ENVISIONING THE FUTURE OF STUDY PLACES

LESSONS LEARNED FROM THE GENERAL EDUCATIONAL BUILDINGS AT TU DELFT

by

L.M.E. (Laura) Tangelder

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Colophon

Laura Tangelder (4495071)

First thesis mentor:	Prof. dr. ir. A. C. (Alexandra) den Heijer
Second thesis mentor:	Dr. ir. E.H. (Esther) Gramsbergen
Delegate of the Board of Examiners:	Dr. J.R.T. (René) van der Velde
Graduation Organisation:	TU Delft, Campus Real Estate & Facility Management Department: Strategic Portfolio Management
Graduation Organisation mentor:	Dr. Ir. Bart Valks

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This thesis *Envisioning the future of study places* has been written to fulfil the graduation requirements for the master track MSc Management in the Built Environment at the Technical University of Delft. Within this one-year graduation project, I have examined the performance of the generic education buildings on the TU Delft campus and which study place typologies exist and how they are used in these buildings. I had the opportunity to conduct this research in practice, at the heart of the university's real estate and policy organisation: Campus Real Estate and Facility Management (CREFM).

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Finally, thanks to my boyfriend David for all of his words of encouragement, as well as my friends and family for all of the meaningful dialogues. I hereby promise that, after graduation, the topics of conversation will be less about study places and the campus.

Sincerely,
Laura Tangelder

Delft, January 2024

Preface

Since I was a teenager, I have actually had a slight fascination with campuses, though at the time I was unable to identify why. During my high school years, I frequently studied in the Vrijhof (Figure 1) rather than at the downtown public library. The way students studied, lived, and recreated in that spacious green environment really captivated me. In my opinion, the architectural configuration of UTwente continues to stand out from other Dutch universities and that sentiment of nostalgia will never leave my heart. I still refer to it as Centerparcs for a reason.

This interest in university and campus life came back during my time in Delft (2016-2024). Not just the setup, but also the social aspect. I got to see what it was like at other universities during my first year (2017: ETH Zurich) and second year (Gdańsk University of Technology) thanks to short exchanges. It was inspiring to see how studios were used by architecture students at various European universities and how much other architecture students valued their study location, faculty, and campus as a 'home'. Other places included diverse cultures and (study) habits; the ETH in Zurich stands out. During deadline weeks, students could enter their buildings and study places 24 hours a day, seven days a week. The ''barracks'' (Figure 2) were several big sheds where creativity could run wild, and the main building's fixed studio spaces did not have to be cleaned up (Figure 3). It was fascinating to see and talk to the students about how this promotes creativity and the process, as well as giving students the freedom to work according to their own preferences.

Although TU Delft does not have 24/7 access and as an Architecture student you walk daily into a cleaned studio, TU Delft also has plenty to offer. There are different study environments on campus. Besides the 'own' faculty, where many students study, especially in the first year when coming to Delft, the central library is very popular. A new building type was added in 2018: the generic educational buildings. These buildings are not faculty-specific, but rather campus-wide and cross-faculty. Despite my initial assumption that generic teaching buildings are a relatively new phenomenon (September 2022), this turns out not to be the case. This became clear to me during the graduation process. I gained much more insight into how this concept developed and changed in current and potential architectural translations on the TU Delft campus.

After careful studying *in* and *about* the cases (library, Pulse, Echo) on TU Delft campus, I hope to inspire you about the future of study places.

Figure 1 The Vrijhof, library UTwente (own image, 2022)

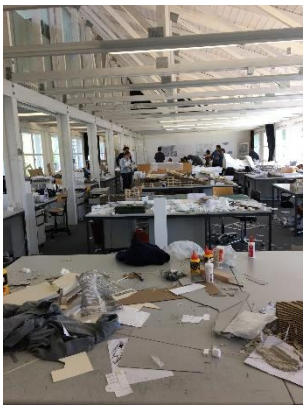

Figure 2 'The barracks', ETH campus Hönggerberg with 24/7 access (own image, 2017)

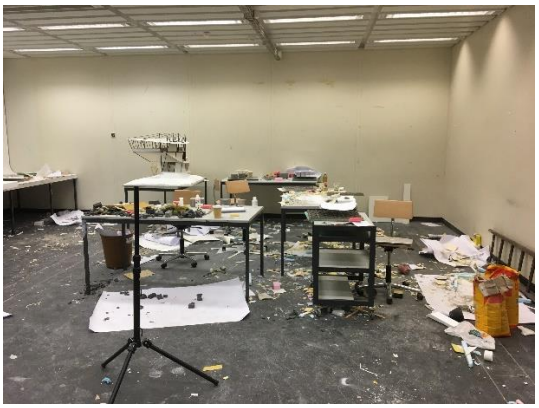

Figure 3 Fixed studios in HIL building, ETH campus Hönggerberg main building. Models (in progress) did not need to be cleared during deadlines and the ateliers had 24/7 access (own image, 2017)

Abstract

This thesis examines how TU Delft could adapt its study places in generic educational buildings to meet current and future demands. This research is done through a literature review and an examination of three representative cases at TU Delft and in-depth, semi-structured interviews.

Despite the expectations of a pandemic-induced shift to online learning, this research emphasises the continued significance of a high-quality on-campus environment. Findings reveal a surplus of study places, urging qualitative enhancements, especially in aspects like community-feeling.

Future prospects suggest a move towards interdisciplinary learning, requiring a diverse mix of study places. Recommendations encompass effective scheduling and smart campus tools, redefining quality parameters for study places and creating adaptive learning environments. The findings advocates for a balanced approach, accommodating both quiet, focused study places and dynamic, socially engaging meeting places.

In conclusion, TU Delft is advised to holistically adapt study places, integrating quantitative and qualitative insights, as detailed in the lessons learned from the general educational buildings.

Keywords: University campus, TU Delft, study places, generic educational buildings, community, DAS framework.

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Abbreviation	Definition
BMO	Bouwmeesteroverleg (in Dutch) - Consultation within CREFM with the aim of safeguarding and enhancing the liveability and visual quality of the campus. Issues include tasks in the development and design process, but also the placement of elements in the outdoor space or on buildings.
CREFM	Campus Real Estate and Facility Management - develops and manages TU Delft's real estate and grounds. This includes campus infrastructure, lecture halls, offices, labs and parks.
CVB	College van Bestuur (in Dutch) – Executive Board (in English).
ESA	Education and Student Affairs. ESA supports students and staff. It manages education organisation, quality, development, and student guidance and well-being.
FMVG	Facilitair Management & Vastgoed, onderdeel van de universiteitsdienst van TU Delft, huidig CREFM (in Dutch). Facility Management & Real Estate, currently CREFM.
FNO	Functioneel Nuttig Oppervlak in m^2 (in Dutch) Functional useful area, in m^2.
Gen. owp	Generieke onderwijsplek (in Dutch). Inzetbaar voor alle faculteiten. Aanwezig in faculteitsgebouwen maar ook in generieke onderwijsgebouwen. – Generic eduction place (in English). Available to all faculties. Present in faculty buildings but also in generic teaching buildings.
ICTO	ICT in het Onderwijs (ICT in Education) – term from TU Delft policy on technology in education in 2008 (van der Zanden, 2008). Also, an initiative where the phenomenon learning café's and learning centres was researched for the first time.
MBE	Management in the Built Environment (master track at the Architecture Faculty, TU Delft).
NEC	New Education Centre (The generic term for the education buildings Echo and Pulse before they received their actual names)
MRQ	Main-research question
OWP	Onderwijsplek (in Dutch) – Generic education place (in English)
PRE	Public Real Estate
R&D	Research and development
Spec. owp	Specifieke onderwijsplek (in Dutch). Een onderwijs werkplek specifiek voor de faculteit (dus studio's van Bouwkunde of IO of een lab voor practicum bij TNW). Een onderwijsplek specifiek voor de opleiding waar deze aanwezig is en niet generiek inzetbaar. – Faculty specific education place (in English). Specific to the programme and not generic.
SPM	Strategic Portfolio Management. SPM consists of programme managers, policy officers and asset managers. SPM creates visions, strategies and policies with campus users and stakeholders. The department works together with faculties and departments of TU Delft, cooperation partners, the municipality of Delft and other departments within CREFM.
SRQ	= Sub-research question
SWP	Studiewerkplek (in Dutch) – Study workplace (in English) in this research the term study place is used
TUL	TU Delft Library

Glossary

Term	Definition
Campus	The area where a university is located, as well as the buildings that house the faculties that form the functional core of academic study (Colenbrander, 2018).
Campus management	The variety of activities done to optimise the university's accommodation to its performance (Den Heijer, 2011) and adapt the campus to the changing context, stakeholder needs, and university performance. A campus manager—usually a facilities director or accommodation department director—is responsible for this alignment (Den Heijer, 2016).
CREM (model)	Corporate Real Estate Management involves aligning a corporation's real estate portfolio and services with its core business processes to maximise added value and improve overall performance (Krumm et al. 2000).
Education	A process of facilitating learning, knowledge acquisition, and the development of skills, beliefs, habits, and values. Education takes place in a formal or informal setting under the supervision of an educated individual, and the experiences people gain have a formative impact on their thoughts, emotions, and behaviour (Venkateswarlu et al. 2020).
Education space	A learning environment in which students receive their education. There are many different types of educational spaces, including lecture halls, instruction rooms, practical spaces, exam halls, and project rooms (Valks, 2021).
Flipped classroom	This type of classroom is based on the idea that there are better ways to use class time than giving lectures or one-on-one lessons. Instead, students learn outside of class, which frees up class time for activities that require more complex thinking.
Frontal teaching	Frontal Teaching is teacher-centred. The lecturer situated at the front elaborates on a subject, shows a presentation on the screen or chalks a formula on the board. The expert explains and elaborates about a topic, and the students take home individual work or group assignments. Active learning components are gradually being brought into these practices, such as direct interaction with a feedback tool (Cookbook Education Spaces, 2018).
Homo zappiens	a generation of learners that exploits the consequences of the reduction of scarcity of information, communication, and presence (Veen, 2006).
Informal learning	learning that takes place outside classes and occurs in libraries, information commons, coffee shops, and any other locations where students can come together (Oblinger, 2006).
Learning environment (locationwise at TU Delft campus)	The Learning Environment on TU Delft campus consists of the library, the auditorium, part of industrial design and Pulse (Ector hoogstad architecten, 2015).
Model A – ''Solid''	The traditional university and campus – represents fixed structures, hierarchy, exclusiveness and the need for territory (Den Heijer, 2021).
Model B – ''Liquid''	The network university and campus – represents flexible structures, multidisciplinary, open and interconnected, with shared spaces on campus (Den Heijer, 2021).
Model C – ''Gas''	The virtual university and campus – represents individual autonomy, mobility, freedom and the possibility to work and study anytime and anywhere, online and off-campus (Den Heijer, 2021).

Portfolio	The collection of all buildings and land that an organisation owns or rents (Valks, 2021).
Rambling (to ramble)	Rambling in interviews means giving a long or unclear answer. 'Rambling' or going off on tangents is encouraged in qualitative interviews because it shows what the interviewee values. In quantitative research, it is considered a nuisance and discouraged (Bryman 2016).
Smart campus tools	Smart campus tools use sensors to measure the usage of space in real time. These data are converted into real-time information on the availability of spaces on the current campus to support students and employees in making more effective use of those places or to direct building services and reduce energy consumption. Campus managers are provided with more detailed and accurate management information to make decisions about the future campus by collecting and analysing data over longer periods (Valks, 2021).
Study place – Type A	(Conform Cookbook education spaces, 2018) a silent study place for individual study to study many hours in a silent area.
Study place – Type A2	(Conform Cookbook education spaces, 2018) a silent study place for individual study to study many hours in a silent area *with* a pc
Study place – Type B	(Conform Cookbook education spaces, 2018) a touchdown study place for group work and for temporary self-study
Study place – Type C	(Conform Cookbook education spaces, 2018) a meeting place with multifunctional places for various social encounters, such as informal meetings or conversation. Such a study place counts half a study place for capacity planning.
University campus and the university's accommodation	The land and buildings, used for university or university-related functions (Den Heijer, 2011).
User (of the campus)	A frequent visitor to the university campus. The term 'user' in this research refers to students, (visiting) lecturers, academics, and other staff.
Utilisation (in Dutch: benutting)	For study places, the number of study places in use is counted per room or group. The occupancy of the whole room is *not* relevant, as each study place is used individually. The average usage over time is the utilisation (Bezettingsrapportage TU Delft, 2023).
White week (in Dutch: witte week)	A lecture-free week at TU Delft. This is the week before exams when students can focus on preparing for them. During white week and exams, the library, Pulse, and Echo are popular places for study.

PART 1 | INTRODUCTION

''If there is shortage of space? Yes… if you ask any manager, they will say yes. But in reality? No. You can always find and invent space. What you need is to think in volume, not in square metres.''

Interview A | Visiting lecturer and former vice president of an international university | Perspective: functional (user)

1.1 Context

Universities are widely recognised as fundamental pillars supporting the progress and development of society. They have a significant impact on the development of a students' character, ambition, future and well-being. Universities influence various aspects of their lives socially, academically and culturally. Universities can play such an important role in shaping students' lives because they are places for skill development and the cultivation of creative talents (Mohamed, 2023). What role does the physical campus play in carrying out the aforementioned functions? Is the campus changing in response to changing user demand, and how will future study places integrate into that?

In the Dutch university landscape renovations, demolitions and new building projects are happening all over Dutch university campuses and will continue in the coming years. The Dutch universities plan to invest more than three billion euros in their real estate (Algemene Rekenkamer, 2021). The basic structure of these universities was laid in the 1950s, 1960s, and 1970s, when Dutch universities experienced rapid growth accompanied by significant spatial changes. Almost every discussion about the university at the time had a spatial component. The spatial issues that arose at the time concerned what type of education is appropriate for such a large number of students, as well as what types of buildings could accommodate this. The overarching question was whether such large institutions were able to protect '*the campus as a community*', with representation from all faculties and a focus on knowledge coherence (Flipse & Streefland, 2020).

In addition to the growth spurt of the second half of the 20th century, other factors have significantly altered the Dutch university landscape and effected the current campuses, including increasing users and the changed funding. Before 1995, universities received public funding for new construction projects. The change in 1995 was consistent with the government's goal to grant universities greater autonomy. This has been an important turning point, universities became economic owners of their buildings, incidentally without (sufficient) additional resources for maintenance, operation, purchase and new construction (Den Heijer, p. 71, 2011). As a result, property management, maintenance and development became a major responsibility of universities. There has been ongoing criticism regarding the perceived risks that universities take in managing their real estate. A major criticism cited here is that this shift in funding in 1995 prevented universities from focusing on their primary responsibilities of conducting research and teaching (Van Eijck, 2015; Flipse & Streefland, 2020).

Not only did the number of users and funding change over time, the needs of the users also changed. The university campuses responded in different ways. There are new study environments and a new type of building other than the 'traditional' faculty buildings and libraries, namely the generic educational building. The question is whether this type of building meets current demand and provides an answer to the future demand and supply. Spaces in generic educational buildings are larger, more flexible and offer more opportunities for digital education. With a generical education building, you respond to the trends of the student population: the quantitative demand. By adopting this approach, the university is consistently better prepared for future challenges in comparison to conventional educational structures. Thus, the user has numerous options and can be more selective about when and why they wish to visit campus to utilise the facilities.

The aforementioned changes are also taking place at TU Delft. TU Delft has grown rapidly over the past two decades, from 13.127 students in 2000 to 27.080 in 2022 (TU Delft jaarverslag, 2001; TU Delft statistics, 2023). As the number of students at TU Delft grows, with the strategic Framework 2024-2030 aiming for 40.000 student enrolments (Bonger, 2022), the need for efficient, flexible, and distinctive teaching spaces grows. While research indicates that better use of spaces, such as corridors

and hallways, contributes to efficiency (Den Heijer, 2016), students frequently express concerns about a lack of study places. The perception of space and how crowded a space feels is an important factor, especially since students' perceptions are contrasting with the data from the CREFM policy department (SPM) at TU Delft. The average occupancy of study places is disappointing, contrary to what most students and faculties on the TU Delft campus believe (Valks, 2021; Interview D, 2023).

1.2 Problem Statement

The future university campus and its learning places must be able to adapt. The rise of hybrid and online learning, changing forms of education with more focus on interdisciplinary aspects, growing awareness of the importance of wellbeing, current student growth, and changing user preferences are all significant challenges for all Dutch universities.

TU Delft is no exception and faces the same developments and trends. Recently, generic educational buildings have been built and used to meet the demand of TU Delft's rapidly growing student population[1], the pressure on the physical campus, and the need for silence study places to concentrate. Flux, an interfaculty, temporary and demountable generic educational building (in use since September 2023), is the most recent respond to the continued growth. Pulse (2018) and Echo (2022) are two permanent generic educational buildings.

They all provide an answer to the question about quantity of study places, but do they also meet the quality requirements of the future?

1.3 Research objective and deliverables

The primary goal of this research is to set guidelines about the use and the need for generic educational buildings at TU Delft and to understand the future of this building type and its potential impact on campus. This involves investigating whether generic educational buildings and its study places meet current and expected needs, whether these offered study places necessarily need to be in this building type and what can be said about the durability. In this way, statements can be made about the performance of study places and how generic educational buildings could possibly be improved.

Part of this research is to determine the level of satisfaction regarding the study places in the ‘heart of the campus’. The library (1997) and the two generic educational buildings on the TU Delft campus: Pulse (2018), and Echo (2022) are the chosen case studies. The outcome of this research will provide practical results for the real estate department (CREFM) at TU Delft. These results might lead to a revision, the policy document Cookbook Education Spaces (2018/2023) part D: Study places. The findings could be useful for other universities dealing with similar issues, as well as for other organisations interested in (re)organising their learning places.

1.4 Research Relevance

According to Den Heijer (2011), the link between real estate and performance is one that organisations strive to manage in order to add value or avoid negative consequences (see Figure 4). Their primary activities require specific quality and quantity of real estate, with individual and organisational goals in mind. As shown in Figure 4, there is an interaction in this study that fits well with the goal of real estate management. Whereas the basic processes involve a certain level of quality and quantity of real estate,

[1] With an aspiration of reaching 40.000 students by 2030 (Bonger, 2022)

this study investigates it at two scales: at building level and study place level. Both study place users and CREFM's organisational objectives benefit from functionality analysis.

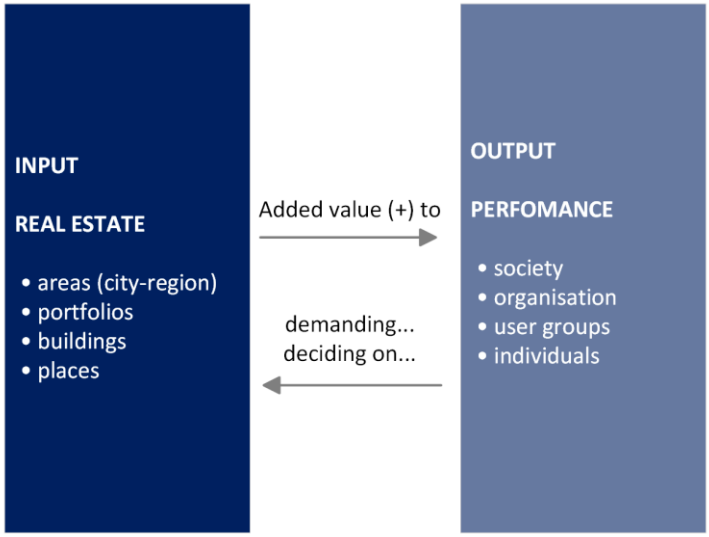

Figure 4 Goal of real estate management: deciding on real estate to create a positive added performance (adapted from Den Heijer, 2011)

Scientific relevance

There is a fair amount of information available about campus design and employee preferences in the (office) workplace. Numerous graduate students within the master MBE are researching the future work environment, particularly after the COVID-19 pandemic. This study contributes to the existing knowledge by examining the future learning environment, focussed on study places in generic educational buildings (see Figure 5). What is known about the performance of these relatively new generic educational buildings on campus? In this manner, this research attempts to introduce a new perspective on the topic of study places and the use of future campuses.

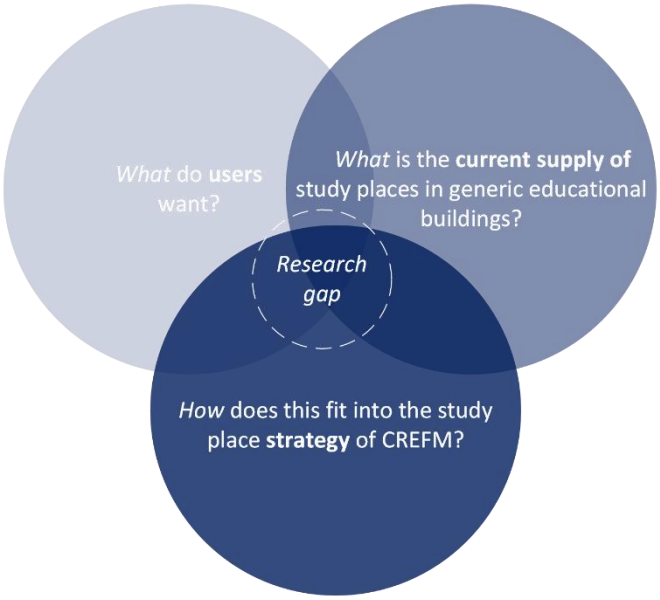

Figure 5 Finding the research gap (source: author)

Societal relevance

On a societal level, real estate reflects societal values and facilitates and defines change. Real estate plays an essential role in a country's economy. Real estate is a country's most significant capital good, and it is an important economic activity to create, change, and maintain real estate stock (De Jonge and Den Heijer, 2008). The buildings on the TU Delft campus, including the case studies, are also part of the national real estate stock. As these buildings are financed by Dutch taxes, it is valuable to test their performance. As a result, improving the functionality of these buildings has implications beyond the academic domain, contributing to the responsible and efficient use of public resources.

The research's results and insights could help CREFM improve their strategy for creating study places that meet the needs of its future users, especially in generic educational buildings.

1.5 Research Questions

The overarching theme is whether there is a space shortage, space surplus or perhaps both. All sub-questions contribute to understanding this theme. In order to meet the research purpose outlined in *1.3 Research objective and deliverables,* the main research question and sub-questions are formulated. The main research question is as follows:

MRQ: *How can TU Delft adapt its study places in generic educational buildings on campus, to meet current and future demands?*

Recommendations for the study place strategy of CREFM are being considered in response to the need for study spaces among students. The sub-questions were constructed using the DAS (Designing an Accommodation Strategy) framework. The process of matching what the organisation (TU Delft) and its users (in this thesis, students) require with what is available, sustainable, and feasible is ongoing: it occurs both on a daily (in operational management) and long-term base (in strategic management), from individuals searching for a meeting space, to organisations implementing a long-term portfolio strategy (Den Heijer, 2021). Four phases or tasks of management are distinguished by this framework. See 2.3 DAS Framework for the positioning of the research questions within this framework and 3.2 Real Estate Management for more information about the framework and how it is used in Real Estate Management.

Step one *is assessing the current situation*: It is important to start with supply side TU Delft: What does the TU Delft have now and does it meet the (future) demand? For this sub-question, it is (extra) important to involve multiple stakeholders.

SRQ1: What is the current quantity and quality of offered study places on campus?

To answer sub-question 1, the following issues must first be researched and established:

1. What characteristics define a study place? Which types does the TUD have?
2. Mapping the study places (Library, Echo, Pulse); quantitative analysis
3. Understanding study areas in different environments
4. What is the current match? Is there a mismatch?

5. What is meant by ''study place'' (e.g., home office, while commuting, a café)?

Step two is *exploring the changing demand:*

SRQ2: What can be said about the future prospects regarding the need for study places?

6. What is the utilisation of study places per typology?
7. What are the essential features of a study place?
8. What is the demand: silent space, social buzz, a mix, other?
9. Mismatch appears to be in specific issues: which ones?

Step three is to *generate future models.* Sub-question three is more conceptual. This includes the 'shift' from faculties (territorial) to more generic educational buildings and study places.

SRQ3: What are alternatives for future study places, based on changing demand and considering the complex context?

10. What characteristics does study places of the future contain?
11. What is the hybrid working policy at TU Delft? Are people entitled/not entitled to a study place on campus?[2]
12. What is the complex context we live in nowadays?[3]

Step four is to *defining projects to transform the current situation into the future.* This will lead to guidelines for future study place strategies for CREFM (TU Delft).

SRQ4: What concrete actions are recommended for the TU Delft to provide the future demand of study places?

13. How can CREFM adapt the current study place strategy?

[2] Based on policy documents, provided by CREFM – TU Delft

[3] Next to digitalisation, internationalisation and post-pandemic, the four perspectives (Den Heijer, see are incorporates to get a better grip on the context we live in nowadays.


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PART 2 | METHODOLOGY

''There is already a societal transformation occurring in society in which we are no longer so rigidly bound by the system or conventional norms. This freedom is also present in the current and future generations that are studying.''

Interview I | Physical perspective – technical manager

2.1 Type of study

The type of research chosen for this thesis is qualitative research. Bryman (2016) explains several research methods that emphasize a more open-ended view of the research process, so that there is less restriction on the kind of things that can be found about. The main steps in qualitative research and which sequence is used in this thesis can be found in Figure 6 (see next page). The literature review, which is also discussed at step 2 of Figure 6, provides an understanding of the campus of the future, how universities have evolved over the past several decades, and the space issue, which has existed for some time but is becoming increasingly urgent, as well as highlighting certain characteristics. To discover these connections and relations, inductive research has been carried out.

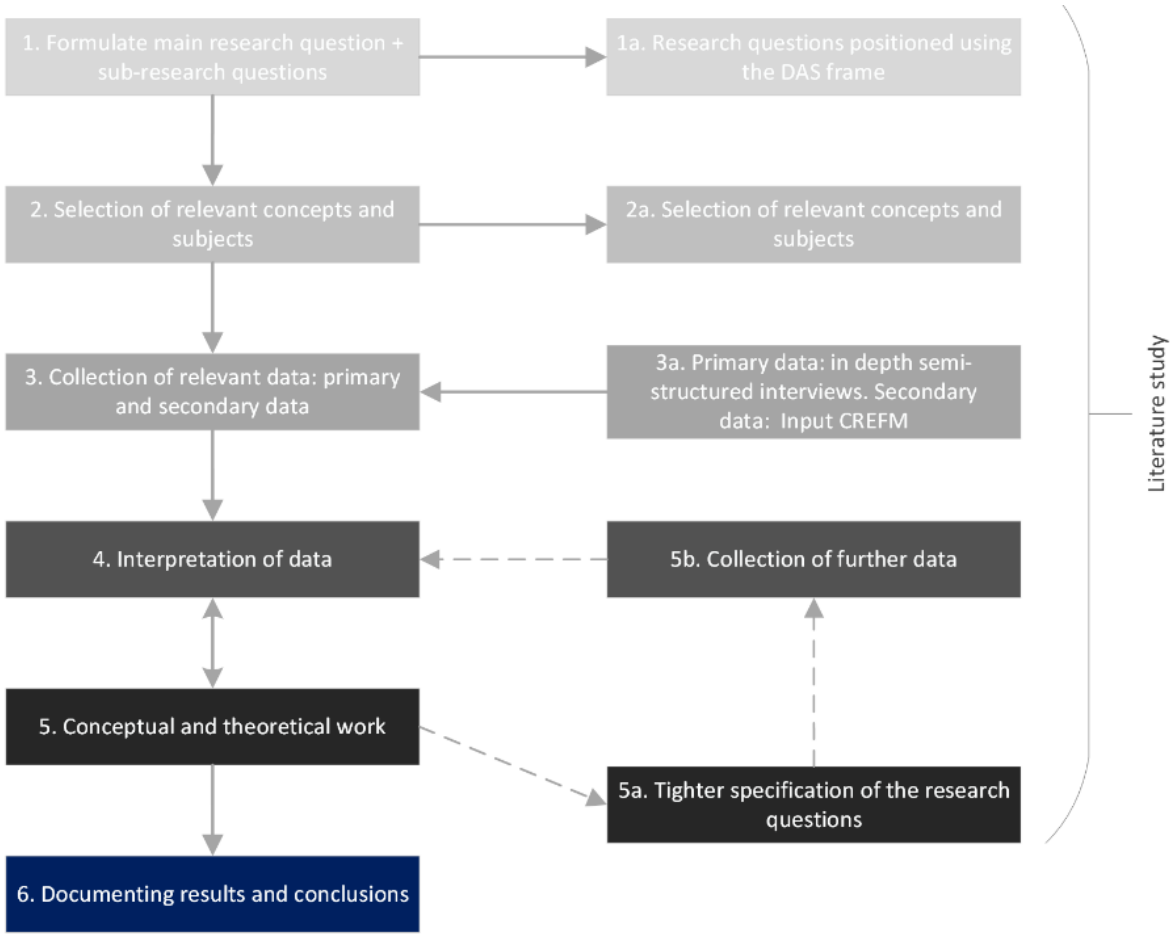

Figure 6 Main steps of qualitative research (Source: Bryman, 2016, adapted)

2.2 Logic of inquiry: Inductive reasoning

According to Bryman, inductive reasoning is a logical component in qualitative research (2016). Inductive reasoning is a bottom-up research strategy in which you evaluate if outcomes may be generalised from a specific observation. Additionally, inductive research is applied to predict future findings. Furthermore, inductive research is employed for predictive questions, design questions, problem-solving questions, and advisory research questions. All of this relates to the main research question:

Main Research Question: How can TU Delft adapt its study places in generic educational buildings on campus, to meet current and future demands?

The inductive process generally consists of four steps: making an observation, collecting data, detecting a pattern, and forming a hypothesis or theory (generalisation). In this research, the final phase, the formulation of a hypothesis or theory, will become a recommendation for a future-proof study place strategy at TU Delft.

2.3 DAS Framework

Despite the fact that the DAS framework, outlined by Den Heijer (2011) and de Jonge (2008), is a conceptual framework and not a method, this section describes how it was implemented in this research. See 3.2 Real Estate Management for an explanation of the DAS framework's applicability in a broader real estate and strategic setting and its application in the context of real estate management.

This research aims to better understand the preferences of campus users in a society and environment that are constantly evolving. It examines how the current supply of study places on campus corresponds to future demand. The number of study places at TU Delft today, future needs for the generic education buildings, and how well they function now as a result of wishes made during the design and planning phases are just a few of the aspects that are looked into, including those included in the sub-questions. The literature review on provides a foundation for understanding how TU Delft can accommodate users' preferences regarding a study location using the Designing an Accommodation Strategy (DAS) framework (see Figure 7), the sub-questions are organised and answered systematically.

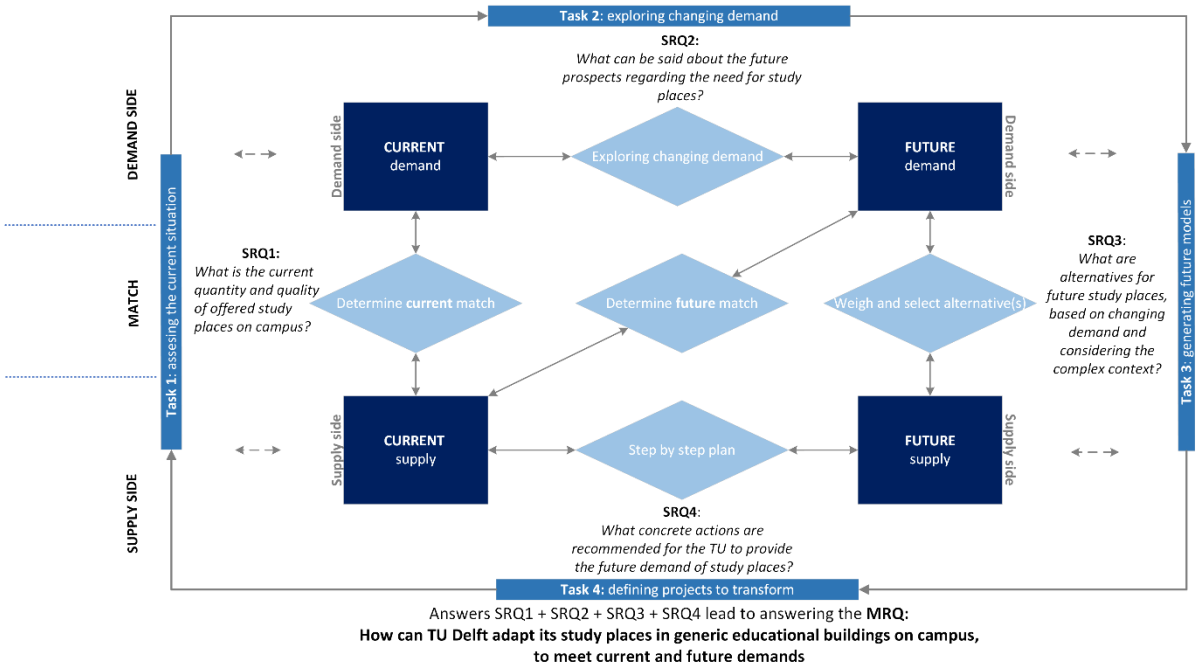

Figure 7 DAS Framework - matching demand and supply, now and in the future. Positioning the SRQ (Source: De Jonge et al. 2008, Den Heijer et al. 2021, adapted)

2.4 Methods and Techniques

The three steps

Firstly, a literature review is done to gain a better understanding of the research topic and to clarify what has already been published. The primary focus is on Real estate management and performance, university campuses, learning spaces and the value of community in learning.

