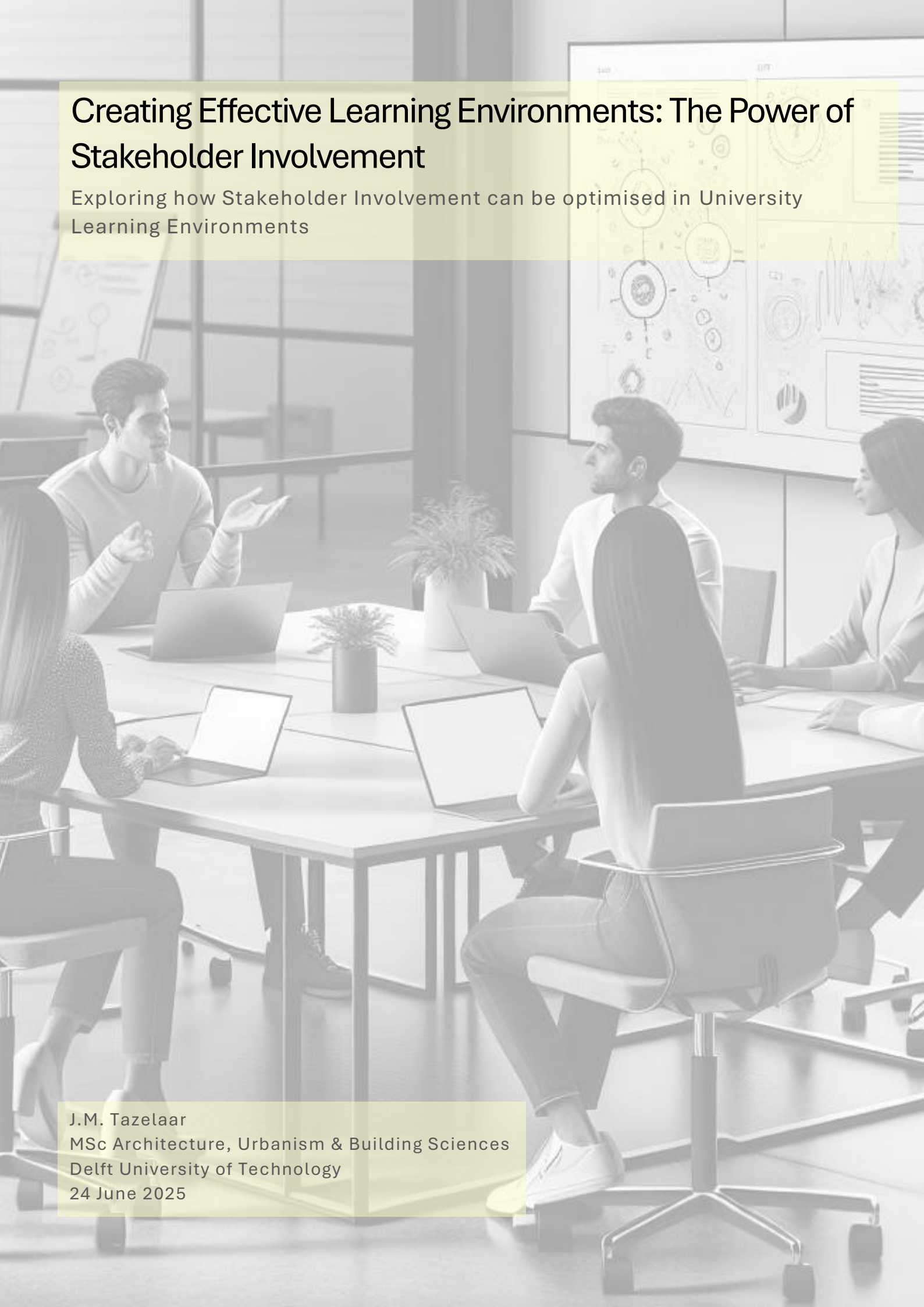
Creating Effective Learning Environments: The Power of Stakeholder Involvement

Exploring how Stakeholder Involvement can be optimised in University Learning Environments



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Preface

With great pleasure, I present my graduation thesis, a report that is the result of my graduation research on the optimisation of stakeholder involvement processes in the creation of effective learning environments. This research project was carried out as part of the master's programme *Management in the Built Environment* at the Faculty of Architecture and the Built Environment, Delft University of Technology.

The joy and inspiration I experienced during my graduation journey were largely due to the support of several people. First and foremost, I would like to thank my supervisors, Dr. Ir. Monique Arkesteijn and Dr. Ir. Vitalija Danivska, from Delft University of Technology. The conversations we had were always enlightening and encouraged me to take my work one step further — all while enjoying the process. My first supervisor, Monique Arkesteijn, has supported me immensely from the beginning, both as my graduation lab tutor and as a supervisor. She helped me shape and focus my research and find my specific area of interest. In the later phases, she provided invaluable feedback, engaged in meaningful discussions, and shared her broad knowledge of research and learning environments. My second supervisor, Vitalija Danivska, kept me sharp with her constructive and academically grounded feedback. She helped me structure and articulate my ideas effectively and contributed a valuable perspective through her expertise in user-centric design, offering a complementary lens on stakeholder involvement processes.

Thirdly, I would like to thank my supervisor from Aestate, Pity Jongens, for her continuous guidance. Her insights from the professional field, combined with her experience in research, were instrumental in shaping and progressing my thesis. I also want to thank the other colleagues at Aestate for their support, interest, and the many fruitful discussions — as well as for their help with time management and staying on track.

I also would like to thank all the stakeholders who participated in my interviews and provided valuable insights. Without their input, this research would not have been possible.

Finally, on a personal note, I would like to thank my parents, my brother, my grandparents, my housemates, and my friends. I am truly grateful for your continued support, encouragement, enthusiasm, and for celebrating every milestone along the way with me.

I hope you enjoy reading this thesis!

Julie Tazelaar

Delft, June 2025

Abstract

While the importance of stakeholder involvement in creating new learning environments in universities is well established, limited research has been conducted on the stakeholder process within learning environments as a distinct field or on optimizing this process. It remains unclear how stakeholder contributions are managed and whether these inputs effectively translate into spaces that meet the expectations and requirements of end-users. This research aims to map out the stakeholder involvement process and explore how it can be optimized. The central research question is: *'How can stakeholder involvement be optimized in the creation of effective learning environments in university real estate?'"*

To answer this question, a mixed-methods study will be conducted, consisting of three components. First, a literature review will provide a theoretical foundation on stakeholder involvement and the effectiveness of learning environments. Following this, a case study will be conducted on selected cases of newly implemented learning environments developed with stakeholder involvement. The case studies will map out the stakeholder involvement process in the creation of these environments. Next, interviews will be held with the stakeholders involved in the process, assessing their perspectives on the process and their views on the effectiveness of the resulting learning environments. Lastly, surveys will be conducted with end-users of the learning environments to evaluate their perceptions of the environment's effectiveness. The goal of this research is to assess whether there is alignment between stakeholder expectations and end-user experiences, and to explore how the effectiveness of the learning environments can be traced back to the stakeholder involvement process. This will ultimately help identify areas for optimization in stakeholder involvement.

Keywords: Stakeholder Involvement Process, Effective Learning Environments, University Real Estate, Optimization

Executive Summary

Introduction

The rise of technology has shifted education from traditional methods to more flexible, learner-centred approaches, requiring the adaptation of learning environments to meet diverse needs. Creating effective learning environments depends on understanding the factors that define success, with stakeholder involvement being crucial. Stakeholders are key to designing environments that align with educational goals and user needs. Early engagement with stakeholders leads to designs that better meet actual requirements, improving user satisfaction and educational outcomes.

However, there is limited research on how stakeholder involvement specifically unfolds within university real estate and how it can be optimized. This gap highlights the need for further research on improving the stakeholder involvement process to create impactful and functional learning environments. This study aims to address this gap and offer insights for optimization. The central research question of this research is: *"How can the stakeholder involvement process be optimised in the creation of effective learning environments in university real estate?"*

Methodology

This research adopts a mixed-methods approach, combining qualitative and quantitative methods to gain comprehensive insights. The study begins with a literature review to refine the problem statement and identify existing knowledge gaps. Subsequently, four case studies were conducted, including 12 semi-structured interviews with stakeholders to examine the stakeholder involvement process and how their input influences the design (sub-questions 1 and 2). Following this, surveys were distributed among end-users to assess their perceptions of the effectiveness of the learning environments (sub-question 3). These insights were then compared to stakeholder input to evaluate the extent of alignment between intended outcomes and user experience (sub-question 4). The goal is to identify which aspects of the stakeholder process can be improved to optimise stakeholder involvement and contribute to the development of more effective learning environments in university real estate.

RQ1: What does the stakeholder involvement process look like in the creation of effective learning environments?
RQ2: How is stakeholder input integrated into the design process of effective learning environments?
RQ3: How do end-users perceive the effectiveness of the learning environment?
RQ4: To what extent is there alignment between end-user perceptions and stakeholder input regarding the effectiveness of the learning environment?

Research Findings

The effectiveness of the four university learning environments can be evaluated from three perspectives: literature, end-users, and stakeholders. The literature defines an effective learning environment based on the concept of *connectedness*, which is achieved through six spatial characteristics: a formal classroom layout, a central position for the teacher, the presence of flexible furniture, group setups, and both digital and technological tools. Based on these criteria, Utrecht University's HALC scores the highest: this environment meets all six characteristics and is effectively used as intended. TU Delft's Projectroom CDEF and Radboud University's OneRoom miss several elements; in particular, the lack of flexible furniture and a central position for the teacher limits functionality. Tilburg University's Collaboration Room is considered the least effective due to the absence of multiple key elements.

End-users' perceptions confirm the importance of these spatial characteristics but also emphasize that actual effectiveness largely depends on how the space is used in practice. In many cases, actual use does not align with the intended blended learning concept; traditional lectures are still being delivered in spaces that are not designed for them. Stakeholders express satisfaction with the design, but note low adoption or misuse of the spaces. This is partly due to poor alignment between scheduling systems and educational formats. This misalignment between design and use proves to be a critical factor in the perceived effectiveness of learning environments.

When these findings are linked back to the stakeholder processes of the cases, a clear correlation emerges between the structure and quality of stakeholder involvement and the ultimate effectiveness of the learning environments. While the literature consistently stresses the importance of involving end-users—particularly teachers and students—throughout all project phases, in practice this often falls short. End-users are frequently not recognized as key stakeholders, are only passively involved, or efforts to motivate them to contribute actively to the process fail. This leads to a mismatch between the design and the actual use. Notably, shortcomings were found in Phase I (Identification & Selection), Phase II (Securing Interest), and Phase III-a (Input Strategy).

In addition to the structure and execution of the stakeholder process, the timing and continuity of involvement also play a crucial role in the success of a learning environment. In cases where stakeholders were actively engaged from the beginning and could provide input throughout the entire project, this led to high levels of satisfaction and strong alignment with user needs. In contrast, the case of Tilburg University illustrates how contract forms such as design-and-build can hinder this process by shifting responsibility to external parties too early, making stakeholder input later in the process ineffective.

Finally, it becomes clear that simply creating a physical learning environment is not enough. To truly embed the shift toward Active Blended Learning, universities must go beyond providing spaces and align this educational transformation with their institutional vision, supported by strong top-down leadership. At the same time, bottom-up support is essential—for example, by training and empowering teachers to use the new spaces effectively.

Conclusion

To optimise stakeholder involvement in the creation of effective university learning environments, the process must shift from assumption-based, expert-driven design to a user-centred approach in which end-users are recognised as key stakeholders and engaged as active co-designers. This requires early and continuous involvement, ensuring their input is taken seriously and reflected in the final outcome. Universities should focus on improving three critical phases in the involvement process: identifying and including end-users from the start, securing their interest through motivation and clear communication, and empowering them with real influence during the design process. Additionally, internal teams must retain decision-making power long enough to allow meaningful participation, which is best supported by more flexible contract forms. Lastly, universities must not only provide the physical learning spaces but also implement change management strategies that actively encourage and motivate the use of these spaces effectively. Only then can learning environments be created that are not only well-designed in theory but effective and usable in practice.

