professionals could also participate in education as a temporary (guest) lecturer, to experience the alignment between the learning environment and education themselves.

7.3.3 REFLECTIONS ON THE STUDIES, LIMITATIONS, AND RECOMMENDATIONS FOR FURTHER RESEARCH

One of the most difficult aspects of doing scientific research is about making choices. One cannot study everything. Just like a giant jigsaw puzzle, scientific research contributes to problem solving in bits and pieces. Every study leads to new insights and so to new pieces of the puzzle. Often, the puzzle lacks some pieces when the research is finished. Also, sometimes the researcher does not succeed in clicking all the

available pieces together in order to discover the greater picture and all underlying connections. New research is needed then, to collect the missing pieces or to seek for missing links. This section discusses the choices that have been made and suggests recommendations for further research that evolve from the studies in this dissertation.

First, the Comparative Floorplan Analysis (CFA) aimed to test how the quadrants of the purpose-process-place framework could be used to analyse education buildings and if/how developments in learning and teaching are represented in the spatial layout. The research method showed to be successful, but CFA does not completely explain the experience and use of learning spaces. Further research is needed, by involving more floorplans to analyse the impact of the developments in society and in educational processes on learning spaces in higher education buildings. Another topic for further research, related to the CFA study, is the quantification of the most desired ratios between different learning spaces, based on the changes in learning and teaching processes, so that the purpose-process-place framework can be used as a valid instrument for learning space planning. The CFA study was limited to desk research of the floor plans of four buildings combined with observations on site (building walkthroughs), and an analysis of documents of the accommodated organisations. Embedding the CFA in a Post Occupancy Evaluation (POE) could lead to more detailed information about the experience and use of the learning spaces. Besides the floor plans of the buildings, also other issues could be involved in a POE, such as lighting, acoustics, temperature, furniture, and finishing. It would be interesting too, to study the occupancy rate of learning spaces, to investigate which settings are frequently used and which settings are hardly used.

Next, alignment not only appears by linking the appropriate physical space to the pedagogy, activities or processes to match. Alignment also occurs when learning space and activities are linked just-in-time. Higher education institutions schedule learning space by, for instance, linking a classroom to a teacher and a group of students. A problem of higher education that goes beyond the scope of this research, but came to the fore in many of the interviews with CRE managers and facility managers the past four years, is the inefficient space use and the low occupancy rate of (particularly) classrooms. Much classroom space should have been occupied according to the schedule and time table, but in reality many classrooms are empty and not used for instructions. In former times, when programmed instructions were the main didactical form in education, fixed schedules were an important instrument for linking physical learning space to teaching activities. Nowadays, the fixed scheduling of lessons in timetables seems to comply less with

developments in higher education learning and teaching processes and with new educational activities that alternate more quickly. With emerging didactical forms and the increasing use of social media in the school building, new opportunities might appear to link physical space to learning and teaching activities in another way than with fixed time tables. This is a topic in which further research can lead to solutions for better learning space planning and for a better alignment of learning space with learning and teaching.

The research in this dissertation is characterised by an empirical part that focussed on investigating the Dutch higher education context. Literature shows many similarities between the present research in Dutch higher education and other contexts such as the UK, for example studied by Foster (2008), Barnett and Temple (2006), Marmot (2006), and the Australasian region with work by Park and Choi (2014), Matthews et al. (2011), and Souter, Riddle, Sellers and Keppel (2011). It would be interesting to study higher education buildings, CRE alignment management issues, students' learning space use and preferences of students based on the methods in this dissertation, in other countries as well. Also, the student population that was involved in the research consisted of business management students. The interviews with CRE managers during the research indicated that there could be differences between students from other programmes, such as engineering, or social sciences. Further research that involves students from other disciplines, would therefore be a preferable next step as well.

The part of this dissertation that studies the supply side of aligning CRE with learning and teaching developments was based on 14 Dutch higher education institutions. The involved institutions are large and together represent almost 75% of all students in Dutch UAS. The research specifically aimed to involve managers of these institutions, who are responsible for alignment issues related to CRE. They were interviewed and were asked to fill in a questionnaire. Further research can contribute to the results of the studies in this dissertation. First, by involving deans and course managers into the research, in order to incorporate the demand perspective in the study into CRE alignment with the core business. Second, by studying cases based on a longitudinal focus. This allows the researcher to draw conclusions over a longer period of time about how managers deal with aligning CRE with core processes and corporate strategies.

Study 4 and 5 (chapter 5 and 6) in this thesis showed that both learning space use and learning space preferences of students strongly depend on their study activities. This finding confirms the value of the purpose-process-place framework, which links the physical learning

environment to educational processes and study activities of higher education students. Further research could address if and how learning space contributes to students' performance and learning outcome, for example, by investigating which settings suit the acquisition of new knowledge and skills best as well as which aspects of the physical learning environment are significantly related to learning outcomes. Such research could specifically aim at studying how learning knowledge and skills are supported and influenced by elements of the physical learning environment. This could be done with controlled experiments with students, in combination with instruments that are used in post-occupancy evaluation studies, to study the impact of learning spaces on learning performance in depth.

For additional research, more advanced techniques, such as an experience sampling method (ESM) could be used besides dairy logbooks (e.g., applied in Smolders, De Kort & Van den Berg, 2013). The ESM aims to obtain self-reports of participants for a representative sample of moments (Larson & Csikszentmihalyi, 2014). In this method, participants carry electronic pagers, which signal them according to a random schedule. The signal is a cue to complete a self-report questionnaire that asks about the participants experience at that moment in time. According to Larson and Csikszentmihalyi (2014), the ESM could be used for examining interactions between situations and persons. Therefore, this would be an appropriate method for studying the relationship between learning spaces and study activities, as well as the motivations for using these spaces. The ESM has three advantages over the diaries that were used in study 4 by higher education students. First, the ESM results in more accurate data than traditional diary methods. The random cues of the ESM require immediate response of the participants, where the reported data in the diary logbooks could be distorted by rationalisation and the personal (subjective) choice to report information at a specific moment (Larson & Csikszentmihalyi, 2014). Second, the ESM offers a method that gears well to students' daily use of technology. Besides the electronic pagers mentioned by Larson and Csikszentmihalyi (2014), there are examples of using smart phones with mobile apps for ESM studies. Last, the use of technology makes data processing more easy, which is an advantage in time efficiency for the researcher. Nevertheless, Larson and Csikszentmihalyi (2014) mention several functional limitations and biases in applying the ESM as a research method, which need to be realised before using the ESM. Besides these obstacles, the method requires time and money to develop appropriate technology and software.

A next issue is the methodology that has been used in the quantitative part of study 4 (chapter 5). The diary logbooks were analysed in SPSS,

using a Pearson chi square test and Cramer's *V* associations. These tests are appropriate to analyse the categorical data of the logbooks concerning what, where, and why. A flaw of the method is that it associates pairs of variables, but not how the items within these variables are correlated. Furthermore, due to the large data set it was necessary to cluster several categories within a variable, to test associations between the variables on statistical significance. The clustering was based on logical arguments, such as clustering open learning spaces or teacher led learning activities. Here, more sophisticated techniques such as a correspondence analysis could be helpful to define the clusters (e.g., used in Van den Ouweland, Zeiler, De Kort, Nierman, Boxem & Maassen, 2014).