Secondly, empirical research was carried out to conduct a qualitative evaluation of the current study places at TU Delft. Semi-structured interviews with TU Delft education stakeholders from a variety of disciplines were conducted to cover the four perspectives (see Figure 8). Interview participants are selected by their different viewpoints and expertise based on the four perspectives on

campus management outlined by Den Heijer (2021).

Thirdly, it will be investigated what types of study places exist at TU Delft (within the cases of Library, Pulse, and Echo) and how they differ. Given the discussion of a future-proof strategy, this implies that there might be room for growth. However, this was not certain at the beginning of the research and should be investigated as well. As the three steps are divided into literature review, the interviews and results as well as the case studies, it is indicated below how this is reflected in the sub-questions (SRQ) of this research. To obtain detailed information about the interviews, see 5.1 Semi-structured interviews.

Additionally see Figure 55, which illustrates the correlation between the sub-research questions (SRQ) and the interview questions (IQ).

Figure 8 Four perspectives (source: Den Heijer, 2021)

SRQ1	What is the current quantity and quality of offered study places?	Occupancy measurements + interviews (IQ4)
SRQ2	What can be said about the future prospects regarding the need for study places?	Literature + interviews (IQ5) + cases
SRQ3	What are alternatives for future study places, based on changing demand and considering the complex context?	Literature + interviews (IQ6)
SRQ4	What concrete actions are recommended for the TU Delft to provide the future demand of study places?	Literature + interviews (IQ2 & IQ7) + cases

Table 1 Overview of which sources were used to answer the SRQ's (source: author)

Cases

The basic case study entails the detailed and intensive analysis of a single case. The most common use of the term ‘case’ associates the study with a location, such as a community or organization (Bryman, 2016). In this thesis, three case studies belonging to one organisation (TU Delft) have been chosen. Namely the chosen cases belonging to TU Delft's real estate portfolio.

Multiple-case designs

The positioning of the research in the framework of Yin (2012) is in the upper right (see Figure 9). The primary spatial and managerial context is concentrated at the campus of the TU Delft. The qualitative research is done through multiple-case designs. Within the cases, it is examined whether the requirements programmes, ambition documents, and vision documents that were in place before the buildings were built are still relevant today, and whether the ideal was realised and is still thriving years later.

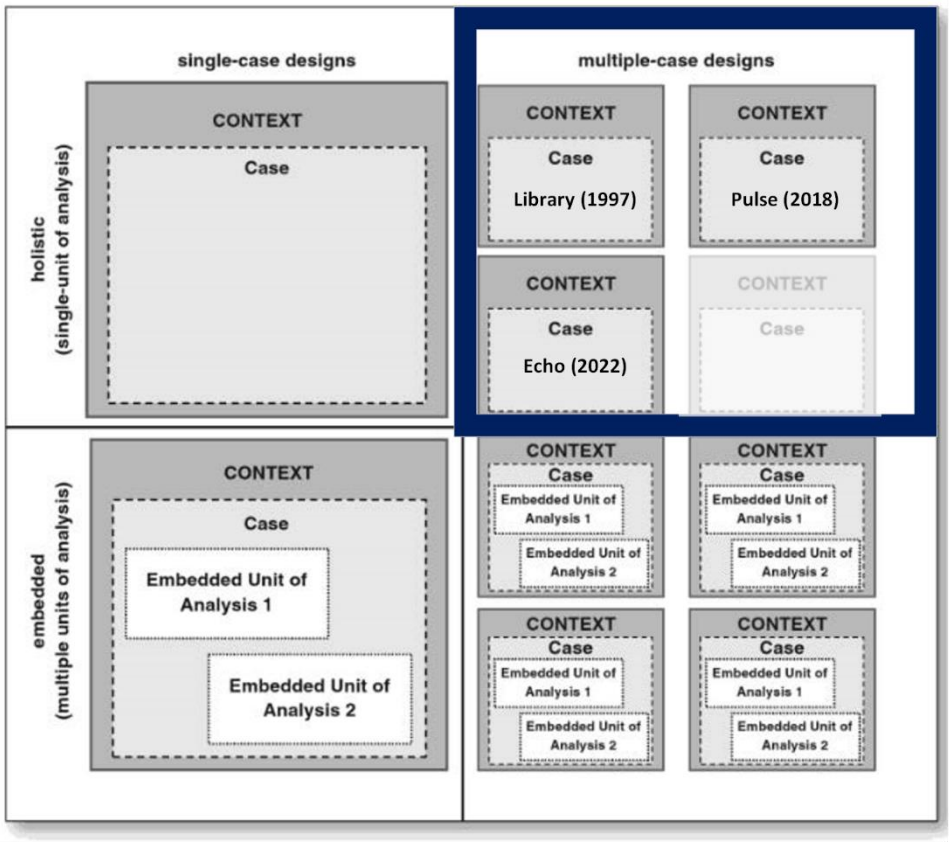

Figure 9 Positioning of research in case study designs (Adapted from: Yin, 2012)

2.5 Validity

Bryman (2016) highlights the role of internal validity, external validity, reliability, and replicability in the evaluation of case study research. In addition, Yin (2009) argues that these criteria are appropriate and provides ways in which case study research might be enhanced to better fit the requirements. According to Blaikie and Priest (2019) internal validity involves the degree to which a finding that incorporates a relationship between two or more concepts is correct. The external validity is ensured by taking into account the degree of generalizability of the results beyond the investigated research context.

Following on from the issue of external validity, it is useful to consider a distinction between different types of cases that is sometimes made by writers. Yin (2009) distinguishes five types. The critical case, the extreme or unique case, the revelatory case, the longitudinal case and the representative or typical case. The three case studies chosen and examined fall into the last mentioned category, also called exemplifying case. With this kind of case, 'the objective is to capture the

circumstances and conditions of an everyday or commonplace situation' (Yin 2009: p. 48). Thus a case may be chosen because it exemplifies a broader category of which it is a member. In this thesis these are generic education buildings including (self) study facilities. The notion of exemplification implies that cases are often chosen not because they are extreme or unusual in some way but because either they epitomize a broader category of cases or they will provide a suitable context for certain research questions to be answered.

In accordance with this thesis and research proposal, the latter is accurate. The selected cases contribute to sub-research question 1: *What is the current quantity and quality of offered study places on campus?* Specifically, the mapping of study places in the case studies and gaining an understanding of study places in various situations and environments. The third sub-research question: *How does the shift from traditional faculties to generic education buildings impact TU Delft's role in facilitating study places?* formulated and integrates spatial and architectural features.

The primary concern is the quality of the researcher's theoretical reasoning when conducting a case study. How well do the data support the generated theoretical arguments? Is the theoretical analysis accurate? For instance, does it reveal links between various conceptual ideas derived from the data? The essential point is not whether the results can be generalized to a bigger context, but rather how successfully the researcher generates theory from the findings (Bryman, 2016).

2.6 Trustworthiness in Qualitative Research

Trustworthiness in qualitative research is a complex topic; consequently, the perspectives of numerous authors on this topic have been searched for and summarised to provide clearest overview possible. Positivists frequently expressed concern on the trustworthiness or validity of qualitative research. Shenton (2004) proposes that this may be due to the fact that the concepts of "validity" and "reliability" cannot be handled in the same manner in naturalistic (qualitative field) research. Trustworthiness is made up four criteria, each of which has an equivalent criterion in quantitative research (Bryman, 2016):

1. Credibility (which parallels internal validity);
2. Dependability (which parallels reliability);
3. Confirmability (which parallels objectivity);
4. Transferability (which parallels external validity).

Guba and Lincoln's (1981) uneasiness with the straightforward application of reliability and validity standards to qualitative research stems in large part from the criteria's presumption that a single absolute account of social reality is feasible. In other words, they are sceptical of the notion that social scientists are responsible for revealing ultimate truths about the social world. Instead, they suggest that there can be multiple and even many accounts. Table 2 summarises the qualitative study's consideration of these aspects:

Aspect	Description
1. Credibility	Confidence in the truth of the data and interpretation of them (Barrow, 2019) The credible understanding of things (Gibbs, 2012).
2. Dependibility	Refers to stability of data over time and conditions. Make sure that the data and interpretation (meaning) is accurate (Barrow, 2019). Same results within the bounds you expect. Depends on the context and zeitgeist (Gibbs, 2012).
3. Confirmability	Refers to neutrality: the potential for congruence between two or more people about data accuracy, relevance, or meaning (Barrow, 2019). Don't let your own feelings show, be aware of the issue. Confirmability is about the attitude of the researcher (Gibbs, 2012)

4.Transferability	The extent to which findings can be transferred to other settings or groups. Research needs to give information about people and settings of the study (Barrow, 2019) Is the sample atypical, then you can adjust for that (Gibbs, 2012).

Table 2 Trustworthiness in qualitative research (Barrow, 2019. Gibbs, 2012, adapted)

Credibility

This emphasis on various accounts of social reality is notably visible in the credibility criterion of trustworthiness. Establishing the credibility of findings includes both ensuring that research is conducted in line with best practices and presenting study participants to the social world in which they were examined for validation that the researcher has accurately grasped that social world. This latter method is commonly known as respondent validation. Triangulation is another technique recommended by Bryman (2016).

Dependability

Lincoln and Guba (1985) propose the concept of dependability as a parallel to reliability in quantitative research and suggest that, to show the merit of research in terms of this criterion of trustworthiness. According to Bryman (2016), researchers should take a 'auditing approach'. This requires keeping detailed records of all stages of the research process. Consider problem formulation, research participant selection, fieldwork notes, interview transcripts, data analysis, and so forth. Everything is presented in an understandable manner (Bryman, 2016).

Confirmability

Confirmability is concerned with ensuring that, while acknowledging that total objectivity is unrealistic in social research, the researcher can be proven to have operated in good faith; in other words, that he or she did not explicitly allow personal values to influence the research (Bryman, 2016).

Transferability

Qualitative findings are typically oriented on the contextual uniqueness and significance of the social reality under investigation. According to Lincoln and Guba (1985: p. 316), whether conclusions "hold in another context, or even in the same context at another time," is an empirical issue. Instead, qualitative researchers are encouraged to use what Geertz (1973) refers to as thick description. According to Lincoln and Guba (1985), a thick description provides others with a database from which to make decisions about the potential transferability of findings to different contexts.

Below is a summary of how the translation is conducted in this research:

Aspect	Required elements to be taken into account
1. Credibility	Using respondent validation and triangulation.
2. Dependibility	Researchers should have an ‘auditing approach’.
3. Confirmability	Researchers have to act in good faith
4.Transferability	Producing a ‘thick description’

Table 3 Summary aspects to ensure trustworthiness (source: author. Adapted from Bryman, 2016)

2.7 Interpretivist paradigm

According to Koolwijk (2022) a paradigm is point of view, a lens through which people view and interpret events in the world around them. Interpretation of reality is constructed by combining many views to one story. The interpretivist paradigm entails that each person constructs his/her reality in their mind. Furthermore, it is essential to recognise that reality is subjective. ‘Multiple realities’ exist because it depends on our perception and how we perceive the world through our senses. The process of constructing an interpretation of reality is iterative: analysing social phenomena by going back and forth between observations and data (Koolwijk, 2022).

As stated by Nickerson (2022), interpretivists are capable of collecting qualitative data through a range of methods. The most typical of these are interviews. These can emerge in a variety of ways, including

in-person, over the phone, and in focus groups. Observation is another strategy for interpretivist data collecting. For this research in-person, semi structured interviews are used (further explanation, see: 2.8 Interviewing in qualitative research. During case study research the researcher is a neutral observer, not an active participant. Conclusions that are meaningfully drawn from case studies ultimately rely heavily on the observational and integrative capabilities of the researcher (Schwartz-Shea & Yanow, 2013). Particularly when conducting interviews, it is important to take the above into account and make oneself as objective as possible.

2.8 Interviewing in qualitative research

In qualitative research, interviews are probably the most common method. The reason for choosing this interview type and particularly semi-structured interviews is because there is much greater interest in the respondents' point of view. Furthermore, 'rambling' or wandering off on tangents is frequently appreciated, as it reveals the interviewee's perspective on what is essential and significant (Bryman, 2016). Obviously, a schedule and guide for interviews will also be established. However, there will be room for new questions that follow-up respondents' replies.

Interview approach

The interview approach (see Figure 10) is based on qualitative interviewing by Moerman (2016):

Semi-structured: the topic of the interview is known to the participants. Although various questions on (sub)topics are written down beforehand, the formulation will be relatively free and there is room for more in-depth follow-up questions that the interviewer might come up with on the spot.

Interview type: the interview scope is narrow as the topic is quite specific. Since the interview is about events and processes, it can be regarded as an investigative interview.

Rapport: to create rapport, a little time in the beginning involves making small-talk. This will make the interviewee more at ease, and possibly result in a better qualitative interview. This section is neither recorded nor transcribed.

Interviewer behaviour: there is a professional-student relationship during the interviews. Despite this, the researcher (student) is relatively outside of the employees' (professional) work processes. As a result, professional experiences are approached as a 'naive outsider'.

Probing: there are different probing-techniques that can be used, but I would like to let the dynamics turn out the way they turn out and then try to steer if I do not get the 'appropriate' results. Consider questions pre-marked as important. This is done by using the probing techniques of Moerman (2016). Some examples that can be applied are: nodding, sentences such as; 'yes', 'tell me more about that', and 'where did it lead to'. When multiple answers contradict each other, follow up questions are proposed, and answers are critically evaluated.

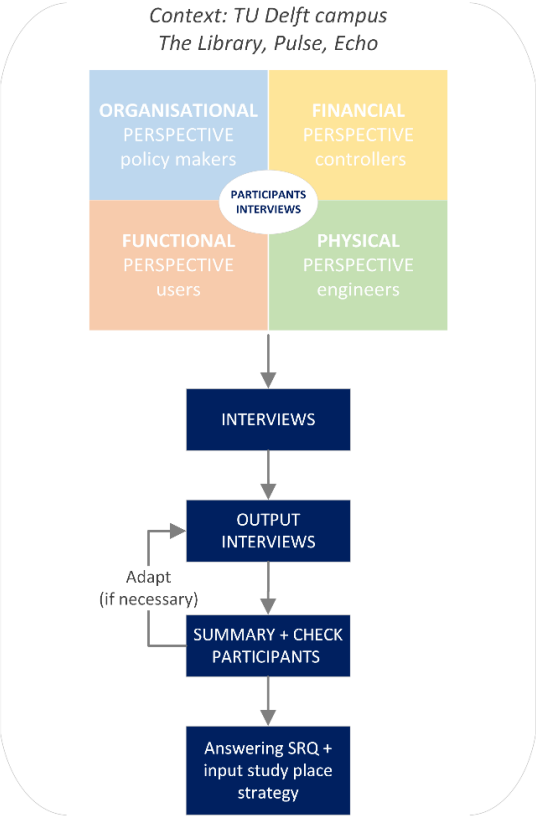

Figure 10 General interview approach (source: author)

In this research, in-depth interviews are the primary method of data collecting. Semi-structured interviews are conducted. The majority of questions in semi-structured interviews are not predetermined. Prior to conducting interviews, an interview protocol (see Appendix VI: Interview protocol) is established because the questions themselves should be carefully considered (Knox & Burkard, 2009). This procedure for the semi-structured interview serves as a guide, but also allows for freedom to ensure that the participant's entire story is exposed (Knox & Burkard, 2009). The strategy permits participants to discuss what they consider essential (Morris, 2015). In addition, the use of semi-structured interviews allows for a more objective comparison of the respondent. Therefore, semi-structured interviews offer the benefits of both organised and unstructured interview techniques.

2.9 Data collection and analysis

Research methods such as semi-structured interviewing are used to keep more of an open mind about the contours of the data. A distinction can be made between the primary and secondary data collected during this research. Primary data is data that is collected by the researcher themselves and secondary data is collected by others (Bryman, 2016). The primary data in this thesis are the in-depth interviews.

Secondary data is provided by CREFM. Measurement data of both teaching spaces and individual study areas are available. In this way, space use can be properly examined and the information can be additionally used in analysing, understanding and placing the results of the interviews. Thus, the primary and secondary data fit well together.

The interviews were conducted in person. This was successful for all interviews conducted except one. All interviews were recorded, for which prior permission was sought. The subsequent step was to transcribe and summarise the interviews. Feedback then took place before the results could be used for processing with permission (see Figure 11). The next step was transcribing and summarising

the interviews. The interview data were analysed using a thematic analysis of the interview transcripts (Jones et al. 2010).

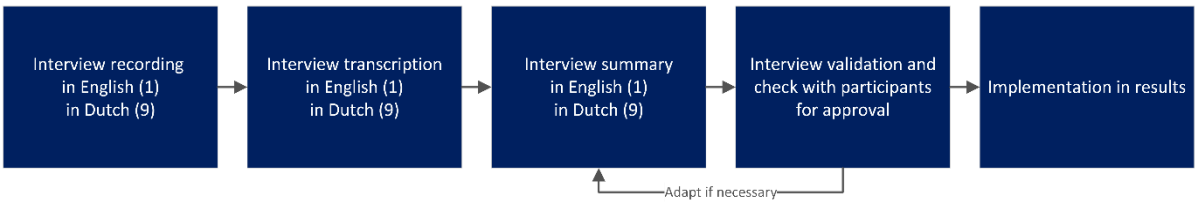

Figure 11 Zooming in on the process of analysing the interviews

This procedure uses closed coding with predetermined codes. Coding was also used in the interview questions. After the interviews, these codes appeared insufficient, because new patterns emerged that could not be coded using the current set of codes. Not only were participants chosen from a variety of the four perspectives by Den Heijer (2021), but their values (shown in Figure 12) were also useful in identifying similarities and contradictions.

Certain perspectives, as shown in Figure 12 have corresponding goals and values. To properly distinguish thinking patterns, the four colours corresponding to the different perspectives are used. It becomes interesting when an interviewee deviates from his/her (main) perspective and includes other interests in his/her answers. For participants of the interviews, subdivided by perspective, see 5.1.2 Participants.

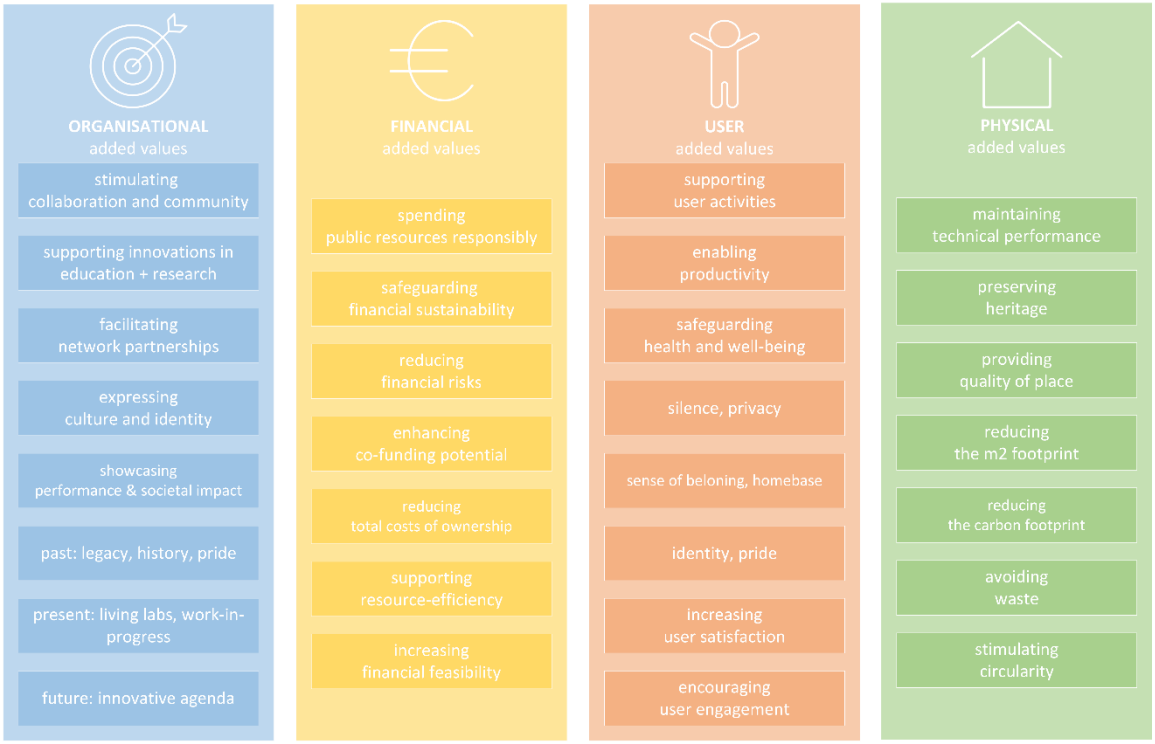

Figure 12 Goals and values categorised by perspective (source: Den Heijer, 2021)

Data management

To enhance the reusability of scientific data from this thesis, the FAIR data principles are applied in this thesis (Wilkinson et al., 2016). These principles are as follows: findability, accessibility, interoperability and reusability. Its applications are explained in table Table 4, below:

FAIR data principle	Application
Findability and accessibility	The thesis will be published on the TU Delft repository and will be publicly accessible. Additionally, search engines index the repository's contents. The abstract and keywords helps facilitating this.
Interoperability	Although the examined topic is embedded in a Dutch context, namely the TU Delft campus, it is written in English. Its interoperability is thus enhanced by making it available to a larger audience.
Reusability	To make it reusable, the methodology has been described in detail; this way, the research may interest other universities dealing with similar issues. Furthermore, all references have been cited (according to APA7 standards) and are available in the reference list.

Table 4 The FAIR data principles applied (source: author, based on Wilkinson et al., 2016)

2.10 Research scope

The research scope includes an in-depth examination of study spaces and campus development on the campus of TU Delft. The research focuses on three cases: the university library (1997), as well as the generic education buildings Pulse (2018) and Echo (2022). The period that is examined is the last 25 years, from 1997 (opening library) to the present (2023). An examination of policy documents, ambition documents, campus visions, and programme requirements is part of the investigation.

To gain a comprehensive understanding, this study incorporates diverse perspectives within the CREM-model (Den Heijer, 2021). The participants for the interviews range from architect of the new generic education building at the TU Delft campus South, to a guest lecturer and former vice president of a foreign university, to a business controller and student counsellor (see explanation: 2.8 Interviewing in qualitative research). They did provide valuable insights into their experiences and expectations related to study places. Due to time constraints, the student perspective is beyond the scope of this research.

2.11 Ethical considerations

According to Bryman (2016) discussions about ethical principles in research, and perhaps more specifically transgressions of them, tend to revolve around certain issues that recur in different guises. They have been usefully broken down by Diener and Crandall (1978) into four main areas:

1. Whether there is *harm* to participants;
2. Whether there is *lack of informed consent*;
3. Whether there is an *invasion of privacy;*
4. Whether *deception* is involved.

Obviously, the above concerns are avoided. It is essential that the ethical considerations are handled with care. Initially, the results will be anonymized if the interviewee so requests. Participation in the interviews is entirely voluntary, and participants are not required to respond to a question if they choose not to. This means that there are no required research questions. However, if interview questions remain unanswered, it is possible that certain answers cannot be utilised in the data analysis.

Only the data required for this thesis is gathered and securely maintained. These precautions ensure that participants are not harmed in any way and that their confidentiality is protected.

Everyone who participates in the interviews is required to sign the consent forms. The benefit of informed consent forms (see appendix) is that they allow participants to be fully informed of the nature of the research and the implications of their involvement from the outset. In addition, the researcher has a signed record of consent in case participants or others afterwards raise concerns (Bryman, 2016).

PART 3 | THEORETICAL BACKGROUND

''Ownership is important, you have to be proud of a place, or like a place, if you want to treat it well. Appearance and building quality can really help in that.''

Interview C | Architect new generic education building (TU Delft campus South 2027) | CREM perspective

This chapter begins with a look at real estate and how buildings can provide us with more than just shelter. In addition to the functions of real estate, there is a strong link to performance, which is also explained in this chapter. There are two conceptual models that help to manage real estate. It is also discussed how these are used and what they entail. The importance of community is not the first thing that comes to mind when discussing study places; how it supports learning and the way it affects students' university experiences are also discussed. Finally, statements about the future campus are made using this knowledge.

3.1 Real Estate theory and performance

> *''How does architecture (the environment) influences us?''*
> Christian Norberg-Schulz (1926-2000) | Former architectural theorist who emphasized the significance of the human experience and sense of place in architecture.

This is one of the questions Christian Norberg-Schulz (1963, p. 22) raises in his book 'Intentions in Architecture'. According to him, it is evident that the environment influences us and determines our 'mood'. Architecture has not only an instrumental purpose, but also a psychological function. A good follow-up question is: *"In what external circumstances do we have a certain experience?"* whereby 'experience' refers to perceptions of which we are not directly aware. Besides the fact that the most fundamental purpose of the physical environment is to shelter people and their possessions (Den Heijer, 2011), architecture fulfils several roles, including the ability to change the environment and its symbolic value.

A building is more than just a shelter. With its form it communicates social ideas and artistic intentions, not only for architects, also for and by commissioners. Spaces are more than just bricks and mortar; form communicates this. Spaces shape our social interactions and influences our wellbeing. This is the purpose of architecture; it can organise certain aspects and control or regulate relationships between humans and their environment (Norberg-Schulz, 1963, p.109). Yet it is possible for a building to negatively affect the performance of its users, for instance when a building lacks the function to shelter people and their belongings. In addition to providing shelter for people and their belongings, a building must facilitate human activities. Buildings must continue to their function over time (Den Heijer, 2011).

Besides the functional and psychological aspects of architecture, which focus on its role in shaping our experiences and interactions with the world, there is also an economic perspective in which real estate is evaluated, namely the link of how real estate is adding value to performance (see Figure 13). Developing and maintaining real estate is often a long-term and high investment where the value of a building is influenced by its performance. From the perspective of investors, management focuses on making financial value.

> *''The assumed added value of real estate, either positively or negatively, serves as the foundation of real estate management. No society, organisation, or individual would invest in real estate if it had no impact on performance.''*
> A. den Heijer | Current professor at TU Delft specialised in real estate and campus management for educational and research facilities.

Den Heijer (2011, p. 91) concludes that performance is about more than just financial outcomes and objectives. Added value may refer to achieving social goals such as individual happiness and well-being. Institutional buildings should help the institution achieve its goals. Real Estate management aims to achieve a positive added value to the performance. Real estate, which includes portfolio management, creating and maintaining buildings, and places, is input which through a process (by use and management) improve the society's, organisations, and/or individuals' performance (output) by adding value (see arrow pointing to the right in Figure 15). The same applies to university real estate.

Along with sheltering people and their belongings, a building should facilitate human activities and must remain functional and support user activities over time. As time passes, real estate wears out due to climate, use, and material ageing. The lifespan is determined by its return, which is also influenced by the local real estate market. If the benefits outweigh the cost, the real estate object will be kept. The durability of a building depends on its ability to adapt to changing requirements and new functions. Real estate has various functions, including technical, functional, financial, economic, cultural, social, and ecological aspects (Den Heijer, 2011).

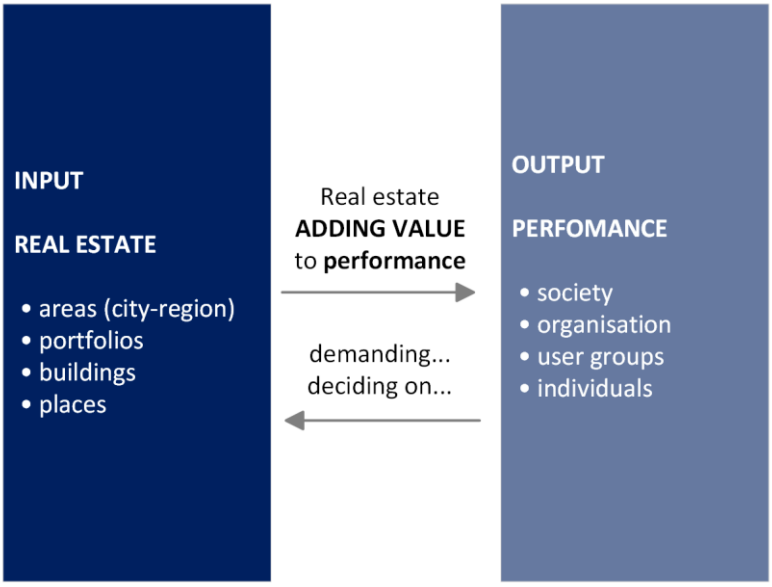

Figure 13 Basis of real estate management: real estate adding value (positive or negative) to performance (source: adapted from Den Heijer , 2011)

3.2 Real Estate Management and campus management

Maximising the added value (Figure 13) of real estate to performance is the aim of real estate management (Valks, 2021). Within real estate management theory there are different views on added value (De Jonge et al., 2009). In general there is a distinction made between Corporate Real Estate Management (CREM) and Public Real Estate Management (PREM). CREM is 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), to obtain maximum added value for the business and to contribute optimally to the overall performance of the corporation"* (Krumm et al., p. 32). This definition demonstrates actually that performance is an integral part of a business strategy. PREM more explicitly addresses performance. It can be summed up as managing a government's real estate portfolio by aligning the portfolio and services with user needs, treasury financial policies, and the government's desired political outcomes (Valks, 2021 and Van der Schaaf, 2002, p. 6). Both CREM and PREM theories apply to university campuses (Den Heijer, 2011).

A conceptual framework developed by De Jonge et al. (2009) that helps managing real estate is the Designing an Accommodation Strategy (DAS) framework. Real estate management is a continuous

process that includes implicit or explicit considerations about the match between supply and demand. The process of alignment is shown as ongoing and iterative in two axes: from supply to demand and from the present to the future. The scope of the process could be a campus, a building or the floor area used by a department. The timeframe of the decision could also vary. As a graphical representation, such a flexible framework appears more useful because organisations' strategies change over time and even within the same market (Arkesteijn, 2019).