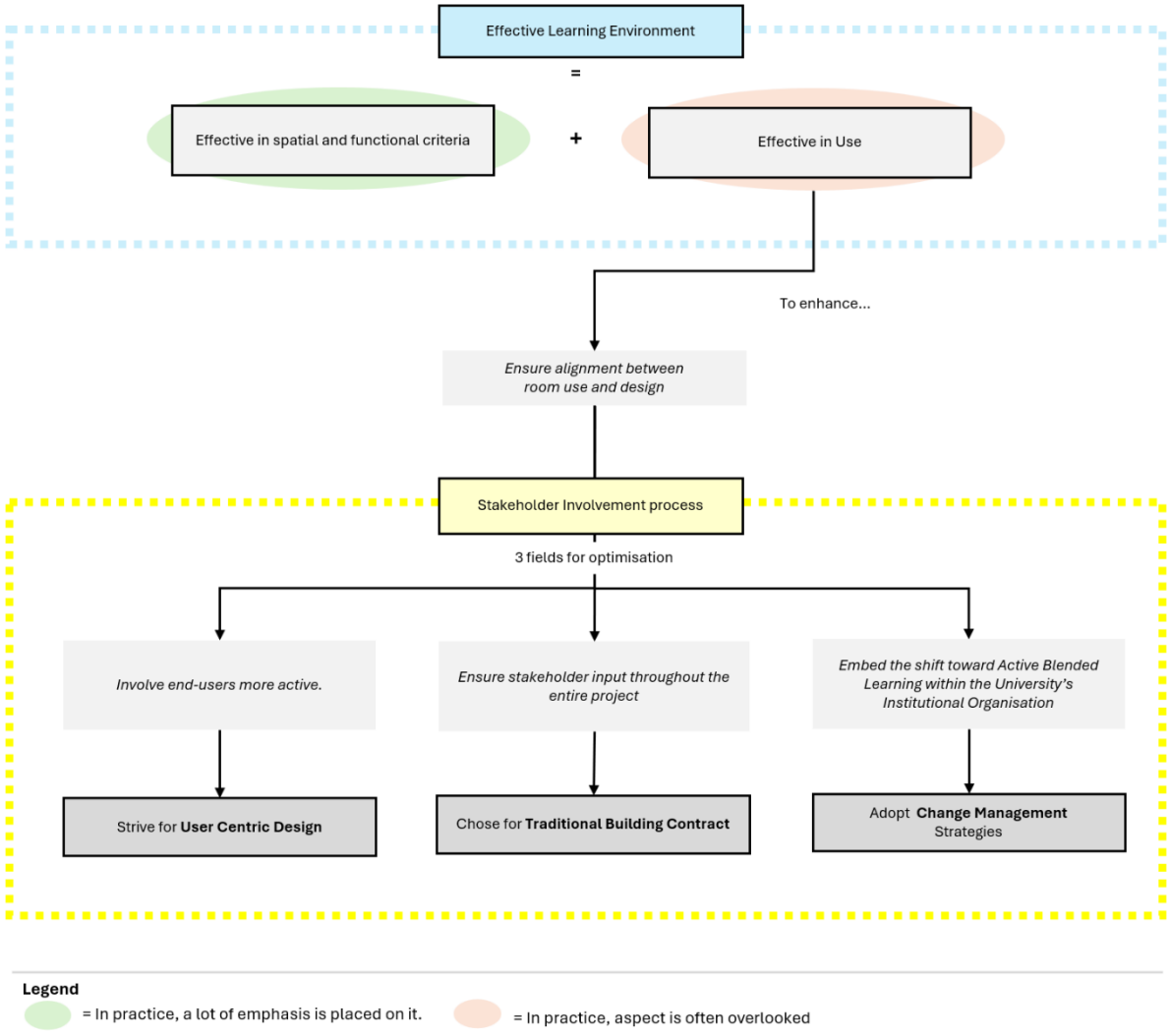


Figure I: Conclusion on how user-centric design could help optimising the stakeholder process to create effective learning environments

Samenvatting

Inleiding

De opkomst van technologie heeft het onderwijs doen verschuiven van traditionele methoden naar flexibelere, studentgerichte benaderingen, wat vraagt om aanpassing van leeromgevingen aan diverse behoeften. Het creëren van effectieve leeromgevingen vereist inzicht in de factoren die het succes bepalen, waarbij stakeholderbetrokkenheid van cruciaal belang is. Stakeholders spelen een sleutelrol in het ontwerpen van omgevingen die aansluiten bij onderwijskundige doelen en gebruikersbehoeften. Vroege betrokkenheid van stakeholders leidt tot ontwerpen die beter aansluiten bij de werkelijke eisen, wat resulteert in meer gebruikerstevredenheid en betere onderwijskundige resultaten.

Toch is er beperkt onderzoek gedaan naar hoe stakeholderbetrokkenheid zich specifiek ontvouwt binnen universitair vastgoed en hoe dit proces geoptimaliseerd kan worden. Deze kenniskloof onderstreept de noodzaak voor verder onderzoek naar het verbeteren van het stakeholderproces om tot impactvolle en functionele leeromgevingen te komen. Dit onderzoek heeft als doel deze kloof te overbruggen en inzichten te bieden voor optimalisatie. De centrale onderzoeksvraag luidt: "*Hoe kan het stakeholderproces geoptimaliseerd worden bij het creëren van effectieve leeromgevingen binnen universitair vastgoed?*"

Methodologie

Dit onderzoek hanteert een mixed-methods benadering, waarbij kwalitatieve en kwantitatieve methoden worden gecombineerd om tot een breed en diepgaand inzicht te komen. Het onderzoek start met een literatuurstudie om de probleemstelling aan te scherpen en bestaande kennislacunes in kaart te brengen. Vervolgens zijn er vier casestudies uitgevoerd, waarbij 12 semigestructureerde interviews met stakeholders zijn afgenomen om het stakeholderproces en de invloed van hun input op het ontwerp te analyseren (subvragen 1 en 2). Daarna zijn enquêtes verspreid onder eindgebruikers om hun perceptie van de effectiviteit van de leeromgevingen te evalueren (subvraag 3). Deze inzichten zijn vervolgens vergeleken met de stakeholderinput om te bepalen in hoeverre de bedoelde doelen overeenkomen met de gebruikerservaring (subvraag 4). Het doel is om te identificeren welke aspecten van het stakeholderproces verbeterd kunnen worden om bij te dragen aan effectievere leeromgevingen binnen universitair vastgoed.

RQ1: Hoe ziet het stakeholderproces eruit bij het creëren van effectieve leeromgevingen?
RQ2: Hoe wordt de input van stakeholders geïntegreerd in het ontwerpproces van effectieve leeromgevingen?
RQ3: Hoe ervaren eindgebruikers de effectiviteit van de leeromgeving?
RQ4: In hoeverre is er overeenstemming tussen de percepties van eindgebruikers en de input van stakeholders met betrekking tot de effectiviteit van de leeromgeving?

Bevindingen

De effectiviteit van de vier universitaire leeromgevingen kan worden beoordeeld vanuit drie perspectieven: literatuur, eindgebruikers en stakeholders. De literatuur definieert een effectieve leeromgeving op basis van 'verbondenheid', gerealiseerd door zes ruimtelijke kenmerken: een formele klaslokaalopstelling, een centrale positie voor de docent, de aanwezigheid van flexibel meubilair, groepsopstellingen, en digitale en technologische tools. Op basis hiervan scoort de HALC van de Universiteit Utrecht het hoogst: deze omgeving voldoet aan alle zes kenmerken en wordt effectief gebruikt zoals bedoeld. Projectroom CDEF van de TU Delft en de OneRoom van de Radboud Universiteit missen enkele elementen; vooral het ontbreken van flexibel meubilair en een centrale positie voor de docent beperkt de functionaliteit. De Collaboration Room van de Universiteit van Tilburg wordt als het minst effectief beschouwd vanwege het ontbreken van meerdere sleutelelementen.

De percepties van eindgebruikers bevestigen het belang van deze ruimtelijke kenmerken, maar benadrukken dat de daadwerkelijke effectiviteit vooral afhangt van hoe de ruimte in de praktijk wordt gebruikt. In veel gevallen komt het daadwerkelijke gebruik niet overeen met het beoogde blended learning-concept; er worden nog steeds traditionele colleges gegeven in ruimten die daar niet voor zijn ontworpen. Stakeholders geven aan tevreden te zijn over het ontwerp, maar signaleren lage adoptie of verkeerd gebruik van de ruimtes. Dit is deels het gevolg van een gebrekkige afstemming tussen het roostersysteem en de onderwijsvormen. Deze misalignment tussen ontwerp en gebruik blijkt een cruciale factor in de ervaren effectiviteit van leeromgevingen.

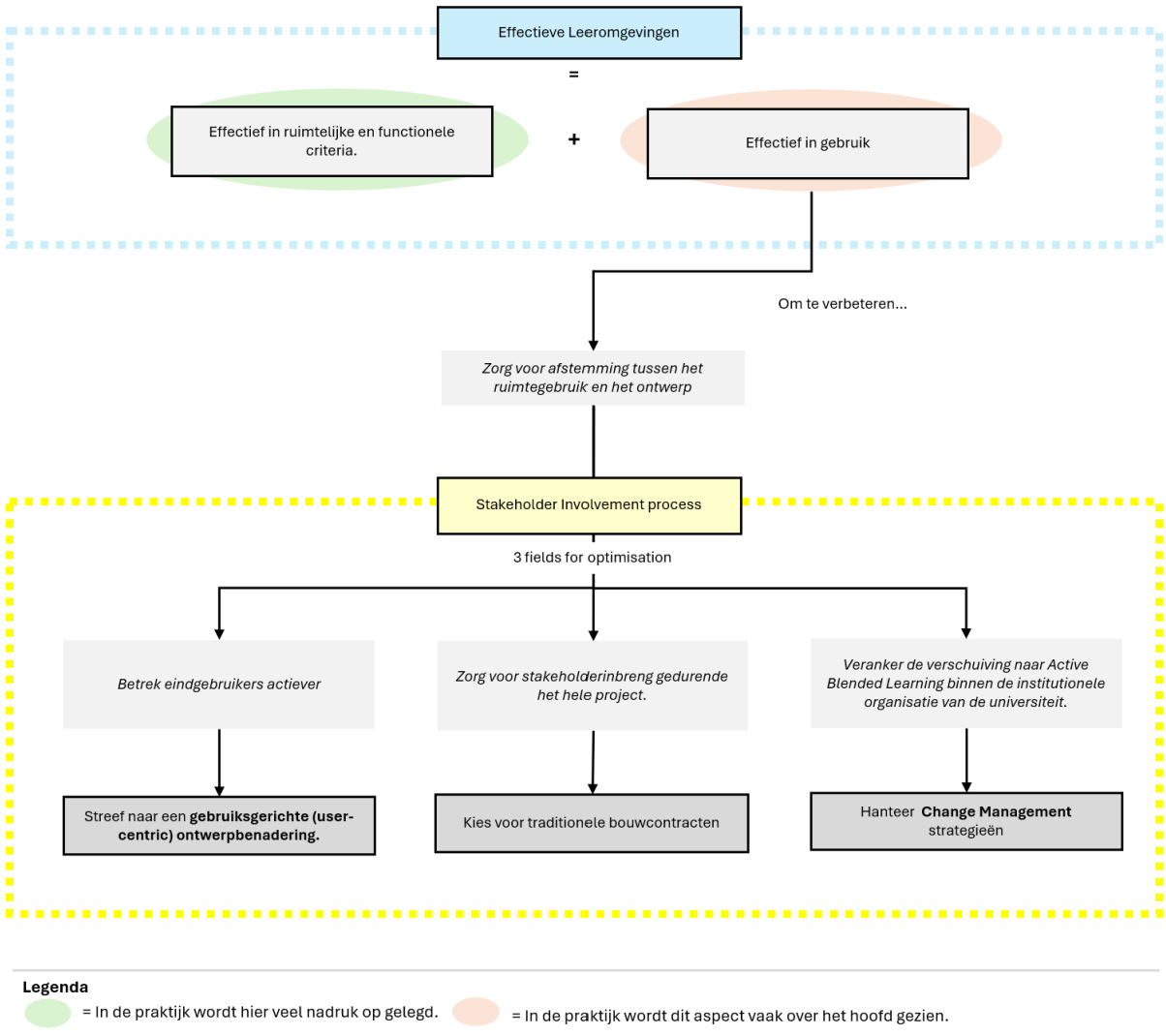
Wanneer deze bevindingen worden teruggekoppeld aan de stakeholderprocessen van de cases, is er een duidelijke correlatie te zien tussen de structuur en kwaliteit van stakeholderbetrokkenheid en de effectiviteit van de uiteindelijke leeromgevingen. Hoewel de literatuur het belang benadrukt van het betrekken van eindgebruikers – met name docenten en studenten – gedurende alle projectfasen, gebeurt dit in de praktijk vaak onvoldoende. Eindgebruikers worden regelmatig niet als sleutelstakeholders herkend, slechts passief betrokken, of er wordt niet in geslaagd om hen te motiveren om actief bij te dragen aan het proces. Dit leidt tot een mismatch tussen het ontwerp en het daadwerkelijke gebruik. Vooral in Fase I (Identificatie & Selectie), Fase II (Interesse Waarborgen) en Fase III-a (Inputstrategie) kwamen duidelijke tekortkomingen naar voren.