In the diary logbooks of study 4 (chapter 5), students used prescribed categories such as comfort and aesthetics, catering services, equipment and ICT, preferred privacy and concentration, or preferred interaction as reasons for choosing specific learning spaces. In the interviews, autonomy and personal control were mentioned as relevant for learning space choices too. The data analysis showed associations between the motivations and learning spaces, but did not show cause and effect relations between motivations and learning space use to a full extent. Study 5 (chapter 6) aimed to further investigate this relationship, in particular the influence of individual preferences and perceived importance of social and physical characteristics on learning space preferences of students for a specific study activity. We selected two main study activities (individual activities and collaborative activities with peers) for which we studied the learning space preferences of students. We measured general preferences of students regarding the social dimension of the environment (privacy, interaction, and autonomy), and the physical dimension of the environment (perceived importance of comfort, aesthetics, layout, and ICT facilities) on a trait level. Furthermore, we analysed correlations between these aspects and the learning space preferences for the two prescribed study activities. In the next paragraphs we reflect on our methodology and the choices we have made in this study.

In our study we measured aspects of the social environment (privacy, interaction, and autonomy) apart from study activities and learning spaces. Regarding one of the aspects of the social environment, privacy, Brierley Newell (1995) mentioned three perspectives: the emphasis on the person, on the environment, and on the interaction between the person and the environment. In line with the first perspective, we measured aspects such as privacy, interaction, and autonomy according to Brierley Newell (1995, p. 89), as "an attitude". Brierley Newell (1995) refers to Bersheid (1977) and Westin (1967) to argue that some people

may have a greater itch for privacy than others, and the preferred privacy of people varies within time. Also, Altman (1975) described privacy as the dynamic process to control the desired level of interaction, which varies according to individual differences and circumstances over time. Therefore, an alternative could have been to measure the aspects of the social dimension according to "privacy as a choice" (Brierley Newell, 1995, p. 96). In that case students' preferred privacy, interaction, and autonomy would be measured in direct relation to their study activities, e.g. the preference for privacy, interaction, and autonomy for individual and for collaborative study activities. Another perspective on privacy that was mentioned by Brierley Newell (1995, p. 90) is "privacy as a quality of place". Some places support the personal control of a person's interaction with his or her social environment more or less than other places, which could be a reason for students to choose that environment for a specific activity. That should plea for further research into place characteristics related to privacy, interaction, and autonomy. What makes learning spaces suitable for activities that require privacy or interaction, and which characteristics are relevant for a feeling of autonomy?

In line with how we measured the aspects of the social dimension, we also measured the perceived importance of various aspects of the physical environment apart from the prescribed learning settings in order to correlate them later. Also here, an alternative option for further research could be to link the perceived importance of various characteristics of the physical environment, such as comfort, aesthetics, layout, and ICT facilities directly to prescribed learning settings. Also linking the preferred social and physical learning space characteristics directly to types of study activities, could make the reason for preferred learning settings more obvious.

A last reflection on the applied method to measure preferences for concepts such as privacy, autonomy, and interaction is whether these could be measured with a limited number of items in a questionnaire. These concepts are rather complex and may need more advanced measurement methods to identify student's preferences in connection to various study activities. Therefore, we recommend as a next step research that further conceptualises and operationalises the social and physical dimension of learning spaces in depth for example by building on additional literature from the field of environmental psychology.

Finally, a relevant aspect of doing research is concerned with bias or deficiency in the data collection and in the data analysis (Saunders, Lewis & Thornhill, 2009). Bias often occurs in an interpretivist research philosophy that particularly is linked to inductive reasoning

based on qualitative data. The research in this dissertation built upon this philosophy, because literature has shown that studies in the built environment often aim at studying phenomena in their natural environment (Van Meel, 2000). Particularly in the interviews with CRE managers (study 2 and 3) and with students (study 4), 'measurement bias' is somehow inevitable. Bias may have occurred during the interviews because the researcher is a lecturer at one of the studied UAS as well. That may have led to a kind of prejudice based on his own experience about the link between education and the physical learning environment, during the interviews with CRE managers. Bias could also have occurred in the analysis of the data. Notwithstanding the interviews were tape recorded and transcribed, the conclusions result from the data interpretation by the researcher. As much as possible, this has been obviated by peer feedback of the supervisors after coding the transcripts. In case of sufficient time or money, it is recommended to conduct the coding of interview data and the evolving analysis with two researchers, in order to increase the reliability of the data analysis.

Some aspects of bias could have appeared in the quantitative studies of this dissertation as well. Especially response bias could have occurred in the diary research method. Although the idea behind the method is that respondents give a full report of their activities, in practice they make choices what to report in their diaries; deliberately or not. Response bias may have shown up in the questionnaire of study 5 too. Student were asked to fill in the questionnaire about their learning space preferences at the beginning of a lecture. Despite that the researcher stressed the relevance of filling in the questionnaire individually, students might have been influenced by their peers in the classroom. Inclusive bias could have occurred in the respondent selection of study 5, where only students who attended lessons filled in the questionnaire.

In the end, bias in research that involves people cannot completely be avoided. Nevertheless, careful procedures and appropriate research instruments have been applied. Aspects as triangulation due to application of different research strategies and techniques, peer consultancy through intensive discussions with both supervisors, and critical reviews of the chapters that have been published as research papers, are expected to support the validity and reliability of the research data, the data analysis, and the resulting conclusions.

7.4 FINAL CONCLUSIONS

This dissertation provides insights into the aspects that influence the alignment of learning space with higher education learning and teaching. This last section summarises the final conclusions based on the five studies that have been addressed in this thesis.

First, based on the Comparative Floorplan Analysis in study 1 (chapter 2), we can conclude that the floor plans of recently built higher education buildings show changes that are in line with the shift in higher education learning and teaching processes from the traditional transaction model with the instructor that teaches the students, to more self-regulation and social interaction of students. The floor plans of new higher education buildings show that classroom space is progressively being replaced by a variety of informal learning settings to support contemporary learning activities. Nevertheless, higher education buildings are still quite traditional. Based on the studied floor plans, the developments in higher education learning and teaching do not lead to a revolutionary change in learning space design on the short term. Changes show more characteristics of an evolution, rather than a revolution.