The framework demonstrates this with four coordination moments (in Figure 14 referred to as steps). Step one is between the current demand and the current supply. Step two is between the future demand and the current supply. Step three is between the future demand and the future supply and step four is from current supply to future supply. These 'steps' (management tasks) are taken in an iterative process of determining the necessary actions that maximise the performance of an organisation. The framework could be used for at least five years, making it a method for corporate real estate - or accommodation - strategies. It could, however, be applied to a time span of less than a year, making it an operational model for short-term space management. When applied to the campus, the four management tasks are as follows (Den Heijer, 2011):

1. Assessing the current campus (to determine the current match)
2. Exploring changing demand (and determining the future match)
3. Generating future models for the campus (to match future demand and supply)
4. Defining projects to transform the campus (to the future campus)

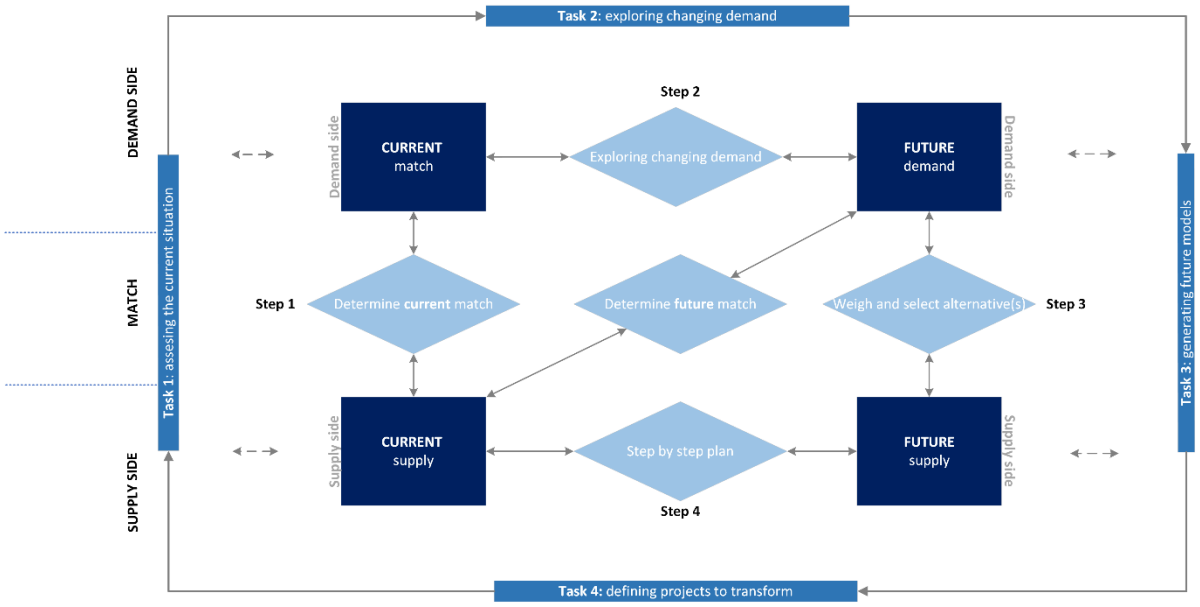

Figure 14 Framework with the four management tasks to match supply and match demand of space, now and in the future (De Jonge et al. 2009)

It is essential to define "*campus management*" since the steps in the DAS frame are already associated with managing the campus. Campus management is defined as making changes to the campus to meet the needs of different stakeholders, the university's changing context, and the overall performance goals. This indicates that the campus manager, who is usually the director of facilities or the director of the real estate department, is in charge of this alignment process. In strategy-making, this process is iterative to explore futures and then to determine how feasible the transition of the existing is. All universities go – implicitly or explicitly – through this steps in their strategic campus plans (Den Heijer, 2016).In addition to this process-based framework for campus management, there is also a second, more substantive conceptual model, the four-perspectives model (see Figure 15). This model identifies four perspectives to be considered in campus management considered: the strategic, functional, financial and physical perspectives.

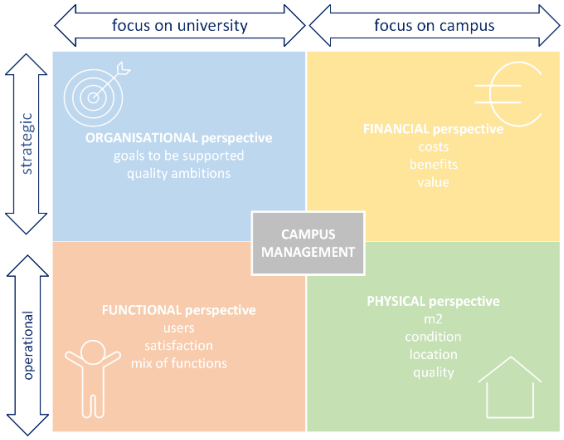

Figure 15 The four perspectives that should be integrated in campus decisions (Den Heijer, 2011 and 2016)

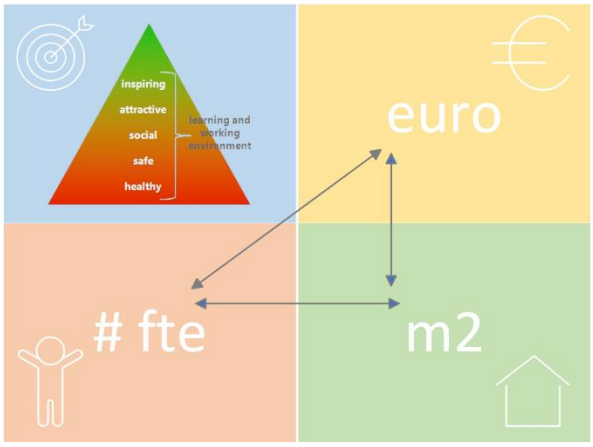

Figure 16 Four campus variables—targets, m2, people, and euros—are combined into core ratios for campus management: "space utilisation" (m2 per fte) and "cost level" (euros per m2), aligning with university goals (Den Heijer, 2011 and 2016)

This campus management model by Den Heijer aims to highlight the fact that strategies should never be evaluated solely based on cost per square metre, but should always be evaluated in the context of university-level goals (facilitating new research themes for which resources are available), the value they add to education and research (improving productivity or preventing productivity reduction), the number of users they facilitate and their satisfaction (see Figure 16).

3.3 The campus as a learning community

Historically, a campus has been defined in a very straightforward manner. According to Colenbrander (2018), a campus is the area where a university is located, as well as the buildings that house the faculties that form the functional core of academic study. It might also contain suitable housing for teachers and students, as well as sports facilities. The phenomenon started in the US, where there was a demand for coherently structured academic settings modelled after the more traditional British universities, like Oxford and Cambridge. Turner (1984, p. 3) cites Thomas Jefferson, who envisioned The American Campus as a ''Academic Village'' when designing the University of Virginia (see Figure 17). This term reflected Jefferson's own views on education and planning, in which he saw colleges and universities as communities in their own right ,in effect like cities in miniature. Large universities in the United States adopted many collegiate characteristics, in contrast to the typical pattern of European universities, which focused on academic matters and paid little attention to their students' extracurricular lives. As a result, American colleges and universities, like those in England, are required to have dormitories, dining halls, and recreational facilities in addition to classrooms and other academic spaces. This means that an architect's job involves more than just designing individual buildings—it also involves creating a community (Turner, 1984).

Figure 17 University of Virginia, designed by Thomas Jefferson, 1817 (source: University of Virginia Archives)

3.4 Building a community

Most universities attach great importance to attracting and retaining talented and motivated students. Once students arrive on campus, there are many factors that influence their satisfaction with their university experience (Waxman et al., 2007). According to Elliot and Shin [24], student satisfaction is determined by their perceptions of their university experience. Student satisfaction is the short-term attitude resulting from the evaluation of the experience, general services and infrastructural facilities. A more long-term phenomenon is students' loyalty to their institutions.
Hennig-Thura et al (2001) developed a model focusing on student loyalty and emphasised that strong relationships within the university community influence this loyalty. The study showed that in addition to high-quality education, a student's emotional connection with the university is crucial. The quality of a student's university experience, including aspects such as the university library, has a significant impact on their loyalty to the institution, which is closely linked to their satisfaction. Lecture halls, student-faculty interactions, course content, the learning environment and library resources are additional elements that influence satisfaction (Kuh et al., 2001; Soikin et al., 2012). This leads to the sub-conclusion that the factors that contribute to satisfaction are closely related to the factors that determine students' loyalty to their university, with a significant overlap between the two. Universities need to know the factors that bind a student to the university to retain students (Waxman et al., 2007). The aforementioned primarily addresses the learning environment - the physical campus - as a whole, with the university library being recognised as a facility that enhances student satisfaction and loyalty. Faculties can also contribute significantly to the perception and identity of a faculty and its users (Valks et al., 2021), but the question is whether generic educational buildings contribute to these values.

Here it possibly could conflict with the generic educational buildings where the 'identity part' is less present or even absent, given the generic and universal character that the generic educational buildings should have - not only in the appearance inside - but also in the function and use of the building. What if a 'one size fits all' approach could lead to a 'one size fits none?' A homebase might be important for the sense of belonging to a group.

According to Oblinger (2006), learning is the central activity of colleges and universities. She makes a distinction between formal and informal learning. Formal learning takes place in classrooms, while informal learning is the result of interactions between individuals. Learning is influenced by space, whether physical or virtual. Informal learning has the power to bring people together and encourage exploration, collaboration and discussion. On the other hand, space can convey an unspoken message of silence and privacy. In colleges and universities, the power of *built pedagogy*, by which Oblinger (2006) means the ability of space to determine how education takes place, is becoming increasingly evident.

What is meant by the term community?

First, it will be explained how the term community is used and understood in the context of this research. For this, different explanations from different authors will be highlighted:

> *''The term **community** refers to the social context of students and their surroundings. A community is a group of people who share a common purpose, values, and goals. It possesses powerful characteristics that shape learning. A community has the ability to inspire its members to achieve extraordinary results.''*
>
> Deborah J. Bickford and David J. Wright (Associate provost for academic affairs and learning initiatives | Director of curriculum innovation and e-learning both at the University of Dayton.

> *''A **community** is group whose members have made a commitment to communicating with one another on an ever more deep and authentic level.''*
>
> M. Scott Peck (former psychiatrist)

It can set expectations for the individual and create an environment in which great things can happen. However, a true community only exists when its members engage in meaningful interactions that allow them to know and learn from each other. In a community, students, including staff, are enriched by collective making sense, mentoring, encouragement, and an understanding of the perspectives and unique characteristics of an ever-changing membership (Bickford et al., 2006). Furthermore, the 'factor' community can also be understood as 'The hidden context for learning.' Bickford and Wright (2006) explain this as follows:

> *''A **community** catalyses deep learning[4] and should be a critical consideration when planning physical and virtual learning spaces.''*

[4] Deep learning in 2006 had a different meaning and use than the current meaning in the field of AI. Deep learning as Bickford and Wright mean is focused study. When a translation should be made into which study place typology it fits, it would be type A: focus places (see 4.2 Study places at TU Delft)

Community fosters deep learning and should be considered when creating physical and virtual learning environments. Specialisation, on the other hand, has a long and comfortable history in higher education, both in the way disciplines are divided and in the way institutions are organised. Bickford and Wright (2006) argued for community on campus. They emphasise how important community is when it comes to learning.

Oblinger argued for the importance of community in her book Learning Spaces in 2006. She spoke at the time of a 'new era' that necessitates 'study spaces that promote connections rather than compartmentalization (separate faculties).' Because projects are so complex, it is impossible for a single point of view to capture all of the necessary requirements and uncertainties. Den Heijer's (2021) assertion that management matters can be linked here; where campus managers must find the best match between the solid, liquid, and gas on campus (see previous section 3.2 Real Estate Management and campus management). Den Heijer's four perspectives (organisational, financial, functional, and physical) emerge to avoid a single viewpoint, which Oblinger addresses as a potential pitfall.

The post COVID-19 era: on-campus versus off-campus

The unexpected COVID-19 pandemic put pressure on the on-campus community. It caused numerous problems to on-campus learning and forced nearly all educational levels worldwide to shift to virtual learning (Dalle et al., 2021). Over 91% of the world's student population had been impacted by temporarily closed educational institutions (Jandrić, 2020). Well-being, engagement, and satisfaction have been major academic topics of debate during the pandemic (Crawford et al., 2020), especially given the significant increase in online education. The internet, 5G, cloud platforms, big data, and artificial intelligence are all used in education. These digital infrastructures are only the beginning of a new paradigm for post-pandemic teaching and learning. This paradigm shift could occur from traditional, teacher-centred, lecture-based activities to student-centred activities such as group activities, discussions, hands-on learning, and limited use of traditional lectures (Jandrić, 2020).

The aforementioned topics of debate have not only been significant during the COVID-19 pandemic. In the post-COVID-19 era, various researchers, educational leaders, and policymakers expressed grave concern about the future education system (Karakose et al., 2022a, Cahapay, 2020). De Jonge-Kannan (2021) states that on-campus class happiness may be associated with students' physical presence on campus, including their participation in a pleasant learning experience, or their willingness for face-to-face interaction. It is also related to the drive of students to interact, study, and perform. The removal of the option of coming to campus to meet with fellow students or not coming to campus is related to the important factors of autonomy and choice. Khalil et al. (2020) found in their research that during the COVID-19 pandemic students might just have felt out of touch with their fellow-students and friends owing to long periods of virtual learning and may have desired to reconnect with fellow students through being on-campus.

This is in line with what Den Heijer (2021) argues: whereas many thought at the beginning of the 21st century that buildings would increasingly be replaced by a virtual campus, the demand for the virtual campus turned out not to be a replacement demand, but an *additional* demand. However, the pandemic confirmed that the physical campus was missed and mattered more than ever. To deepen one's understanding of the various campus models currently being implemented by universities and their divisions, see the following section.

Solid, liquid and gas

According to Den Heijer (2021) changing universities nowadays can be divided into three categories: solid, the traditional university (model A), liquid, the network university (model B) and gas, the virtual

university (model C). Although traditional model A (see: Figure 18) is favoured for its faculty-specific study places, libraries, and restaurants, it has been criticised for its compartmentalization (separate faculties), high costs, and large footprint (m2 and energy consumption). Maintaining Model A's value while reducing expenses and energy is difficult. Network model B (see: Figure 19) is praised for its interdisciplinary collaboration and diverse target groups. More people use shared facilities. This results in better utilisation and occupancy reduces student and employee m2 use and frees up funds for quality facilities or the primary process. Nevertheless, model B may cause anonymity and a lack of home or group bonding if standardisation is overdone and individuality disappears, affecting student loyalty, performance, and university attractiveness. Virtual model C (see: Figure 20) is popular due to its time and place independence, ICT opportunities, and blurred campus boundaries. The freedom to learn remotely, work from home, or offer the most beautiful, best-suited place in that city, country, or world can reduce campus space usage (and costs), but it risks turning the university community into individuals. That may be a bigger price and cost more than 'just' financial campus savings (Den Heijer, 2016).

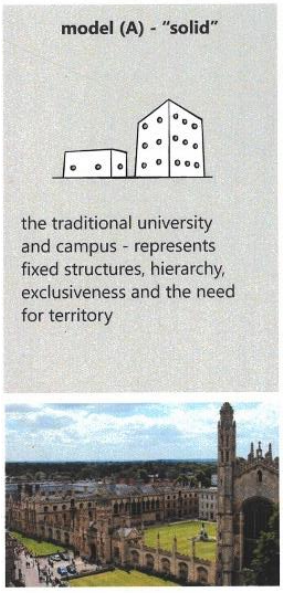

Figure 18 Summary of the traditional campus model (source: Den Heijer, 2021)

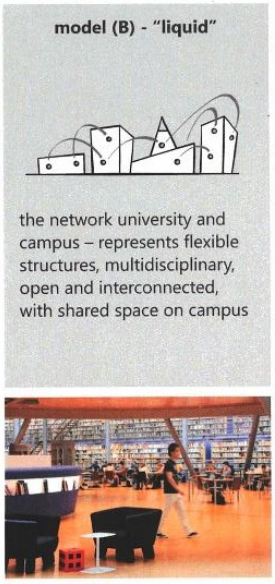

Figure 19 Summary of the network campus model (source: Den Heijer, 2021)

Figure 20 Summary of the virtual network model (source: Den Heijer, 2021)

Most universities today can be imagined to be a combination of the three states of matter (Den Heijer, 2021), as described above.

PART 4 |CASE STUDIES

4.1 Towards generic educational buildings

Towards generic educational buildings is a development that has been going on for decades, though under different names. To get a better grip on these developments over the past decades around this type of building and to understand the similarities and differences, each development will be looked at chronologically, with an emphasis on how this has led to the creation of generic education buildings on the TU Delft campus. Whereas previous developments focused on a learning café, then a learning centre, and finally generic (interfaculty) educational buildings, they all have one thing in common: they are all educational buildings that require a significant long-term investment. Joint Information Systems Committee (JISC), an e-learning and innovation team funded by the Higher Education Funding Council for England (HEFCE), wrote in 2006 a guide to 21st century learning space design, called *Designing Spaces for Effective Learning*. Due to the costly long-term resource of an educational building, its individual spaces must be designed with the following criteria in mind (JISC, 2006):

1. **Flexible**: to accommodate both current and evolving pedagogies;
2. **Futureproof**: to enable space to be re-allocated and reconfigured;
3. **Bold**: to look beyond established technologies and pedagogies;
4. **Creative**: to energise and inspire students and teachers;
5. **Supportive**: to develop the potential of all visitors;
6. **Entrepreneurial**: to make each space capable of supporting multiple purposes, also in the future.

Nowadays, these are still the terms used in programmes of requirements for new generic educational buildings and thus still as relevant and topical as back in 2006. A learning environment, such as a generic educational building, must be capable of motivating students and promoting learning as an activity, supporting collaborative as well as formal practice, providing a personalised and inclusive environment, and being adaptable to changing requirements.

The learning café

TU Delft's ICTO (*ICT in het Onderwijs*) programme (2000-2005) generated the initial concept for a Learning Cafe in 2003. The concept was also investigated by a number of policy makers of TU Delft. Glasgow Caledonian University (GCU) introduced the concept of a Learning Cafe, a relaxed environment where intense learning takes place. As a pioneer, GCU completed a brand-new building called the Saltire Centre with the latest didactic principles and innovative technology. In 2005, a group of researchers and policy makers from TU Delft visited the Saltire Centre (GCU) in order to learn from and implement various aspects of this new type of learning environment on the Delft campus (interview E, 2023). See the images below (figure 21) to get a sense of what was considered a 'pioneer' at that moment, in terms of the latest didactical principles and modern technology.

Figure 21 Impressions of GCU in 2006, electronic information posts display guidance information such as maps, activity locations and welcome messages for users of the building (source images: Jisc infonet, 2006)

A learning cafe can be described briefly as follows:

A learning cafe is a relaxed space where intense learning takes place

The learning centre

The general concept of learning centres was introduced around the year 2000. This was a transition from traditional libraries - where silence was required at all times – to a place where students were able to discuss depending on where this was permitted[5]. Several staff of the library in Delft (BTUD at that time worked on a large long-term programme for the reorientation for the library in Delft from the 'silent old-fashioned library'' to the modern ''student workplace'' (interview E, 2023). In 2006, at the time the report *Designing Spaces for Effective Learning* was published, the concept of the learning centre was still evolving. Particularly in universities, where this library environment is envisioned as the social and academic hub of the campus, substantial new-built initiatives have resulted from rethinking the learning centre. Nonetheless, smaller-scale learning centres are also appearing – connected to teaching accommodation to form curricular clusters, for instance, or as a distinct high-tech, highly individualised learning environment in addition to the library (JISC, 2006).

JISC (2006) anticipated that learning would entail numerous diverse activities, each of which would be accompanied by corresponding behaviours. This can make the learning centre one of the most adaptable spaces available. A large central learning centre in a university, provides social spaces, student services and study support and various types of working environments, such as comfortable seating for collaborative group work and project rooms for practising presentations. These diverse purposes require different designs for every area of the building. Zones, or different floors for different types of learning, are common strategies for management (JISC, 2006).

In August 2008, a Programme of Requirements for Learning Centres came out which the new building of TU Delft's Learning Centre should meet. The trigger for this project was a reference visit in 2005 to the Learning Centre of Glasgow Caledonian University (TU Delft, 2008). According to the vision document in 2008 the TU Delft student in 2015 would be an *integral engineer* and a *driving force*

[5] The 'learning centre' concept is a place where teaching and learning come together, with Glasgow Caledonian University and its Saltire Centre pioneering this concept.

behind the development and implementation of new technologies and activities. The engineer *thinks and acts with an international perspective.* The educational programmes place a high value on the student's commitment and personal responsibility. The intake of students is very heterogeneous. The application of ICT to new forms of education, virtual cooperation, and 'distance education' (what is now called hybrid working) is self-evident. Students collaborate in international project teams with fellow students and teachers on 'real life' (authentic, societal related) research questions originating in society and business. The two types of learning are inseparable. This means, on the one hand, that the Learning Centre is a place where formal and informal learning collides, and on the other, that forms of education that contribute to future learning are developed (TU Delft, 2008).

When the above is summarised, the TU Delft came in 2008 to the following vision for the Learning Centre:

"The Learning Centre is a TU-wide home base for students and teachers. This is where teaching and learning come together. In the Learning Centre, lecturers employ innovative teaching methods in multifunctional teaching spaces that rise above faculty facilities. Students can work together on multidisciplinary and topical business projects. By creating a pleasant learning climate both informal and formal learning is optimally facilitated and encouraged''

Extracted from: *Concept programma van Eisen v.04* – Learning Centre TU Delft (2008)

Learning centres and the sense of community

In the Hennig-Thurau et al. (2001) study on student loyalty (mentioned in 3.4 Building a community) the library was listed as one of the campus facilities that highly impact a student's impressions of their university experience. The university library has a ability to serve as a foundation of the community and can provide a place for companionship and relaxation, while enriching the community and public life in general (Lawsen, 2004).

The chosen case studies are The Library (1997), Pulse (2018) and Echo (2022). These were chosen because in its essence, they can all be traced back to the principles of a learning centre. This is related to the liquid aspect of the solid, liquid, gas theory by Den Heijer (see 3.4 Building a community) – to study their generic aspects. The common denominator of these buildings is that the buildings are well liked by students, especially The Library (the best-used building on campus) and the newcomer Echo are doing well. Each (new) generic educational building is an improvement over the previous variant (interview G, 2023), hence the choice of these three buildings.

The library, TU Delft's hub for academic resources and knowledge, supports individual and collaborative learning. The library supports students' changing needs with well-designed study places and learning spaces. Important to note is that the University Library is *not* a generic educational building, or at least not built with the purpose of being a generic educational building as Pulse and Echo. The use differs significantly in that there is no scheduled education in the library. No (frontal) teaching areas were included in the programme of requirements at the time, nor are they realised today for scheduled lectures and/or working groups. Pulse and Echo are the two generic education buildings that are relatively new and exemplify the university's vision of a future-proof campus. As campus-wide and interfaculty structures, they are designed to foster interdisciplinary collaboration, making them perfect complements to the design-oriented faculties. These buildings reflect TU Delft's efforts to create flexible and adaptable spaces that can meet the changing needs of its student community.

TU Delft and its policy to build a community

Prior to the COVID-19 pandemic, working from home and flexible working were not standard components of TU Delft's working policy; however, campus users view it very differently today. To clarify TU Delft's definition of hybrid employment, the following definition has been provided (TU Delft beleid Hybride werken, 2021): ''TU Delft defines hybrid working as a possible combination of working at the workplace (on campus or at another work location designated by TU Delft) and working at the home address in the Netherlands. The choice of workplace is partly determined by the activities being performed. Collaborating with colleagues is considered a campus-related activity.'' An important sidenote here is that *the TU Delft beleid Hybride werken 2021* excluded students, they are outside the scope of this policy document.

The TU Delft Campus presents itself as a vibrant hub for students, and scientific and support staff. The campus, after the Covid-19 pandemic, functions as the social and innovative centre of the university, where members of the TU Delft community come to study, work and socialise. Employees come to campus to collaborate, meet colleagues, work in labs and attend, among other social activities, offline team meetings and lunches. Exhibitions, thematic seminars and lectures are organised at various hotspots on campus (such as the Aula and the Science Centre). Some tasks require a high degree of concentration, and some prefer to work on campus or at home. On average, employees are allowed to work at home up to 40% of the time, contributing to their well-being and work-life balance. Hybrid meetings, both scheduled and unscheduled, are beneficial for appointments and meetings with externals, contributing to sustainability goals. Campus activities, such as laboratory work, catering work, and teaching, remain essential for the TU Delft community (TU Delft beleid Hybride werken, 2021). The Executive Board (CVB) decided on 'freedom in connectedness' (vrijheid in gebondenheid). This is in line with TU Delft's value of autonomy and personal responsibility (freedom). However, a framework has also been established. An important point that emerges here is the proposition:

''TU Delft is a campus university. We collaborate on campus.''

When this is considered, study places could be perceived differently. Collaboration and on-campus are fundamental values at TU Delft. Examining whether this is reflected in the translation to study places is interesting, as it initiates testing on a different scale: from policy-making (which is zoomed out) to study places (which is zoomed in).

4.2 Study places at TU Delft

What is a study place? This is one of the main underlying questions in this thesis research. At TU Delft, there are 6.000 permanent study places that are always available and this number is scaled up to 10.000 during exam weeks (see chapter 5: interview D, 2023). Besides numbers, it is important to find out what characteristics a study place should have, as the term is interpreted in different ways.

According to Valks (2021) a study place is a place which can be used by students to study; either alone or in groups. In the semi-structured interview the definition was discussed with professionals that work on the policy on campus as well as professionals outside from the CREFM department (see 5.1 Semi-structured interviews) determined by the type of course that students are following (interview A), but there are certain characteristics that are mentioned frequently, for instance: visibility, comfort, focus, diversity of choice and touchdown study places.

CREFM makes the distinction between formal and informal learning. Formal learning can be seen as traditional frontal education, for instance scheduled lectures. Study places, as investigated in this research, are of the type informal learning (see grey box Figure 22). Informal learning happens during homework and other out-of-place assignments. However, informal learning can also be self-study done individually. Informal learning takes place outside classes and occurs in libraries, information commons, coffee shops, and any other locations where students can come together (Oblinger, 2006). To better understand the distinction between formal and informal learning the following axes system was developed (see Figure 22). It is essential to distinguish between formal and informal learning, as well as learning as an individual in a community versus learning as an individual in a more solitary setting.

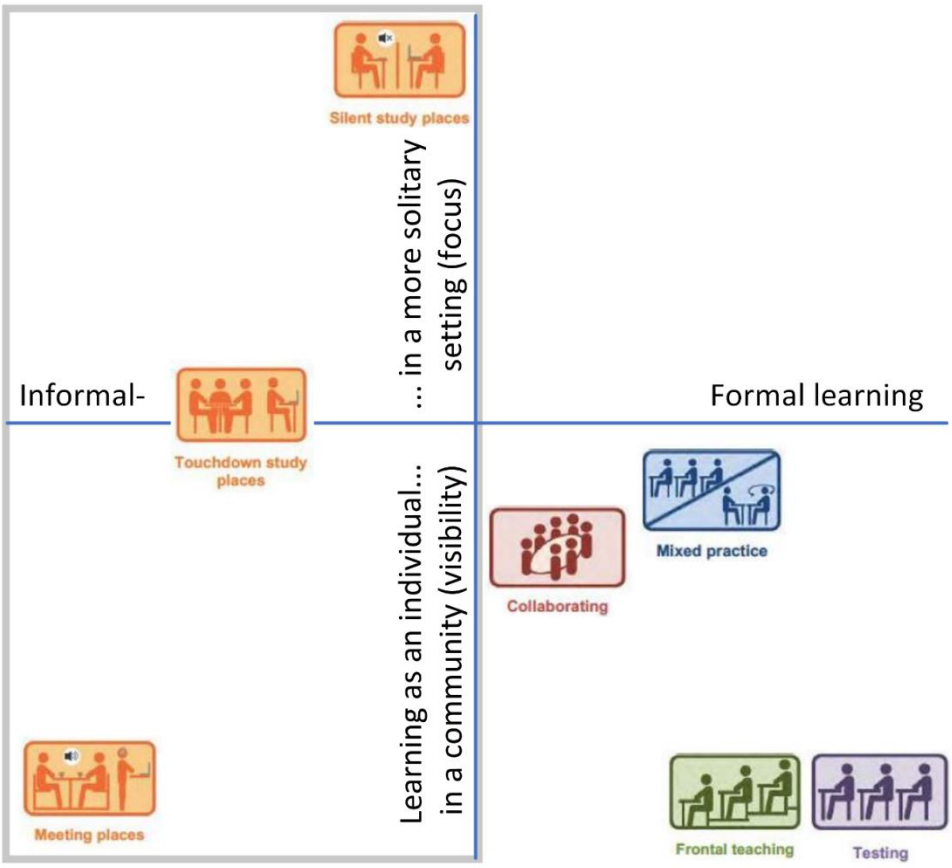

Figure 22 Positioning type A,B,C study places in the learning dimensions (source: author)

Delft's CREFM *Cookbook education spaces* (2018) distinguishes different types and categories (see Figure 23). The characteristics mentioned in the interviews correspond to the A/B/C study places that CREFM uses as guidelines, for a detailed explanation of which characteristics, also in a more quantitative manner, belong to each type see Appendix II: Requirements per studyplace. This way, the Cookbook provides an overview of education spaces, gives requirements per education space and sets guidelines for standardisation, operation and usability[6].

[6] The development of the Cookbook has been a collaborative effort involving teaching staff, students, and supporting staff. Specialised spaces, such as lab spaces, studios and workrooms that are typically faculty-bound, are accounted for by the faculty and are therefore not discussed within this Cookbook Education Spaces.

Figure 23 Classification of all education spaces at TU Delft (source: Cookbook Education Spaces, 2018)

There are a variety of uses for places to study, including self-study, group work, places to focus and meet other students. Four types of study places are distinguished within TU Delft, each with its own use. The categories can be summarised as follows:

	**Type A – Silent study places (individual study place)** **Type A2 – Silent study places with a pc (individual study place)** Study places to study individually for many hours in a silent area.
	**Type B – Touchdown study places** Study places for group work and for temporary self-study.
	**Type C – Meeting places** Multifunctional places for various social encounters, such as informal meetings or conversation. Such a study place counts half a study place for capacity planning.

Table 5 Classification of study places (source: Cookbook Education Spaces, 2018)

The majority of study places on the TU campus are classified as either type B or type C (see Table 6)[7]. Study places of Type C are located in various restaurants and coffee corners throughout the campus. Study places categorised as Type B are typically located within faculties and education buildings, predominantly situated in or near circulation areas. Type A study places are primarily located within the Library and faculty buildings. During periods of exams, these study areas experience high popularity and become overcrowded. In order to establish or enhance study environments that meet the standards of type A specifications, it is necessary to not only provide suitable furniture but also make structural modifications to create quiet and noise-free study places (Cookbook Education Spaces, 2018). The type of study places needed varies throughout an academic year's curriculum. During teaching weeks, the demand for group work places is larger, whereas during exam weeks, the demand for quiet self-study places is greater. One way to address this issue is by providing access to lecture halls as dedicated spaces for study places during non-lecture hours[8]. Because the demand for certain types of study places changes during a curriculum and academic year, CREFM has investigated how to turn a group and touchdown study places (B) into quiet study places during exam time. The most efficient way is to adjust the space (temporarily). One of the easiest ways is to turn the room or zone in which the group workstations and/or touchdown study areas are located into a quiet area (Cookbook Education Spaces, 2018).

[7] For a breakdown of type of study places per case study, see table 10
[8] Additionally, "parking discs" and baskets are available in the library for storing study materials temporarily on tables. While the "first" student uses the parking disc with a time limit for a break, this study place is available for use by other students. A great option on a small scale during peak hours.

Type study place	% Campus-wide	Description
A	12.3%	Silent study places
A2	8.2%	Silent study places with PC[9]
B	50.0%	Touchdown study places[10]
C	22.8%	Meeting places
Mixed	6.7%	Mix of A, A2, B or C

Table 6 Distribution type of study places on campus by categories A,A2,B,C (source: Cookbook Education Spaces, 2018)

Quantitative analysis study places – TU Delft

One of the questions central to this thesis is the current state of study places. To determine the current match (see step 1 DAS frame, Figure 14), the SRQ1 examines: *What is the current quantity and quality of offered study places on campus?* The quantity will become clear in this chapter. The tables below (Table 7, Table 8 and Table 9) show the amount of study places on TU Delft campus. All buildings are included, this allows to quantitatively distinguish between faculty buildings, and generic educational buildings. A campus map (see Figure 24) is shown below to get an idea of where the buildings are located.

CREFM has contracted the SPM department to measure campus space use at the start of each academic year since 2015. In this chapter data collected for the study year 2022-2023 is investigated (Bezettingsmeting Onderwijs 2022-2023, TU Delft). For the study places, utilisation is measured during the 'white week' (witte week), and the first examination week (weeks 1.8 and 1.9). In total, 9.217 study places are included in the count. This is the total number of study places, including seats in classrooms (lecture halls), available for students to study independently. When lecture halls are not in use, these are made available to students for independent study. There are approximately 6.000 permanent study places available. Meeting places (category C) are counted as half a study place (Bezettingsrapportage TU Delft, 2023). The 6.000 study places are taken into account in the statements as they are permanent, providing the most accurate representation.