Naast de structuur en uitvoering van het stakeholderproces blijkt ook de timing en continuïteit van betrokkenheid een cruciale rol te spelen in het succes van een leeromgeving. In de cases waarin stakeholders vanaf het begin actief werden betrokken en gedurende het hele traject input konden leveren, leidde dit tot een hoge mate van tevredenheid en een sterke afstemming op gebruikersbehoeften. Daarentegen laat de case van de Universiteit van Tilburg zien hoe contractvormen zoals design-and-build dit proces kunnen belemmeren, doordat de verantwoordelijkheid vroegtijdig verschuift naar externe partijen, waardoor input van stakeholders later in het proces weinig tot geen invloed meer heeft.

Tot slot blijkt dat het realiseren van een fysieke leeromgeving op zichzelf niet voldoende is. Om de overgang naar Active Blended Learning werkelijk te verankeren, moeten universiteiten verder gaan dan het enkel faciliteren van ruimtes. Ze moeten deze onderwijskundige transformatie afstemmen op hun institutionele visie, ondersteund door krachtig top-down leiderschap. Tegelijkertijd is bottom-up support essentieel, bijvoorbeeld door docenten te trainen en te ondersteunen in het effectief gebruiken van de nieuwe ruimtes.

Conclusie

Om het stakeholderproces te optimaliseren bij het creëren van effectieve universitaire leeromgevingen, moet de aanpak verschuiven van veronderstellings- en expertgestuurd ontwerp naar een gebruiksgerichte benadering waarbij eindgebruikers worden erkend als belangrijke stakeholders en actief worden betrokken als medeontwerpers. Dit vraagt om vroege en continue betrokkenheid, waarbij hun input serieus wordt genomen en terugkomt in het uiteindelijke resultaat. Universiteiten moeten zich richten op het verbeteren van drie cruciale fasen in het betrokkenheidsproces: het vanaf het begin identificeren en betrekken van eindgebruikers, het borgen van hun interesse door middel van motivatie en duidelijke communicatie, en het geven van echte invloed tijdens het ontwerpproces. Daarnaast moeten interne teams voldoende beslissingsmacht behouden om zinvolle participatie mogelijk te maken, wat het beste wordt ondersteund door flexibelere contractvormen. Tot slot moeten universiteiten niet alleen de fysieke leeromgevingen faciliteren, maar ook verandermanagementstrategieën toepassen die het gebruik van deze ruimtes actief stimuleren en motiveren. Alleen dan kunnen leeromgevingen ontstaan die niet alleen theoretisch goed zijn ontworpen, maar ook effectief zijn in gebruik.



Figuur I: Conclusie over hoe gebruikersgericht ontwerp kan bijdragen aan het optimaliseren van het stakeholderproces voor het creëren van effectieve leeromgevingen

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Part 1

Introduction

1.1 Introduction

In this chapter, the problem statement is presented, along with the research context. Finally, this chapter also addresses the societal and scientific relevance of this research.

1.1.1 Research Context

The rise of technology has significantly transformed the educational landscape. While traditional teaching methods once prevailed, technology now offers unprecedented opportunities to make learning and teaching more efficient and interactive (SURF, 2023). At the beginning of this century, it was already observed that technology had a growing impact on education. Winn (2002) already stated that when effectively integrated, technology can greatly enhance both teaching and studying processes.

In addition to digital advancements, another notable trend in education has emerged: the shift from traditional methods to flexible learning. This shift emphasizes a learner-centred approach, empowering students with autonomy over how, what, when, and where they learn. The rise of innovative, technical, and online teaching methods, along with the move toward flexible education, necessitates a transformation in learning environments. These spaces must adapt to the diverse needs of students while integrating these new forms of learning into on-campus settings (Gatlin, 2021; Pnevmatikos et al., 2020; SURF, 2023). As a result, there has been a growing demand for new, supportive learning environments that can facilitate these changes.

A learning environment can be defined as the physical, social and psychological setting in which learning occurs, and in which experiences and expectations are co-created among its participants (Rusticus et al., 2023). Various studies have demonstrated that a positive experience of the learning environment has a beneficial effect on students' learning capacity (Gatlin, 2021; Könings et al., 2014; Pnevmatikos et al., 2020). Some even stated that learning environments in universities are part of the learning experience and learning spaces can be seen as ‘’third teachers’’ (Borri, 2023).

However, to create an effective learning environment, it is essential to first determine what defines its effectiveness. This is where stakeholder involvement plays a crucial role. By enabling stakeholders who may benefit from the development of new learning environments to actively participate in the design process and clarify what they consider essential for an effective learning environment, it results in settings that are better aligned with the specific needs of learners and educators, thus enhancing both educational outcomes and user satisfaction (Könings et al., 2014). Pnevmatikos et al. (2020) even argue that stakeholders should not be limited to end-users but should include other interested parties in the design process. They explain that by involving a larger number of potential stakeholders who may benefit from the development of a new learning environment, researchers aim to prevent incorrect assumptions about the needs of different groups and to design ecologically appropriate, viable, and effective learning environments that enhance satisfaction with the learning experience.

1.1.2 Problem Statement

In response to growing trends such as digitalisation, flexibilisation, and student-centred learning, universities are increasingly investing in new learning environments. These spaces are expected to be adaptive, functional, and aligned with diverse pedagogical needs. In the literature, it is

widely recognised that the creation of such effective learning environments heavily relies on the involvement of stakeholders (Frelin & Grannäs, 2021; Könings et al., 2014; Pnevmatikos et al., 2020; Rudman et al., 2018; Victorino et al., 2022). Stakeholders play a crucial role in shaping these environments to meet educational objectives and user needs.

Extensive research has been conducted on stakeholder involvement as a field in itself. Studies have examined the stages, roles, and strategies involved in stakeholder processes across a variety of domains. However, the application of this knowledge to the specific context of developing new learning environments in university real estate remains underexplored. Because this field is still in an early stage of development—given that the shift from traditional to new learning environments is only just beginning—systematic research on effective stakeholder involvement in this specific context is limited.

Yet, it is precisely important to understand how stakeholder involvement can be optimally applied in learning environments, as it is inextricably linked to the effectiveness of these spaces. Unlike generic building projects, the development of learning environments is not solely about physical design; it also concerns the facilitation of educational processes. For this reason, it is essential to understand how stakeholder input contributes to spaces that genuinely enhance education.

Practice would therefore greatly benefit from more research on this topic. As a stakeholder who was involved in the development of a new learning environment noted: *"We're also just doing what we think is best, but there is to my knowledge no standard step-by-step guide available. We actually have no idea if we're doing it right, apart from our own experiences. And we're very curious about how other universities are approaching this and whether we can learn from each other or improve our own methods."* (A2, 2025).

So, although some case studies describe stakeholder involvement in the context of educational spaces, there is little empirical research that systematically investigates how these processes unfold, how stakeholder input is handled, and to what extent it contributes to learning environments that meet the expectations and requirements of end-users. The connection between stakeholder contributions and the actual effectiveness of the resulting spaces remains largely unclear. Furthermore, it is still unknown which phases or aspects of stakeholder involvement are most crucial, or how the process could be improved to enhance learning environment outcomes.

So, while there is broad consensus in the literature that stakeholder involvement contributes to the success of learning environments (Borri, 2021; Frelin & Grannäs, 2021; Gatlin, 2021; Könings et al., 2014; Pnevmatikos et al., 2020; Rudman et al., 2018; Victorino et al., 2022), more applied research is needed to understand how these processes can be effectively designed, implemented, and optimised. This leads to the following problem statement: *Little is known about the process of stakeholder involvement in creating effective learning environments and how it can be optimised*.

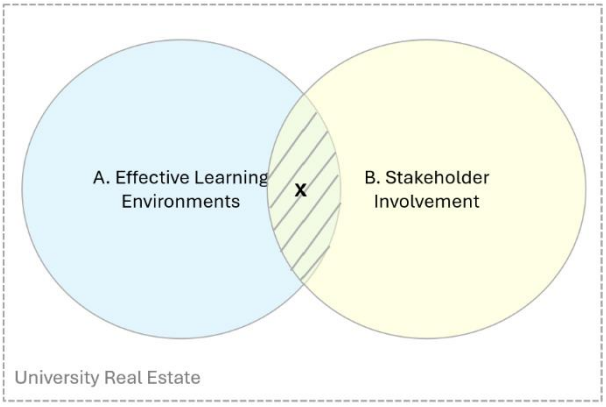


Figure 1 Concepts for Literature Search

Part 2

Methodology

2.1 Methodology

This chapter describes the research questions, research method, data collection and analysis, and the research output.

2.1.1 Research Questions

The main question of the research is as follows: ***"How can the stakeholder involvement process be optimised in the creation of effective learning environments in university real estate?''***

In order to answer this main research question, sub-questions are formulated. Those sub questions are listed below and help to make the research structured and insightful.

SQ1: What does the stakeholder involvement process look like in the creation of effective learning environments?

SQ2: How is stakeholder input integrated into the design process of the effective learning environments?

SQ3: How do end-users perceive the effectiveness of the learning environment?

SQ4: To what extent is there alignment between end-user perceptions and stakeholder input regarding the effectiveness of the learning environment?

2.1.2 Conceptual Framework

This section outlines the methodology of this study and the rationale behind the data selection process. Careful planning is essential to ensure that the data collected effectively addresses the research question. As mentioned in the previous subsection, this research investigated the stakeholder involvement process in the creation of effective learning environments, the

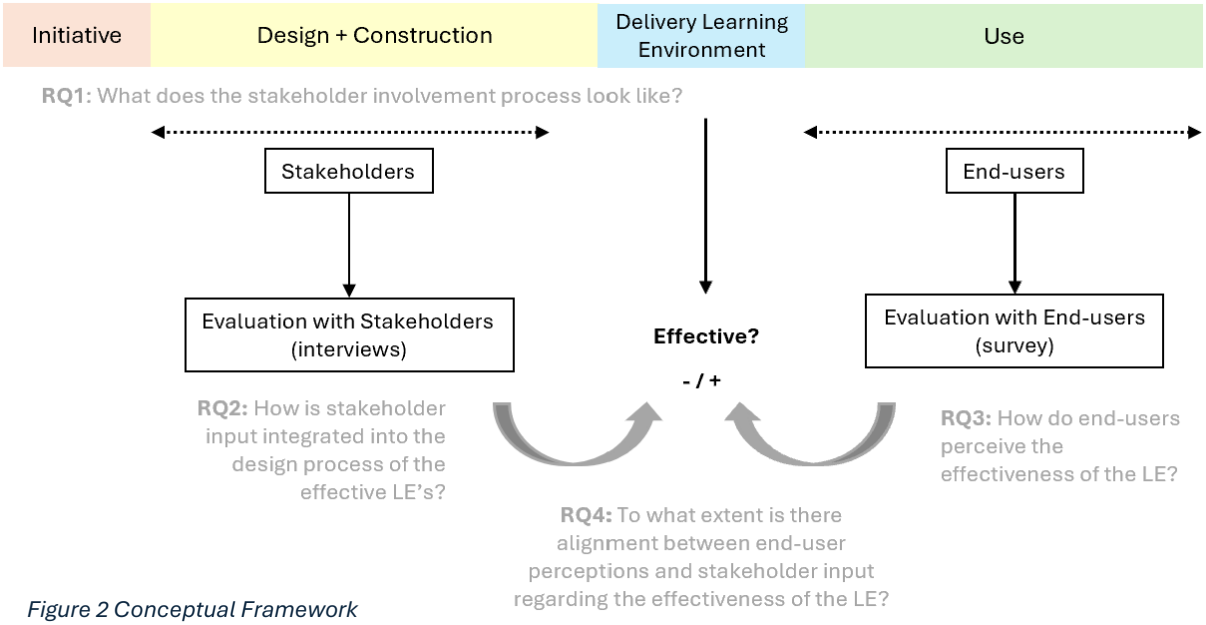


Figure 2 Conceptual Framework

integration of stakeholder input into the design process, and the alignment between end-users' perceptions of the learning environment's effectiveness and the success criteria based on the stakeholders' input.