From the survey study among students in study 5 (chapter 6), it can be concluded that students prefer quiet learning spaces for individual study activities as well as for collaborative activities in small groups. Students prefer home for individual activities or quiet closed areas at school or at the university (project rooms or personal cockpits). The diary study of this dissertation in study 4 (chapter 5) showed that students' actual learning space use is in line with the learning spaces which they prefer. Where students prefer to do individual study activities at home, they actually conduct these study activities at home. According to the interviews, reasons for this behaviour are that, in case of studying at home, students do not have to travel to school or the university. Besides, students associate home with comfort, autonomy, and personal control by being in their own environment that they can manipulate themselves and in which they can do their own things. Also in the survey, the degree of autonomy and the living situation (living with parents) seemed to be a factor that influenced the preference of conducting individual study activities at home. Students go to the university to conduct study activities that are scheduled by the institution or because they have to work together with other students. For the latter activities, students prefer quiet, closed learning settings. These preferences are influenced by functionality and comfort of the setting. In practice, the diary logbooks show that students actually use open areas in the building for working together in small groups, such as learning spaces in corridors, hallways, coffee bars, catering areas. The survey points out that students prefer

these spaces mainly because of interaction reasons. This is in line with the motivation in the logbooks to use open spaces because of the wish for social interaction with other students and for being part of the group. When students use quiet, closed spaces, they motivate their choice in the logbooks with comfort aspects of the space too. It may be concluded that students in university buildings do not use the learning spaces that they rather prefer. One of the main reasons seems to be that universities do not provide sufficient quiet, closed spaces. Furthermore, students do not prefer to study in public (third) places. Besides in public transport underway, public places are hardly used for study activities.

Although in study 2 (chapter 3), the interviews with CRE/FM managers show that they do focus their CRE strategies and CRE operating decisions on supporting user activities, it looks like that they lay emphasis on other activities more than study activities. They highly support the social activities in higher education by creating fancy informal learning spaces with aesthetical interior elements. Yet, the survey in study 5 (chapter 6) pointed out that students, for their study activities, value functionality of learning space more than the experience aspects. Because higher education buildings increasingly have to support the social aspects of education and have to add value to the image of the institution, CRE/FM managers have to make more balanced choices between the effectiveness of the learning environment, experience value, and efficiency. Study 3 (chapter 4) has shown that students currently are hardly involved in these choices and that CRE/FM managers apply coordination, communication, and decision-making mainly based on a control-oriented alignment strategy in which students are only informed about CRE issues. In order to shift to a more involvement-oriented CRE alignment strategy, it is relevant that CRE/FM managers not only involve policy makers and education managers in CRE issues, but also teachers and especially students, being an important end-user group.

The analysis of the interviews with CRE/FM managers and the strategic plans of higher education institutions in study 2 (chapter 3) show that the CRE strategies of CRE/FM managers in daily practice seem to be better aligned than the CRE strategies that are formulated in the strategic plans. This shows that CRE/FM managers seem to be more aware of the added value of the physical learning environment for education than policy makers and educational managers. This leads to the conclusion that CRE/FM managers have to take the initiative for alignment activities of CRE and higher education learning and teaching, and that they should not be too reactive on demands of education.

Although this thesis identified several aspects that influence the alignment of learning spaces and learning and teaching, the main

conclusion is that learning spaces in higher education should primarily functionally be aligned with gradually changing learning and teaching activities and processes as well as with student preferences regarding self-regulation, concentration, and social interaction.

In the end, the research in this dissertation endorses that the interrelationship between buildings, organisations and end users is influenced by many physical and human variables, and is very complex. As such, this subject will be an ongoing challenge for both researchers and practitioners!

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SAMENVATTING (SUMMARY IN DUTCH)

ACHTERGROND, DOELSTELLING EN ONDERZOEKSVRAGEN

Het onderwijs van hogescholen is decennia geleden ontwikkeld vanuit een systeem, gericht op standaardisatie en efficiency, dat studenten behandelt alsof ze op een lopende band door een leerfabriek worden gevoerd. In de huidige tijd vol razendsnelle veranderingen realiseren hogescholen zich dat ze voor de opgave staan om een nieuwe generatie jonge mensen op te leiden voor de kenniseconomie van morgen. Dat vraagt een paradigmashift met een hernieuwde visie op onderwijs en nieuwe didactische concepten waarin de ontwikkelingen in de informatie en communicatie technologie (ICT) zijn geïntegreerd. Dit zogenaamde Nieuwe Leren is vraaggestuurd in plaats van aanbodgericht en het onderwijs is een coproductie tussen docent en student. De docent is daarin niet meer de alwetende die vanuit een positie voorin de klas de kennis over de studenten uitstrooit. Hij of zij is een van de vele bronnen die de student kan gebruiken. De docent stelt zich vooral op als een ondersteuner van het leerproces van de student. De student is zelfsturend en werkt aan vaardigheden die nodig zijn voor de 21ste eeuw door samen te werken in netwerken in zowel een fysieke als virtuele leeromgeving.

Deze en andere ontwikkelingen in het hoger onderwijs leiden tot de vraag of we dat onderwijs van de toekomst nog wel kunnen aanbieden in de traditionele schoolgebouwen van nu. In hoeverre gaan deze ontwikkelingen de vraag naar huisvesting beïnvloeden en hoe kunnen hogescholen het aanbod van de fysieke leeromgeving afstemmen op die veranderende vraag?

Een bijdrage aan het beantwoorden van dit managementvraagstuk vergt inzichten op twee vlakken, te weten: het product en het proces. Het product gaat over de harde kant van het vraagstuk, namelijk: de fysieke leeromgeving zelf. Het proces gaat meer over de zachte kant van het vraagstuk zoals de manier waarop hogescholen het afstemmingsproces van huisvestingsvraag en -aanbod organiseren en coördineren. In de literatuur en de praktijk van het hoger onderwijs blijkt dat er nog steeds slechts beperkt inzicht is in zowel het afstemmingsproces van huisvesting op de ontwikkelingen in het onderwijs, als dat wat er nodig is aan huisvesting als product of resultaat van dat proces. Derhalve is de doelstelling van dit proefschrift tweeledig, namelijk: inzicht verkrijgen in de belangrijkste aspecten die van invloed zijn op de afstemming van vraag en aanbod van huisvesting in het hoger onderwijs, en deze inzichten gebruiken om met name hogescholen te ondersteunen en te adviseren over hun besluitvormingsprocessen met betrekking tot de afstemming van huisvestingsaanbod op de veranderende vraag.

De onderzoeksvraag die centraal staat in deze dissertatie is: 'Welke aspecten beïnvloeden de afstemming van vraag en aanbod van huisvesting in het hoger onderwijs?'. Om deze vraag te kunnen beantwoorden zijn vijf deelvragen geformuleerd. Deze vijf deelvragen worden onderzocht in vijf studies, die geresulteerd hebben in vijf wetenschappelijke publicaties. In het vervolg van deze samenvatting worden de belangrijkste bevindingen van de vijf studies nader toegelicht en samengevoegd tot de overall conclusies van dit promotieonderzoek.