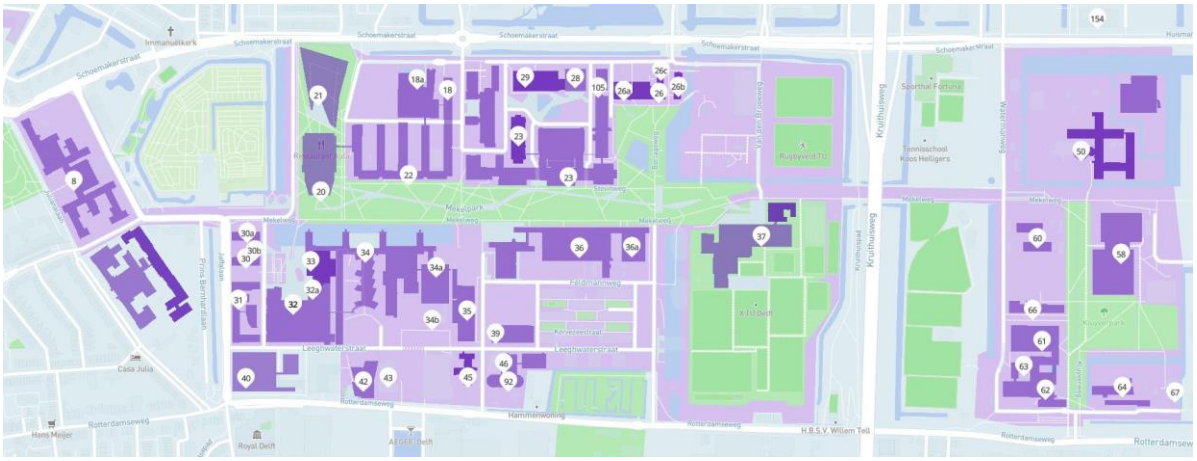

Figure 24 Cut-out of campus map with corresponding building numbers (source: TU Delft, via OpenStreetMap, 2023)

[9] It is not always clear whether this is a desktop PC, or whether monitors with docking station are also always described as A2 spots.
[10] In the past, a distinction was made between B and B2 touchdown study places, where B2 places were in an instruction room (not scheduled for teaching activities). This distinction is no longer made.

Campus area	Building number	Faculty building	Study places (swp)
North	8	BK	251
North (total)			**251**
Central	31	TBM	333
Central	32	IO	702
Central	34	3ME	968
Central	22	TNW PH	294
Central	23	CITG	746
Central	36	EWI	149
Central (total)			**3.192**
South	58	TNW AS	214
South	62	L&R	119
South (total)			**333**
Total			**3.776**

Table 7 Faculties and their current study places on TU Delft campus (source, Bezettingsrapportage TU Delft, 2023)

Campus area	Building number	Generic building	Study places (swp)
Central	29	Echo	300
Central	33	Pulse	275
Central	35	Drebbelweg	48
Central	39	Flux	20
Central	20	Aula	271
Central	21	Library	1.113
Central (total)			**2.027**
South	66	Fellowship	97
South (total)			**97**
Total			**2.124**

Table 8 Generic buildings and their current study places on TU Delft campus (source, Bezettingsrapportage TU Delft, 2023)

The case studies highlighted:

Case study	Generic owp	Study places (swp)	% Ratio of permanent swp to amount of owp
Echo	1.328	300	22.6%
Pulse	734	275	37.5%
Library	-	1.113	100%

Table 9 Current ratio of permanent swp to amount owp (source: Bezettingsmeting Onderwijs 2022-2023, TU Delft)

Type study place	Echo	Pulse	Library
A (Silent study places)	17.7%	-	13.8%
A2 (Silent study places with PC)	-	-	12.7%
B (Touchdown study places)	57.0%	82.1%	53.6%
C (Meeting places)	25.3%	17.9%	2.6%
Mixed (Mix of A, A2, B or C)	-	-	17.4%

Table 10 Study place distribution for each case study based on Cookbook 2018 types of study places (source: Bezettingsmeting Onderwijs 2022-2023, TU Delft)

Outcomes per building[11]

Figure 25 shows the results of all study places. This graph divides utilisation into two categories: places occupied by students (bezet) and places occupied by personal belongings (spullen). SPM investigated the results per type of study place in addition to measurements and results per building. As previously

[11] Because I do not have access to the original Excel source files, not everything in the figures can be translated into English.

discussed in 3.1 - Cookbook education spaces TU Delft (2018/2019), study places are classified as A, A2, B, or C. All measured study places are classified into one of these groups. Some of the study places are a mix. There is no separate subdivision for these spaces, and the study places are labelled as 'mixed' (Bezettingsmeting Onderwijs 2022-2023, TU Delft).

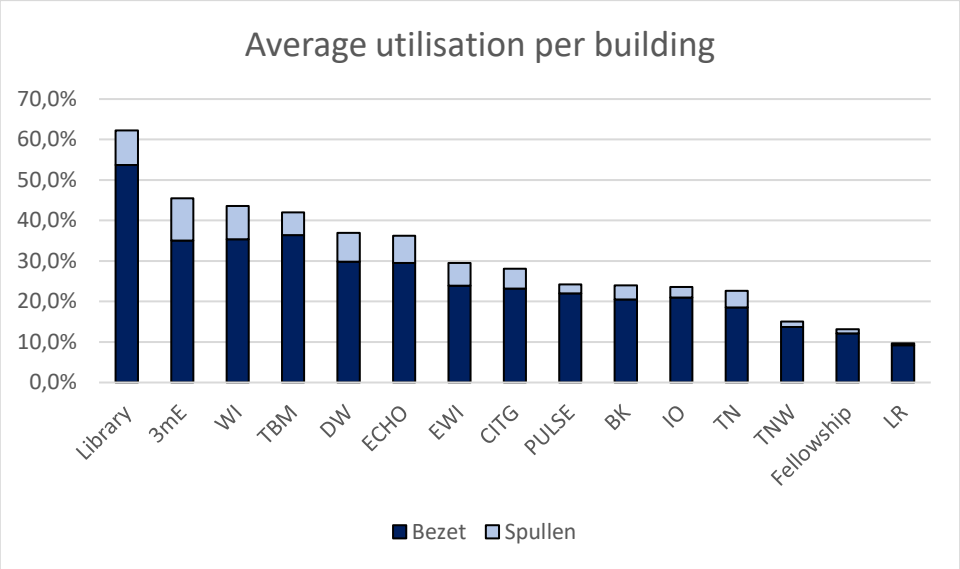

Figure 25 Average utilisation of study places in weeks 1.8 and 1.9 (source: Bezettingsmeting Onderwijs 2022-2023, TU Delft)

Figure 26 shows the shift of use over time. The afternoon is busier than the morning for all buildings. The hours indicated on the x-axis are lecture hours during which classes are taught.

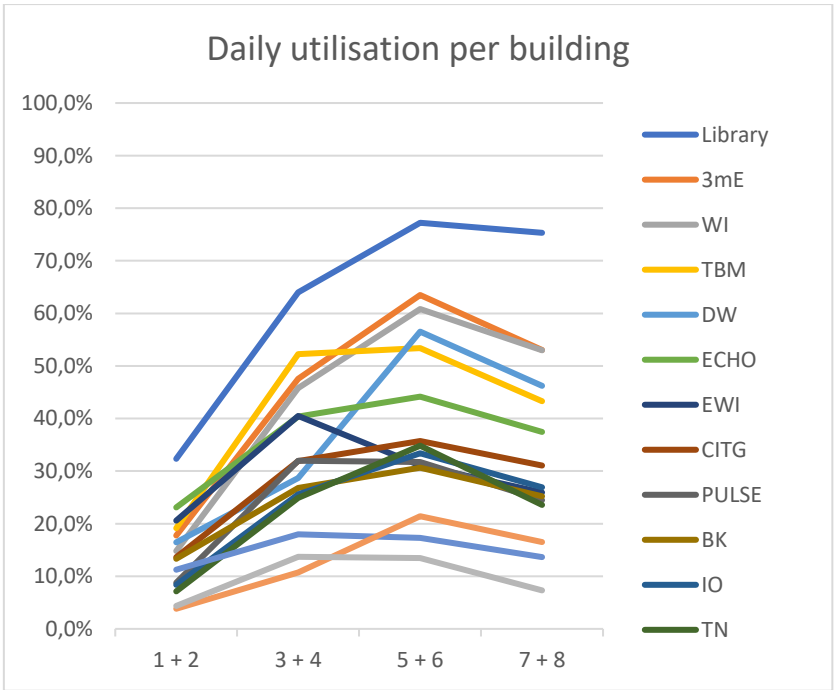

Figure 26 Course of utilisation over the day (source: Bezettingsmeting Onderwijs 2022-2023, TU Delft)

When the utilisation rates before the Covid-19 pandemic compared to after it are looked at below, conclusions can be drawn on a quantitative level. The comparison being made is in 2019-2020 (pre-pandemic) and 2022-2023 (post-pandemic).[12] It is clear that utilisation has decreased. A few buildings, most notably the Library and Pulse, are notable exceptions (see Appendix III: Utilisation

[12] The academic year 2020-2021 was excluded because the TU Delft campus was regularly closed or only partially open.

figures study places – Campus-wide and The Library, Pulse and Echo). The large increase in Echo can be explained by the fact that Echo did not exist in 2019. This is confirmed by participant D during the interviews (2023), who states that the awareness of the generic educational buildings Pulse and Echo could and still may grow, but that they are actually doing very well.

Zooming in on type of study place

	Building	Space and Description	Type study place	Capacity	Total Utilisation
2022	WI	02 960 STUDIERUIMTE	A2	6	135.3%
	Library	1.09 GLAZEN ZAAL	**A2**	140	**92.1%**
	Library	2.20 STUDIERUIMTE	**B**	59	**91.7%**
	Echo	02.210 Studieplek A 2e	**A**	74	**86.9%**
	EWI	HB 02.300 STUDIERUIMTE - plekken raamzijde	A,A2,B	87	86.4%
	TBM	A0.821 GANG	C	6	85.1%
	Library	0.06/0.12 RODE ZAAL	**A**	38	**84.8%**
	TBM	D1.010 STUDIERUIMTE - Computers	A2	62	81.0%
	Echo	02.802 Studieplek B 2e	**B**	48	**77.6%**
	3mE	E-4-330, 340 GROEPSRUIMTEN	B	5	76.5%

Table 11 Most utilised spaces with corresponding type study place in 2022, in bold the case studies (source: Bezettingsmeting Onderwijs 2022-2023, TU Delft)

Another count was taken for the larger self-study areas, which had at least 100 study places. The Library's popularity among students is unquestionable. In comparison to previous years, utilisation has not changed significantly. Below is an excerpt from the results of the Library:

	Gebouw	Ruimte en Omschrijving	Type Werkplek	Capaciteit	Totale Benutting
2022	**Library**	1.09 GLAZEN ZAAL	**A2**	140	**92.1%**
	Library	3.01 STUDIERUIMTE - kegel - 3	**B**	137	**69.9%**
	Library	4.01 STUDIERUIMTE - kegel - 4	**B**	125	**60.4%**
	3mE	C-0-010 STUDIERUIMTE - C vleugel BG	B	104	52.0%
	Library	1.01 GROTE HAL - tafels rechts van entrée	**A, B, C**	192	**49.7%**

Table 12 Utilisation of larger self-study spaces with at least 100 study places (abbreviated, source: Bezettingsmeting Onderwijs 2022-2023, TU Delft)

The least utilised spaces are shown in the table below (Table 13). This demonstrates clearly that there is a significant fluctuation between the spaces that are most and least occupied (Table 11). Additionally, study place type C comes up frequently in this; its location in relation to the campus buildings may be significant. Unfortunately, study places are underutilised; however, smart campus tools and apps can help students find available study spaces.

	Gebouw	Ruimte en Omschrijving	Type Werkplek	Capaciteit	Totale Benutting
2022	WI	801 GANG	C	10	0.0%
	TN	F 325, 350, 375 GANG	C	37	0.5%
	Pulse	A2.700 BREAK OUT	**B**	40	1.4%
	Bouwkunde	01.Oost.620 STUDIERUIMTE > Docentenruimte	C	22	1.9%
	TNW	C1.150 PROJECTRUIMTE	B	24	2.2%
	Bouwkunde	BG.Zuid.400 RESTAURATANT	C	38	3.7%
	EWI	HB 01.513 GANG - lange tafel	C	72	4.8%
	Bouwkunde	BG.Zuid.300 RESTAURANT	C	130	4.9%
	The Fellowship	00.(802) GANG	B,C	35	5.3%
	TNW	A1.010 RESTAURANT	C	36	5.6%

Table 13 Least utilised spaces on TU Campus (source: Bezettingsmeting Onderwijs 2022-2023, TU Delft)

Conclusions study places

Based on the report *Bezettingsmeting Onderwijs 2022-2023* (TU Delft) the conclusion about de utilisation of study places are as follows:

1. Although the use of study places varies greatly throughout the day, there is generally a pattern in which the morning is relatively quiet and the afternoon hours see the highest use (see figure 17);

2. Type A and A2 study places are the most utilised (40–50%), followed by B (35–45%), and C study places are the least utilised (approximately 15-20% at peak). With the exception of C study places, there has been a drop of up to 10% from 2019—the year before the pandemic.

The following correlation can be observed when the interview responses and measurement results are compared:

3. The type of study places that do best in terms of utilisation are the A, A2 and B places. This corresponds to the results of the interviews. When asked what a study place should contain in terms of characteristics, focus was mentioned 5/10 times (see also chapter 5). This is actually reflected in the total utilisation the best-used places (A, A2). See Table 11 space Library - 1.09 glass room (type A2) and Echo - 02.210 Study place A 2e (type A).

4.3 The case studies

4.3.1 Case I - The university library (1997)

Facts and figures	
Architect	Mecanoo
Discipline	Architecture and landscape
Typology	Library, University/Campus
Size	15.000m^2
Project Design	1993-1995
Building completion	December 1997

Type study place	Distribution
A (Silent study places)	13.8%
A2 (Silent study places with PC)	12.7%
B (Touchdown study places)	53.6%
C (Meeting places)	2.6%
Mixed (Mix of A, A2, B or C)	17.4%

Introduction and urban integration

The Executive Board made in 1989 the decision to build a new library. This was due to the poor condition of the existing library and to the fact that the building was located in the historical city centre, far away from the rest of the TU district. Back then, the institute could not function optimally in the outdated building. Following the decision to have a new library built, the Executive Board had several locations studied in 1990. The site behind the auditorium was the preferred plot (see top left in Figure 27), because of its central location on campus, near the main auditorium. The Advisory Group saw the realisation of the library in conjunction with the auditorium and restaurant as a unique opportunity, to give the campus a face towards the Schoemakerstraat, by opening up to it. By opening up to the Schoemakerstraat, the new library building could eliminate 'the rear character,' i.e. the feeling that this area of campus was considered the back. The establishment of a clear approach route across the Schoemakerstraat to the campus resulted in the formation of a new transverse axis (Lemmens, C. et al., 2007).

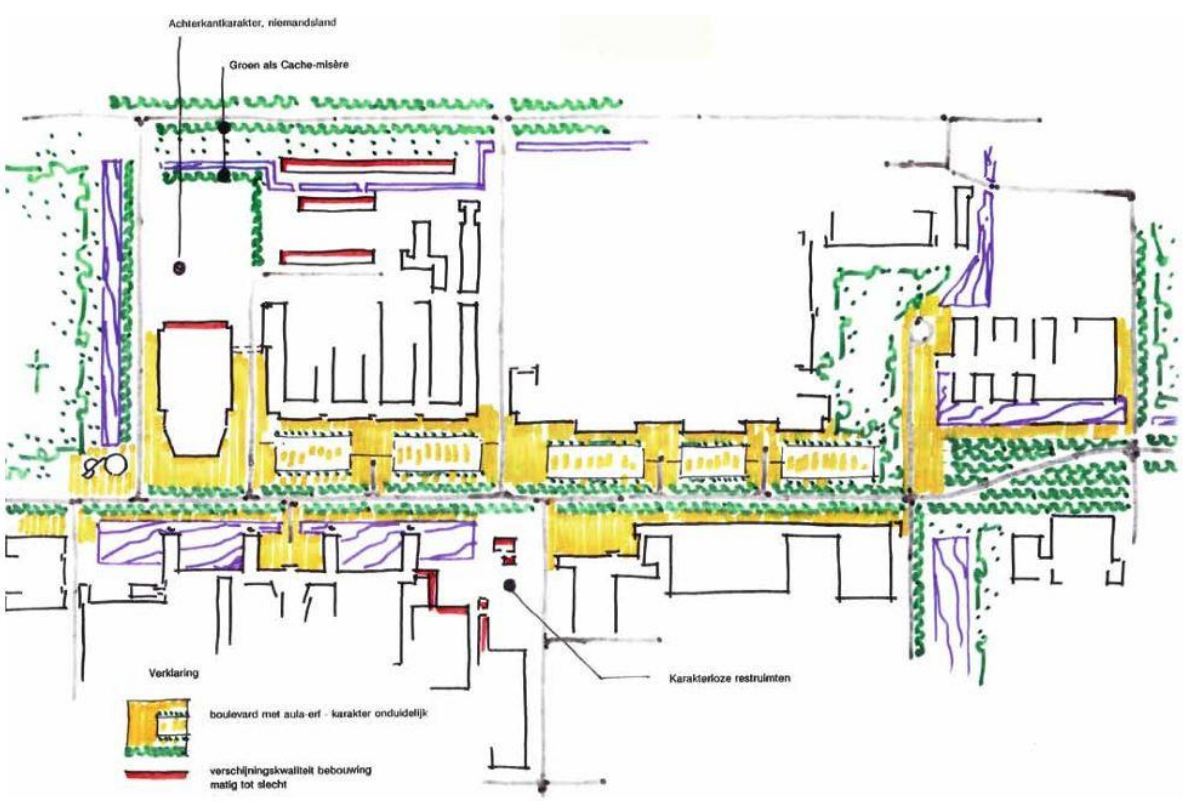

Figure 27 Sketch by Mecanoo showing the chosen plot, referencing the 'rear character', where the new library would rise (source: Architectuurarchief TU Delft, n.d.)

The brief at the time called for a preliminary study and creating a draft sketch (schetsontwerp). A competition had been launched and Mecanoo was the winner. In terms of technical scientific information, the library was regarded as one of the leading libraries in the Netherlands. This was reflected in the number of visitors, one-third of whom came from outside the university. A service with unusual opening hours was proposed, from 9-22:00 for borrowing books and until midnight for study places. The library's accessibility and efficiency should ensure the best possible service. The design was proposed as a flexible variation on the classic 'traditional' set-up of a university library (study rooms, offices, storage and archive), with the entrance hall serving as the fourth component. A hall equipped with a lending and information desk, terminals, copying machines, and coffee machines (Lemmens, C. et al., 2007).

The brief required a pleasant living space for the site layout. Mecanoo solved the 'problem' of urban planning by denying the library as a building (see Figure 28). They hid the library beneath a green grass roof to avoid confrontation with the auditorium (Figure 29) and 'pierced' a cone through the grass roof as a symbol of technique, but also of rest and contemplation. Like a drawing pin, it pins down the 'infinite form of the landscape'. The public-access storage rooms were combined with a large study environment within the cone (Figure 28) which was built around a vide spread over four stories (Lemmens, C. et al., 2007)

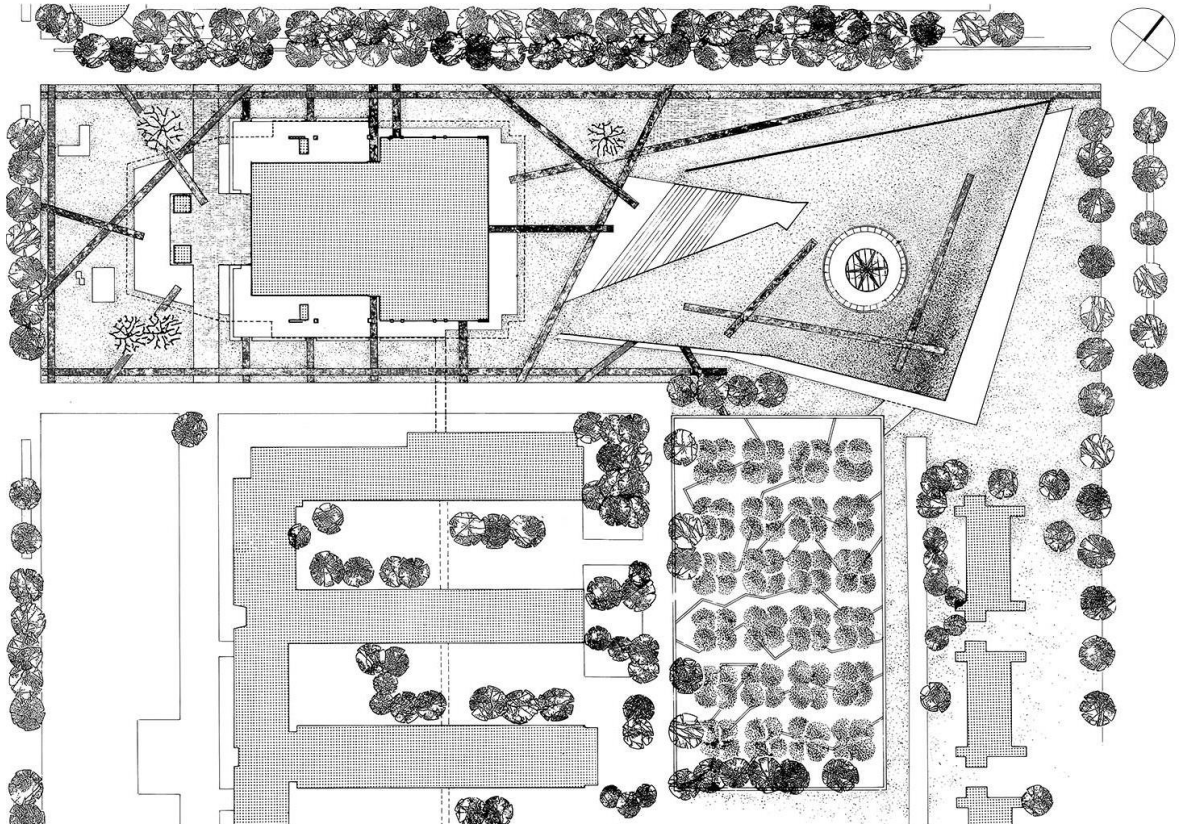

Figure 28 Situation drawing, the auditorium (left) in relation to the library (right) (source: Mecanoo, n.d.)

Francine Houben, co-founder of Mecanoo, originally envisioned the building full of books and cosy reading areas. However, practical constraints confined all books to a storage, accessible only on request. This gave the impression of a bookless library. The dream for the area around the new library was to create a vibrant campus with green lawns, trees, and spaces for students to gather. Yet, an imposing auditorium by Van den Broek and Bakema dominated the area. Houben envisioned turning the new library structure into a fusion of grass and glass, aiming to make it a part of the landscape where people could walk, relax, and read. The transformation was driven by a desire to create a space that resembled more of a natural landscape than a conventional building. Houben's personal

experiences as a student in Delft inspired this innovative design, aiming to unite students across disciplines within a welcoming campus setting (Houben, 2004).

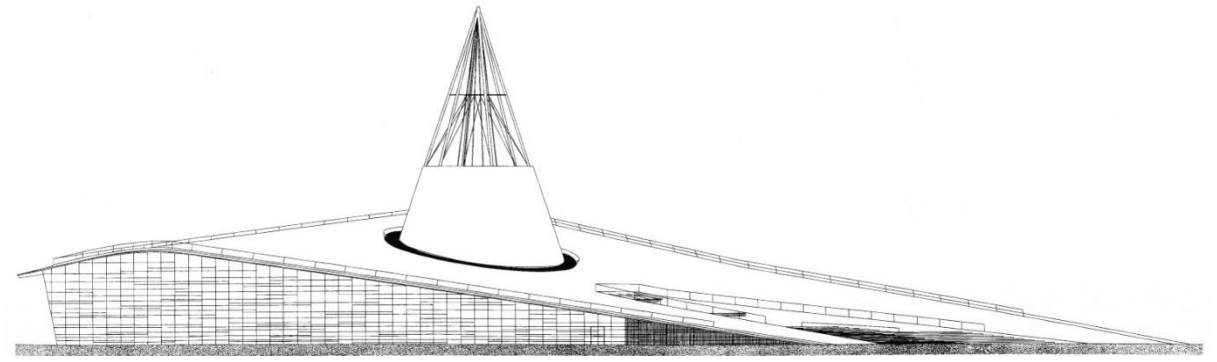

Figure 29 View of how the library is hidden under a grass roof to blend with the landscape (source: Mecanoo, n.d.)

Transformations library - Library Learning Centre as Centre of Belonging

As the library has been in use for the longest time compared to the other cases (since 1997), it is the only case that has undergone multiple transformations and thus moved with the changing context, the most important transformations are discussed in this paragraph. The redesign and refurbishment of the TU Delft library (TUL) took place in two phases, phase 1 called 'fast and visible' from 2008 to early 2009 and phase 2, called 'structural and sustainable, from 2009 to 2010.[13] These transformational ideas came into being after the year 2000. A team of policy staff members from BTUD (library) were at the time working on a large, long-term reorientation programme from the traditional "silent old-fashioned library" to the contemporary "student-centered workplace." In order to gather ideas for the transformation, the project manager and interim librarian visited more than 20 libraries worldwide (Interview E, 2023).

In 2007, when the building had only been in use for 10 years, it was inevitably clear that new demands were being made on the teaching and research environment, and the TU Delft Library (TUL) wanted to adapt its services and the physical space(s) to the new needs. The question that was at the heart of the transformation at the time can be summarised as follows:

Shift in user requirements

Our students, one of our most important customer groups, bring with them constant innovations and challenges. What is the purpose of the library for Homo zappiens[14]? We know that the unique quiet of the library is still important, but so is collaboration on projects. Working with the latest technology is also essential. Furthermore, the library should be a place where people want to visit, stay, and create. The library should serve as a place of belonging.

Source: TU Delft Library Centre – Inform, reform and transform (internal document, n.d.)[15]

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13 Extracted from: Project plan *Library Learning Centre (*September 2008)

[14] Term introduced in the Netherlands by Wim Veen in 2006, full professor in emeritus status in Education and Technology at TU Delft. Homo zappiens are generation of students (learners) that exploits the consequences of the reduction of scarcity of information, communication, and presence

[15] This internal document was written by the interim librarian at the time, Wilma van Wezenbeek, and is based on the presentation "21st Century Libraries: Changing Forms, Changing Challenges, Changing Objectives", 8th Frankfurt scientific symposium, November 3-4, 2008, Frankfurt, Germany.

According to Veen (2006), students at that time were Homo Zappiens, who stated that school (university) is more for meeting friends than for learning. In 2010, the central library was renovated and transformed into a Library Learning Centre: a place for study, research, and the exchange of knowledge based on future academic requirements. (Curvelo et al., 2017). The building is the centre of the TU Delft and functions as a campus landmark. The university library features good places to study individually, project rooms for group work, places to relax, and stimulating activities, like the different symposia that one can attend, also as a non-student or employee of the TU Delft. This shows that the library is an important link between education, research, and society through its activities, which often have a current social topic as their theme to debate. The ambition in the transformation is for the Library Learning Centre to be a building that is the continuous factor in the 'life cycle' of the 'user' (see Figure 30).

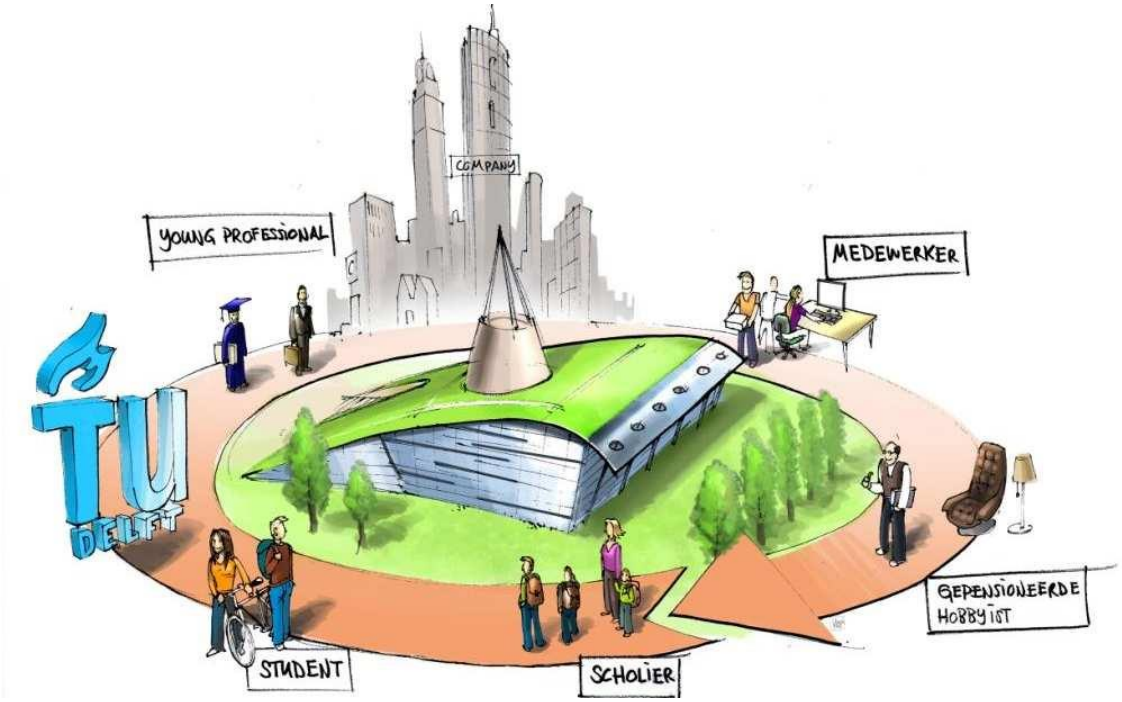

Figure 30 Library Learning Centre as 'Centre of Beloning' (Source image: Guido Kuip for TU Delft, 2007)

Functional spatial layout | Architectural appearance | Interior

As mentioned in the beginning of this paragraph, TU Delft Library is a building that aspires to be a landscape rather than an actual building. The lawn is lifted at one point and supported by columns, much like a sheet of paper (see Figure 31).

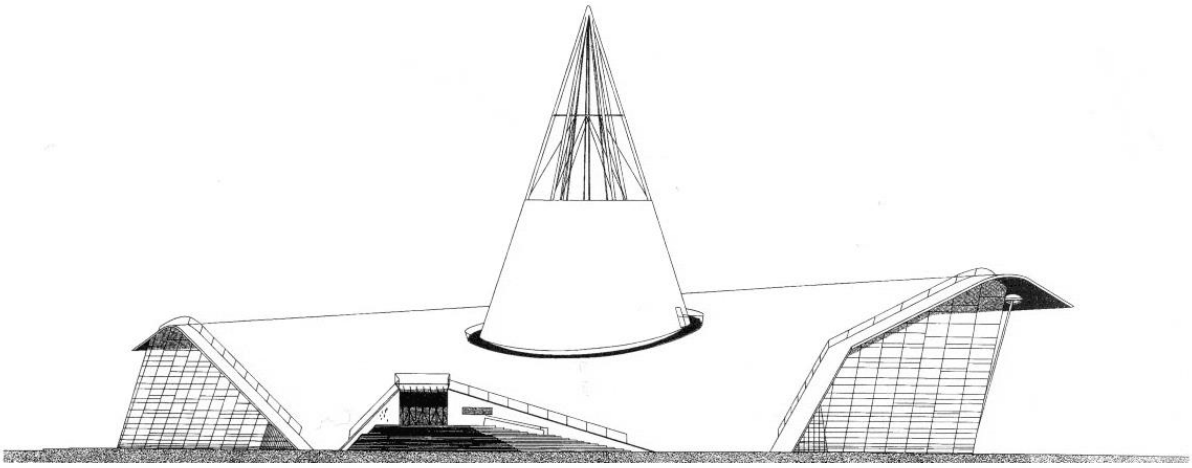

Figure 31 The 'lifted lawn' which flowing but interrupted by the steps leading to the main entrance (source: Mecanoo, n.d.)

In terms of interiors and look and feel, Houben wanted to achieve the following: (…)*''You had to feel the landscape inside too. The enormous expanse of the floor has literally the colour of the Sahara. The blue wall with the suspended bookcase has the presence almost of a stage-set (Figure 32). In Figure 33- you find a good example of the spatial experience of the large central hall beneath the curved roof. Dynamic architectural spaces with the character of urban exterior spaces such as squares and boulevards. The hall is presided over by two elements: the cone poking through the roof and the vast steel "bookcase" or open book depot. Reading rooms are slung from the tip of the cone, making the hall an enormous column-free space. The large circulation desk in the hall is the central hub of the library, for enquiries, research, and the issue and return of books* (Mecanoo, 2000).''[16]

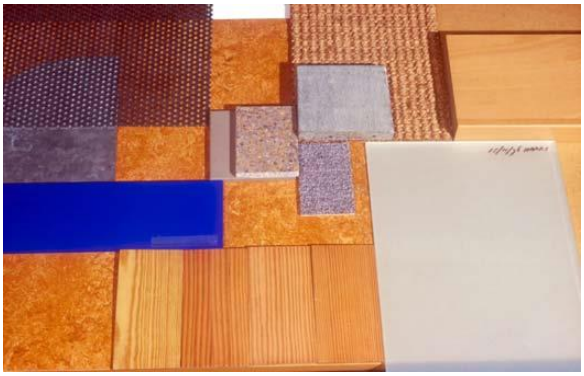

Figure 32 The chosen colours and materialisation that are a reference to natural elements (source: Mecanoo, n.d.)