In figure 3, the conceptual framework is presented, outlining the design of this study. The conceptual research model displays a timeline in which the process of creating a learning environment is simplified. It highlights the key phases of this process and maps the involvement of two distinct groups of actors: stakeholders and end-users. By identifying when and how these groups contribute, the model provides a structured basis for evaluating their roles. Beside that, evaluation are conducted to analyse the extent to which stakeholder input and expectations are reflected in the outcomes of the learning environments and assess whether these outcomes align with end-users' perceptions of an effective learning environment.

End-users are the individuals or organizations that ultimately use a product or service. In the field of real estate, the interpretation of who qualifies as an end-user may vary depending on the context of the study. For example in corporate real estate, the term 'end-user' often refers to end-user organisations, which is the organisation as a whole who generally purchases a property with an intent to reside in it. In the context of learning environments, this means that the university, as the formal owner and occupant of the space, is considered the end-user of the real estate (Colliers, 2017). While in, for example, the field of facility management (FM), the term 'end-users' typically refers to the individual users of a space (Hebert & Chaney, 2012). For learning environments, this includes the teachers and students who physically use the space.

Within the scope of this research, the term *end-users* refers to the actual individual users of the learning environment, namely teachers and students. End-users are the most important actors during the usage phase of learning environments, as they are the ones engaging with the space as a means to support their education. Therefore, evaluations with end-users are conducted to assess how effective they perceive the environment to be. End-users can also be stakeholders; however, in this research, it is not necessarily the case that the individuals involved as stakeholders are the same as those who are end-users.

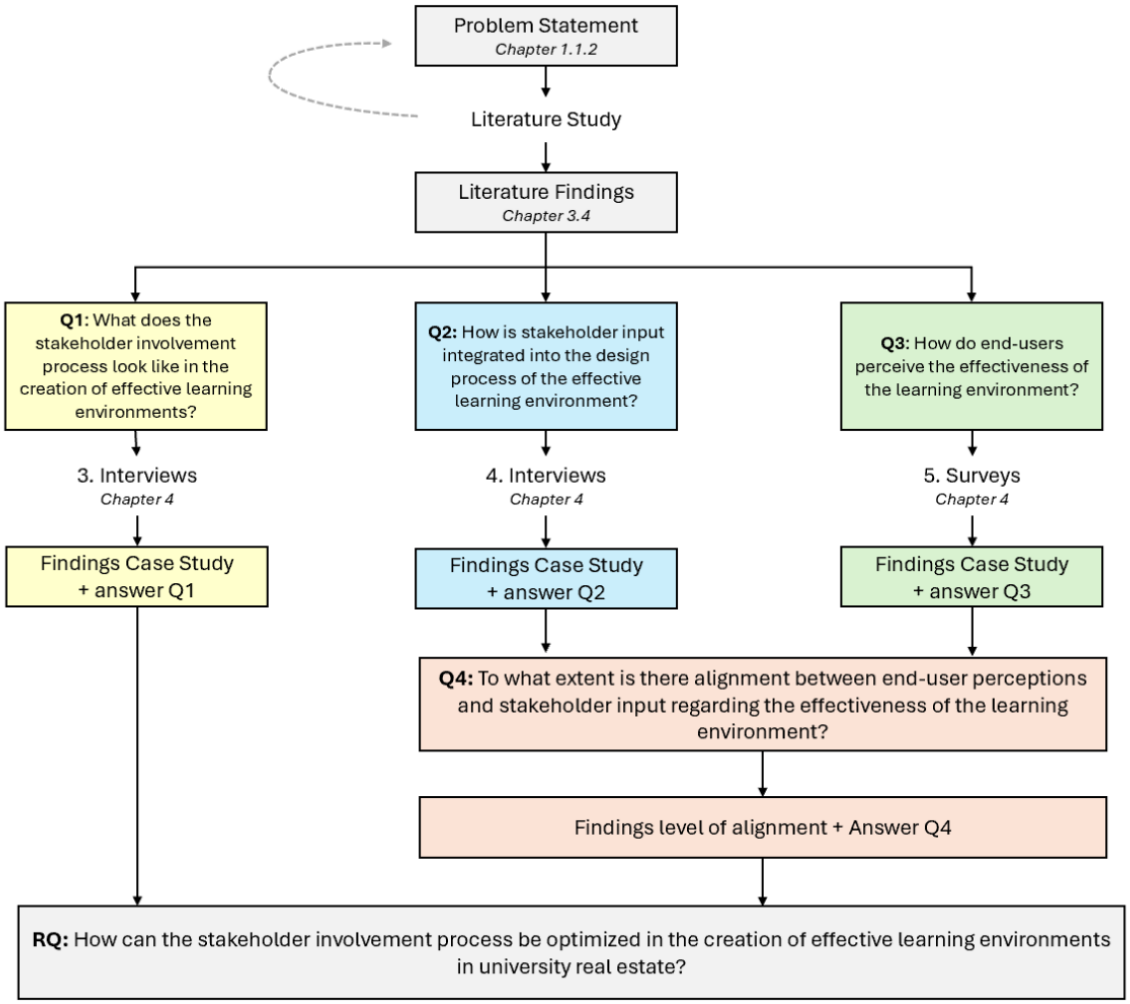
This research approach will ultimately help determine how stakeholder involvement can be optimized to enhance the effectiveness of university learning environments.

Literature Study, Case Study, Interviews & Surveys

In this research, a mixed-methods approach was adopted, involving the collection, analysis, and integration of both quantitative and qualitative data within a single study or series of studies (Cresswell & Plano Clark, 2017). By combining these research approaches, the aim was to achieve a more comprehensive and detailed understanding than could have been obtained through either qualitative or quantitative methods alone (Blaikie & Priest, 2019).

The research initially focused on gaining insights into existing studies and data on the creation of learning environments with stakeholder involvement in university real estate. Therefore, the study began with a literature review. Following this review, four case studies were conducted as part of the empirical research, which consisted of two components: interviews and a survey. Figure 4 illustrated the research concept and set-up.

Figure 3 Research Concept and Set-up



The research process began with a literature review to establish a theoretical framework on stakeholder involvement in educational environments. This review informed the development of the research questions and clarified the knowledge gap, particularly concerning how stakeholder processes influence the actual effectiveness of university learning spaces. Following this, the empirical study was conducted.

The first empirical component involved conducting interviews with stakeholders. To examine the stakeholder involvement process in depth, semi-structured interviews were conducted with stakeholders who were directly involved in the design and development of the learning environments. The aim was to gain a deeper understanding of the stakeholder involvement process in the creation of effective learning environments, thereby addressing sub-question 1. The analysis focused on identifying who was involved, the relationships between stakeholders, and the timing of their involvement in the process. Additionally, the interviews explored how and to what extent stakeholder input was integrated into the design of the learning environments. This provided insights into the types of input stakeholders contributed, how this input was collected, how decisions were made, and how stakeholder contributions influenced the design of the spaces. These findings provide the foundation for answering sub-question 2.

The rationale for using interviews is twofold: First, stakeholder involvement is a process-oriented and interpretative phenomenon, which is best explored through open-ended, qualitative methods that allow participants to share their experiences and perceptions. Second, the interviews enabled detailed reconstruction of who was involved, how decisions were made, how input was collected, and to what extent input actually influenced the final design—aspects that are difficult to capture through surveys or documents alone. The semi-structured format facilitated two-way communication, allowing for both guided discussions and flexibility to explore emerging topics (Blaikie & Priest, 2019).

While interviews focused on the *design and decision-making side*, the study also aimed to assess the *actual user experience* of the learning environments. Therefore, structured surveys were distributed among the end-users: students and teachers who use the spaces. The aim of the survey was to gather information about their experiences with the spaces, allowing for an assessment of whether the intended goals—formulated by the involved stakeholders—were achieved in practice. These findings provide the foundation for answering sub-question 3.

Surveys were used for this group because they allow data collection from a larger and more diverse sample than interviews, which is essential for capturing general patterns in user satisfaction and perceived effectiveness, the use of closed-ended questions ensures comparability across cases and enables the aggregation of responses for analysis and iimportantly, end-users compared to involved stakeholders often lack detailed knowledge about the background, intentions, or design rationale of the spaces. As such, conducting interviews with them would be of limited value and may place an unreasonable burden on participants. A survey, in contrast, allows them to reflect on their own experiences in a low-threshold and accessible way, without requiring prior knowledge about the project's development.

By combining stakeholder interviews with user surveys, the study was able to explore both the intentions behind the design and the experiences of the users, allowing for possible to examine the alignment between the stakeholder input identified in the interviews and the experiences of the end-users. This comparison allows sub-question 4 to be answered.

This mixed-method research follows an exploratory sequential design, in which the qualitative phase preceded the quantitative phase. The initial qualitative insights served to uncover unknown variables and informed the design of the subsequent quantitative study (Blaikie & Priest, 2019).

Table 1 gives an overview of the research questions and corresponding objectives and techniques.

Table 1 Research Questions and corresponding objectives and techniques

Sub Question	Objective	Research Method	Addressed in Report
SQ1: What does the stakeholder involvement process look like in the creation of effective learning environments?	To gather insight in the process of stakeholder involvement in creating effective learning environments.	Literature study Interviews	Chapter 4.x.2
SQ2: How is stakeholder input integrated into the design of the effective learning environments?	To explore and understand the ways in which stakeholder input is incorporated into the design process of effective learning environments.	Interviews	Chapter 4.x.2 & Chapter 4.x.3
SQ3: How do end-users perceive the effectiveness of the learning environment?	To evaluate how end-users perceive the effectiveness of the learning environment.	Surveys	Chapter 4.x.4
SQ4: To what extent is there alignment between end-user perceptions and stakeholder input regarding the effectiveness of the learning environment?	To assess whether there is alignment between what stakeholders envisioned and what end-users actually experience regarding the effectiveness of the learning environment.	Interviews Surveys	Chapter 4.x.5

2.1.3 Literature study approach

A systematic literature review has been conducted to explore existing knowledge on stakeholder involvement processes in the creation of learning environments. This review examines what is currently known about these processes, who has researched these topics, how they have been studied, and identifies any agreements or controversies in the literature. The methodology for this review is detailed in this section, while the findings are presented in Chapter Two.

Search strategy

First, the research conducted in the field of stakeholder involvement processes in the creation of learning environments is explored. To identify relevant papers, the Scopus database is used as primary search engines. Selecting the right keywords for the systematic literature review was a crucial first step.

My primary supervisor, who is part of the Campus NL research group, is conducting research on trends within learning environments. Alongside supervising my thesis, she is also guiding two other graduate students, one focusing on learning environments in combination with shared

spaces and the other exploring their relation to stress. To maximize efficiency and ensure a comprehensive review, we collectively decided to conduct an extensive literature search as a team. By pooling our efforts, we broadened the scope and depth of the search, enabling a more thorough understanding of the diverse aspects of learning environments.

The search process in Scopus focused on trends within learning environments, guided by a brainstorming session in which the team identified key search terms. These terms were categorized into four main aspects. The first aspect focused on the educational theme, using keywords such as "education" and "learning." The second aspect addressed the context of the environments, incorporating terms like "university" and "higher education." The third aspect captured the physical dimension of learning environments, with keywords including "space" and "real estate." Lastly, the fourth aspect emphasized contemporary relevance by including terms such as "trend" and "innovation.". Below is a table that schematically represents the structured approach to identifying key search terms for the systematic literature review:

Table 2 Literature Search Terms

	Aspect 1	**Aspect 2**	**Aspect 3**	**Aspect 4**
Synonyms:	‘’Education*’’	‘’Universit*’’	‘’Space*’’	‘’Trend*’’
Combine with OR	‘’Learning*’’	‘’Higher education*’’	‘’Real Estate*’’	‘’Innovation*’’

In Scopus, each of the synonyms from Aspect 1 was systematically searched in combination with the synonyms from Aspect 2, Aspect 3, and Aspect 4, as illustrated in figure 4 and table 3.