STUDIE 1

De eerste studie had betrekking op deelvraag 1: 'Wat zijn implicaties van de onderwijsontwikkelingen in hogescholen voor ruimtetypologieën in onderwijsgebouwen?'. Daartoe is er eerst een conceptueel model ontwikkeld waarbij literatuur is gebruikt uit verschillende vakgebieden, zoals onderwijskunde, vastgoedmanagement en facility management. Dit model is vervolgens gebruikt als kader om te onderzoeken in hoeverre nieuwe didactische onderwijsvormen en de ontwikkelingen op het gebied van ICT zichtbaar worden in de fysieke leeromgeving binnen hogeschoolgebouwen. Dat is gedaan door middel van een plattegrondenanalyse van vier gebouwen van Nederlandse hogescholen. Tevens zijn jaarverslagen en strategische documenten van hogescholen bestudeerd en zijn de vier gebouwen uit de studie en diverse andere onderwijsgebouwen van Nederlandse hogescholen bezocht.

De studie laat zien dat de traditionele klaslokalen in deze onderwijsgebouwen steeds meer vervangen worden door informele onderwijsruimte om nieuwe onderwijsvormen met hoge samenwerking en zelfsturing van studenten te faciliteren. De resultaten van deze studie kunnen gebruikt worden bij ruimteplanningsvraagstukken van hogescholen.

STUDIE 2

Voortbouwend op het voorgaande, was de volgende stap om vastgoedmanagers en/of facility managers van hogescholen te bevragen over hun visie op de fysieke leeromgeving in relatie tot de ontwikkelingen in het hoger onderwijs. De veranderingen in de maatschappij en in het hoger onderwijs in het bijzonder hebben hun weerslag op de strategische doelstellingen van hogescholen. De onderzoeksvraag van studie 2 was: 'Hoe is de afstemming tussen de strategische doelstellingen van hogescholen en hun vastgoedstrategieën?'.

Ook voor deze studie is een conceptueel kader ontwikkeld op basis van de literatuur. Dat kader is vervolgens gebruikt om te onderzoeken welke veranderingen vastgoedmanagers ervaren in het kernproces van hun hogeschool, hoe zij die veranderingen vertalen naar vastgoedstrategieën en hoe die vervolgens weer zichtbaar worden in de vastgoedbeslissingen die ze nemen gericht op concrete gebouwoplossingen. Voor deze studie zijn de strategische plannen van 13 grote Nederlandse hogescholen onderzocht op de visie en strategische doelstellingen. Daarna zijn de vastgoedmanagers/facility managers van deze hogescholen geïnterviewd over hun huisvestingsstrategieën en huisvestingsbeslissingen.

De resultaten laten zien dat er verschillen bestaan tussen de huisvestingsstrategie die hogescholen verwoorden in hun strategische plannen en de huisvestingsstrategie die vastgoedmanagers in de praktijk uitdragen. Die laatste lijkt op basis van het onderzoek beter afgestemd te zijn op de instellingsstrategie. Vastgoedmanagers richten zich daarin vooral op het ondersteunen van de eindgebruiker en op het beheersen van kosten. Deze twee huisvestingsstrategieën zijn ook leidend in de huisvestingsbeslissingen die vastgoedmanagers nemen om de fysieke onderwijsomgeving aan te laten sluiten bij de instellingsstrategie van hun hogeschool.

STUDIE 3

De vraag die voortkomt uit de resultaten van de vorige studie is hoe vastgoedmanagers van hogescholen ervoor zorgen dat hun vastgoedstrategie en de huisvestingsbeslissingen in lijn zijn met de strategie van de instelling en de behoeften van de eindgebruikers. Hoe doen vastgoedmanagers dat en welke aanpak en instrumenten gebruiken ze om die afstemming te bewerkstelligen?

Uit de literatuur is op te maken dat er drie procesactiviteiten ten grondslag liggen aan het afstemmingsproces van huisvesting op de behoeften van de organisatie en de eindgebruikers: coördineren, communiceren en beslissen. Bij 14 Nederlandse hogescholen is onderzocht hoe vastgoedmanagers deze activiteiten inzetten in hun dagelijkse praktijk. Daaruit blijkt dat onder de drie procesactiviteiten totaal acht tegenstellingen liggen, die per procesactiviteit zijn weergegeven in tabel 1. De bovengenoemde tegenstellingen impliceren twee uiterste managementstrategieën die door vastgoedmanagers gehanteerd kunnen worden, namelijk: een strategie gericht op beheersing en een strategie gericht op betrokkenheid [control orientation versus involvement orientation]. Het onderzoek laat zien dat de vastgoedmanagementstrategie zich in de praktijk tussen deze twee uiterste strategieën bevindt. Het beschrijven van de twee strategieën en de onderliggende acht tegengestelde benaderingen dragen bij tot een betere bewustwording van vastgoedmanagers hoe ze de afstemming tussen onderwijshuisvesting en de onderwijsstrategie van de instelling tot stand kunnen brengen.

TABEL 1 PROCESACTIVITEITEN, ACHT TEGENSTELLINGEN EN TWEE MANAGEMENTSTRATEGIEËN

Procesactiviteiten	Strategie gericht op beheersing	Strategie gericht op betrokkenheid
Coördineren	– Stakeholders worden gezien als homogene groep. – Interactie met stakeholders gebeurt gestructureerd. – De vastgoedmanager heeft veel invloed op aanwending van financiële budgetten. – Een kostengerichte benadering.	– Stakeholders worden gezien als heterogene groep. – Interactie met stakeholders gebeurt ad hoc. – De vastgoedmanager heeft marginale invloed op aanwending van financiële budgetten. – Een klantgerichte benadering.
Informeren	– Een lange termijn visie op basis van strategische informatie.	– Een korte termijn visie op basis van operationele informatie.
Beslissen	– Een proactieve benadering van huisvestingsvraagstukken. – Top down besluitvorming. – Een directieve rol van de vastgoedafdeling.	– Een reactieve benadering van huisvestingsvraagstukken. – Besluitvorming die bottom-up tot stand komt. – Een adviserende en uitvoerende rol van de vastgoedafdeling.

STUDIE 4

Uit de eerdere studies bleek dat het ondersteunen van de eindgebruikers een belangrijk uitgangspunt is voor de doelstellingen van vastgoedmanagers van hogescholen. Studie 3 wees echter uit dat eindgebruikers, en dan met name studenten als een van de grootste groep gebruikers, niet of nauwelijks bij huisvestingsvraagstukken betrokken worden. Een beperkte inbreng van gebruikers kan leiden tot een beperkt inzicht in de gebruikerswensen en -eisen voor wat betreft de fysieke leeromgeving.

De vierde studie richtte zich derhalve op het beantwoorden van de vraag: 'Welke factoren beïnvloeden het gebruik van de fysieke leeromgeving door studenten?'. Om dit te onderzoeken is een dagboekstudie uitgevoerd onder 52 bedrijfskunde studenten van de Hogeschool van Arnhem en Nijmegen. De studenten hielden een week lang bij aan welke studieactiviteiten ze werkten, waar ze dat deden en waarom ze juist die plek daarvoor kozen. Voordat ze hun dagboek bijhielden hebben de studenten een vragenlijst ingevuld met persoonlijke gegevens, om de mogelijke invloed van persoonlijke omstandigheden op het gebruik van studieplekken mee te kunnen nemen in het onderzoek. Na analyse van de data, zijn de resultaten van de dagboeken in groepsinterviews met een aantal van de deelnemende studenten besproken.