Figure 33 ''The square''; an enormous colomn-free space (source: Mecanoo, n.d.)

[16] Quotes about the building come from Mecanoo architects, "Delft University of Technology Library", 010 Publishers, Rotterdam 2000.

4.3.2 Case II - Pulse (2018)

Facts and figures	
Architect	Ector hoogstad architecten
Discipline	Architecture
Typology	Generic educational building
Size	4.700m^2
Start project	Q2 2014
Design	Q4 2014
Implementation	Q3 2016
Building completion	August 2018

Type study place	Distribution
A (Silent study places)	-
A2 (Silent study places with PC)	-
B (Touchdown study places)	82.1%
C (Meeting places)	17.9%
Mixed (Mix of A, A2, B or C)	-

Introduction

The initiative to build the first generic educational building was motivated by three factors: student growth, educational development, and an attempt to improve efficiency. Each of these factors influenced the context and served as the motivation for this new building type. In particular, the student population's growth is an increase in the number of freshmen and an increasing number of student progression to master's degrees. Pulse could be interpreted as a result of the former 'Learning Centre' concept, which has been first applied with the library and its transformation in though the definition of learning centre has evolved, changed, and eroded over time (interview E, 2023). Although the spirit of the times has changed, it has many characteristics that have been applied in library transformations, as highlighted in the previous section.

As the didactic learning environment changes, the generic educational building must be adaptable to pedagogical innovation, new forms of (blended and digital) learning, and new principles such as the flipped classroom. This flipped classroom concept is based on the idea that there are more efficient ways to use class time than one-on-one lessons or 'traditional' lectures ('zenden' in hoorcolleges). Instead, student learning takes place outside of class, freeing up classroom time for tasks that call for more intricate cognitive processes. In summary, the main idea behind the creation of this new generic educational building is to provide a possible answer to the problem of quantity[17] and to afford flexibility in terms of faculty occupancy and building configuration. Although Pulse's lecture hall capacity is meant to be supplemented, it also offers more study spaces by opening its lecture halls during exam and white week.[18]

Urban integration

Pulse (building A) is part of the Learning Environment[19], which is actually one axis. The Learning Environment consists of the auditorium (building B), the library (building C) and a part of the faculty Industrial Design. The public space of this area is of great importance and is formed by the green space in front of the Library and the auditorium, a part of the Mekelpark and the square in front of Pulse. This public space is enhanced by an 'urban' square where the square walls are closed by Pulse and Coffee & Bikes (see Figure 34). The way how Pulse is positioned connects to the to the buildings next to it, the faculty Industrial Design and 3mE (see Figure 35 and Figure 36). The urban plan (stedenbouwkundig plan) for TU Delft distinguishes between three areas (‘zones’) on campus: TU City, TU Science and TU Business (visie stedenbouw en architectuur, 2014). Pulse is realised in the TU science area, and thus extended the Learning Environment axis (see Figure 38).

[17] The vision and the programme of requirements for Pulse make it very evident that students are supposed to use Pulse for scheduled instruction and classes. For self-study, working and collaboration with project groups, studying for exams, they should visit the library (extracted from: Internal document, Programma van Eisen Pulse, n.d.).
[18] Self-study places in Pulse are seen as ‘secondary use’. The halls and spaces in Pulse are primarily designed for ‘activating’ and scheduled education (extracted from: Internal document, Programma van Eisen Pulse, n.d.).
[19] It is TU Delfts aim to provide a concentration of educational facilities for all faculties in this area.

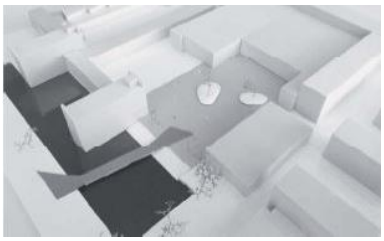

Figure 34 Embedding in the environment, location (source: Ector hoogstad architecten, 2015)

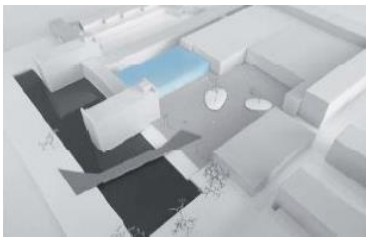

Figure 35 Connecting volume between IO and 3mE (source: Ector hoogstad architecten, 2015)

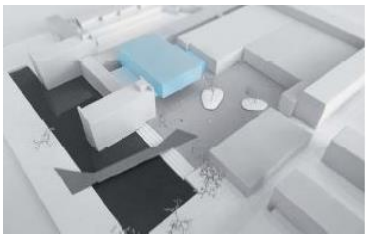

Figure 36 Connecting volume with building 7 (source: Ector hoogstad architecten, 2015)

The entire Learning Environment is devoted to education and development, allowing for students' optimal academic and social development. It is an environment different from the faculties where cross-pollination (kruisbestuiving) between students and professors occurs (see Figure 39 and Figure 41) (TU Delft, 2014).

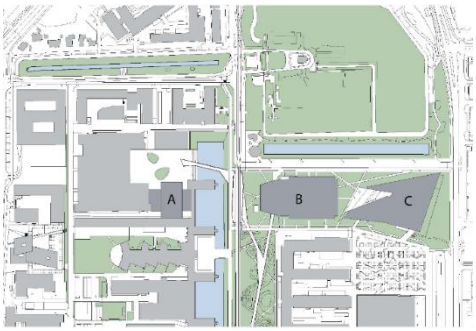

Figure 37 The learning Environment axis with an addition of building A: Pulse and the connection between B (the auditorium) and C (the library) (source: Ector hoogstad Architecten, 2015)

Figure 38 Fitting in with the surroundings: impression of Pulse, the learning environment axis and the square (source: Ector hoogstad Architecten, 2015)

Education and study places

As explained before, Pulse is not primarily intended to provide self-study places. Initially, the Programme of Requirements (2014) describes the various types of education and states that Pulse intends of stimulating education. Under the guidance of teachers, students are given the opportunity to acquire knowledge and grow through various activating forms of work in an activating education. This is based on interaction, guidance, and expertise. This may be accomplished through interactive working lectures, flipped classrooms, video conferencing, or studio classrooms. Interfaculty courses are scheduled in the building, and when students and professors finish their classes, the building facilitates meetings. This is accomplished by incorporating numerous seating areas and corners throughout the building (see Figure 40 and Figure 43), as well as by displaying inspiring images or configurations of TU Delft. Pulse is a social hub where one can always be surprised by diverse and new viewpoints, promoting academic growth (TU Delft, 2014).

Figure 39 Pulse supports activating forms of education (Source: TU Delft, 2014)

It provides a stimulating educational environment at TU Delft. This implies that the building must have extended hours of operation in order to optimally meet the needs of a large population. This includes professors who teach there between 9-17:00 as well as students looking for places to study until late at night in the weeks preceding exams and evening training sessions for professors. In addition to sufficient facilities, users demand an inspiring environment in which they can study and meet. The concept being pursued is a living campus (see Figure 40 and Figure 41).

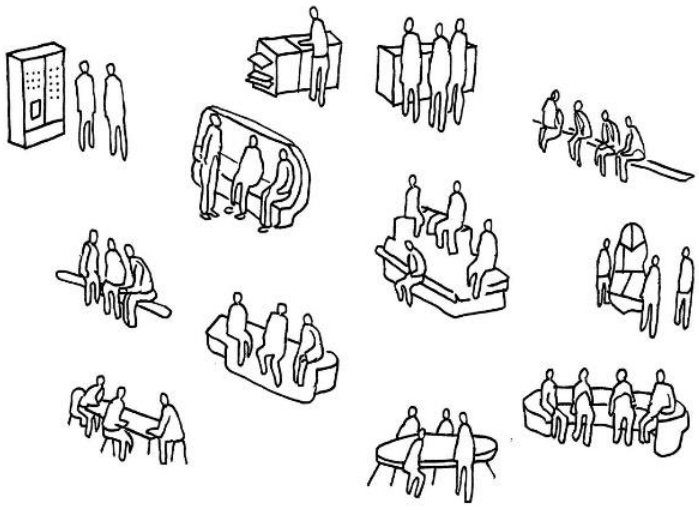

Figure 40 Sketch for informal meeting places for social gatherings in the building (Source: TU Delft, 2014)

Functional spatial layout | Architectural appearance | Interior

The building's appearance is inviting and approachable to visitors. This is reflected in the variety of meeting places and the use of colour. Light and transparency (Figure 41- Figure 43) are central to this, promoting a pleasant environment for teachers and students. The study places visible in these images are category type C: Meeting places. This are multifunctional places for various social encounters, such as informal meetings or conversation. Such a study place counts half a study place for capacity planning.

Figure 41 The large stand can be used multifunctionally. For (informal) lectures, meetings and during breaks for lunch (own image)

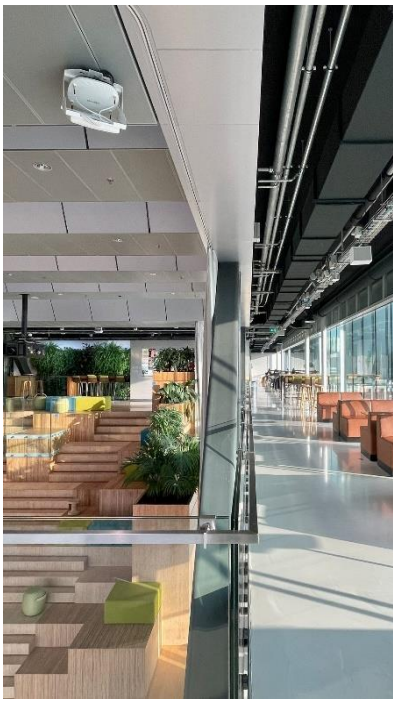

Figure 42 The transition between study places and open space that can be separated by a partition (own image)

Figure 43 Seating near coffee corners allows students to take a study break together (own image)

Daylight is something that is very central at Pulse. You feel it immediately when you walk through the building, especially on the higher floors. Personally, I experience it as the higher you get in the building, the more the building opens up and the more transparent it feels. The fact that the (few) self-study places present in the building, self-study places for secondary use since the rooms are primarily used for activating education, are mainly located on the facade helps.

> *''The sun-oriented programme creates a pleasant atmosphere. From the entrance hall, take the main staircase to the light. The north-east façade protects the teaching rooms from sunshades and harsh sunlight. Here, maximum daylight creates pleasant study areas. Skylights and the large square window let in evening sunlight. This makes it pleasant at night and allows for studying, philosophising, or having a coffee in the sun.''*
>
> (Quote adapted: shortened)| Ector hoogstad Architecten

The façade of the building is divisible every 3.6 metres, which ensures building flexibility, which was also one of the main objectives in the programme of requirements. Due to the lack of columns, the building can accommodate standard instructional furniture arranged in different ways in the teaching halls. Furthermore, the selected support system guarantees that surfaces can be made open or closed at any time. This can still be modified should the building's purpose change in the future (TU Delft, 2014).

The building is envisioned by Ector hoogstad Architecten to be roughly divided into two sections (see Figure 44) "Communication and meetings" are located on the ground floor, while "study and concentration" are located on the upper floors.

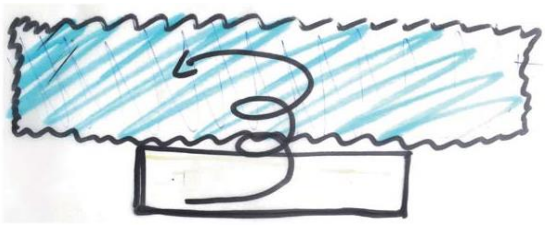

Figure 44 Concept diagram Pulse (source: Ector hoogstad Architecten, 2015)

Since the ground floor is mainly public domain and therefore the most vibrant environment with more pronounced colours and materials, the upper floors are quieter, with an emphasis on activating education and individual and group study. This is visible in the chosen colours and materials (see Figure 45 - Figure 47).

Figure 45 Ground floor - on the ground floor, the base is complemented by a natural stone floor and warm colourful tones in the hospitality units and loose furnishings (source: Ector hoogstad Architecten, 2015)

Figure 46 Base pallet - Natural and neutral materials are used for the base of the building are used. Such as metal, clear/translucent glass complemented by a wood finish (source: Ector hoogstad Architecten, 2015)

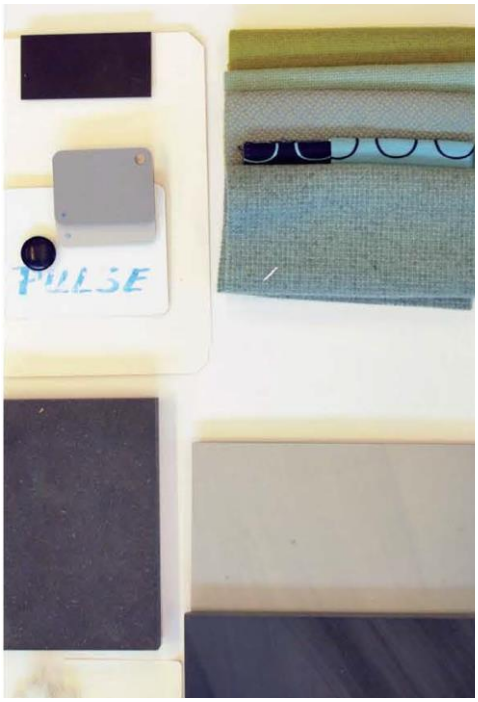

Figure 47 Floors - On the floors, the base is complemented with grey cast floor, and light writable whiteboards and blue-green tones for the interior (source: Ector hoogstad Architecten, 2015)

''Unlike traditional campuses that operate in silos, the future campus needs to be programmed with agile spaces that invite students and faculty to learn, collaborate and co-create. As student numbers continue to grow, educational buildings need to be extremely flexible, to operate through a model based on shared interfaculty use that can promote a more generalist education.''

Ben van Berkel l UNStudio's Founder and Principal Architect Echo

4.3.3 Case III - Echo (2022)

Facts and figures	
Architect	UNStudio
Discipline	Architecture
Typology	Generic educational building
Size	8.844m^2
Project Design	2017-2022
Building completion	2022

Type study place	Distribution
A (Silent study places)	17.7%
A2 (Silent study places with PC)	-
B (Touchdown study places)	57.0%
C (Meeting places)	25.3%
Mixed (Mix of A, A2, B or C)	-

Introduction

Back in 2013, the TU Delft campus vision was adopted, and the policy included the need for more study spaces. This established the goal of having enough high-quality facilities (teaching rooms and study places) on campus to accommodate the student population (by creating 10% more places). For the time being, it was assumed that these facilities would primarily be realised in faculty buildings. However, the student population has grown to the point where this was no longer feasible. According to the forecast (December 2015), there will be 25.000 students in 2025 (TU Delft, 2016).

A programme of requirements had been established in collaboration with Twynstra-Gudde, an organisational consulting firm. The development of new generic educational building (back then: New Education Centres aims to achieve the following objectives (TU Delft, 2016):

1. Additional room capacity to serve the growth of the student population
2. Realise teaching capacity in line with the desired quality as described in the cookbook
3. Alignment with TU Delft's real estate strategy
4. Connection to TU Delft's campus vision.

According to the brief (2016), the contextual environment was as follows: there was a desire for a vibrant learning environment[20] with central educational facilities. It should function as an autonomous teaching facility with meeting space for students from all faculties. In contrast to Pulse - where the design focus was on complementing the lecture halls an teaching facilities on campus - Echo was also realised for students to come - and stay - to study. Furthermore, the new generic educational building had to respond to the growing student population, which was expected to increase from 21.000 (time of the brief, 2016) students to 25.000 students in 2025.[21]

[20]The motto by which TU Delft strives to educate its students is ''Development of students into creative, critical and social engineers''. Thus, as it was in 2016, it continues to be so in 2023 (TU Delft, 2016 and TU Delft, 2023).
[21]This was a prediction, but the limit was already reached in December 2019: there were 25.130 students at the time (TU Delft facts and figures - student population, 2023).

Urban integration

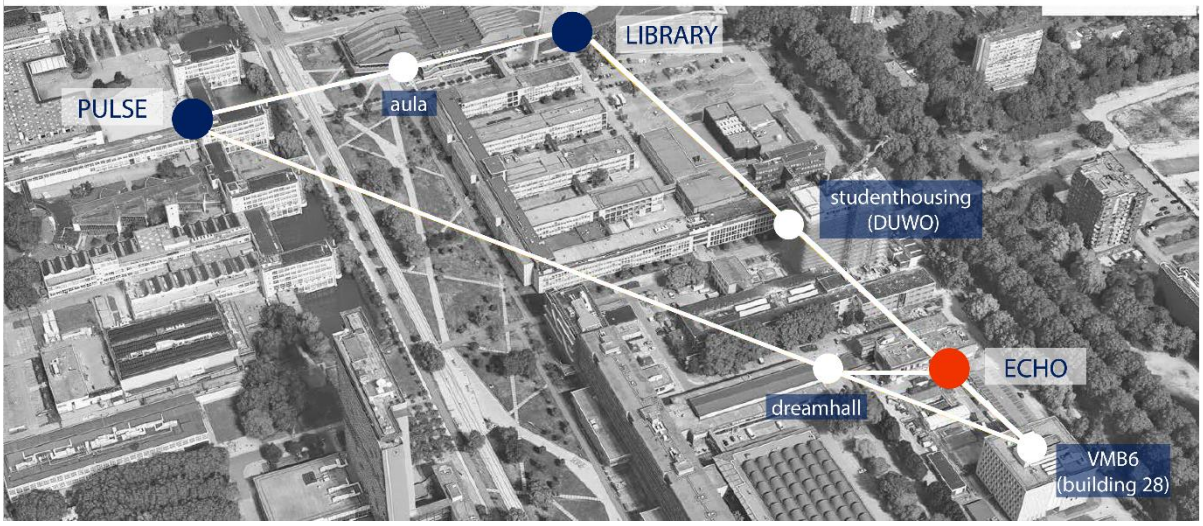

Figure 48 Position Echo with respect to the nearby buildings and zoomed out to the other cases (adapted from: UNStudio, 2018)

The goal of Echo's (2018) final design was to integrate with the Stevin area and its surroundings and functions. The dreamhall, Duwo's student housing (Stieltjesweg), and VMB6 (building 28, which is internally connected as well to Echo), are all located in the same area (see Figure 48). By arranging the building in a way that aligns with the campus plan's orthogonal structure, the sightlines have been respected. Echo in order positions itself in between this rectangular structure (TU Delft, 2018). The transparent facades of the building opens up on two sides, namely to the Stevinplein and also towards the Schoemakerstraat. UNStudio wanted Echo to be open and approachable from all sides, so they made the building resonate in both directions . The transparency and openness of the facades ensure that the building engages with Stevinplein and its surroundings (see Figure 48 and Figure 49).

Figure 49 Axonemetry (source: UNStudio, 2018)

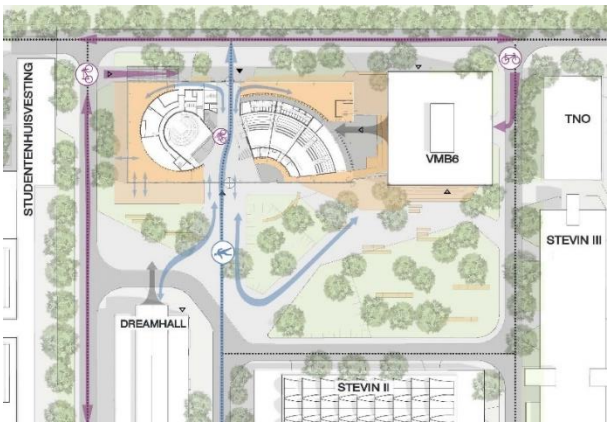

Figure 50 Primary routing (source: UNStudio, 2018)

Study places

Type A study places in Echo are designed for long-term study, such as studying the whole day. These study places are for independent study (zelfstudie). Work is done quietly in these areas, and there is no room for meetings or discussions (see Figure 45). Some type A study places will have screens/computers (1:6 in Echo). Half of the study places (type A) will be in quiet enclosed areas, while the other half will be in quiet areas throughout the building. All workplaces have access to natural light (TU Delft, 2016). Type B study places are designed for short-term study. These are settings for independent study or project-based self-study (in groups or alone, see Figure 52). The places are suitable for consultation, but with consideration for other users (gedragsregels). Type C study places are intended as multifunctional workstations and meeting places. In these spaces, students can meet, consult, as well as eat & drink. They are not functional workstations, but seating areas that include internet and power facilities so that work can also be done (see Figure 53). Consultation and sound are allowed. This type C also combines well with the catering facilities, which is also realised in Echo on the ground floor. Each meeting place counts as 0.5 study workspace. As a result, 120 study type C places are included in Echo (TU Delft, 2016).

Figure 51 Type A study places on ground floor, facing the Schoemakersstraat side (own image)

Figure 52 Type B study place on first floor with a possibility to use it individual or for group work (own image)

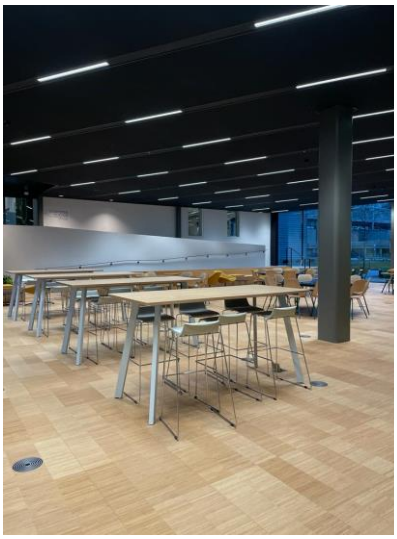

Figure 53 Type C study places on ground floor, where meeting and having lunch is possible (own image)

Functional spatial layout | Architectural appearance | Interior

Figure 54 Selected colours and materials (source: UNStudio, 2018)

Vibrant spaces that aren't overwhelming or distracting can be achieved with a soft, serene background that serves as the ideal, adaptable, and timeless backdrop for furniture and signs (bewegwijzering) (UNStudio, 2018). This is also visible in the colour scheme that was selected (see Figure 54). The building features a large open square for the reception area, which draws the eye directly to the extravagant staircase and should inspire movement.

4.4 Conclusions case studies

TU Delft Library, Pulse, and Echo were designed in different contextual environments and periods, although with some overlap in their ambitions. Consider that the buildings should offer flexibility, to accommodate both current and evolving educational forms. Some degree of future-proofing to enable space to be re-allocated and reconfigured to respond to future changing didactic forms of education. They should also promote creativity; to energise and inspire students and teachers. These principles correspond to what was pursued by JISC and underpinned the first major transformation of the library (see 4.1 Towards generic educational buildings).

The TU Delft Library (Mecanoo), established in 1997 and thus the oldest case in use, underwent several transformations to meet the demands of the present time to evolve into a Library Learning Centre and how the Library is used nowadays. Pulse (2018), designed by Ector hoogstad architects, focuses on accommodating student growth and pedagogical innovations as part of the Learning Environment, notably by adding lecture halls, the building had no intention from the outset to provide additional study spaces. Echo (2022), designed by UNStudio, complements both study places and lecture halls and is thus a response to the growing student population, emphasising the provision of study places in a vibrant learning environment. While Pulse and Echo both bear the definition of generic educational buildings, the library is the only one that is not an official generic educational building, since there is no scheduled education nor lecture halls. Nevertheless, all the cases have many similarities and can actually be said to be reactions to each other.

The similarities in terms of urban integration are that all three buildings are carefully integrated into the campus environment, with attention to sightlines and interaction with the surrounding space. In terms of flexibility there is a shared emphasis on flexibility in space use, with the buildings adapting to changing needs in the educational landscape.

The following are the architectural design distinctions: The TU Delft Library has an eye-catching green roof and is located underground. Pulse values lightness and transparency, whereas Echo values openness and connection to the environment. The only case that has undergone significant transformations to become a Library Learning Centre is the TU Delft Library. Pulse and Echo were created with changing educational needs in mind, but they have not undergone major transformations like the library. This is because, unlike the library, these generic education buildings are still relatively new (2018 and 2022).

Summarising

I think there is a difference in a library (case I) transformed into a public attractive informal gathering and learning space and an originally intended generic educational building (case II Pulse and case III Echo) with both formal teaching rooms and informal collaborative and different types of study places (from A to C). At the same time, I find that every case examined can be characterised as a modern *interpretation* of the initial concept of a learning centre from around 2000. When there isn't any instruction going on, students can use the formal classrooms as study places. Generic educational buildings serve as both teaching and learning centres. These educational buildings seem to better fit the contemporary and future vision of study places.

Taking chapter 3 (theoretical background) and the case studies into account, a final note would be that the cases are a welcome addition to the faculties but cannot replace them in terms of shaping students' identities and the importance of community building.


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PART 5 | INTERVIEWS

5.1 Semi-structured interviews

The figure below was created to help clarify the relationship between the sub-research questions, the interview questions and the DAS-frame. It is critical to understand that the order of the interview-questions (IQ) mentioned in the figure is not chronological, but is linked to the sub-research questions for which the order and positioning are important in relation to den Heijer's DAS. The simplified DAS frame representation in Figure 55 below is only meant to show their position and sequence.

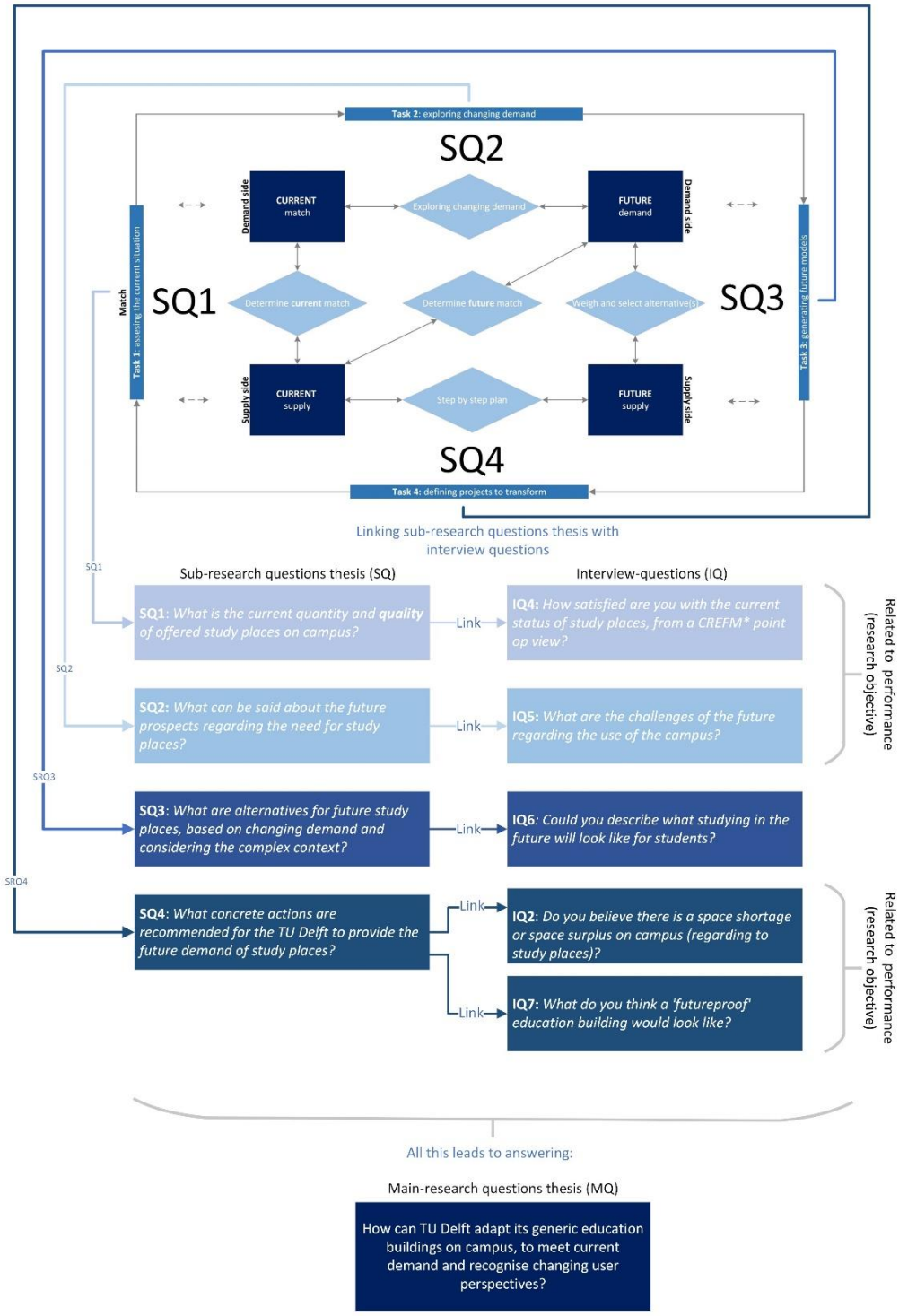


Figure 55 Linking sub-research questions thesis with interview questions (own figure)

5.1.2 Participants

All participants are listed in Table 14. Participants are divided according to their profession, expertise, and thus perspective, based on Den Heijer's four perspectives (for more in-depth information, see 2.3 DAS Framework and 3.2 Real Estate Management and campus management). A participant is classified as CREM if he or she has knowledge of all four perspectives. A good example would be a campus manager. Table 14 shows a visual representation of the classification. The number of participants per perspective is indicated by Roman numbers. There are participants that have contributed to (the policy of) the TU Delft library and/or the generic educational buildings, but there are also participants that are not related to one particular case study.

	Profession	Perspective
A	Visiting lecturer and former vice president of an international university	Functional - user
B	Manager Campus Strategy	All
C	Architect new generic education building (TU Delft campus South 2027)	All
D	Policy maker	Strategic – policy maker
E	Education expert AV-IT in teaching and learning spaces	Physical – technical manager
F	Senior business controller	Financial - controller
G	Program manager sustainability	Physical – technical manager
H	Education housing advisor	Functional - user
I	Assetmanager education spaces	Physical – technical manager
J	Student counsellor	Functional - user

Table 14 Participants of the interviews with their profession and perspective (own table)

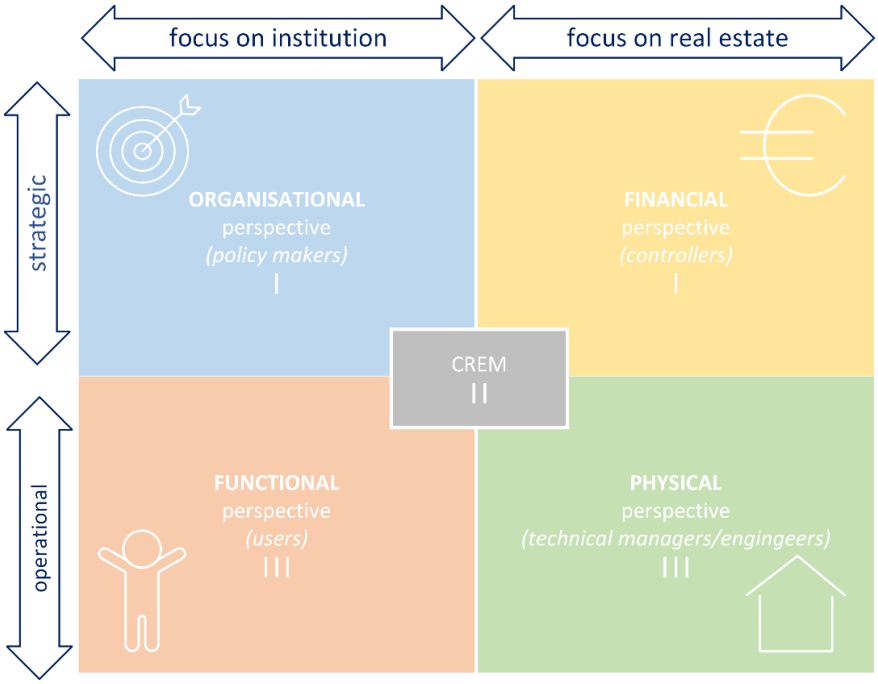


Figure 56 Division of participants per perspective according to Den Heijer's four perspective model (source: adapted from Den Heijer 2021)

Participant A
The participant is a former advisor to the president of a European University and a graduate architect. She talks about her role in the creation of new campuses and the design of various buildings. The participant also discusses her experiences at various campuses, including MIT, Harvard, and TU Delft. She is a visiting professor at TU Delft in the field of Architecture

Participant B
The participant works in the CREFM's Strategic Portfolio Management (SPM) department and contributes to campus strategy, particularly portfolio management. The campus strategy is updated on an annual basis, but the topics of hybrid working and multi-campus strategy require a year of in-depth research before the 2024 update.