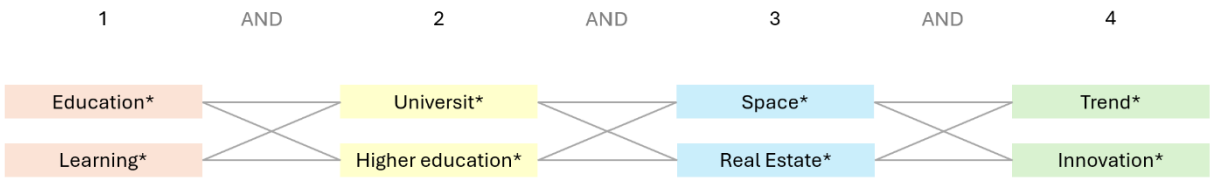


Figure 4 Literature Search for Trends in Learning Environments

Scopus	X (1+2+3+4)	TITLE-ABS-KEY(((education* OR learning*) AND (universit* OR "higher education*") AND (space* OR "real estate*") AND (trend* OR innovation*)))	2557

Table 3 Literature search results for X

The initial search yielded 2,557 articles. After applying additional filters for the year of publication (post-2000) and language (English only), and removing duplicates, the number of potential articles selected for title screening (1st screening phase) was reduced to 2,156. Subsequently, the articles were divided among the four researchers for evaluation.

To ensure reliability, each article was reviewed by two individuals during both the title screening and abstract screening phases. The articles were assessed for relevance to the four research

topics within the Campus NL project: research on learning environments, shared spaces, stakeholder involvement processes, and stress in learning environments.

This systematic evaluation process resulted in a refined selection of articles for each topic. For Stakeholder involvement processes within learning environments, the number of relevant articles was narrowed down to 47.

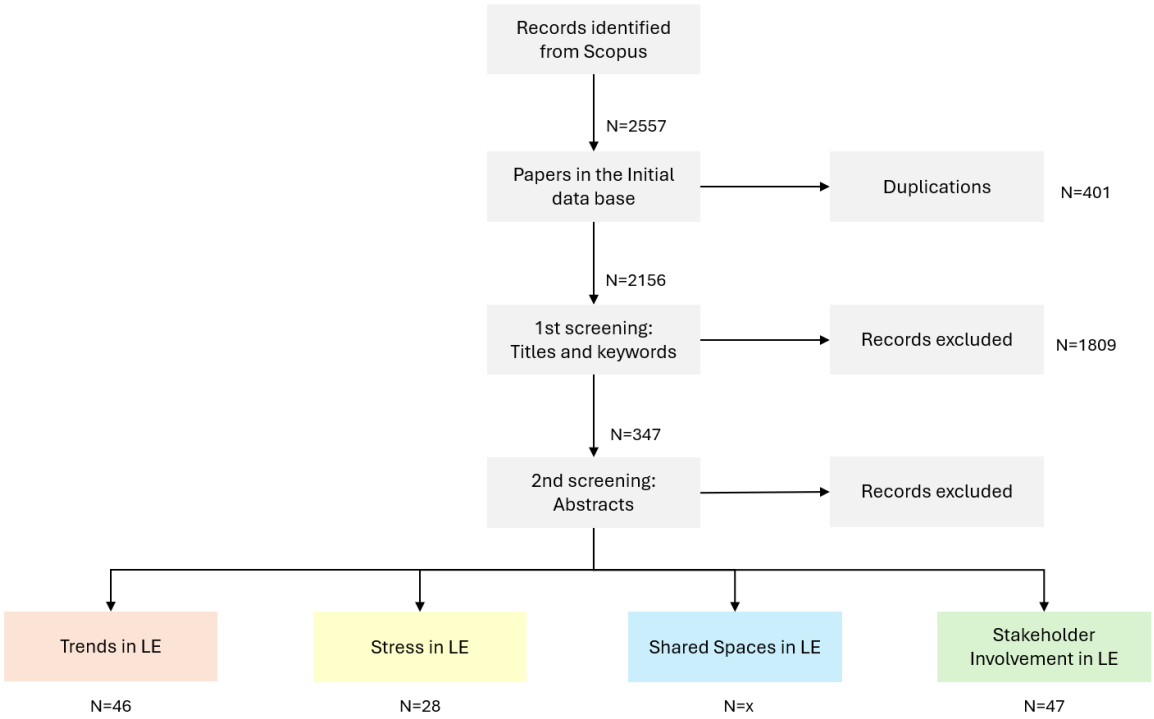


Figure 5 Overview Screening Process for all four studies

Study Selection

From the Scopus literature review, 47 papers were identified during the abstract screening phase, focusing on stakeholder involvement. However, since some papers were categorized under stakeholder involvement by other researchers who may not fully understand the scope of my study, it was necessary to conduct further screening to ensure relevance.

First, a quick screening of the titles and keywords was carried out by the researcher to exclude irrelevant papers. This led to the exclusion of 7 papers. Then, a closer review of the abstracts resulted in the exclusion of 23 additional papers, leaving 17 papers for further analysis.

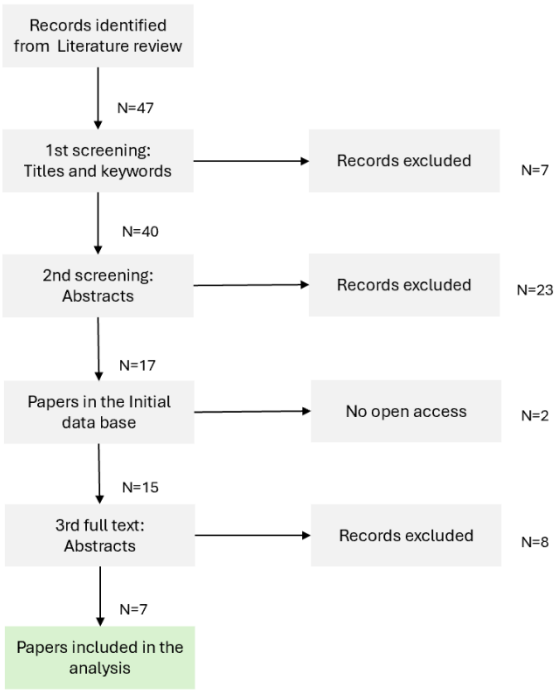


Figure 6 Overview of the screening process for Stakeholder Involvement processes within Learning Environments

A full-screen analysis was then conducted on these 17 papers. During this phase, it was discovered that 2 of these papers were not available as open access, so they were excluded. After thoroughly reviewing the remaining 15 papers, a final selection of 7 papers was made; Borri, 2021; Frelin & Grannäs, 2021; Gatlin, 2021; Könings et al., 2014; Pnevmatikos et al., 2020; Rudman et al., 2018; Victorino et al., 2022. These 7 papers focus on the stakeholder involvement process in the creation of learning environments, clearly describing who should be involved and how the process should unfold.

In each phase, papers were excluded based on specific criteria, as outlined in the table 4 . For example, papers discussing the creation of virtual learning environments and the stakeholder processes involved were excluded, as virtual learning environments do not have physical real estate and therefore are not within the scope of this study. Similarly, papers focusing on the creation of teaching methods rather than physical learning environments were also excluded.

Inclusion Criteria	**Exclusion Criteria**
Setting: University real estate	Setting: other then (university) real estate
Study focusses on the involvement of stakeholders	Study does not mention the involvement of stakeholders
Study focusses learning environments with a physical aspect	Learning environments that the study focusses on does not have a physical aspect, like virtual learning environments
Purpose of the study is related to the real estate usage	The purpose of the study is related to other areas, such as pedagogical learning methods

Table 4 Inclusion and exclusion criteria used in the paper selection process

For the search regarding “stakeholder involvement processes within learning environments,” only seven papers were found, which is a relatively small number. Therefore, to gain a deeper understanding, it was necessary to explore additional background theories related to the concepts of effective learning environments and stakeholder involvement.

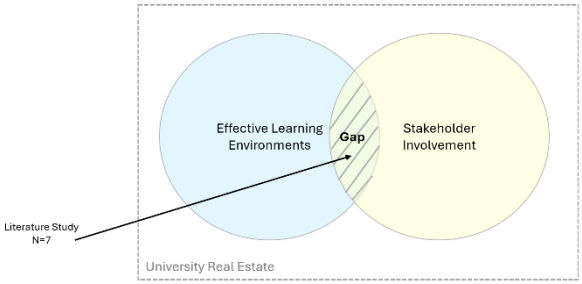


Figure 7 Systematic Scheme of research gap, at the interface of A & B only 7 studies were found

For the learning environment aspect, 46 selected papers from the research on trends in learning environments are used as a starting point. Based on these papers, trends are explored and background information is gathered to identify key elements of effective learning environments (refer to figure 5 for details). Additionally, the snowball effect was employed to find relevant background theories to expand the research base.

For the stakeholder involvement process, the search was exclusively focused on the theoretical framework of the stakeholder involvement process, as the goal was to gain insight into the framework for stakeholder involvement and how to approach it. The emphasis was placed on identifying the different phases and steps involved in the process, as well as the activities associated with them. This resulted in 410 articles being found (Table 5). After systematically screening these articles, those focused on practical applications or the application of stakeholder involvement within cases were excluded, leaving only five articles that described the theoretical stakeholder involvement process. These five articles were used for the extensive literature review on the phases of stakeholder involvement. Other articles from the 410 were used to clarify or describe different activities but did not form the basis for creating an overall framework. Additionally, articles found through the snowball effect contributed to the background information and further refined the theoretical understanding of stakeholder selection and the process itself.

Scopus	B	TITLE-ABS-KEY((("stakeholder involvement") AND ("process" OR "steps" OR "stages" OR "phases" OR "model" OR "framework" OR "approach")AND ("co-design")))	410

Table 5 Literature search for Stakeholder Involvement

2.1.4 Case Study Approach

After the literature review, which explores all existing information on the topic, a case study was be conducted to further analyse the stakeholder process in the creation of learning environments and to identify opportunities for optimization.

Case Selection

According to the analysis in the chapter on learning environments, there are four main types of learning environments: physical, blended, hybrid, and virtual. Among these, the last three are particularly interesting as they represent the direction education is moving toward. However,

virtual learning environments lack a physical space and therefore are not within the scope of this research. This leaves hybrid and blended environments as relevant options.

Given other educational trends, such as flexibilization and student-centredness, blended learning environments appear to be the most promising for the future. The role of stakeholders in blended environments is particularly significant, as it revolves around the design and experience of the physical space. In contrast, hybrid environments tend to focus more on utilization rates and functional optimization rather than the experiential aspects of space design. Additionally, the incorporation of active learning methods within blended environments further underscores their potential. For these reasons, this research intends to focus on blended learning environments and the stakeholder process involved in their creation. This focus serves as a primary criterion for case selection when determining which learning environments to study. The other criteria that the selected cases must meet are outlined in the table 6.

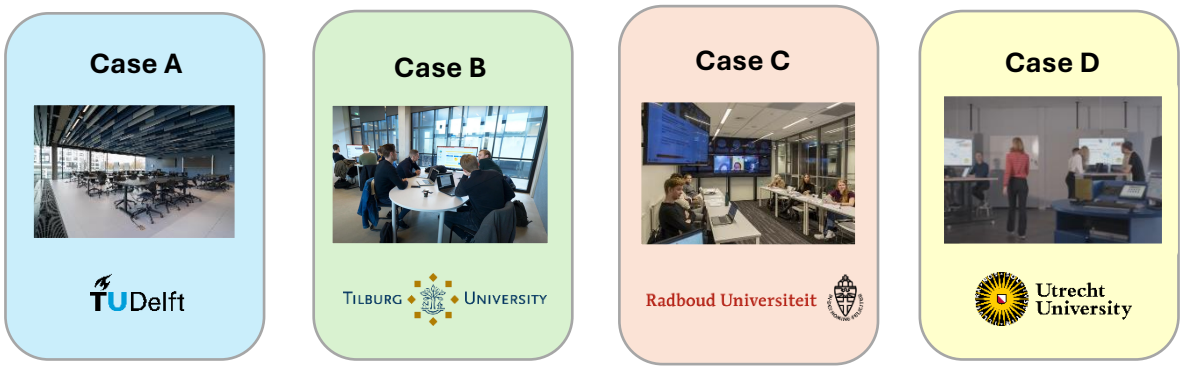
The sample size selected for this study is four case studies. This size allows to perform an in-depth analysis of each case while also enabling cross-case comparisons to validate findings. Conclusions derived from multiple independent cases are generally more robust than those based on a single case (Patino & Ferreira, 2018).

1	Project	The case is a Learning Environment created within a university
2	Type of Learning environment	Blended Learning Environment
3	Year	The project has been executed in the past 7 years
4	Location	The project is located in the Netherlands
5	Specification	Stakeholders are involved in the creating of the Learning Environment

Table 6 Case Criteria for case selection

Selected Cases

A. Project room CDEF – TU Delft
B. Collaboration Room – Tilburg University
C. OneRoom – Radboud Universiteit
D. Hybrid Active Blended Classroom (HALC) – Utrecht University



Data Analysis Case Study

The case study aims to provide insight into the stakeholder processes involved in the creation of these learning environments. Project analyses will be conducted to understand which stakeholders were involved, at what stages, what activities were undertaken, the methods used, the decisions made, and the impact of these actions. To carry out this analysis, documents and records related to these aspects will be collected.