Het dagboekonderzoek laat zien dat het studieplekgebruik van studenten samenhangt met hun studieactiviteiten van dat moment. Studenten gebruiken verschillende plekken voor verschillende activiteiten. Individuele studieactiviteiten doen studenten bij voorkeur thuis. Los van de ingeroosterde lessen komen studenten vooral naar de hogeschool om in kleine groepjes samen te werken aan projecten of onderwijsopdrachten. Daarvoor gebruiken ze veelal studieplekken in open gebieden, zoals atria, gangen en de centrale entreehal.

Tevens wordt duidelijk dat het gebruik van studieplekken gerelateerd is aan de voorkeur voor comfort, de behoefte aan autonomie met betrekking tot de omgeving en de sociale invloed van medestudenten.

Verschillen tussen studenten (zoals geslacht, leeftijd of studiejaar) zijn slechts beperkt gecorreleerd aan studieplekgebruik. Aspecten als thuiswonend of uitwonend en de reisafstand naar de hogeschool blijken helemaal niet samen te hangen met het studieplekgebruik. Ook de relatie met ICT-ontwikkelingen, die het mogelijk maken om plaats en tijd ongebonden te studeren en meer gebruik te maken van publieke ruimten (third places), is (nog) beperkt.

STUDIE 5

Het studieplekgebruik is voor een groot deel afhankelijk van de ruimtelijke settings die voor studenten beschikbaar zijn. Settings die er niet zijn, kunnen immers niet gekozen worden. Daarom was de laatste studie van deze dissertatie erop gericht om te onderzoeken welke studieplekken studenten bij voorkeur zouden gebruiken voor hun studieactiviteiten. De onderzoeksvraag van deze studie luidde: 'Welke aspecten beïnvloeden de studieplekvoorkeur van hogeschoolstudenten?'. Daartoe is een kwantitatief onderzoek uitgevoerd. De vragenlijst voor dit onderzoek is zelf ontwikkeld op basis van literatuur uit verschillende vakgebieden, zoals omgevingspsychologie, vastgoedmanagement, interieurarchitectuur en facility management. De studie richtte zich op het onderzoeken van de studieplekvoorkeur voor twee studieactiviteiten: individuele activiteiten die concentratie vergen en studieactiviteiten waarbij studenten samenwerken in groepjes. De veronderstelling van de studie was dat zowel gedragsaspecten (zoals de behoefte aan privacy, interactie en autonomie) als kenmerken van de fysieke omgeving (comfort van de plek, vormgeving, ICT faciliteiten en lay-out) van invloed zijn op de studieplekvoorkeur.

De vragenlijst is ingevuld door 697 studenten van de Hogeschool van Arnhem en Nijmegen. De resultaten laten zien dat de voorgenoemde aspecten slechts beperkt gecorreleerd zijn aan de studieplekvoorkeur. Ook persoonlijke aspecten zoals geslacht, leeftijd, studiejaar of woonsituatie beïnvloeden de studieplekvoorkeur slechts ten dele. Studenten linken hun studieplekvoorkeur vooral aan hun studieactiviteit. Zowel voor individuele studieactiviteiten als voor studieactiviteiten waarbij studenten samenwerken hebben rustige plekken de voorkeur. Individuele studieactiviteiten doen studenten daarom het liefste thuis. Samenwerken gebeurt bij voorkeur in rustige, gesloten ruimtes op school, zoals een projectruimte. Drukke, open gebieden in schoolgebouwen zoals gangzones, atria, de centrale entreehal, maar ook restauratieve ruimtes en een grand café zijn minder gewenst voor studieactiviteiten. Ook publieke ruimten (third places) zijn niet populair voor studieactiviteiten.

De resultaten van deze studie bevestigen de bevindingen van het dagboekonderzoek dat de studieplekvoorkeur en het daadwerkelijke gebruik van studieplekken sterk gerelateerd zijn aan de studieactiviteiten. Echter, waar uit het dagboekonderzoek sommige persoonskenmerken en aspecten als autonomie en comfort relevant bleken voor de keuze van studieplekkeuze, worden die relaties niet een-op-een gevonden voor de studieplekvoorkeur. Kennelijk is er een verschil tussen wat studenten graag willen ter ondersteuning van hun studieactiviteiten en de ruimte die ze daadwerkelijk gebruiken. Dit maakt het interessant om te onderzoeken of en in hoeverre studenten de bijdrage van de fysieke leeromge-

ving aan hun studieactiviteiten of studieresultaten kunnen inschatten en waarderen. Is het inderdaad zo dat de fysieke leeromgeving en studiegedrag c.q. motivatie van studenten samenhangen, of wordt deze omgeving beschouwd als een 'commodity' of een 'hygiëne factor' die studenten vooral frustreert als de omgeving niet aan hun behoeften voldoet?

CONCLUSIES

De bevindingen en inzichten van de vijf uitgevoerde studies dragen bij aan het beantwoorden van de hoofdvraag die in deze dissertatie centraal staat: 'Welke aspecten beïnvloeden de afstemming van vraag en aanbod van huisvesting in het hoger onderwijs?'. De overall conclusies van de vijf studies zijn samengevoegd tot drie afstemmingsmechanismes, die in figuur 1 zijn aangegeven met de cijfers I, II en III.

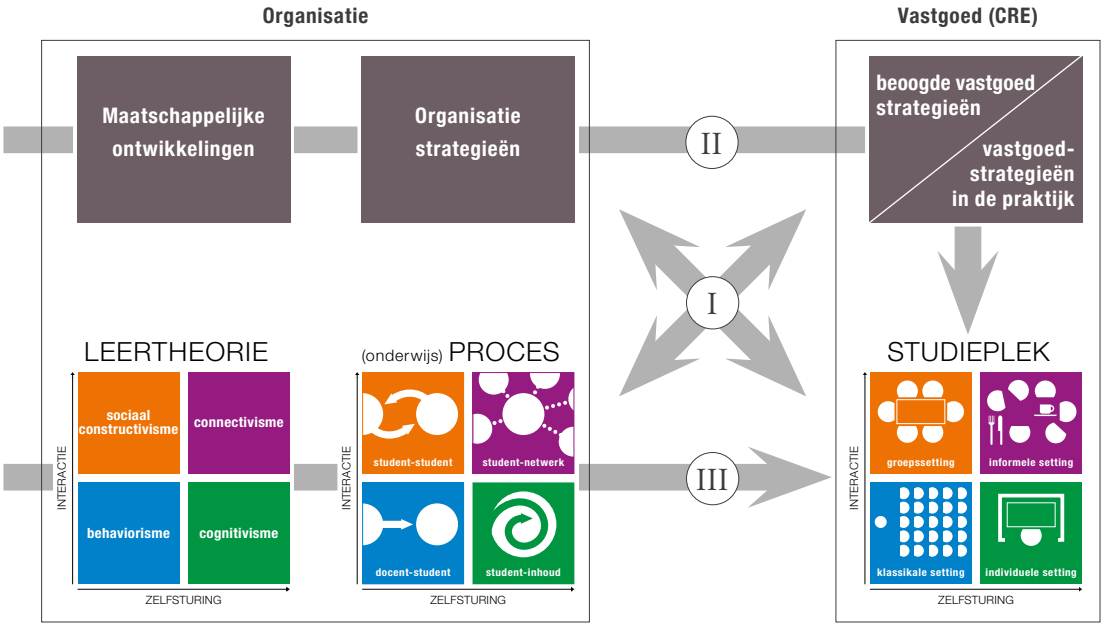

Figure 1
Drie afstemmingsmechanismes voor studieplekken op ontwikkelingen in hogescholen