Participant C
The participant is a senior architect and involved in the design of the new generic education building on the south side on the TU Delft campus. The participant previously worked on similar projects such as the Neuron building in Eindhoven and the new university building for the VU in Amsterdam and has a lot of knowledge on campus design and (generic) education buildings.

Participant D
The participant is a policy officer at CREFM and has been there for about ten years. CREFM is concerned with portfolio management, campus strategy, and policy on teaching and learning spaces. The participant has also engaged in hybrid work and works on (tangential) policy themes such as TU's hospitality policy, student housing, and policy application in projects.

Participant E
The participant is an expert on the future classroom. He is a Learning Spaces expert who has worked as a management consultant for various organisations for over 25 years. He has participated in strategic studies and applied ICT for business communication and collaboration within complex organisations and organisational settings.

Participant F
The participant is a senior business controller with a strong background in strategy development & implementation, business economics and finance. He deals with the financial aspects within CREFM and tests the financial feasibility of various projects.

Participant G
The participant develops, monitors and implements campus strategy tools to ensure campus sustainability. The participant worked to integrate sustainability principles into the campus strategy and secured [a large sum of money] for sustainability projects on campus until 2030.

Participant H
The participant is a highly experienced professional with decades of experience in education at TU Delft, both in the development and management of teaching spaces and study rooms at the university. He was a co-author of the *cookbook Education Spaces* (2018).

Participant I
The participant is accommodation advisor at TU Delft's Department of Education Student Affairs, responsible for the quantity and quality of teaching and study spaces on campus. She was also a co-author of the *cookbook Education Spaces* (2018).

Participant J
The participant is a student advisor at the Faculty of [faculty at the TU Delft]. Since the participant was employed prior to the COVID-19 pandemic, she can make accurate statements regarding the welfare and desires of students before, during, and after this period. She is also involved in topics such as the university's duty of care, the undergraduate curriculum renewal, the conference for student advisers, the disability advisory group, and initiatives such as Let's Talk, the student portal, and capturing organisational processes through various working groups.

5.1.3 Results semi-structured interviews[22]

IQ2: category Use of space

Participants' views on the question if there is a space shortage or space surplus on campus, regarding to study places.

General remarks

For the first time, a hybrid component has been adopted for the campus strategy. The investment programme is 10 years. If a hybrid component would not be applied, there would be a shortage by 2031 (B). There are 6.000 study places that are always available and with 28.000 students, the ratio is 1:4 (1 study place per 4.67 students) During exam periods, 4.000 additional places are added which amounts to a total of 10.000 study places (1 study place per 2.8 students) (D). Sometimes it is in the faculty's interest to go a bit overboard to get something done, with this, faculties will be more likely to talk over a shortage (C). Although many study places are available, the average occupancy of the self-study places, which are supposed to be the most popular spots, is disappointing. During the busy periods, the 'white week before exams', the occupancy rate from Monday-Friday from 9:00-17:00 is less than 50%, while you would expect 75% (D).

Answers, stating that there is a surplus:

- A surplus, you can always find and invent spaces. You have to think in volume, because then you can divide up spaces, not just square metres. The answer 'both' does not exist, the more space we have, the more we will fit it in, in a way (A).
- Currently, there is a surplus of study places on campus. We have a very high ratio comparing to other universities (D).
- For 2028, I predict we will have a surplus. For the whole campus strategy, you look at a period of over 30 years. So at what moment in time you look is also important (F).
- There is a surplus, so there is room to densify. There needs to be smarter use of space allocation, it needs to be more flexible. Smart campus tools are a solution for the future in this (G).
- Definitely a surplus, the question is whether there are not too many study places. Students cry that there are no study places, but we have almost 6.000 study places. The discussion should focus on the quality requirements associated with the ABC categories, rather than the number (H).

Answers that stating that the answer is both:

- The supply follows the demand; right now, there is just enough; things like that take care of themselves. Looking at the new generic educational building in the south, new places will become available to meet demand (E).
- Can be reasoned in both directions; the starting point could be that need should be leading. There are many times during the week when it is extremely quiet, so it has more to do with the preferred times of both staff and students, as well as peak hours (I).
- It varies who you ask (J)

[22] The first interview question was left out since it was an introductory question. Therefore, the count starts with IQ2.

KEY TAKEWAYS:

IQ2: Do you believe there is a space shortage or space surplus on campus (regarding to study places?)

Key terms	Participant (linked to 4 perspectives)	Total
Space shortage	None	[0/10]
Space surplus	A, B, D, F, G, H	[6/10]
Both	E, I, J	[3/10]
No answer / don't know	C	[1/10]

Conclusion IQ2:

The majority of participants agree on the campus's space surplus, with 6000 study places available and even 10.000 during exam periods due to extra capacity. However, occupancy measurements show disappointment in study places, which could be addressed by increasing visibility and accessibility. If there are disagreements about the question if there is a space shortage or surplus, they should focus on *quality* of study places rather than quantity.

Recommendations for study-place strategy:

1. **Make the most of the existing space:**
   Think creatively about how we use the spaces we already have. Can we make them work for different needs throughout the day? This is to better accommodate peak hours on campus.
2. **Help students to find available study places:**
   Let's make it easier for students to know where they can study. Imagine having signs or an app that shows which spots are free or quiet at any given time. In addition, screens in coffee machines and TVs could also be used to provide a live indication. Smart campus tools are a solution to help students find the available study place they need.
3. **Focus on quality over quantity:**
   Focus on improving the quality of existing study spaces to meet specific needs and preferences. Where quality is now mainly traced back to quantifiable requirements, a more holistic view of what a study place should entail is needed. During exams and peak hours, there should be enough study spaces for everyone without compromising on quality.

IQ3: category Definition

Participants' views on what they understand by the term: study place

Terminology study place:

- Depends on discipline and study (A)
- Place where a student can land (aanlanden), and a place that is not classified as a teaching place. A place that cannot be reserved for business activities and nor has an office function. You must be able to concentrate with minimum noise pollution (B).
- Variety is key. A generic education building must accommodate multiple study spaces. Demand must match supply. With the advisory group (klankbordgroep), we saw many study areas, including old ones at technical sciences. I don't like those areas, but many students do. With architectural glasses on I might view those study places too critically (C).
- A study place includes different types: self-study places (category A), touchdown study places (B: aanlandplekken), meeting places (C). However, being able to study focused is an important

ingredient. If you as a student can study there and it is intended for that purpose, then it is a study place (D).

- Various interactions call for (new) study places. More attention may be paid to the international student. CREFM mentions study place type B, a different mix could and even may increase. So that especially the international student does not have to sit in his/her dorm room (E).
- A place where you can 'land' and study focused (F).
- A study place is a place where you can study quietly and concentrate and not be sent from place to place. The focus aspect is important (G).
- I don't really have an opinion on that, that's because I know what documents underpin it, such as the Cookbook Education Spaces. And yes, that is based on conversations with students and of course needs have already emerged from that. Well, the demand from students will always perhaps be just a bit greater than what we end up noting. Somewhere there is a limit at which we say, so far and no further (I).
- A study place is a place where a person can study in a concentrated way for an extended period of time. In this, I distinguish between an individual place and a group place, which in my opinion does not necessarily go together (J).

KEY TAKEWAYS:
IQ3: What do you understand by the term: study place?

Key terms	Who? (Four perspectives)	Total
Study and activity dependent	A,	[1/10]
Focus	B, D, F, G, H, J	[5/10]
Touch down study place	B,	[1/10]
Variety	C, D, E	[3/10]
No answer / don't know	I,	[1/10]

Sub-conclusion IQ3:

Focus is cited as the most important factor by the majority of participants, and it is often named in the same breath combined with the term "study place." It is also acknowledged that where you study, what you study and the type of environment you prefer are determined by the work to be done. There must be a variety of study spaces (categories A, B, and C), and demand must match supply.

Recommendations for study-place strategy:

4. **Acknowledgement of focus as 'crucial'**
   Prioritize creating environments that facilitate concentration and focus. Minimize noise pollution and distractions to enable students to study without interruptions.
5. **Focus on international students**
   More attention may be paid to the international student. Offer a mix of study places to prevent them from being confined to their dorm rooms for studying and to stimulate meeting and integrating on campus.
6. **Quality and quantity balance**
   Maintain a balance between focusing on the quality of study places and ensuring an adequate quantity to meet demand. Strive for excellence in the design and functionality. TU Delft should be a frontrunner in this.

IQ4: Category Current supply and demand

Participants' views on how satisfied they are with the current status of study places, from a CREFM perspective*

**If applicable*

General remarks Currently, study places in faculties are not under the management of CREFM, but the faculties manage the study places in their buildings.

- The 'ingredients' that belong to a study place are a focus of attention (B)
- In terms of quantity and facilities, satisfied. However, students need help with findability, availability (online) and visibility (localisation) (C)
- As for informal study places, some changes could be made. There are various interactions among students and they should be facilitated. The amount of the more ''social study workspace'' could increase (E).
- Satisfied from a financial point of view. No overdue maintenance at study places, quite the contrary (F).
- Outdoor space could be used more as a study place. A great opportunity for the future, which is also in the area vision, is to make the campus a place where you can meet each other in a *Beestenmarkt achtige* setting, terrace, lots of greenery, *reuring*, and a courtyard-like setting to study. But also focus spots in the middle of greenery, away from noise. Different people study quietly. Two green options to use outdoor spaces differently (G).
- Satisfied with current status. For the generic education buildings, I am absolutely content, but for the study places in the faculty buildings I have my doubts (H).
- In recent years, significant progress has been made. Many underutilised study areas have been improved or new areas have been created. We also get positive feedback from students, which is backed up by the fact that they sell out quickly. Many study areas on campus will still need to be improved, which is complicated by the fact that these areas are also managed by the faculties. As a result, we have no insight into it. A central line in the study areas could be an added benefit (I)
- Hard to answer, as students also study at other places like DOK in the city. I often give tips on where students can study on campus and then it turns out that some places are not known to them, which is interesting (J).

KEY TAKEWAYS:

IQ4: How satisfied are you with the current status of study places, from a CREFM point of view?*

Sub-conclusion IQ4:

In general, participants are satisfied except for managing study places. This raises discussion: The faculties and CREFM occasionally have difficulty communicating, and the data is not always updated: both not in terms of the numbers, set-ups and also the type of study place.
For students, visibility, availability and findability could be improved. There should be more social settings, as well as spaces for informal studying (category C). More outdoor spaces, especially quiet, green spaces, could be used as study areas with an emphasis on focus. While experts are satisfied with the state of study places in general educational buildings, they are uncertain about the state of study places in faculty buildings.
A possible solution would be to move from separate management of study places (by faculties) to a unified system (by CREFM). The benefits of efficiency, consistency and better quality from managing

these study spaces across campus are pointed out. The resistance of faculties wanting to retain control is acknowledged. Building trust and adopting a new mindset are advised to facilitate this shift. Rather than limiting management and enhancements to specific faculties, the goal is to establish a campus-wide system.

Recommendations for study-place strategy:

7. **Centralized management and oversight for study places**
   Advocate for a shift towards a centralized management system led by CREFM to ensure consistency, efficiency, and improved quality across all study spaces campus-wide.
8. **Collaborative approach with faculties**
   Collaborate with faculties to streamline the transition to a unified system, emphasizing the benefits of efficiency and quality improvements while addressing concerns about retaining some degree of local control.
9. **Facilitation of informal and social spaces and study places**
   Modify existing study places that are less popular in use or allocate new study places within buildings to facilitate informal interactions among students, also for the international students. Create more social study places to encourage collaborative learning and engagement. This could also be in outdoor space.

IQ5: Category Future supply and demand

Participants' views on the challenges of the future regarding the use of the campus

Future campus challenges

- The biggest challenge is the beautiful architectural buildings they have on campus, very valuable, significant and iconic. Environmentally, they are either monsters or very weak. That's the big challenge, how to keep them and convert them, not ruin their significance (A).
- A little overcapacity is acceptable but spread it out over the week. Personal growth should also happen on campus. Here you make lifelong friends and form networks. Work out, eat, the whole '*Bildung*'. That philosophy should apply to all workplaces, not just campuses. It is a challenge to facilitate this (B).
- Campus expansion and housing are difficult. When your city lacks student housing, issues arise on all sides. Living in the city where you study is part of the experience. In Delft, living in your study city should not be a luxury (C).
- Focus remains the challenge now and to come. How can you make a room quiet and have acoustic separations? However, students can choose to check their phones every two minutes. TU Delft/CREFM wants to make conditions as good as possible, but students are responsible for their own behaviour (D).
- Mono-disciplinary work is the past. Teamwork, interdisciplinary collaboration, and communication are essential for engineers today. Facilitating student collaborations like dream teams and spaces that facilitate this is the ultimate future challenge (E).
- TU Delft represents itself as a campus university. That will stay for meetings and collaboration. Although offline campus education is hard to estimate, you will always have a physical connection with the campus (F).
- Flexibility and visibility. That could be an app that shows you where it's busy and empty, giving you study-place options (G).

- Education is about to change. AI is advancing rapidly. That supports project-based learning and interdisciplinary collaboration. Project-based learning with complex problems that simulate real-life situations. I see education buildings becoming meeting places for project groups and teachers (H).
- Easy: student enrolment growth. The future will involve more projects. Many things will change with the hybrid component (I).
- Due to the high amount of stimuli people face, low-stimulation study areas for concentration are in demand. What happens to TU Delft's community-feeling when it expands across cities (multi-campus strategy) (J).

KEY TAKEWAYS:
IQ5: What are the challenges of the future regarding the use of the campus?

Key terms	Who? (Four perspectives)	Total
Architectural component	A	[1/10]
Focus / low stimuli study places	D, J	[2/10]
Increasing student numbers	B, C, I,	[3/10]
Spread peak hours	B, D, F, G,	[4/10]
Student housing (in Delft/on campus)	A ,C	[2/10]
Personal growth	A, B, I	[3/10]
Interdisciplinary / project education	E, H, I,	[3/10]

Sub-conclusion IQ5:

With the significant increase in student population, it is necessary to spread peak hours throughout the week. Teaching will become much more interdisciplinary and project-based as a result of the rapid development of artificial intelligence. Focus and low stimuli study places will remain important in the future too, given the many stimuli a human being has to process.

Recommendations for study-place strategy:

10. **Peak hour distribution: upgrading system**
    Encourage the distribution of peak study hours throughout the week and the whole academic year to alleviate overcrowding. Implement scheduling strategies or incentives to promote off-peak studying. For example, when studying outside peak-hours one may be entitled to a better study place (perhaps trace back to A,B,C terminology: from a C study place to A)
11. **Adaptation to interdisciplinary education**
    Design study places that accommodate the shift towards interdisciplinary and project-based teaching. Create environments that encourage collaborative learning and project work.
12. **Integrate technology for future learning**
    Incorporate technology into study places to support the integration of artificial intelligence into education. Provide spaces equipped with the necessary tools for interactive (in the future maybe AI-driven) learning experiences. A great example is the debating room in Echo.

IQ6: Category Future supply and demand - performance

Participants' views on how studying in the future will look like for students

General remarks: Hybrid education is now part of the campus strategy. This is still in its early stages, but a lot will change. It is necessary to implement hybrid education. The interaction of digital and on-campus learning will be fascinating. Allowing for both social buzz and no-wifi zones. If interfaculty communication can be facilitated in general educational buildings, so that businesses can be located there, that is truly the future.

The way students will study in the future:

- The digital environment is expanding. Digitalization is also beneficial. Ownership is essential: take control of your time and your life. The campus as an inspiration hub, rather than simply 'one way education' (lectures) (B)
- Each university has its own name for it, but it is commonly referred to as a 'multi-room' in generic educational buildings. In terms of functionality, you can give linear lectures (lectures) and collaborate in that space. That space allows linear lectures and collaboration. Lecturers struggle to switch between digital and live, so their perspective should be considered (C).
- The digital world is increasingly becoming part of your own. Balance between silence and social buzz is needed, and no Wi-Fi zones may be necessary (D).
- The curriculum of the future will include collaborative design labs, interfaculty education, and working together, which were previously taught in companies (E).
- Living labs, research & development, a different curriculum for obtaining a bachelor's/master's degree. The future is that you solve current societal problems much more interdisciplinary with students, but also with companies. And you can do that because the campus is one big living lab (G).
- Despite the university's claim that "we are a campus university," 700-person lecture halls do not contribute to learning, unlike Echo's future-proofed debating room. Online education is controversial, but students are customers and sometimes set demands. It says a lot about education quality if students don't come to campus because a lecturer reads 40 slides. That says a lot about the quality of the education (H).
- More project-based work, interfaculty, cross-fertilisation (I).
- Hopefully, studying will change in terms of the education system. In terms of facilities, that would mean more room for group dynamics instead of static lecture halls (J).

KEY TAKEWAYS:

IQ6: Could you describe what studying in the future will look like for students?

Key terms	Who? (Four perspectives)	Total
Digital environment is one with (student) life	A, B,C, D I,J	[6/10]
No more lectures	B,E, G, H	[4/10]
Interdisciplinary / project education	E,G H, I,	[4/10]

Sub-conclusion IQ6:

The digital environment is expanding, requiring students to take control of their time and life. Campuses are becoming inspiration hubs, offering a balance between silence and social buzz. The future curriculum will include collaborative design labs, interfaculty education, and working together, similar to companies. Students are becoming customers and sometimes set demands, and

online education is controversial. Project-based work, interfaculty, and cross-fertilization (kruisbestuiving) are becoming more important. The education system is expected to change, allowing more room for group dynamics and a more interactive learning environment.

Recommendations for study-place strategy:

13. **Digital environment**
    Provide study places equipped with the necessary technology to support students in merging their (digital) lives with their academic (student) life.
14. **Contemporary teaching spaces, no more lecture halls**
    Move away from traditional lecture halls. Instead, design spaces suitable for collaborative learning, interdisciplinary projects and group discussions to create an interactive learning environment.

PART 6 | DISCUSSION AND CONCLUSION

6.1 Synthesis

The following section answers the sub-research questions before addressing the main research question in the conclusion.

SRQ1: What is the current quantity and quality of offered study places on campus?

The current state of study places on TU Delft campus indicates a surplus, based on occupancy measurements and insights gathered from interviews. Throughout the academic year, there is a consistent supply of 6000 permanent study places on campus, and an upscaling to 10.000 study places during exam periods. With 28.000 students, the ratio is ≈ 1:5 (1 study place per 4.67 students throughout the whole year and are ≈ 1:3 (1 study place per 2.8 students) during exam weeks.

Regarding the current quality of study places, there is room for improvement, particularly in how the quality of study places is perceived and interpreted. The Cookbook Education Spaces (2018), which serves as a guideline for CREFM, focuses primarily on quantitative indicators, such as functionally useful space in square metres (FNO) per study type, minimum dimensions of furniture as well as distances between furniture, amount of power sockets, material use etc. This offers helpful recommendations, but they tend to overlook other essential but harder to measure characteristics of study places, such as community-feeling, sense of belonging and visibility. This gap offers a chance to create a more complete guide to optimising study places on campus by incorporating these subtle aspects into an enhanced, holistic version of the desired quality of study places. This would be a welcome addition to the existing Cookbook Education Spaces, from a different perspective looking at the concept of 'quality'.

SRQ2: What can be said about the future prospects regarding the need for study places?

Future prospects for study places at TU Delft suggest a shift in teaching methodologies towards more interdisciplinary and project-based learning. This shift suggest that the need for quiet, low-stimuli environments and a variety of study places (focus, social, collaborative) will not go away. The anticipated rise in the number of students emphasises how important it is to control peak hours on campus. Since technology will ensure that the separation between private, academic and digital life will disappear more, the TU Delft needs to look at how this is incorporated in the study places. Besides being able to completely isolate yourself from the amount of stimuli (no-Wi-Fi zones), the expanding digital learning environment emphasizes the need for study places equipped with the necessary technology.

SRQ3: What are alternatives for future study places, based on changing demand and considering the complex context?

Given the changing demands and complex context (e.g. post-pandemic, internationalisation, digitalisation), the alternatives for future study places at TU Delft are threefold. These alternatives can be summarized as creatively optimising existing spaces, focusing on quality over quantity and accommodating all students by offering a diverse mix of study places. The integration of technology in study places, along with designing spaces suitable for interdisciplinary collaboration and project-based teaching, emerge as important considerations.

Adaptive design principles are important to consider, because transform to popular quiet study places during exams and peak hours (A,A2) and to interactive study places for collaborative projects on a regular basis throughout the rest of the academic year (B). Community-oriented study places (C) that

foster a sense of belonging and cultural exchange among students from various backgrounds can significantly improve the overall student experience.

'Only' providing and offering study places with aforementioned characteristics in generic educational buildings is *not* enough. Interdisciplinary education should also be actively programmed, to achieve this interdisciplinary character and create cross-pollination (kruisbestuiving). Cooperation between CREFM and the faculties is critical in this case because the faculties are in charge of scheduling as well as the curriculum of their students, while CREFM is in charge of the generic educational buildings. If communication is effective here between those two stakeholders, the generic educational buildings and their study places and education spaces are extremely suitable for interdisciplinary education, which also provides the cross-pollination between students from all faculties which is mentioned often in several briefs and vision documents.

SRQ4: What concrete actions are recommended for the TU Delft to provide the future demand for study places?

1. Scheduling and smart campus tools

Effective scheduling plans can be created to work around peak hours, especially during exam periods. These scheduling plans can be employed to make the best use of available space. Moreover, students perceive the campus as more crowded than it actually is. By using data-driven insights, which can be provided by smart campus tools and apps, students can be led to their preferred type of study place. Additionally, one could think of some system that uses incentives to use study places during off-peak hours. For example, when studying outside peak-hours one may be entitled to a better study place (perhaps trace back to A, B, C terminology: from a C study place to A2 study place).

2. Redefine quality: Complement Cookbook Education Spaces

Currently, the Cookbook Education Spaces focuses on guidelines for standardisation, operation and usability. It has mostly quantitative requirements for each teaching space and study place that guides as a checklist for designers, consultants, suppliers and technical support staff. The opportunity to produce a more comprehensive guide can be provided by a qualitative addition. By incorporating these subtle aspects into an improved, holistic version of the desired quality of study places, it is possible to optimise study places on campus. Qualitative concepts that are hard to measure, such as fostering community, can complement the Cookbook in a qualitative way.

3. Create learning environments for interdisciplinary education.

Collaboration in education is the future; traditional lectures (frontal teaching), in which the teacher and students only communicate in one direction (teacher to student), are not. Students will still come to campus for collaboration, to meet fellow students and to be part of a larger community, but not for lectures, as these can also be pre-recorded and watched online, on-demand. If amphitheatres - which often take lots of space and involve high costs - are no longer needed, more space will become available for teaching and study places that promote interdisciplinary learning.

It is possible to convert traditional lecture halls into collaborative spaces (study places for group work, B) that are perfect for interdisciplinary projects. This provides an interesting learning environment. The future curriculum will focus on collaborative design labs, living labs and cross-faculty teaching in response to the changing needs of society. In particular, many current societal challenges require perspectives from different disciplines.

4. Think and facilitate in extremes: no-Wi-Fi versus social buzz

Focus on the two types of study places furthest apart - the "extremes" - namely Type A and Type C. Type A, the quiet study place that facilitates deep learning and full concentration with the possibility of an additional computer screen (subtype A2), with the possible addition of no-Wi-Fi zones in the future, and type C: the meeting place where community and social interaction are essential. Recall that type B study places constitute of 50% of the total, while type A and C make up around 25% each of the total (Table 6). Despite having low occupancy rates, type C study places are crucial for the feeling of community in the current situation. Therefore, it is not necessary to add more study places of type C, but instead it is important to investigate how the occupancy rate of type C can be improved. On the contrary, type A study places have the highest occupancy rates and during peak-hours they seem to be even more occupied than the other types. Think about how these percentages might be distributed differently. Type B study places can be roughly categorised in study places for group work and in touchdown study places. Reevaluating touchdown study places could be a promising improvement, because they already make up 50% of all places and have the potential to become partially type A. Project places (B) benefit the (academic) community, so these study places can remain as in the current situation and ideally within the faculty instead of in generic educational buildings.

5. Centralised management and oversight for study places

Overall, participants are satisfied with the study places, except for the management of study places. CREFM has the responsibility for study places in generic educational buildings but not for study places in faculties. Some points of contention exist in the discussion about centralised management of the study places. The faculties and CREFM occasionally have difficulties communicating, since the data is not always up-to-date (in terms of numbers and the set-up of study places). Changing from separate management of study places (by faculties) to a centralised system might be a potential solution. Centralised management of all study places on campus yields several advantages, including increased effectiveness, uniformity, and higher quality.

It is acknowledged that faculties who wish to maintain control will resist. To help with this change, developing trust and embracing a different perspective are suggested. The intention of a centralised system would be to implement a campus-wide system for management and improvements, as opposed to restricting them to individual faculties. However, it is important to note that only participants who are proponents of centralised management were interviewed. More research is needed and a possible outcome could also be to look at better communication between faculties and CREFM. A possible disadvantage of centralised management is that it ignores the individual, unique, character of study places in faculties that is often also different for each study discipline. As a consequence, a very generic character may emerge where ‘one size fits all’ results into ‘one size fits none’.

6.2 Conclusion

How can TU Delft adapt its study places in generic educational buildings on campus, to meet current and future demands?

Various sources indicate that the value of real estate goes beyond financial evaluation. Particularly, the importance of evaluating strategies in the larger context of the university goals is greater than models that are predominantly based on costs and m2. The concept of a campus is to foster a holistic experience where social interactions are just as important as academic work (Den Heijer). In addition, facilitating a shared identity, fostering a strong connection to the institution and improving the overall education journey by the historical context are essential as well (Turner, 1984). Moreover, architectural significance was also a key finding in literature. Architecture is not just shelter, but it influences emotions, social interactions, and psychological well-being (Norberg-Schulz, 1963). In other words, it shapes experiences and communicates ideas.

Three main findings emerged from the empirical research, which consisted of in-depth interviews with professionals and a quantitative analysis of the occupancy rate of study places in the library, Pulse and Echo and lastly by studying the case studies. As for the current situation, the amount of study places seems adequate. If there should be a discussion, it should be about the quality of study places. Then, with a view to future demand, there is an expected shift towards interdisciplinary, project-based learning, with an emphasis on varied study places and the integration of (new) technologies. Finally, recommendations are made for investigating centralised management for study places (as well as the study places in faculties as in generic educational buildings). Furhtermore redefining quality and supplementing the Cookbook Education Spaces (2018), facilitating focus study places, using smart data and thinking in 'extremes' such as no Wi-Fi zones and meeting places with social buzz.

Furthermore, each case can be described as a modern transformation of the original learning centre concept from around the year 2000. When there is no instruction, students can use the formal classrooms as study places, demonstrating how adaptable these educational buildings are as learning environments. Although these buildings are valuable additions, particularly in light of future and contemporary study space ideas, they cannot replace faculties in forming students' identities and promoting community building.

This research found that in order to meet future demand and adjust to the changing perspective of its users, TU Delft needs to reconsider its current study place strategy. Therefore, three different levels of solutions are suggested, each with one or two specific actions that best support TU Delft (CREFM) and its study places in generic educational buildings according to the findings. The first and highest level is concerned with the management of the campus as a whole. The second level is the building level, where issues such as identity, community, and sense of belonging come into play. The final level is the individual level, of which the focus lies on the study places.

1. Campus Level – CREFM

Redefine quality - Complement cookbook education spaces. The Cookbook Education Spaces currently focuses on standardization, operation, and usability, with quantitative requirements for each study place. A qualitative addition on the cookbook should focus on incorporating subtle aspects like fostering community.

Ensure better communication between CREFM and faculties. Currently, faculties manage their study spaces in their own buildings and are in charge of their students' schedules and curriculum. CREFM is

in charge of the generic educational buildings. Collaboration and communication could be explored for improvement. Centralising the management of the campus could be a way to improve effectiveness, uniformity, and higher quality of study places. However, centralising management has some significant drawbacks that can lead to “one size fits none”. Therefore, the focus should be working on good communication between CREFM and the faculties, which can improve aligning strategy on study places as well.

2. Building level – Generic educational buildings and faculties

Creating learning environments for interdisciplinary education. Literature study and empirical research indicate that collaboration in education is the future. Particularly, traditional lectures are replaced by online lectures and students visit the campus for community, interdisciplinary learning, and collaboration. Therefore, traditional lecture halls should have the flexibility to be converted into collaborative spaces for interdisciplinary projects. Moreover, the learning environments should reflect the future curriculums, which will focus more and more on collaborative design labs, living labs, and cross-faculty teaching.

3. User level – Study place

Scheduling and smart data tools. Deploying data-driven insights from smart campus tools and apps, to make the best possible use of the available space. This can be done by using incentives to encourage students to use study places during off-peak hours. If done right, the students’ perception of crowdedness can decrease, and as a result the likelihood of a positive study experience can increase.

Think and facilitate in extremes: no-Wi-Fi versus social buzz. Type A study places have the highest occupancy rates. Touchdown study places (type B) seem most promising to convert to (temporary) type A study places. So, it is important to re-evaluate the touchdown study places. Think about adding computer screens, and/or no-Wi-Fi zones. In addition, project places (type B) benefit the academic community and should remain within the faculty instead of generic educational buildings. Meeting places (type C) have a low occupancy rate but are crucial for community. Therefore, it is not necessary to add more of such places, but it is more important to investigate how the occupancy rate of type C can be improved.

6.3 Limitations

A number of limitations in this research can be distinguished:

1. **The amount of interviews**. One of the limitations of this qualitative study may be the number of interviews conducted, even though no minimum requirements for a strong body of evidence have been established beforehand. Although there were "only" ten interviews, they lasted a long time—45 to 60 minutes on average. This gave participants the opportunity to respond to the interview questions in-depth and provided opportunity for them to add information and their own perspectives. An increased number of interviews might have revealed other outcomes.
2. **The roles of participants**. A fair number of participants are associated directly to CREFM, which might bias the interview results. However, the participants covered the four perspective model of Den Heijer (2021) well.
3. **Limited representation from finance**. Only one person from the field of finance has been interviewed. This causes a certain bias.
4. **No students were interviewed**. Students could have made a significant contribution in the evaluation of study places, especially on qualitative aspects.
5. **TU Delft context.** The research focuses on generic educational buildings in TU Delft and the participants of the interviews were associated to TU Delft. Other Dutch universities have similar issues[23]this is evident from the UNL conference I attended. But I could not say this with certainty for a broader international context.
6. **Uncertainty in future student numbers.** The expected future number of students may be subject to change to a considerable extent due to external influence of the political landscape. There is a possibility that the student numbers will decrease due to the policy on international student numbers in the future.
7. **Scope of the study.** This research focused on the informal unscheduled study place.
8. **TU Delft campus (in Delft).** A multicampus strategy has not been taken into account.

[23] Attended UNL's CampusNL 2030 conference in Utrecht to understand and hear which challenges other universities in the Netherlands face (October 2022)

6.4 Recommendations

The following recommendations can be given:

1. First of all, the opinion of students should also be taken into account, either via interviews or via a survey. It is important to know which study places they would like to have, but also what qualitative aspects are important to them.
2. Researching occupancy rates: not only looking at whether a study place is occupied (quantitative) but also asking students if the place was their preference or if they sit there for lack of better initiatives. See to what extent the existing Cookbook Education Spaces can be expanded to include qualitative aspects.
3. Make it easier for students to find available study places, as it has been shown that currently there is no shortage of study places. This could be done by smart campus tools and apps or by implement scheduling strategies or incentives to promote off-peak studying.
4. Examine to see if a larger number of study places A and A2 can made available, at least temporarily: during exam weeks and peak hours.
5. Centralize the management of study places to ensure consistency, efficiency, and improved quality across the campus.
6. Buildings are more than only study places. Which impact have future study places on the architecture of educational buildings.
7. Interfaculty cross-pollination is a nice educational vision, but must also be implemented programmatically.
8. Regarding the future of building (more) generic educational buildings: generic educational buildings are a complementary to faculties. The faculties continue to play a major role in the development, identity and formation of the student.