2.1.5 Interview approach

Semi-structured interviews are conducted to collect data from stakeholders involved in the creation of learning environments for the selected cases. The goal of these interviews is to explore the stakeholder process, gain insights into their experiences with stakeholder involvement, assess their satisfaction with the final outcomes, and understand whether they felt their contributions were adequately reflected and valued throughout the process. For each case, stakeholders from various groups are interviewed, including 1.) end-users, 2.) experts, 3.) design teams, 4.) strategic decision-makers, 5.) service units, and 6.) external stakeholders. This categorization corresponds to the stakeholder groups identified in the literature on learning environments (chapter 3.3.1).

Interview Protocol

The interview protocol for the semi-structured interviews has been developed and is included in Appendix 3. To ensure that the interview questions will generate the necessary data for this research and maintain the internal validity, a test interview will first be conducted (Patino & Ferreira, 2018). This allows for the identification of any missing or redundant questions, which can then be revised or adjusted as needed

The interview questions explore the role and experiences of the involved stakeholders in the creation of learning environments. The first set of questions (1 to 4) focuses on the background and role of the individual in the project, aiming to gather background information and establish context. The next set of questions (5 to 15) addresses the stakeholder process. The goal of these questions is to gain insight into how the process worked, what activities and tools were used, how collaboration with other stakeholders occurred, and whether stakeholders were actively asked for input. The final category of questions (16 to 18) is about reflecting on the final outcome and the process. The aim here is to understand how stakeholders view the delivered result and the process, and to assess whether they believe stakeholder involvement was valuable or not in creating the learning environment.

Data Analysis Interviews

During the interviews, data is collected using a sound recording device. Additionally, the interviewer takes notes to serve as a log of the conversation. After the interviews, the recordings are transcribed and anonymised, after which they are analysed and coded in Atlas.ti to draw further conclusions.

2.1.6 Survey Approach

Surveys will be conducted to assess how end-users of the learning environments perceive the effectiveness of these spaces. In this survey, students are asked about the functionality and other aspects of the learning environment in relation to various elements that, according to the literature (Section 3.1.3), contribute to an effective learning environment. The aim is to gather feedback on how users experience these environments and whether they consider them effective, in order to answer sub-question 3 of the research.

Additionally, the survey results will be compared with findings from other parts of the study, such as stakeholder interviews. This comparison will reveal whether stakeholder input during the process aligns with how users actually experience the learning environments. By identifying areas of alignment or misalignment, and linking specific user experiences to elements of the stakeholder involvement process, this analysis will contribute directly to answering sub-question 4. These insights can inform how the process might be improved.

The survey questions are outlined in the Appendix 4 and 5. The survey is based on a questionnaire developed by the Centre for Academic Teaching and Learning of Utrecht University (2022), which examined how end-users experienced the learning environments they had designed. This survey specifically assessed the HALC, a case that is also included in this study. For this reason, and given the significant overlap in questions and outcomes, it was decided not to repeat the survey, but instead to base the evaluation of case D on the existing results. Therefore, the findings from the original survey were adopted for our analysis.

The questions cover topics such as the type of education being delivered, from where and how it is accessed, and which elements of the space are used and to what extent. The next section focuses on the engagement and dynamics experienced by users in the space, followed by an evaluation of the classroom layout. Finally, respondents are asked to indicate what aspects of the space work well and which could be improved, including their suggestions. To conclude, they are asked to provide an overall rating of the space.

Based on the results, a comprehensive picture can be drawn of how the learning environments are used, experienced, and evaluated.

Data Analysis Surveys

The questionnaire used for this research will be a digital survey created in Qualtrics. It will be accessible through an anonymous QR code, with IP address tracking disabled to ensure anonymity. The survey will be distributed via QR codes, which will be displayed in the selected learning environments for the end-users. The questionnaire will be designed to ensure that each mobile device can only submit a response once, in order to prevent response bias.

Once the surveys are completed, the data will be analysed and processed. The results will be used to answer sub-question 3 and will be compared with the findings from the stakeholder interviews. This comparison will help determine whether there is alignment between the perspectives of the end-users and stakeholders.

2.1.7 Data Plan

In this thesis, data protection will be ensured by incorporating the principles of data protection by design and by default, as defined in the General Data Protection Regulation (GDPR). Throughout the research process, measures will be taken to protect participants' rights. Personal data will be anonymized, including transcripts of interviews and survey responses, which will be gathered without including IP addresses. Data minimization will be applied by only collecting the necessary information to achieve the research objectives (Blaikie & Priest, 2019).

Furthermore, secure storage platforms will be utilized to protect the collected data, with access restricted to authorized individuals. The data will be stored on TU Delft's OneDrive and temporarily on an external recording device, while the surveys will be stored on the Qualtrics server. Prior to data collection, explicit consent will be obtained from participants, ensuring they are fully informed about how their data will be processed and stored. These precautions are designed to reduce risks such as unauthorized access or misuse of personal data, and to safeguard participants' privacy and security. Participants will also have the option to withdraw at any time, and their data will no longer be used if they choose to do so.

By integrating these practices at the outset of the research, the study will adhere to GDPR principles and address ethical concerns regarding data processing. A Data Management Plan has been created for this research, which is included in Appendix 6.

2.1.8 Ethical Considerations

Ethical considerations are essential in research to protect human participants from any harm during or after the study. Ensuring participants' protection is the primary concern throughout the entire research process (Blaikie & Priest, 2019). To address this, ethical approval will be sought from the Human Research Ethics Committee (HREC), which includes the HREC checklist, data management plan, and informed consent forms.

Before conducting the interviews, participants will receive an introductory email explaining the purpose of the research, along with an informed consent form that they are asked to sign to grant permission for participation. The potential risks will be thoroughly explained in the consent form, ensuring that participants are fully informed before agreeing to take part (Millum & Bromwich, 2021). Additionally, for each interview, participants will be asked for permission to record the session. These recordings will be transcribed and anonymized, and any recordings will be destroyed afterward. For the surveys, an informed consent form will also be provided at the beginning, containing details about the research. Participants will be asked to explicitly agree to participate before proceeding with the survey. All these steps aim to ensure that participants are fully informed, their privacy is protected, and any potential risks related to their participation in the research are reduced.

Part 3

Theoretical Background

3.1 Effective Learning Environments

To gain a better understanding of what learning environments are and what makes them effective, the concept will first be defined. Subsequently, existing literature will be reviewed to identify key trends within the framework of effective learning environments. This approach will provide a comprehensive overview of essential characteristics and emerging developments that contribute to creating effective learning environments.

3.1.1 Definition of Learning Environments

A learning environment can be defined as the physical, social and psychological setting in which learning occurs, and in which experiences and expectations are co-created among its participants (Rusticus et al., 2023). Learning environments can take many forms and are not limited to schools or universities; any context where learning takes place qualifies as a learning environment (Moos, 1984; Rusticus et al., 2023). These environments are not confined to a single format. While traditional learning environments consist of physical spaces where interaction between students and educators takes place, there has been a noticeable shift toward online learning environments. Additionally, hybrid models have emerged, blending physical and digital components, where technology plays an increasingly central role in facilitating learning experiences (den Heijer et al., 2016; Lo & Hew, 2020). One of the first researchers who studied learning environments and is still frequently cited today is Moos (1984), who, regardless of its specific form, characterizes a learning environment by three key dimensions: 1.) Personal development or goal direction, 2.) relationships and 3.) system maintenance and change.

The first dimension, personal development or goal direction, reflects the environment's potential for fostering personal growth, supporting emotional well-being, and contributing to the development of self-esteem. This includes motivating learners through clear goals, encouraging personal achievements, and creating an emotionally supportive atmosphere.

The second dimension concerns relationships, emphasizing the types and quality of social interactions that occur within the environment. It highlights the extent to which individuals engage with one another, form supportive connections, and collaborate toward common goals. Learning environments play a crucial role in facilitating these interactions by creating opportunities for cooperation, dialogue, and mutual support, ultimately enhancing the overall learning experience.

The third dimension is system maintenance and change, which refers to how well the learning environment is organized, clear, and open to improvement. It includes both organizational and physical aspects, ensuring that the learning setting is well-structured while remaining adaptable to new developments or challenges (Moos, 1984).

This research focuses on learning environments within universities, with a specific emphasis on those that include a physical component. For the purpose of this study, a learning environment is defined as a physical setting within a university in which learning occurs, and in which experiences and expectations are co-created among its participants. This definition and scope will be used consistently throughout the remainder of this research.

3.1.2 Trends in Learning Environments in Dutch University Real Estate

To gain insight into the different types of learning environments and the demand for certain types, it is important to understand the trends that will impact universities in the coming years. One organization that has conducted significant research on this is SURF, the ICT cooperative for education and research in the Netherlands, consisting of over 100 educational and research institutions. SURF has published a report, based on research by experts from various perspectives, outlining thirteen trends that will impact higher education in 2040, both physically and virtually (SURF, 2023). These trends are shown in Figure 8.

Figure 8 Thirteen trends that will impact the future campus (SURF, 2023)

All of these thirteen trends will influence how campuses will look in the future, but among them, three of the trends have a direct impact on the design of learning environments, namely trend 1: *Rise of blended, hybrid, and online education*, trend 3: *Extensive flexibilization and personalisation of education* and trend 7: *Extensive digitalisation and datafication of the learning/work environment*.

The reason for focusing on these three trends specifically, and not the other ten, is because the latter do not have a direct influence on the physical design of learning environments. Instead, they mostly impact the organization of the university, such as its structure or community and ethics. Although these other trends can have an indirect effect on how learning environments are designed, these three trends are the only ones that have a direct influence since they pertain specifically to the arrangement of the changing education system and thereby the functioning of learning spaces. Therefore, it is essential to focus on these three trends and delve deeper into their implications for the development of future learning spaces.

Trend 1: Rise of blended, hybrid, and online education

Due to significant advancements in digitalization, new forms of education are becoming increasingly possible, which are not limited to the physical classroom but are also supported by digital methods. The COVID-19 pandemic played a major catalytic role in this shift, driving the large-scale move to online education during that period (SURF, 2023). Learning environments are therefore no longer limited to physical space (Wong & Looi, 2011). These new forms of education require the support of suitable, innovative learning environments. There are four main types of learning environments: 1.) Physical learning environments, 2.) Blended learning environments, 3.) Hybrid learning environments, and 4.) Online learning environments.

Physical learning environment

Physical learning environments often refer to traditional classrooms or learning spaces designed for face-to-face interaction. These spaces are typically structured with fixed seating arrangements and a centralized, teacher-focused layout, emphasizing the transmission of knowledge from instructor to student (Khamitova, 2023).

Physical learning environments focus on formal interactions between instructors and students, which often limits opportunities for active, collaborative, or student-centred learning (Bozkurt, 2022; Khamitova, 2023). With the rise of digitalization and the demand for more flexible education, these traditional environments are increasingly seen as less effective. They lack adaptability to diverse learner needs and emerging practices, such as blended or active learning approaches. As a result, there is a growing shift toward learning environments that better support modern educational practices (Bozkurt, 2022; Khamitova, 2023; SURF, 2023).

(Active) Blended learning environment

Blended learning is a method of education that integrates traditional classroom sessions with online learning materials (Gil et al., 2022). It combines face-to-face and online activities, where both types of learning mutually reinforce each other. This approach facilitates synchronous and asynchronous learning across physical and digital platforms (SURF, 2023)

A key advantage of blended learning is its flexibility, allowing students to learn anytime and anywhere, while addressing the limitations of both in-person and online education (Krismadinata et al., 2020). This flexibility is achieved through variations in time, space, path, and pace, creating a balanced and effective educational experience (Bozkurt, 2022). Blended learning also aligns with student-centred active learning strategies, promoting improved learning outcomes and efficient teacher involvement (Krismadinata et al., 2020). That is why blended learning environments are often referred to as active blended learning environments. This term emphasizes not only the integration of digital tools but also the active engagement and personalization of learning (Talbert & Mor-Aviv, 2019).