Het eerste afstemmingsmechanisme (I) verwijst naar het afstemmingsproces van het huisvestingsaanbod op de vraag. Het betreft de manier waarop de gebruiker, op diverse niveaus, betrokken wordt bij deze afstemming c.q. coördinatie, communicatie en besluitvorming. Afhankelijk van de wijze waarop deze drie aspecten worden ingevuld acteren vastgoedorganisaties tussen twee uiterste afstemmingsstrategieën, namelijk: een strategie gericht op beheersing en een strategie gericht op betrokkenheid [control orientation versus involvement orientation].

De twee andere afstemmingsmechanismes (II en III) hebben betrekking op het resultaat c.q. product van mechanisme I. De vertaalslag van de strategieën van de instelling als geheel naar vastgoedstrategieën staat centraal in afstemmingsmechanisme II. Dit afstemmingsmechanisme laat zien dat vastgoedstrategieën op twee manieren in de organisatie voorkomen, namelijk de zogenaamde 'beoogde' strategieën, zoals die op papier geformuleerd zijn [espoused] en de vastgoedstrategieën zoals die in de praktijk uitgedragen worden [in-use]. Verschillen tussen deze twee soorten strategieën kunnen leiden tot verstoringen in de afstemming tussen de instellingsstrategie en de vastgoedstrategie. Ook kunnen verschillen tussen de beoogde vastgoedstrategieën en de vastgoedstrategieën in de dagelijkse praktijk leiden tot verschillende prioriteiten in beslissingen over vastgoedoplossingen om afstemming met de instellingsstrategie te bewerkstelligen.

De vastgoedstrategieën van de hogescholen vormen samen met de vertaling van de onderwijsprocessen naar typen studieplekken input voor de keuze van aantallen en typen studieplekken (afstemmingsmechanisme III). Voor wat betreft afstemmingsmechanisme III is er sprake van afstemming tussen vraag en aanbod van huisvesting als de fysieke leeromgeving aansluit bij de onderwijsprocessen en de leertheorie die daaraan ten grondslag ligt. Bovendien is het binnen afstemmingsmechanisme III relevant dat de fysieke leeromgeving en studieplekken aansluiten bij behoeften van de studenten. In de praktijk betekent dit dat de studieplekken de studieactiviteiten van de studenten en de behoefte aan autonomie en interactie afdoende ondersteunen.

BIJDRAGE VAN HET ONDERZOEK

Deze thesis draagt in diverse opzichten bij aan de beschikbare literatuur. De belangrijkste bijdrage is dat het onderzoek verschillende wetenschappelijke disciplines in samenhang bestudeert, zoals onderwijskunde, vastgoedmanagement, facility management, omgevingspsychologie en ontwerpdisciplines. Dat wordt zichtbaar in de diverse modellen die op basis van de literatuur zijn ontwikkeld. Onderzoekers uit die disciplines kunnen hierop voortbouwen. Ten tweede biedt het onderzoek nieuwe inzichten in de fysieke leeromgeving vanuit het gebruiksperspectief. Een derde bijdrage voor met name het vastgoedmanagement onderzoeksgebied is dat het onderzoek verschillen zichtbaar heeft gemaakt tussen beoogde vastgoedstrategieën en de vastgoedstrategieën die in de praktijk worden uitgedragen. Het onderzoek verschaft tevens inzichten in de processen die vastgoedmanagers hanteren om vraag en aanbod naar huisvesting op diverse abstractieniveaus op elkaar af te stemmen. Tenslotte draagt het onderzoek bij aan de wetenschap door de manier waar-

op de diverse onderzoeksmethoden in samenhang zijn toegepast, zoals plattegrondenanalyse, dagboekonderzoek en meer traditionele methoden zoals interviews en vragenlijsten.

AANBEVELINGEN

Deze thesis eindigt met twee soorten aanbevelingen voor de praktijk, namelijk aanbevelingen gericht op het verbeteren van space planning in hogeschoolgebouwen en aanbevelingen gericht op het verbeteren van het managen van de fysieke leeromgeving. De aanbevelingen op het gebied van space planning gaan over de inrichtingsconcepten voor de fysieke omgeving, de lay-out van hogeschoolgebouwen en de flexibiliteit van de fysieke omgeving en kunnen als volgt worden samengevat:

- Creëer een fysieke leeromgeving die aansluit bij de toenemende diversiteit aan didactische concepten die worden toegepast binnen hogescholen, al dan niet ondersteund door digitale platforums.
- Bouw de fysieke leeromgeving rondom leergemeenschappen [learning communities]. Die omgevingen omvatten zones voor studenten, voor docenten en plekken waar beiden samenkomen voor geplande/geroosterde en niet geplande/geroosterde interactie.
- Onderken en onderscheid gebieden in onderwijsgebouwen die gericht zijn op het ondersteunen van studieactiviteiten en van sociale activiteiten.
- Creëer een activiteit-gerelateerde studieomgeving voor studenten met zones die ondersteuning bieden aan: concentratie, routinematige studieactiviteiten en interactie tussen studenten; niet 'one-size-fits-all'.
- Scheid plekken die studieactiviteiten ondersteunen van circulatie zones in het gebouw; maak geen studieplekken in de gangen.
- Ontmoetingsplekken voor sociale doeleinden zijn daarentegen wel weer dichtbij circulatiezones gesitueerd om ontmoetingen te vergemakkelijken.
- Experimenteer met zogenaamde hybride instructiezones die het midden houden tussen traditionele klaslokalen en studiegebieden waar studenten in kleine groepjes samenwerken. Ontwikkel hybride instructiezones die zijn vormgegeven rondom nieuwe didactische onderwijsvormen waarbij de docent acteert als 'begeleider/coach van het leerproces' en waarbij sprake is van een hoge mate van zelfsturing van studenten en interactie tussen studenten, ondersteund door ICT-faciliteiten.

De tweede categorie aanbevelingen houdt verband met het verbeteren van het managen van onderwijsruimte en is gericht op het formuleren van de juiste vastgoedstrategieën, het gebruik van onderwijsruimte en de

manier waarop gebruikers worden betrokken bij het ontwikkelen van de fysieke leeromgeving. Hogescholen wordt geadviseerd om de gebruikersparticipatie bij huisvestingsvraagstukken als een continu proces te organiseren en niet alleen gebruikers te betrekken bij huisvestingsvraagstukken als er informatie nodig is voor het veranderen van die omgeving. Een andere aanbeveling is om niet alleen gebruikers op directieniveau te laten participeren in huisvestingsissues, maar ook docenten en vooral ook studenten. Zij representeren immers verreweg de grootste gebruikersgroep van onderwijsgebouwen.