References

Algemene Rekenkamer. (2021). *Vastgoed bij universiteiten, twintig jaar na overdracht van eigendom.* Algemene Rekenkamer. https://www.rekenkamer.nl/publicaties/rapporten/2018/01/18/vastgoed-bij-universiteiten

Arkesteijn, M. H. (2019). *CRE Alignment. A preference-based design and decision approach*. (Ph.D.). University of Technology, Delft.

Barrow, J. (2019). *Trustworthiness in Qualitative Research* [Video]. YouTube. https://www.youtube.com/watch?v=V66KYGCq0IM

Mecanoo Architecten. (2000). *Bibliotheek Technische Universiteit Delft*, Uitgeverij 010 Publishers Rotterdam

Blaikie, N. and Priest, J. (2019) *Designing Social Research*, The Logic of Anticipation, 3rd Edition, Polity Press, Croydon, UK.

Chism, N. V. N., & Bickford, D. J. (2002). *The importance of physical space in creating supportive learning environments*. San Francisco, Calif: Jossey-Bass.

Colenbrander, B. (2018). Sleutelen aan de campus: Een vergelijkend onderzoek naar concept, morfologie en ontwikkeling van de TU-complexen in Delft en Eindhoven. *OverHolland*, 11(18/19), 145–158. https://doi.org/10.7480/overholland.2017.18/19.2436

Curvelo Magdaniel, Flavia & Den Heijer, A.C. (2017). *International overview of the University Library as a central facility.*

Dalle, J., Raisinghani, M. S., Putra, A. P., Suriansyah, A., Hadi, S. and Sahara, B., (2021). *A technology acceptance case of Indonesian senior school teachers: Effect of facilitating learning environment and learning through experimentation.* International Journal of Online Pedagogy and Course Design (IJOPCD), 11(4), pp. 45-60

De Jonge, H., Arkesteijn, M. H., Den Heijer, A. C., Vande Putte, H. J. M., and De Vries, J. D. (2008). *Designing an accommodation strategy.*

De Jonge, H., Arkesteijn, M. H., Den Heijer, A. C., Vande Putte, H. J. M., De Vries, J. C., & Van der Zwart, J. (2009). *Designing an accomodation strategy (DAS Frame).* Delft: TU Delft Faculty of Architecture.

De Jonge, H., Den Heijer, A. C. (2008). ''Corporations & cities, Envisioning Corporate Real Estate in the Urban Future'' (introduction) in *Corporations & Cities*, Brussels.

Den Heijer, A. C. (2011). *Managing the University Campus: Information to support real estate decisions* (PhD thesis). Eburon Uitgeverij BV.

Den Heijer, A. C. (2021). *Campus of the future: Managing a matter of solid, liquid and gas.* TU Delft, Architecture, Management in the Built Environment.

Den Heijer, A.C. and J.C. De Vries (2005), *Analyse universiteitsgebouwen, resultaten benchmark twaalf recente projecten*. Delft, TU Delft, Faculteit Bouwkunde, Real Estate & Housing.

Den Heijer, A. C. (2021). *Trends voor de campus van de toekomst: Van traditioneel naar netwerk en virtueel, maar ook terug.* In S. Arbeek, B. Breems, & C. Pieterse (editors), Samen werken aan de leeromgeving van morgen: Inspiratieboek 2010-2025 (blz. 511-515). Schooldomein B.V.

Den Heijer, A. C., Arkesteijn, M., de Jong, P., & de Bruyne, E. (2016). *Campus NL: Investeren in de* toekomst. TU Delft, Architecture, Management in the Built Environment.

Diener, E., & Crandall, R. (1978). *Ethics in social and behavioral research* (pp. x, 266). U Chicago Press.

Finnigan, T., & Howden, J. (2006). *Case studies / Glasgow Caledonian University - Saltire Centre*. https://jiscinfonetcasestudies.pbworks.com/w/page/45407218/Glasgow%20Caledonian%20University%20-%20Saltire%20Centre

Flipse, A. C., & Streefland, A. (Eds.) (2020). *De universitaire campus: Ruimtelijke transformaties van de Nederlandse universiteiten sedert 1945*. Verloren.

Glasgow Caledonian University. (n.d.). Flickr. https://www.flickr.com/photos/jiscinfonet/albums/72057594135346630/with/146799477/

Graham R Gibbs. (2012). *The Quality of Qualitative Research. Part 2 of 3 on Research Quality and the Research Process* [Video]. YouTube. https://www.youtube.com/watch?v=dGeh_foiwu0

Guba, E. G. (1981). Criteria for Assessing the Trustworthiness of Naturalistic Inquiries. *Educational Communication and Technology*, *29*(2), 75–91.

Hennig-Thurau, T., Langer, M. F., & Hansen, U. (2001). Modeling and managing student loyalty: An approach based on the concept of relationship quality. *Journal of Service Research, 3*(4), 331–344. https://doi.org/10.1177/109467050134006

Jandrić, P. (2020). Postdigital research in the time of Covid-19. *Postdigital Science and Education,* 2, 233–238. https://doi.org/10.1007/s42438-020-00113-8.

Joint Information Systems Committee (JISC), JISC. , & Marmot, Alexi & AMA,. (2006). *Designing spaces for effective learning: A guide to 21st century learning space design*. Higher Education Funding Council for England (HEFCE). 10.13140/RG.2.2.22776.24321.

Jones, I. R., Leontowitsch, M., & Higgs, P. (2010). The Experience of Retirement in Second Modernity: Generational Habitus among Retired Senior Managers. *Sociology, 44(*1), 103–120. https://doi.org/10.1177/0038038509351610

Knox, S., & Burkard, A. W. (2009). Qualitative research interviews. *Psychotherapy Research*, *19*(4–5), 566–575. https://doi.org/10.1080/10503300802702105

Koolwijk, J.S.J. (2022). *06 Interpretivist paradigm and your role as a researcher* [Video]. YouTube. https://www.youtube.com/watch?v=QzJp65YaJ68

Krumm, P. J. M. M., Dewulf, G., & De Jonge, H. (2000). What is Corporate Real Estate. In G. Dewulf, P. J. M.M., Krumm, & H. De Jonge (Eds.), *Successful Corporate Real Estate Strategies* (pp. ch. 2). Nieuwegein: ARKO Publishers.

Kuh, G. and Hu, S. (2001) The Effects of Student Faculty Interaction in the 1990s. *Review of Higher Education, 24*, 309-332. https://doi.org/10.1353/rhe.2001.0005

Lemmens, C., De Kievit, H., Van Der Klugt, S., Richters, C., Van Der Heul, J., Wijman, F., De Lijser, H., & *TU Delft Facilitair Management & Vastgoed*. (n.d.). FMVG TU Delft Library [Slide show]. adoc.pub. https://adoc.pub/fmvg-tu-delft-library-1-tu-delft-library.html

Moerman (2016, September 11). *Playlist Research Methods and Statistics | Qualitative Methods | Qualitative Interviewing | UvA* [Video]. YouTube. https://www.youtube.com/watch?v=ZfSGKivni_E

Morris, A. (2015). *A Practical Introduction to In-depth Interviewing*. SAGE.

Nickerson, C. (2022). Interpretivism Paradigm & Research Philosophy. Simply Sociology. https://simplysociology.com/interpretivism-paradigm.html

Oblinger, D. G. (2006). *Learning Spaces*. Washington, DC: Educause.

Pulse, Technische Universiteit Delft | ector hoogstad architecten. (n.d.). https://www.ectorhoogstad.com/nl/project/pulse-technische-universiteit-delft

Ringel, R. (2021). When Do We Actually Need to Meet in Person? Harvard Business Review. https://hbr.org/2021/07/when-do-we-actually-need-to-meet-in-person

Saltire Centre. (n.d.). BDP. https://www.bdp.com/en/projects/p-z/Saltire-Centre/

Schwartz-Shea, P., & Yanow, D. (2013). *Interpretive research design: Concepts and processes*. Routledge.

Shenton, A. (2004). Strategies for Ensuring Trustworthiness in Qualitative Research Projects. *Education for Information*, *22*, 63–75. https://doi.org/10.3233/EFI-2004-22201

Sojkin, B., Bartkowiak, P. and Skuza, A. (2012). Determinants of Higher Education Choices and Student Satisfaction: The Case of Poland. *Higher Education, 63*, 565-581. https://doi.org/10.1007/s10734-011-9459-2

Tawfik Mohamed, S., Mandour, A., & Baker, H. (2023). Improving Quality of Student's Life on University Campus (Guidelines of New Assessment Tools). *Engineering Research Journal*, *178*(0), 429-445. doi: 10.21608/erj.2023.303065

TU Delft. (2005). *Wegen naar innovatie: Instellingsplan TU Delft 2005 – 2010* [in Dutch]. In Universiteitsdienst (Ed.) (pp. 58)

TU Delft. (2007). *Eindrapport TU Delft Library – Ruimte voor de toekomst*

TU Delft. (2008). *CONCEPT PROGRAMMA VAN EISEN versie 04: LEARNING CENTRE TU DELFT*.

TU Delft. (2016). *Programma van Eisen New Education Centre - 2019*

Turner, P. V. (1984). *Campus: An American planning tradition*. New York: Architectural History Foundation.

UNStudio. (n.d.). *Echo, TU Delft*. https://www.unstudio.com/page/13592/echo-tu-delft

Valks, B. (2021). *Smart campus tools. Technologies to support campus users and campus managers*. Delft: TU Delft, Faculty or Architecture and the Built Environment. https://doi.org/10.7480/abe.2021.18

Van Der Zanden, A.H.W. (2007). *Hoe is het idee van een Learning Centre gestart | Learning Centre*.https://learningcentre.weblog.tudelft.nl/2007/01/02/hoe_is_het_idee_van_een_learning_centre_/

Van der Zanden, A.H.W. (2010). *The Facilitating University* , Eburon, Delft.

Van Eijck, G. (2015). *De campus-economie*. De Groene Amsterdammer. https://www.groene.nl/artikel/de-campus-economie

Veen, W., & Vrakking, B. (2006). *Homo Zappiens Growing up in a digital age.* Continuum International Publishing Group Ltd.

Venkateswarlu, P. , Malaviya, S. and Vinay, M. (2020). Determinants of the Satisfaction of Students Studying in Private Universities—Application of Kano Model. *Theoretical Economics Letters*, **10**, 1-16. doi: 10.4236/tel.2020.101001.

Waxman, Lisa & Clemons, Stephanie & Banning, Jim & Mckelfresh, David. (2007). *The library as place: Providing students with opportunities for socialization, relaxation, and restoration.* New Library World. 108. 424-434. 10.1108/03074800710823953.

Widikasih, P. A., Widiana, I. W. and Margunayasa, I. G., (2021). *Online Learning Problems for Elementary School Students*. Journal of Education Research and Evaluation, 5(3), pp. 1-10

Wilkinson, M. D., Dumontier, M., Aalbersberg, Ij. J., Appleton, G., Axton, M., Baak, A., Blomberg, N., Boiten, J.-W., da Silva Santos, L. B., Bourne, P. E., Bouwman, J., Brookes, A. J., Clark, T., Crosas, M., Dillo, I., Dumon, O., Edmunds, S., Evelo, C. T., Finkers, R., Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data*, *3*, 160018. https://doi.org/10.1038/sdata.2016.18

Y.S. Lincoln and E.G. Guba (1985). *Naturalistic inquiry*. Beverly Hills: Sage.

Yin, R. K. (2009). *Case Study Research: Design and Methods*. 4th edn. Los Angeles: Sage.

Yin, R. K. (2012). *Applications of Case Study Research*. SAGE.

Appendices

Appendix I: Other influences and knowledge gained while graduating

Several events contributed to my understanding of the future of universities and maintained my interest and enthusiasm throughout the graduation year. This cannot be divided into pre-classified sub-steps nor into any particular section in this chapter. Nevertheless, they did contribute to this research and are therefore listed below.

Key events include attending UNL's CampusNL 2030 conference in Utrecht and the talk "The Rise of the UniverCity: How Universities Impact Cities" at the Dépendance Rotterdam.[24] An open-access debate organised by Studium Generale, The future of universities – The colossal campus: Is bigger always better? also attended by Delft municipality residents, highlighted the social and political sensitivity of the topic of TU Delft's possible expansion. It was remarkable to hear the – often very contrary – perspectives of teachers, students, political parties, and residents.[25]

Recurring meetings which have been made possible during the internship at CREFM include the Smart Campus programme and the sounding board meetings for the new generic education building (2027) at TU Delft Campus South. Together with the steering board there were various generic educational buildings visited in the Netherlands, such as the Neuron building at TU/E in Eindhoven and the MFO II at Erasmus University in Rotterdam. During the sounding board group with students (from various study associations as well as the faculty student council), I could give my opinion on different scales for the new Generic Educational building and had a voice from a student perspective. The monthly Bouwmeester meetings (BMO) provided me with an understanding of how the overall visual quality of the TU Delft campus is achieved by testing and ensuring the quality of the connection between the interior, architecture, infrastructure, landscape, functionality, and use. I sat on the other side of the table and gained insight into various spatial issues and trade-offs made to improve and protect the campus's appearance and liveability.

[24] Public talk (24/11/2022): Universities bring diversity and innovation but also worsen housing inequality and gentrification. They influence labour practices and occupy space in vulnerable areas. The talk with Davarian Baldwin explored their impact on cities and how to make sure they contribute positively to fairness and vibrancy. More info: https://dedependance.eu/events/the-rise-of-the-univercity/

[25] Theater dialogue (09/05/2023): Should universities always meet society's demands? TU Delft's Executive Board shifts focus from the university's capacity to what society needs—more engineers. The aim is to educate substantially more students, 40.000, across various campuses incl. Rotterdam and The Hague. More info: https://www.delta.tudelft.nl/article/dialoog-over-groeiplannen-roept-spanning-op

Appendix II: Requirements per studyplace

An important note is that the requirements are mainly based on new buildings. Many study places are in existing buildings and faculties, so realising the optimal study place is not always feasible. The existing situation sometimes does not allow certain requirements to be met. For example, it is not always possible to create a lockable space for quiet study workstations or to provide study workstations with direct daylight. In these situations, the most important requirements for realising good study places are indicated with a ✓. These are the minimum components needed to create a good study workplace (Cookbook Education Spaces, 2018).

In addition, these requirements below still make a distinction between B1 and B2 study places, where B2 places were in an instruction room (not scheduled for teaching activities). This distinction is no longer made, but is still stated as such in the requirements per type below.

Requirements per type (A,B1,B2,C)

Type A – Silent study places

Study workplaces to study individually for many hours in a silent area.

Library TU Delft (photo J. van der Heul)

EEMCS TU Delft (photo Gispen.nl)

Fontys Eindhoven (photo Gispen.nl)

Space indicators & location

- Learning Place Area ≈ 4,0 m² (i.e. Functioneel Nuttig Oppervlak FNO)
- ✓ Direct or indirect daylight, mind glare from sunlight.
- Study places located next to exterior façade in a silent and enclosed area
- ✓ Situated in a silent enclosed area or silent zone in the building.
- In case of an enclosed area:
  - Advised minimum capacity of 50 places.
  - Silent closing doors
  - Glass in partition walls to see if places are vacant and to create a social save environment, mind distraction from outside the space.
- Situated close to education spaces.
- Easy to find and reach, mind longer opening hours in the evening in relation to accessibility, access to facilities and social safe environment.
- Space materialization and detailing are optimized for easy cleaning and low maintenance.

Furniture & accessories

- ✓ Table top large enough for laptop and notes for student, min. 100 x 80 cm per person.
- ✓ Height adjustable chair on casters with adjustable armrests.
- ✓ 1 power socket available for device student. Cable cubby in table top
- Partitions between places for privacy and clear demarcation
- Distance between rows of tables around 80-90 cm.
- Pathways around 90 cm
- Materials of furniture resistant to food and drinks.
- Bins

AV & IT

- WiFi for specifications see 'Blueprint TU Delft Wireless Network'.
- 1:4 study places provided with a monitor on campus.
- No loose cables and wirings

Optional:

- Study places can be provided with a computer to make special software available. What kind of software depends on programme of study. Advice is to provide this facility nearby de faculty.

Requirements per type (A,B1,B2,C)

Type B1 – Group study places

Study workplaces for group work.

CEG TU Delft (photo M. Blommaert)

TPM TU Delft

Library TU Delft (photo G. Schoonewille)

Space indicators & location

- Learning Place Area ≈ 2,5 m² (i.e. Functioneel Nuttig Oppervlak FNO).
- ✓ Daylight or indirect daylight, mind glare from sunlight.
- ✓ Situated in a quiet zone of the building.
- Easy to reach and find. mind longer opening hours in the evening in relation to accessibility, access to facilities and socially safe environment .
- Situated nearby education spaces,
- Space materialization and detailing are optimized for easy cleaning and low maintenance.

Furniture & accessories

- ✓ Group-table between 4 -10 persons, size depends on demand of the users in the building. Can also be a combination of 2 group- tables for more flexibility.
- ✓ Table top surface large enough for laptop and notes per student around 80 x 60 cm per person.
- ✓ Variation of height adjustable chairs.
- Centre-to-centre distance of chairs is at least 55 cm
- ✓ 1 power socket per 2 places available for device student. Cable cubby in centre of table top.
- Distance between tables around 90 cm
- Pathways around 100 cm
- ✓ Whiteboard available, can also be used as a separation with an acoustic function between the group-tables.
- Materials of furniture resistance to food and drinks
- Bins

Optional:

- High table or sitting/standing table.
- Possibility to change group study places to silent-study places by signing
  Conditions of the group study places:
  - The group study places must stand in a quiet zone where it is possible to create a silence area by signing.
  - Height adjustable chair.

  Extra option 1: Change setup in rows of tables. Extra option 2: Place partitions on table.

AV & IT

- ✓ WiFi for specifications see ‘Blueprint TU Delft Wireless Network’.
- No loose cables and wirings

Optional:

- LED display

Climate, electrification, acoustics & lighting

- ✓ Sufficient climate. For specifications see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).
- ✓ Spatial acoustics, noise reduction measures are required (e.g. partitions) see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).
- ✓ Sufficient light, 500 lux on workplace see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).
- Shades, dependent on sunlight circumstances
- Electrification to table from sidewalls or floor units, covers floor outlets must be able to be closed when in use.

Signing

- At the entrance of the building an overview of the available study places.
- Signage through the building (English)
- Visual functional pictograms of the function of the space and rules at entrance of space / zone: collaborate, speak softly, clean up.

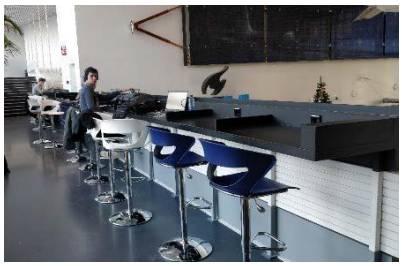
Facilities

- Printer in close vicinity (no disturbing noise)
- ✓ Coffee and food nearby
- Lockers nearby
- Toilets nearby

Requirements per type (A,B1,B2,C)

Type B2 – Touchdown study places

Study workplaces for temporary self-study



AE TU Delft

IDE TU Delft (photo M. Sleeuwits)

FellowshipTU Delft

Space indicators & location

- Learning Place Area ≈ 2,5 m² (i.e. Functioneel Nuttig Oppervlak FNO).
- ✓ Daylight, or indirect daylight.
- Situated in a quiet zone or along a hall way.
- Easy to reach, to find, mind longer opening hours in the evening in relation to accessibility, access to facilities, and social safe environment
- Situated close to education spaces,
- Space materialization and detailing optimized for easy cleaning and low maintenance.

Furniture & accessories

- ✓ Table top surface large enough for laptop and notes for student, min. 80 x 60 cm per person.
- ✓ Variation of height adjustable chairs.
- ✓ 1 power socket per 2 places available for device student, cable cubby in table top.
- Line in table surface between places for clear demarcation
- Materials of furniture resistance to food and drinks
- Bins

Optional

- High table or sitting/standing table.
- Possibility to change touchdown to silent-study places by signing
  Conditions of touchdown places:
  - The touchdown study places must stand in a quiet zone where it is possible to create a silence area by signing.
  - Height adjustable chair.

  Extra option: placing partitions on table.

AV & IT

- ✓ WiFi, for specifications see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).
- No loose cables and wirings

Climate, electrification, acoustics & lighting

- ✓ Sufficient climate. For specifications see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).
- ✓ Spatial acoustics, noise reduction measures are required, see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).

- ✓ Sufficient light, 500 lux on workplace see ‘Ruimtematrix TU Delft version 3.0” by Campus & Real Estate (CRE).
- Shades, dependent on sunlight circumstances

Electrification to table from sidewalls or floor units, covers floor outlets must be able to be closed when in use.

Signing

- At the entrance of the building an overview of the available study places.
- Signage through the building (in English)
- Visual functional pictograms of the function of the space and rules at entrance of space / zone: study, rumor, clean up.

Facilities

- Printer in close vicinity (no disturbing noise)
- ✓ Coffee nearby
- Lockers nearby
- Toilets nearby

Requirements per type (A,B1,B2,C)

Type C – Meeting places

Multifunctional places for various social encounters, such as informal meetings or conversation. Such a study place counts half a study place for capacity planning.

Architecture TU Delft (photo R. 't Hart)

EEMCS TU Delft (photo M. Blommaert)

Fellowship TU Delft (photo T. Bogerd)

Space indicators & location

- Learning Place Area ≈ 2,0 m² (FNO, user space)
- Direct or indirect daylight
- Situated:
  - In combination with Food and Beverages spots the seats can be used as study places outside regular breaks.
  - Couches and (lounge)seats in corridors nearby education spaces.
- Space materialization and detailing optimized for easy cleaning and low maintenance.

Furniture & accessories

- Variation of arrangements
- Chair, bench or stool. Preferably: furniture which accommodates the usage of a laptop
- Power socket nearby. Preferably: at least 1 power socket per 3 a 4 places.
- Materials of furniture resistance to food and drinks
- bins

AV & IT

- WiFi for specifications see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).

Climate, electrification, acoustics & lighting

- Sufficient climate. For specifications see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).
- Spatial acoustics, noise reduction measures are required, see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).
- Sufficient light, 300 lux on workplace, see 'Ruimtematrix TU Delft version 3.0" by Campus & Real Estate (CRE).
- Shades, dependent on sunlight circumstances
- Electrification from sidewalls or floor units, covers of floor outlets must be able to be closed when in use.

Signing

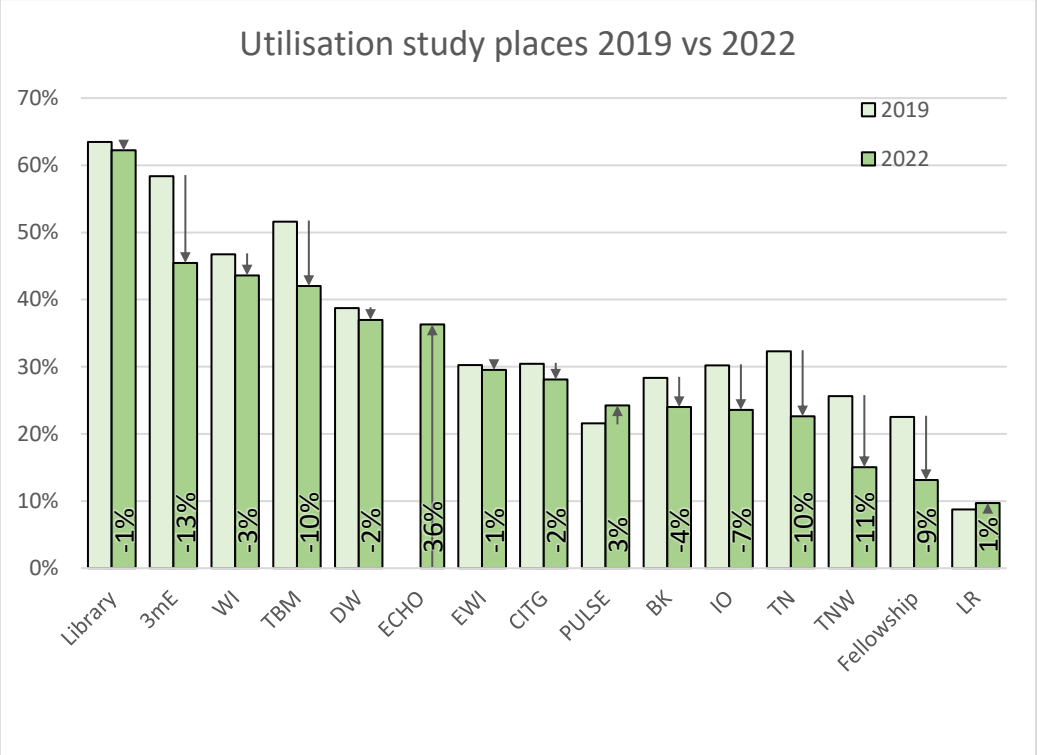
- At the entrance of the building an overview of the available study places.
- Signage through the building (in English)
- Visual functional pictograms of the function of the space and rules at entrance of space / zone: study, rumor, clean up.

Facilities

- Toilets nearby

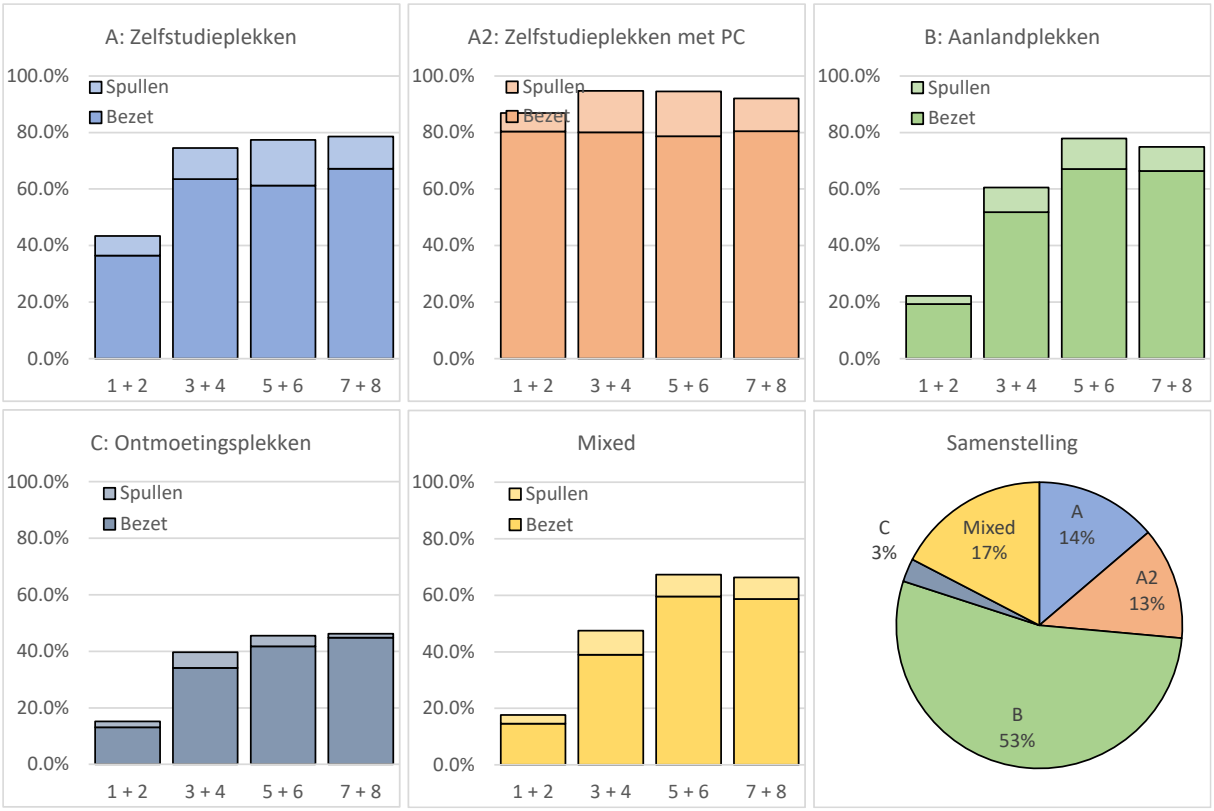
Appendix III: Utilisation figures study places – Campus-wide and The Library, Pulse and Echo

In general:



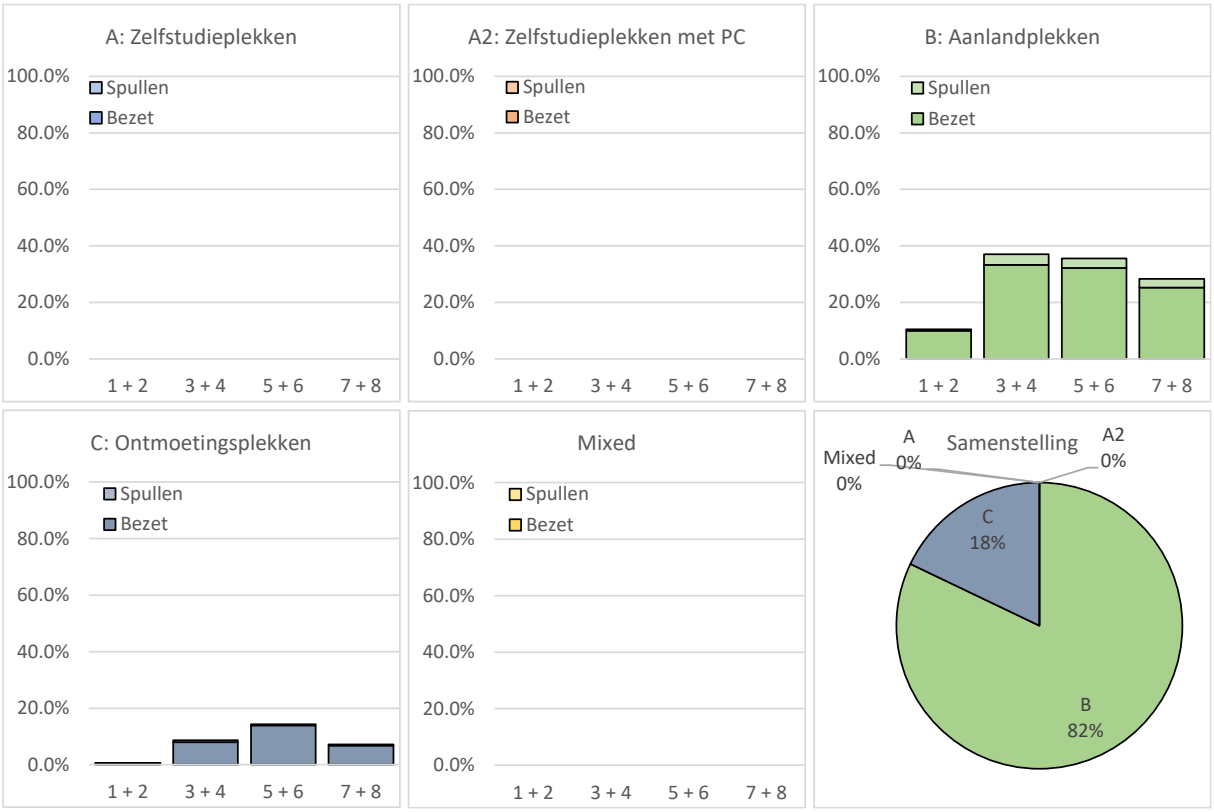
Case: The Library

Soort Plek	Percentage Totaal	Bezet 1+2	Bezet 3+4	Bezet 5+6	Bezet 7+8	Spullen 1+2	Spullen 3+4	Spullen 5+6	Spullen 7+8	Totaal 1+2	Totaal 3+4	Totaal 5+6	Totaal 7+8
A	13.8%	36.4%	63.5%	61.3%	67.2%	7.0%	11.1%	16.1%	11.4%	43.4%	74.5%	77.4%	78.6%
A2	12.7%	80.4%	80.1%	78.7%	80.5%	6.6%	14.6%	15.9%	11.6%	86.9%	94.7%	94.6%	92.1%
B	53.6%	19.3%	51.8%	67.1%	66.4%	2.9%	8.8%	10.8%	8.4%	22.2%	60.6%	77.9%	74.9%
C	2.6%	13.1%	34.1%	41.7%	44.8%	2.1%	5.5%	3.8%	1.4%	15.2%	39.7%	45.5%	46.2%
Mixed	17.4%	14.6%	39.0%	59.6%	58.7%	3.1%	8.5%	7.7%	7.7%	17.7%	47.4%	67.3%	66.4%