Active blended learning environments integrate digital tools and technologies with traditional learning spaces to create a flexible and interactive setting. These environments typically feature adaptive furniture, high-speed internet, and access to digital learning platforms (SURF, 2023). The primary goal of active blended learning environments is to facilitate a seamless transition between online and offline modalities, maximizing the benefits of both approaches. Flexibility is central, enabling customisation of the classroom to accommodate diverse learning needs and preferences. This adaptability ensures that both students and instructors can fully leverage the advantages of blended learning. (Khamitova, 2023).

Hybrid learning environment

Hybrid learning has significantly grown since the COVID-19 pandemic (SURF, 2023). In hybrid education, some students attend classes online, while others participate simultaneously in a physical space. It is thus a combination of synchronous online and offline education. Hybrid learning provides the opportunity to make education more flexible, as it can be accessed from anywhere in the world (Gil et al., 2022; SURF, 2023)

Hybrid education requires hybrid learning environments. Hybrid learning environments integrate digital elements into the non-digital learning setting (Gil et al., 2022). A widely accepted configuration for this type of space includes classrooms equipped with suitable acoustics, video and audio hardware, interactive whiteboards, and similar technologies (Khamitova, 2023)

Online learning environment

An online learning environment is a cohesive system of services and applications that support educators and students in the learning and teaching process (SURF, 2023; Khamitova, 2023). It is built on design principles such as flexibility, connectivity, personalization, safety, comfort, and organization, facilitated by devices that enhance teaching and learning (Khamitova, 2023).

Digital learning environments and their design are becoming increasingly important and play a growing role in education. However, this study focuses on stakeholder involvement in the creation of physical learning environments. For this reason, online learning environments will not be included in this research.

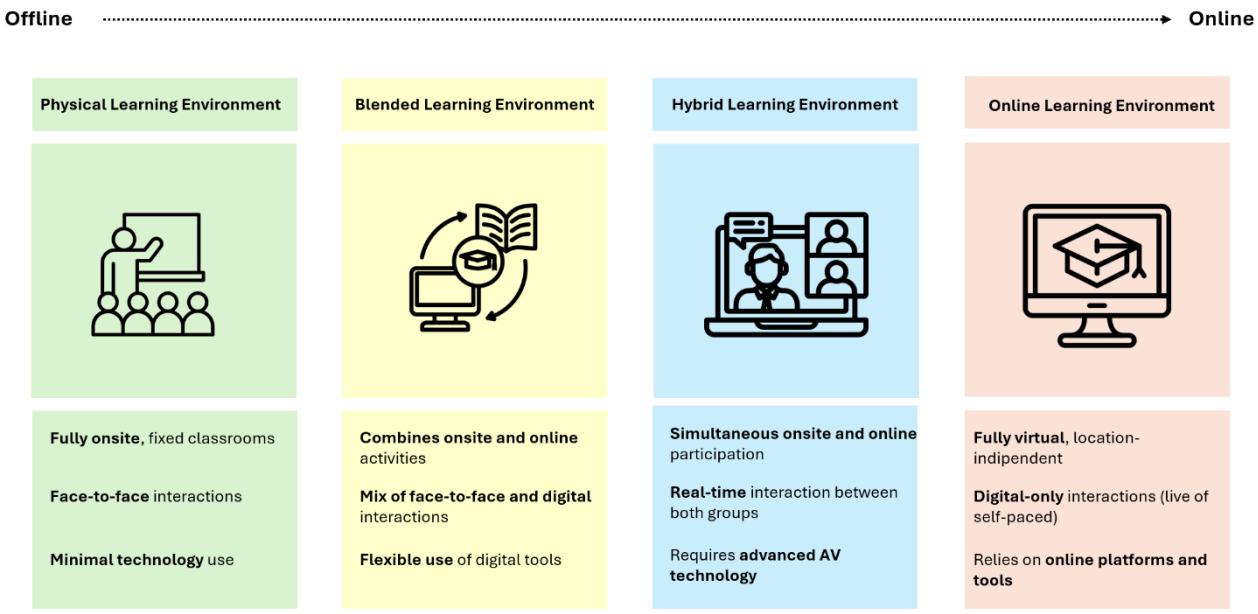


Figure 9 The four types of Learning Environments (Visualisation based on SURF, 2023)

Trend 3: Extensive flexibility and personalisation of education

The increasing flexibility in education is a transformative development that significantly impacts the future of campuses and learning environments. Flexible learning, as described by Moran and Myringer (1999), is a learner-centred approach that empowers students with autonomy over how, what, when, and where they learn. This approach adapts to diverse student needs by tailoring physical spaces, schedules, and teaching methods to better align with the diverse needs and preferences of students (Demetriadis & Pombortsis, 2007). Examples include online platforms for self-directed learning and hybrid models that blend traditional classroom instruction with digital tools.

Loon (2021) conducted an extensive literature review on flexible learning covering the years 2016 to 2021. In his analysis, he highlights that the rise of flexible learning has been significantly driven by the advent of the internet, which has established online education as a mainstream mode of learning. Additionally, the COVID-19 pandemic in early 2020 further solidified the necessity of flexible learning, as universities were compelled to adapt rapidly to ensure educational continuity. As a result, the focus within academic discourse has shifted from questioning the necessity of flexible learning to exploring strategies for its effective implementation. This shift underscores the critical role flexible learning now plays in modern education systems (Loon, 2021).

This shift toward flexible education requires a transformation in learning environments, demanding spaces that are adaptable to the diverse needs of students. Both virtual and physical learning spaces must be designed to support a wide range of teaching methods, enabling students to learn at their own pace, in their preferred location, and at a time that suits them. Greater flexibility in learning spaces fosters a broader repertoire of instructional strategies, enhancing the overall learning experience (Khamitova, 2023)

To support flexible education, learning spaces must be designed with adaptability and multifunctionality in mind, enabling them to quickly adjust to changing needs. High spatial quality and efficiency are essential, with areas tailored for specific purposes such as focused work, group collaboration, informal learning, and experimentation. Open designs, characterized by large spaces, permeable boundaries, and diverse furnishings, encourage flexibility in both teaching and learning (Chapman et al., 2014). These designs prioritize student comfort, health, and adaptability, creating environments conducive to varied educational activities (Benade, 2019; Chapman et al., 2014).

From a practical standpoint, this trend emphasizes modular and adaptable layouts featuring lightweight, intelligent, and sustainable furniture (Brink et al., 2023). With this kind of adaptable furniture, the layout of the classroom can be easily modified to suit different learning activities. Seating arrangements, for example, play an important role in supporting different learning activities, as they can significantly influence student engagement and performance. The layout of seating should align with the tasks at hand and the desired learning behaviours (Khamitova, 2023). For individual tasks, rows of tables where students are not facing one another are more appropriate, while for group work, desks arranged in clusters foster interaction and collaboration (Wannarka & Ruhl, 2008). Research has shown that seating arrangements have a significant impact on academic performance, for example in blended learning environments, where round tables or semicircular seating arrangements are particularly effective in promoting engagement and interaction (Asino & Pulay, 2018; Yang et al., 2022). These flexible seating layouts, when implemented with the right teaching strategies, enhance "student-student communication and collaboration" (Xu et al., 2019), ultimately contributing to a more dynamic and interactive learning environment.

Trend 7: Extensive digitalisation and datafication of the learning/work environment.

Technological advancements are rapidly transforming education, opening up new possibilities for teaching and learning. Three significant developments are driving this trend: the rapid rise of AI, the increased use of immersive technologies, and the growing datafication of education, combined with improved technologies that integrate physical and virtual learning environments (SURF, 2023).

To harness the potential of these advancements, it is crucial for universities to adapt their campus infrastructure to meet digital needs and capabilities. To effectively integrate these new digital developments, physical learning spaces must be thoughtfully designed to complement and integrate digital tools (Khamitova, 2023). This includes integrating digital tools into the physical educational settings, such as interactive whiteboards, tablets, laptops, and digital learning platforms. As such, the technological advancements outlined above are set to profoundly shape the future of campuses and the learning environments by influencing both virtual and physical spaces.

3.1.3 Effective Active Blended Learning Environment

Based on the trends and typologies of learning environments described in Section 3.1.2, this study focuses on active blended learning environments. These environments offer an optimal combination of flexibility, digitalisation, and physical space, leveraging the strengths of each component. The rationale for this selection is further elaborated in Section 2.1.4 (Case Selection).

Fuchs et al. (2024), commissioned by the Centre for Academic Teaching and Learning at Utrecht University, conducted a literature review on the effectiveness of active blended learning environments and identified concrete elements that can be used to assess their effectiveness. Their review focuses primarily on peer-reviewed literature, with Talbert and Mor-Aviv (2019) serving as a key source.

In this literature review, Fuchs et al. (2024), that the primary objectives of active blended learning environments are to foster interaction, support diverse learning activities, maintain a student-centred approach, and provide hybrid functionality Talbert and Mor-Aviv (2019, as cited in Fuchs et al., 2024) identify six key characteristics that an active blended learning environment should possess.

First, an active blended learning environment is situated in a formal classroom, meaning it is a designated space where learning occurs as an educational activity. This excludes less formal spaces such as in-between self-study areas located in hallways or foyers. Additionally, active blended learning spaces incorporate design attributes specifically intended to promote active learning. This is reflected in three key features: flexible furniture that can be easily rearranged to support different learning activities, a group seating arrangement to encourage collaboration, and a polycentric or eccentric design, meaning there is no clearly defined front of the room, allowing the teacher to occupy a central position and interact dynamically with students. Finally, the last two characteristics involve the presence and easy access to analogue and digital tools, including multiple digital projectors, tablets, laptops, wall-mounted and personal whiteboards, and screens at each table. Figure 10 provides a visual overview of these characteristics.

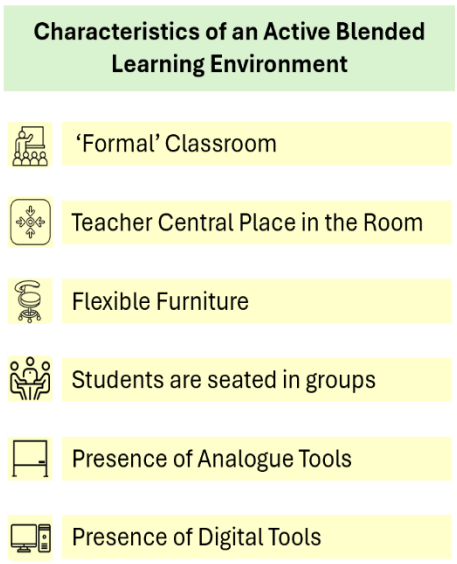


Figure 10 Six characteristics of an Active Blended Learning Environment

Having established the objectives and characteristics of an active blended learning environment, the next step is to explore what specific design elements contributes to the effectiveness of such an environment and how these key principles can be successfully achieved. Talbert and Mor-Avi (2019, as cited in Fuchs et al., 2024) conducted research on how these environments contribute to the success of active blended learning environments in terms of student learning outcomes, instructor practices, and engagement. Their study highlighted the importance of "connectedness" as a fundamental design concept that leads to the most effective learning spaces. They identified three key aspects that contribute to achieving this connectedness: mobility, visibility, and learning tools

To create connectedness through mobility, two important elements were emphasized: the freedom of movement provided by chairs and the flexibility to transform learning spaces. The first element focuses on ensuring that students have the freedom to move, which requires consideration of their individual needs. Recognizing that every student is unique, with different physical requirements and preferences, designing learning spaces that accommodate these differences ensures a more inclusive and comfortable environment. Adjustable furniture, such as chairs with wheels and a rotating design, allows for flexible layouts that enhance accessibility and support a diverse range of learners. Harvey and Kenyon (2013) emphasized the importance of seating arrangements, stating that although seating is only one of many design considerations, it is among the most easily changeable variables in classroom environments and has a more significant impact than often assumed. The second element of mobility concerns the flexibility to transform the learning space. Traditional classrooms, with their fixed tables and immobile chairs, can restrict student interactions and hinder collaboration. This limitation can be overcome by incorporating movable furniture and flexible seating arrangements, allowing teachers to create dynamic spaces that foster communication, group work, and student engagement. Studies have shown that teachers who move around the classroom are more likely to engage in discussions with students, reinforcing the benefits of flexible learning spaces (Fuchs et al., 2024)

Another key aspect of connectedness is visibility, which plays a crucial role in active blended learning spaces. This is influenced by the design of educational spaces, particularly seating arrangements, as well as the shape of tables, which help shape the overall learning environment. According to Park and Choi (2014), learning spaces reflect the pedagogical philosophy of teaching and learning. The way students are seated can influence their behaviour, engagement, and communication. For instance, seating arranged in rows directs attention toward the front of the room, fostering a listening-based approach, whereas a polycentric layout encourages active communication and collaboration among students. Research has demonstrated that well-designed learning spaces enhance student engagement, promote cooperative learning, and facilitate social interaction (Fuchs et al., 2024).