Vastgoedstrategieën van vastgoedmanagers richten zich vooral op een het creëren van een balans tussen de efficiency, effectiviteit van vastgoed en experience/beleving die met vastgoed nagestreefd wordt. Deze drie aspecten zijn echter niet altijd verenigbaar en conflicteren. Op welk aspect de focus ligt hangt sterk af van welke stakeholders betrokken zijn, op welk niveau ze naar huisvestingsvraagstukken kijken, of het vertegenwoordigers betreft van het kernproces, of dat ze vanuit het vastgoedperspectief naar vraagstukken kijken of zelfs vanuit een maatschappelijk belang invloed uitoefenen op de onderwijshuisvesting. Dit vraagt om wederzijds begrip en een gemeenschappelijke vocabulaire, jargon of taal met betrekking tot huisvesting in relatie tot de doelstellingen vanuit het onderwijs. Het is essentieel dat huisvesting niet volgt op onderwijsontwikkelingen, maar dat beiden deel uit maken van een gemeenschappelijke visie en strategie. Daarom verdient het aanbeveling om vastgoedprofessionals dichter bij het onderwijs te positioneren, zodat huisvestingskennis meteen aan tafel zit als er gesproken wordt over onderwijsontwikkelingen. Huisvestingsprofessionals kunnen dan de toegevoegde waarde van onderwijshuisvesting vergroten door de huisvestingsconsequenties van ontwikkelingen in het onderwijs in een vroeg tijdig stadium te overzien, te adviseren over oplossingen en er zo voor te zorgen dat nieuw onderwijs wordt ondersteund met een passende fysieke onderwijsomgeving.

APPENDICES

THE DUTCH EDUCATION SYSTEM

A

A.1 THE CONTEXT OF DUTCH EDUCATION

The Dutch education system consists of eight years of primary education, four to eight years of secondary education (depending on the type of school), and two to six years of higher education (depending on the type of education and the specialisation) (EP-Nuffic, 2015a). In total, there are almost nine million pupils and students in Dutch education (table A.1).

NUMBER OF PUPILS/STUDENTS IN DUTCH EDUCATION SYSTEM (X1,000) (CBS, 2014)

TABLE A.1

	2010/'11	2011/'12	2012/'13	2013/'14
Primary education	6.849	6.808	6.743	
Secondary education	940	949	961	
Senior secondary education (MBO)	528	523	513	
Higher education				
- Universities of applied sciences		424	422	440
- Research universities		245	241	250
Total		8.949	8.880	

In 2012, the total expenditure in the Dutch education system came to 40.6 billion euros of which the Dutch government payed 33.2 billion euros. The latter concerned 12% of the total Dutch government expenses in 2012 and equals 6.8% of the GDP (CBS, 2014). Looking at the level of education, most people in the Netherlands in the age of 15

TABLE A.2

THE LEVEL OF EDUCATION IN THE NETHERLANDS (AGE 15 TO 65 YEARS) (CBS, 2014)

9%	Primary education
19%	Prepatory secundary vocational education [VMBO]
41%	General secondary education [HAVO, VWO] and senior secondary vocational education [MBO]
18%	Higher education bachelor
11%	Higher education master
2%	Unknown

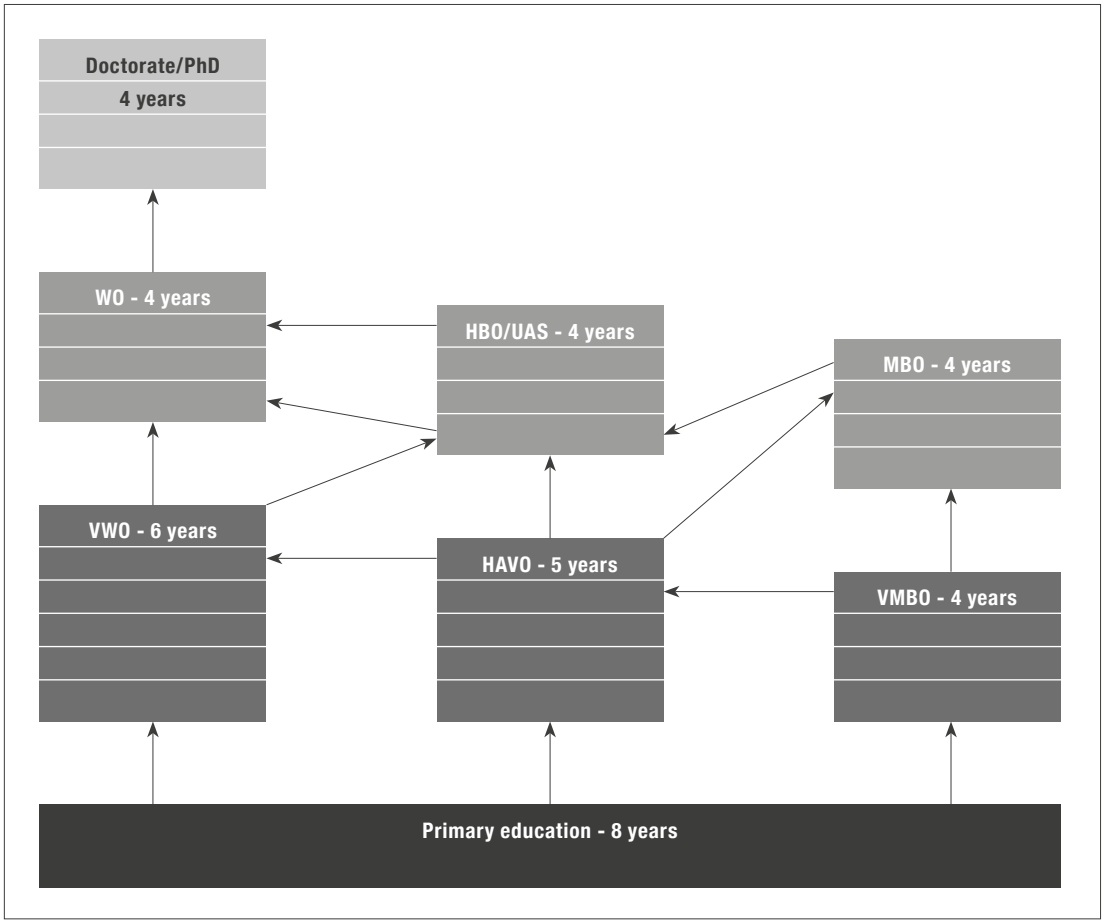

Figure A.1
Diagram of the Dutch education system (derived from EP-Nuffic, 2015b)

to 65 years are educated at the level of secondary education (60%). The minority (9%) only has finished primary education. 29% has a degree in higher education (table A.2).