A: Zelfstudieplekken
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
Spullen
Bezet
1 + 2
3 + 4
5 + 6
7 + 8
A2: Zelfstudieplekken met PC
Spullen
Bezet
B: Aanlandplekken
C: Ontmoetingsplekken
Mixed
Samenstelling
A
14%
A2
13%
B
53%
C
3%
Mixed
17%

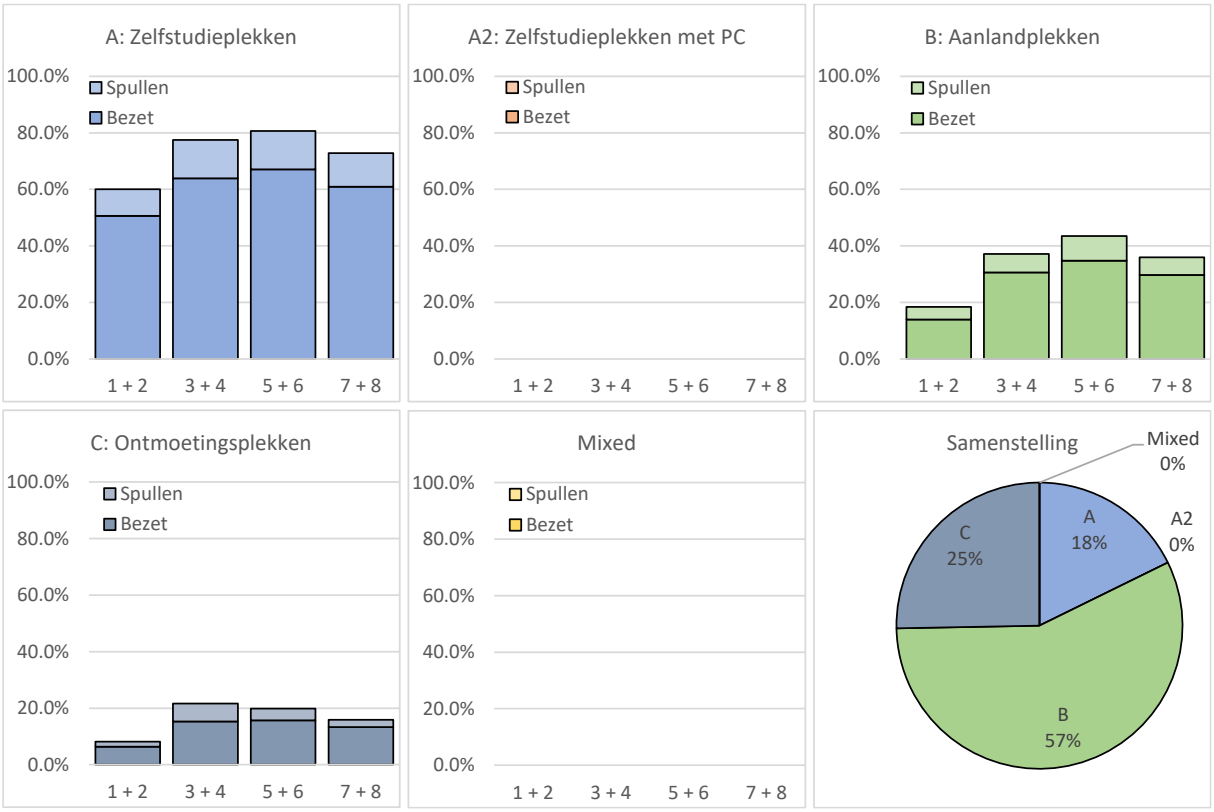
Case: Pulse

Soort Plek	Percentage Totaal	Bezet 1+2	Bezet 3+4	Bezet 5+6	Bezet 7+8	Spullen 1+2	Spullen 3+4	Spullen 5+6	Spullen 7+8	Totaal 1+2	Totaal 3+4	Totaal 5+6	Totaal 7+8
A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
A2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B	82.1%	10.0%	33.3%	32.2%	25.3%	0.5%	3.8%	3.3%	3.0%	10.5%	37.1%	35.5%	28.3%
C	17.9%	0.6%	7.9%	13.9%	6.8%	0.0%	0.8%	0.4%	0.4%	0.6%	8.7%	14.3%	7.2%
Mixed	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%



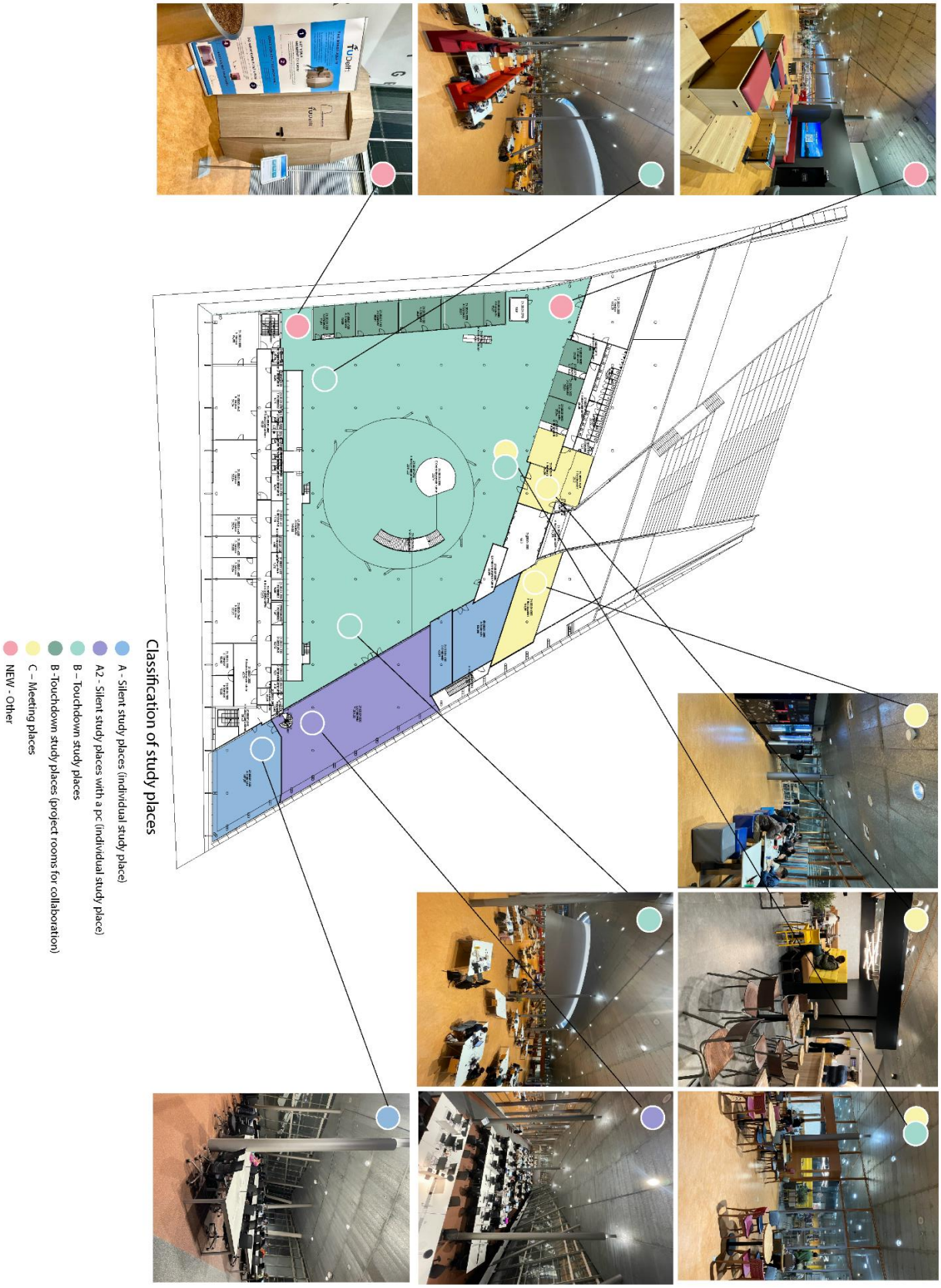
Case: Echo

Soort Plek	Percentage Totaal	Bezet 1+2	Bezet 3+4	Bezet 5+6	Bezet 7+8	Spullen 1+2	Spullen 3+4	Spullen 5+6	Spullen 7+8	Totaal 1+2	Totaal 3+4	Totaal 5+6	Totaal 7+8
A	17.7%	50.6%	63.9%	67.1%	60.9%	9.5%	13.6%	13.6%	11.9%	60.0%	77.5%	80.7%	72.9%
A2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
B	57.0%	14.0%	30.6%	34.7%	29.7%	4.4%	6.6%	8.7%	6.2%	18.4%	37.2%	43.5%	35.9%
C	25.3%	6.4%	15.3%	15.7%	13.4%	1.8%	6.3%	4.2%	2.5%	8.2%	21.7%	19.9%	15.9%
Mixed	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

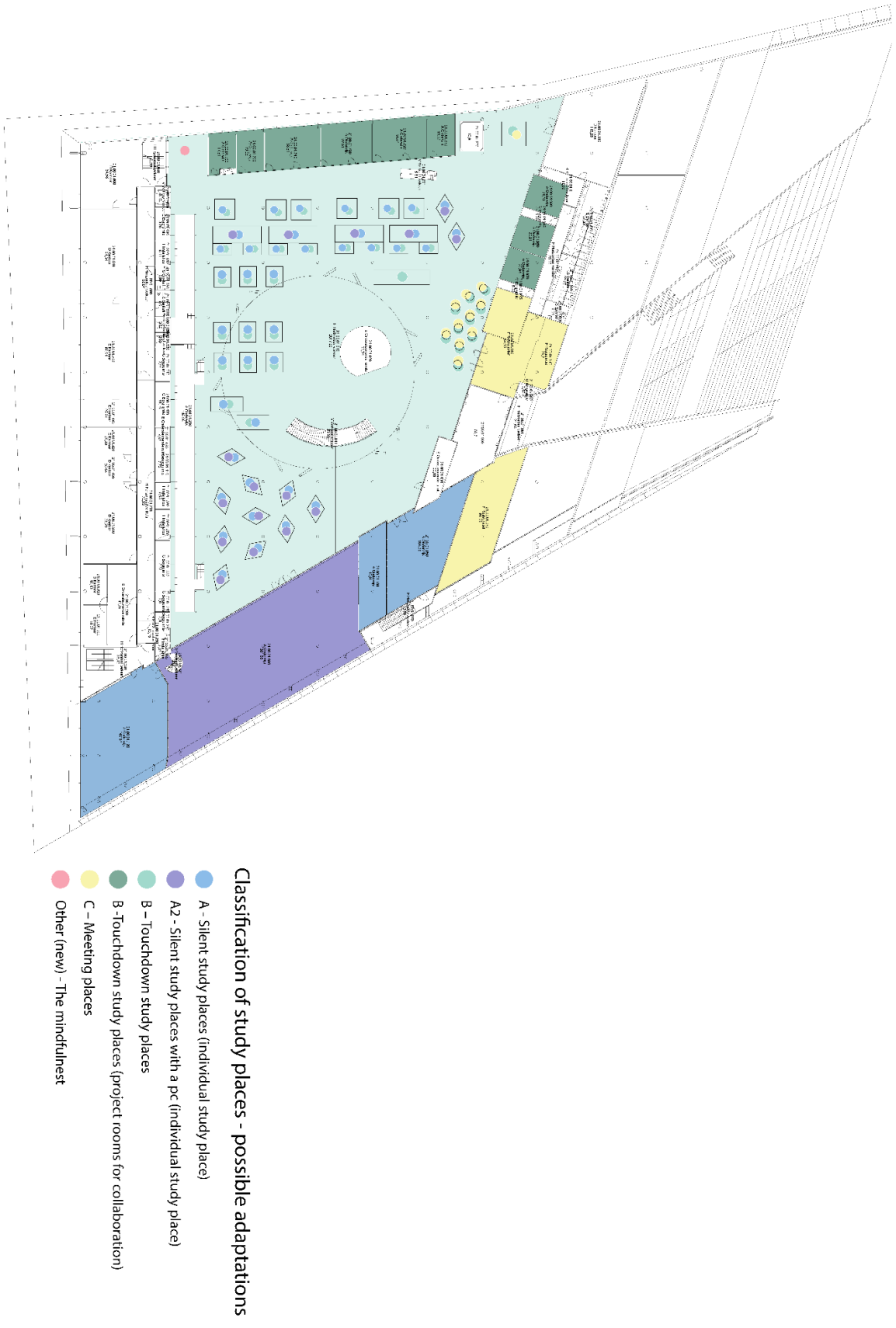


Floor plans case studies – type of study places

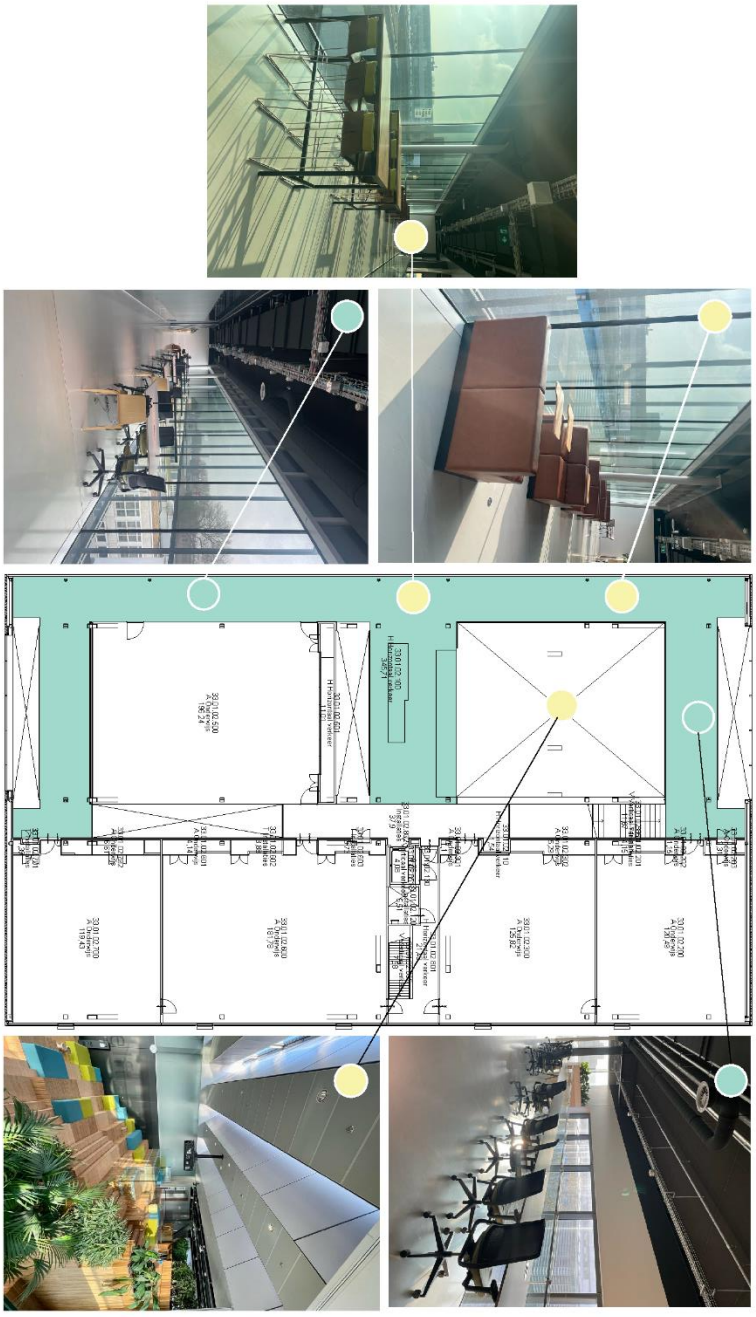
Case I - Library



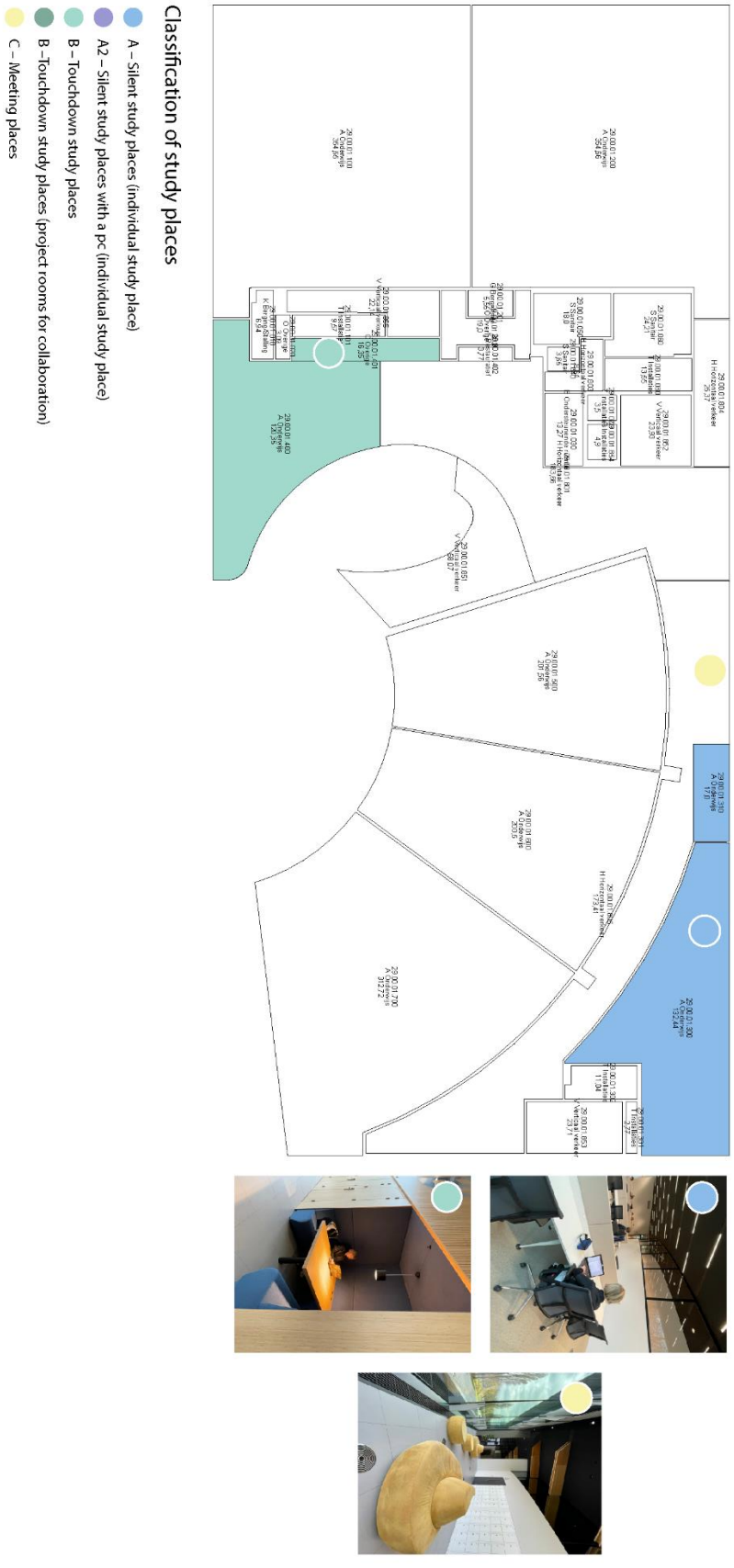
Case I – Library and possible adjustments



Case II – Pulse



Case III – Echo



Appendix IV: Informed consent form

Betreft: geïnformeerde toestemming onderzoek

Datum: …….. - ……. - …….

Geachte heer/mevrouw,

U wordt uitgenodigd om deel te nemen aan een interview voor een afstudeeronderzoek genaamd:

ENVISIONING THE FUTURE OF STUDY PLACES - DEVELOPING A STRATEGY FOR TU DELFT THAT MATCHES STUDENTS' PREFERENCES WITHIN THE CHANGING CONTEXT

Dit onderzoek is een afstudeeronderzoek dat wordt uitgevoerd door Laura Tangelder, student aan de opleiding *MSc Management in the Built Environment* aan de TU Delft. Het bedrijf waar de afstudeerstage plaatsvindt is Campus & Real Estate Facility Management (CREFM) van de TU Delft. CREFM ontwikkelt en beheert het vastgoed en de terreinen van de TU Delft.

Doel onderzoek: Het doel is om te onderzoeken of er een (mis)match is tussen het aanbod en de vraag van studieplekken op de campus van de TU Delft. Hierbij wordt gefocust op 3 cases: de universiteitsbibliotheek (UB), Pulse en Echo. Naast het onderzoeken van de theoretische achtergrond worden interviews gehouden met zowel professionals als studenten om verschillende perspectieven te horen en zowel het strategische als ook het individuele schaalniveau te verwerken.

Interview: U wordt gevraagd om deel te nemen aan een interview voor dit onderzoek. De data uit het interview zullen gebruikt worden voor wetenschappelijke doeleinden (het afstudeeronderzoek en afstudeerproces). Het interview zal ongeveer 60 minuten in beslag nemen. Graag zou ik de audio van dit interview willen opnemen om achteraf uit te werken en te analyseren. In dit interview zullen o.a. de volgende onderwerpen aan bod komen:

- Een ruimtetekort of ruimteoverschot op de campus?
- De term studieplek;
- Generieke onderwijsgebouwen;
- Welke verbeterslag de TU Delft kan maken in het aanbieden van (toekomstige) studieplekken.

Vertrouwelijkheid en data: Uw data wordt vertrouwelijk behandeld. De data worden geanonimiseerd en alleen voor de wetenschappelijke doeleinden van dit onderzoek gebruikt. Het uiteindelijke onderzoek wordt gepubliceerd op de TU Delft Repository en zal publiek toegankelijk zijn. Interview-transcripten zijn alleen inzichtelijk voor de begeleiders van het afstudeeronderzoek en zijn niet inzichtelijk buiten de TU Delft. Uw functie en thema wordt kort omschreven als ook uw ervaring (senioriteit). Uw naam blijft uiteraard anoniem. De audiobestanden worden verwijderd na vaststelling van de interviewverslagen.

Terugkoppeling: Na het interview wordt ter validatie een samenvatting van de resultaten van het interview aan u teruggekoppeld. De samenvatting van de bevindingen vanuit de interviews wordt verwerkt in het te publiceren onderzoek.

Deelname: Uw deelname aan dit onderzoek is volledig vrijwillig, en u kunt zich terugtrekken tot uiterlijk 26/5/2023 zonder opgave van reden. U bent vrij om vragen niet te beantwoorden. Voordelen van deelname aan dit onderzoek is inzicht in hoe het ervoor staat met studieplekken op de campus en

kunnen bijdragen aan een strategie voor de nieuwe onderwijsgebouwen op de campus. Risico's voor deelname: geen.

Bij vragen en/of klachten kunt u met mij contact opnemen.

Met vriendelijke groet,
Laura Tangelder

In te vullen door de geïnterviewde & onderzoeker

- Ik verklaar op een voor mij duidelijke wijze te zijn ingelicht over de aard, methode, doel en belasting van het onderzoek.

- Mijn vragen zijn naar tevredenheid beantwoord.

- Ik begrijp dat het geluids- en/of beeldmateriaal (of de bewerking daarvan) en de overige verzamelde gegevens uitsluitend voor analyse en wetenschappelijke presentatie en publicaties zal worden gebruikt.

- Ik begrijp dat de audio opname nadat de uitwerking heeft plaatsgevonden wordt vernietigd. De samenvatting van het interview wordt in de vorm van een verslag (circa 1 A4) ter goedkeuring voorgelegd aan de geïnterviewde.

- Ik behoud me daarbij het recht voor om tot 26/05/2023 zonder opgaaf van redenen mijn deelname aan dit onderzoek te beëindigen.

Ik heb dit formulier gelezen en ik stem in met deelname aan het onderzoek.

□ **Graag ontvang ik aan het eind van het onderzoek de gepubliceerde thesis.**

Plaats: _____

Datum: _____

_____
(volledige naam, in blokletters)

_____

(Handtekening deelnemer)

"Ik heb toelichting gegeven op het onderzoek. Ik verklaar mij bereid nog opkomende vragen over het onderzoek naar vermogen te beantwoorden."

NAAM

_____

Contactgegevens onderzoeker:

Naam: Laura Tangelder
Telefoon: *[telefoonnummer]*
E-mailadres: *[privé mail]*

Begeleiders afstudeerscriptie:

Eerste begeleider

Naam: Alexandra den Heijer
E-mailadres: *[mail]*

Tweede begeleider

Naam: Esther Gramsbergen
E-mailadres: *[mail]*

Begeleider afstudeerbedrijf

Naam: Bart Valks
E-mailadres: *[mail]*

Appendix V: Research introduction letter for participants

Betreft: Interview afstudeeronderzoek studieplekken (generieke onderwijsgebouwen)

Geachte heer/mevrouw,

Voor mijn afstudeeronderzoek over studieplekken op de TU Delft campus zou ik gezien uw functie en expertise graag een interview met u willen afnemen. Op die manier kan ik ook de financiële invalshoek integreren.

Het doel is om te onderzoeken of er een (mis)match is tussen vraag en aanbod van studieplekken op de campus van de TU Delft. Hierbij zullen 3 cases centraal staan: de Universiteitsbibliotheek (UB), Pulse en Echo. Het interview zal ca. een uur in beslag nemen.
De thema's die gedurende het interview de revue passeren zijn o.a:

- Een ruimtetekort of ruimteoverschot op de campus?
- De term studieplek;
- Generieke onderwijsgebouwen;
- Welke verbeterslag de TU Delft kan maken in het aanbieden van (toekomstige) studieplekken.

Indien u interesse heeft plan ik graag een afspraak met u in en zal ik ook verdere informatie verstrekken. Bij vragen kunt u contact met mij opnemen (per mail of telefonisch).

Met vriendelijke groet,

Laura Tangelder
(tevens bereikbaar op: [telefoonnummer])

Appendix VI: Interview protocol
Version: 18/03/2023[26]

Main research question:

How can TU Delft adapt its study place strategy to meet future students' preferences while recognising sustainable, financially feasible challenges?

Sub-questions:

SQ1: What is the current quantity and quality of offered study places on campus?

SQ2: What can be said about the future prospects regarding the need for study places?

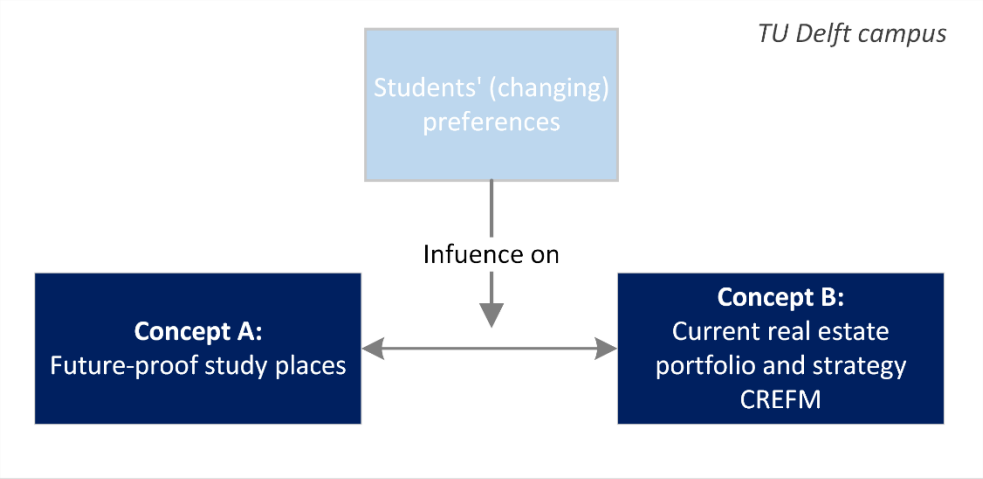
SQ3: What are alternatives for future study places, based on changing demand and taking into account the complex context?

SQ4: What concrete actions are recommended for the TU to provide the future demand of places to study?

Goal: The aim is to investigate whether there is a (mis)match between the supply and demand of study places on the TU Delft campus. This research will focus on 3 cases: the University Library (UB), Pulse and Echo.

Method: A top-down and bottom-up approach are both used. The first interview round focuses on educational/strategic level (top-down and zoomed out) and the second interview round on students (bottom-up and individual preferences).

Conceptual model:



Interview approach
The interview approach is based on qualitative interviewing by Moerman (2016).

Semi-structured: the topic of the interview is known to the interviewee. Although various questions on (sub-)topics are written down beforehand, the formulation will be relatively free and there is room for more in-depth follow-up questions that the interviewers might come up with on the spot.
Interview type: the interview scope is narrow as the topic is quite specific. Since the interview is about events and processes, it can be regarded as an investigative interview.

[26] After establishing and approving this interview protocol, it was decided not to include students in the second round of interviews

Rapport: to create rapport, it is planned to spend a little time in the beginning making small-talk. I expect this will make the interviewee more at ease, and possibly result in a better qualitative interview. This section is neither recorded nor transcribed. In the second round of interviews, this is also subtly incorporated into the beginning of the interview. The second interview question asks about experiences abroad. This also contributes to creating report, as people often talk about experiences abroad. In addition, comparisons can be drawn that might otherwise not have been addressed.

Interviewer behaviour: As different people are interviewed, there will be a difference between the different interview rounds and thus categories. The first round of interviews are the professionals. I am aware of the professional-student relationship in these interviews. Despite this, I am relatively outside of employees' work processes. Therefore, I approach their working experiences as a 'naive outsider'. The questions I ask students are not controversial, though I have to be careful of the 'student to student' relationship. It does have to remain an academic setting in which I have to be careful not to accept answers too quickly.

Probing: I am aware of the different ways of probing, would like to let the dynamics turn out the way they turn out and then try to steer if I do not get the appropriate results, specifically, in asking questions that are market as important. This is done by using the probing techniques of Moerman (2016). Think about, nodding, and sentences such as; 'yes', tell me more about that' and 'where did it lead to'. I also intend to critically evaluate the answers when multiple answers contradict each other.

Literature:

Jansen, S. J. T., Coolen, H. C. C. H., & Goetgeluk, R. W. (Eds.). (2011). The Measurement and Analysis of Housing Preference and Choice. https://doi.org/10.1007/978-90-481-8894-9

Moerman (2016, September 11). *Playlist Research Methods and Statistics* | *Qualitative Methods* | *Qualitative Interviewing* | *UvA* [Video]. YouTube. https://www.youtube.com/watch?v=ZfSGKivni_E

Checklist pre-interview

- Read up on the participant (expertise, work experience, niche: Which domain do I really want to find out more about with that person)
- Consent form (send in advance by e-mail and have printed out to sign)
- Use back-up recording devices (laptop recording (Word)+ phone (dictatofoon app)

Interview introduction procedure

1. Expressing thanks for participating in the interview
2. Asking consent to record the interview (anonymous results, confidential)
3. Asking to sign the consent form (in case not already signed by e-mail)
4. Introducing myself
5. Asking interviewee to introduce himself
6. Introducing interview topic (briefly; as said in the email…; not saying too much already)
7. Interview (round 1: +/- 60 min. round 2: +/- 30 min.)

Wrapping up:

1. Expressing thanks for collaborating in the interview.
2. Ask if the interviewee has something else to add to the interview, and/or forgot to mention something.
3. Asking to be kept informed about the thesis research
4. Indicate that a summary of the interview (max. 1 A4) will be sent for approval as feedback

Checklist post-interview

- Upload recordings of the interview
- Transcribe interviews
- < 1 week: summary interview send

About the interview questions

In case many questions are generated. Then possibly add in the interview that there are many questions to be answered (preferably straight to the point). Important questions are noted, the translation in italics is in Dutch. When these red questions are not sufficiently answered, ask for examples or more elaboration about the topic. As 'kapstokhaakjes', an ‘answercheck’ (see bullet-points) for each question has been added, which includes terminology that is preferably mentioned or has intersections (raakvlakken) with the interviewee's answer. When these questions are answered in-depth, use the probing techniques of Moerman (2016) to stimulate the interviewee in giving more information (for examples see above, the paragraph about probing).