The current Dutch education system exists approximately 200 years, whereas the history of the Dutch education system goes back till the early years of the 19th century. The first education act dates back from the year 1801 as a concept, which was confirmed in the year 1806 (Rietveld et al, 2003; Noordhoff, 2008). That law introduced class learning. Before that time, education was based on the concept of personal tuition and education was available for only a small group. From 1900, the Netherlands have compulsory education and a distinction occurred between primary and secondary education. Nowadays, Dutch children go to a primary school when they are four years old. After eight years in primary education, children select a type of secondary education based on a recommendation from their school and their own preference (EP-Nuffic, 2015a, 2015b) (figure A.1).

Children have three options to choose from: two in general secondary education [algemeen voortgezet onderwijs, HAVO or VWO] and one in preparatory secondary vocational education [beroepsgericht voortgezet onderwijs, VMBO]. The latter prepares pupils for senior secondary vocational education [middelbaar beroepsonderwijs, MBO], which can be followed at regional training centres [ROCs], agrarian training centres [AOCs] and vocational schools [vakscholen]. Senior secondary education [MBO] lasts two to four years, depending from the level of education. Students with a diploma based on four years of senior secondary education can go to a higher education institution. Just like general secondary education [HAVO or VWO] is required for admission to higher education. Dutch higher education has a binary system, which means that a distinction is made between research oriented education [wetenschappelijk onderwijs – WO] and higher professional education, nowadays called Universities of Applied Sciences (UAS) [hoger beroepsonderwijs – HBO] (EP-Nuffic, 2015a).

The research-oriented universities have the longest history of the two types of higher education. From the current fourteen Dutch universities the oldest are founded in the 16th and 17th century, such as Leiden (1575), Groningen (1614), Amsterdam (1632) and Utrecht (1636) (Den Heijer, 2011). The youngest university is the Open University in Heerlen (1984) which aims at distance learning concepts. Dutch higher professional education dates from 1900. Based on the requirements of the professional practice, higher education schools developed learning programs to educate students for a specific occupation. In 1983, these mainly small schools, with often only one or two courses, were told by

the Dutch government to cooperate with the final goal to merge into larger institutions [STC-operation, Schaalvergroting, Taakverdeling en Concentratie] (Van Bemmel, 2014; Meens, 2002). From 1992, all Dutch higher education institutions came within one law that regulated higher and scientific education [Wet Hoger en Wetenschappelijk Onderwijs – WHW] (Van Bemmel, 2014; Meens, 2002). That act still coordinates for instance quality, accreditation, credits, diplomas and funding of higher education institutions.

The funding and the financial resources of the Dutch UAS are mainly based on the number of enrolled students and their number of student graduations. In the first place, UAS receive money (70.3%) directly from the Dutch Ministry of Education [Ministerie van OC&W]. Second, enrolled students pay their course fees (19.8% of the revenues of UAS). Till this year (August 2015), every student who was enrolled in a government-funded Dutch higher education institution received a payment by the Dutch Ministry of Education as a free contribution to their study costs [studiefinanciering]. From September 2015, this governmental gift has been replaced by a student loan system (Rijksoverheid, s.d.). The third revenues (9.8%), mostly for commercial activities, come from other parties (figure A.2).

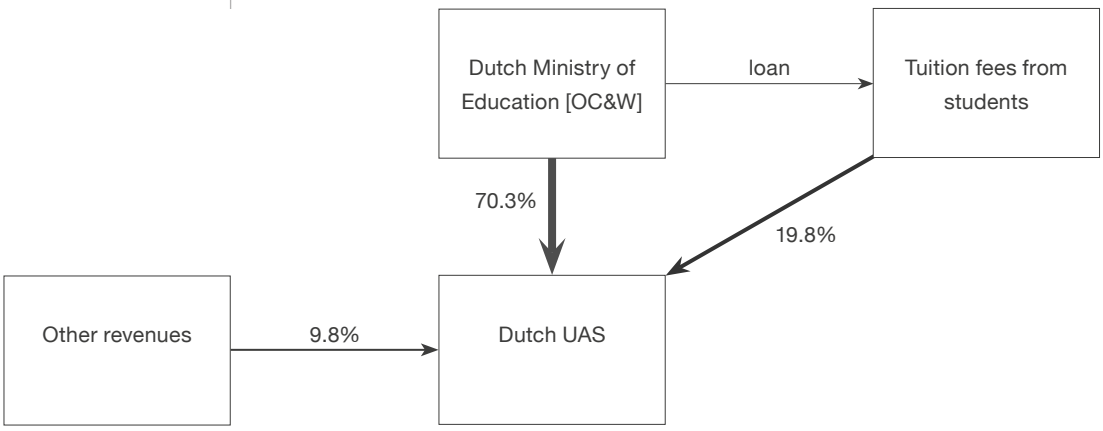

Figure A.2
Funding of Dutch UAS (derived from OC&W, 2012, p. 130; figures from Vereniging hogescholen, 2013)

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B LIST OF PUBLICATIONS RELATED TO THIS RESEARCH

B.1 SCIENTIFIC PEER-REVIEWED JOURNAL PAPERS

Beckers, R., Van der Voordt, T., & Dewulf, G. (2015). A conceptual framework to identify spatial implications of new ways of learning in higher education. *Facilities*, 33(1/2), 2-19.

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B.2 PEER-REVIEWED CONFERENCE PAPERS

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B.3 PUBLICATIONS IN PROFESSIONAL JOURNALS (IN DUTCH)

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B.4 OTHER PUBLICATIONS (IN DUTCH)

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ABOUT THE AUTHOR

Ronald Beckers was born in Delft on February 13, 1968. After secondary school, he started his study Civil Engineering at Delft University of Technology. In 1989, he finished his first year [propedeuse]. He continued his education at Eindhoven University of Technology [doctoraal], to study Technology and Society [Techniek en Maatschappij] at the department of Technology Management, where he focussed on the built environment from a user perspective.

After his graduation in 1993, Ronald accomplished military service as an officer in the Royal Dutch Army. In 1994, he started his active career as a consultant in the field of facility management and corporate real estate management. Twelve years later, in 2006, Ronald switched to the HAN University of Applied Sciences [Hogeschool van Arnhem en Nijmegen], where he still works as a senior lecturer at Diedenoort Academy for Facility Management.

Next to his lectureship, in 2011, he started his doctorate research as an external PhD candidate at the University of Twente, the department of Construction Management and Engineering of the Faculty of Engineering Technology.

Additional to his publications related to this PhD dissertation, Ronald published several articles in professional facility management journals since he started his career in 1993. Besides, together with a colleague, he is the author of a book for facility management students and professionals [Zo maak je een facilitair plan, 2010].

Ronald Beckers is married to Karin Janssen. They have two daughters, Berit and Bente.

A LEARNING SPACE ODYSSEY

Exploring the alignment of learning space in universities of applied sciences with the developments in higher education learning and teaching

RONALD BECKERS