The choice of furniture, particularly tables, also plays a crucial role. Talbert & Mor-Aviv (2019, as cited in Fuchs et al., 2024) have found that seating students in clusters rather than rows encourages interaction and teamwork. They also proposed round tables as a way to foster collaboration, while research by Brooks (2012) suggested that the shape of tables influences how students engage during activities. Additionally, studies on group composition have explored differences in student interactions, productivity, and learning outcomes when working in pairs or small groups, highlighting the impact of thoughtful seating arrangements on learning effectiveness (Fuchs et al., 2024).

The final element of connectedness is the use of learning tools. Active blended learning environments are characterized by several design features, including a combination of analogue and digital learning tools. Traditional classrooms typically have a single blackboard at the front, which limits accessibility for students seated at the back of the classroom. In contrast, active learning spaces integrate a variety of analogue tools such as whiteboards, glass-marker boards, and writable glass tabletops. These tools promote creativity, group cohesion, and active participation, especially when they are strategically distributed around the classroom to be easily accessible for both teachers and students. Digital tools, including projectors, laptops, and smart boards, are also considered essential for enhancing student learning and increasing interaction. The ability to project digital content on multiple screens enables students to engage with learning materials from different angles and locations, making a polycentric layout an effective design choice. By integrating digital and analogue tools, active learning spaces create a more interactive and student-centred learning environment (Fuchs et al., 2024).

Figure 11 summarizes chapter 3.1.3 in a clear table. In this table, the three main elements of connectedness—visibility, mobility, and learning resources—are presented, which together contribute to the effectiveness of the active blended learning environment. For each main element, the specific sub-elements are listed. Under each sub-element, the design variables that, according to the literature, contribute to improving that sub-element are specified. These improvements lead to enhancements in either visibility, mobility, or learning resources, ultimately resulting in greater connectedness and an effective active blended learning environment.

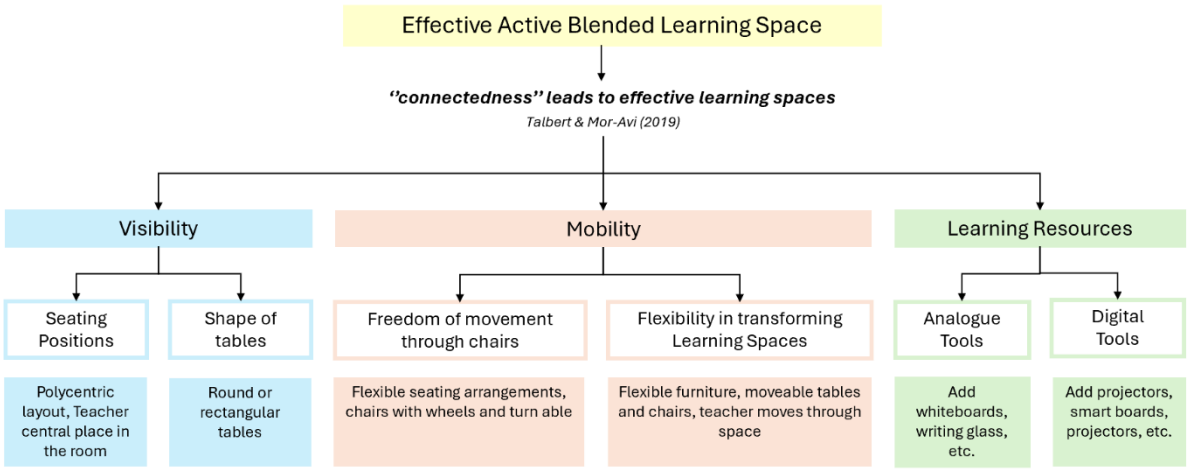


Figure 11 Integrating Visibility, Mobility, and Learning Resources for Enhanced Connectedness, Resulting in Effective Active Blended Learning Environments (Visualisation based on Fuchs et al., 2024).

3.1.4 Conclusion on Effective Learning Environments

A learning environment is a physical, social, and psychological setting in which learning takes place, and in which experiences and expectations are co-created among its participants (Rusticus et al., 2023). Recent trends in learning environments emphasize the importance of flexibility, adaptability, and technological integration. These developments are driven by a shift toward student-centred and active learning approaches, as well as an increased focus on accessibility and collaboration in education. All these elements come together in so-called *Active Blended Learning Environments*.

These environments are characterized by six key elements: a formal classroom setup in which the teacher maintains a central position, the use of flexible furniture, group-based seating arrangements, and the integration of both digital and analogue tools to support learning activities.

To develop an effective Active Blended Learning Space, *connectedness* must be fostered. This can be achieved by enhancing visibility—through group seating and the use of round or square tables—and by promoting mobility within the room. Mobility is supported by allowing freedom of movement via flexible seating and the possibility to reconfigure the space. Lastly, the presence of appropriate learning resources, including analogue materials and digital tools, is essential.

When these principles are effectively combined, Active Blended Learning Environments can significantly enhance engagement, collaboration, and the overall learning experience.

3.2 Stakeholder Involvement

To gain a better understanding of what stakeholder involvement processes entail, the concept of stakeholder management and stakeholder involvement will first be explained based on previous studies and literature. Subsequently, an analysis will be conducted of the various frameworks currently available in the literature for so-called stakeholder involvement processes. This involves examining existing models and methodologies to understand how these processes are designed, implemented, and evaluated.

3.2.1 Definition of Stakeholder Management

The traditional definition of a stakeholder is "any group or individual who can affect or is affected by the achievement of the organisation's objective" (Freeman, 1984). Engaging stakeholders is crucial, as they have the potential to influence actions, either disrupting or contributing to success. Through interactions with stakeholders, organisations can identify their preferences and explore opportunities for mutually beneficial solutions (Franklin, 2020)

In the real estate sector, however, stakeholder involvement has become increasingly recognized as a crucial process in recent decades. Historically, the design of buildings and urban plans was reserved for trained experts, with little consideration given to the interests of other parties (van Bueren, 2020). This perspective began to shift in the 1990s, as it became evident that involving additional actors in projects fosters knowledge exchange and increases support and engagement for plans, even beyond the implementation phase (Hajer, 2011)

This change gave rise to the concept of stakeholder management, which identifies stakeholders as "those groups without whose support the organisation would cease to exist" (Pedrini & Ferri, 2018). Nowadays, the management of project stakeholders by taking into account their needs and requirements is an essential element of project success (Aaltonen & Kujala, 2010).

3.2.2 Definition of Stakeholder Involvement

Stakeholder management is a broad concept that encompasses how an organization interacts with its stakeholders and how they are involved in the process. It differentiates between "*stakeholder engagement*" and "*stakeholder involvement.*"

Stakeholder engagement is primarily about fostering one-way communication. It's a process where the organization strategically shares important information with stakeholders, ensuring values such as transparency, accountability, and accessibility are upheld. The goal is to inform and build awareness, thereby enhancing the organization's sustainability (Franklin, 2020).

On the other hand, stakeholder involvement is a more interactive, two-way communication process. Stakeholders actively participate in the decision-making, and their feedback and concerns are taken into account and integrated into the planning and design processes. This approach allows for continual dialogue until all concerns are addressed and the project aligns as much as possible with stakeholder needs and expectations. This involvement ensures that stakeholders are not just informed but also actively shaping the outcome (Franklin, 2020; Noordam, 2021).

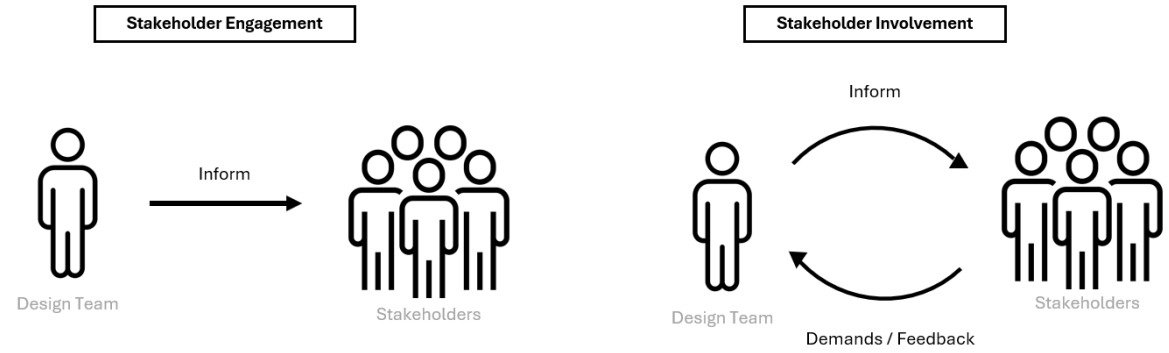


Figure 12 The difference between stakeholder Engagement and Stakeholder Involvement (Noordam, 2021, p. 20)

This research will focus on how stakeholders can be involved and provide input that is integrated into the design of learning environments. Therefore, the emphasis will be on stakeholder involvement rather than stakeholder engagement.

3.2.3 Relevance of Stakeholder Involvement in Learning Environments

The trend analysis of learning environments highlights a current shift towards flexible and human-centred education (SURF, 2023). This shift emphasizes the importance of placing users at the centre of the design process and understanding their needs and preferences (Gatlin, 2021; Victorino et al., 2022). Consequently, stakeholder involvement in creating these learning environments is crucial.

Stakeholder involvement ensures improved engagement (Gatlin, 2021; Pnevmatikos et al., 2020) enhanced collaboration (Gatlin, 2021), and alignment of the project with user needs (Borri, 2021; Pnevmatikos et al., 2020; Rudman et al., 2018). Without it, there is a risk of mismatch between design and expectations, leading to dissatisfaction and underutilization (Frelin & Grannäs, 2021; Könings et al., 2014). Moreover, early involvement also fosters a sense of ownership and familiarity, easing implementation (Könings et al., 2014).

Additionally, incorporating stakeholder input during the design phase can broaden the project's vision and promote the value of flexibility. This ensures that learning environments and their design principles are better equipped to adapt to changing needs without compromising structurally or financially (Frelin & Grannäs, 2021; Victorino et al., 2022).

3.2.4 Stakeholder Involvement Process

Stakeholder involvement is a dynamic and active process that aims to ensure the effective participation of individuals, addressing their needs throughout the process. Unlike passive observation, where stakeholders may simply watch from the sidelines, active engagement is crucial for successful involvement (Reymond & Bassan, 2014).

There is no universally agreed-upon process for stakeholder involvement, as various studies and frameworks propose different models for effective engagement. A literature review based on five different studies (Franklin, 2020; Hester et al., 2010; Lane & Devin, 2018; Luyet et al., 2012; Marais & Abi-Zeid, 2021; Preble, 2005) shows that each study adopts a unique framework. In Chapter

1.2.3, the method for selecting the papers used in this research is explained. Table 7 illustrates the different steps of the stakeholder process as identified in the respective studies.

Author	Steps of the Stakeholder Involvement Process					
Lane & Devin (2018)	*Identify + select SH*	*Secure SH Interest*	*Input Strategy*	*Method*	*Outcome*	
Luyvet et al. (2012)	*SH Identification*	*SH Characterisation*	*Degree of Involvement SH*	*Choice of Participation Technique*	*Implementation of P. T.*	*Evaluation*
Franklin (2020)	*Identifying SH*	*Selecting Participation Techniques*	*Understanding SH Motivations*	*Facilitating SH Participation*	*SH Engagement Outcomes*	
Preble (2005)	*SH Identification*	*Determine Nature of SH expectations*	*Determine Performance Gaps*	*Prioritize SH Demands*	*Organizational Responses*	*SH Monitoring*
Marais and Abi-Zeid (2021)	*Identification*	*Characterisation*	*Levels of Engagement*	*Available Participatory Techniques*	*Participation Plan*	

Table 7 Comparative Overview of Stakeholder Involvement Frameworks from selected studies

The differences between these models often do not stem from the content of the steps themselves but rather from how these steps are grouped or categorized. Therefore, an analysis of all steps, including their content and associated activities, was conducted. In Table 8, the steps are color-coded, with corresponding colours indicating that the content and activities within these phases align. In Table 9, these different steps are categorized according to their respective colours.

This reveals that, despite the use of different terminology, the underlying processes are quite similar. For example, Luyet's *stakeholder characterization* (2012) corresponds to Preble's *determine the nature of stakeholder expectations* (2005).

These apparent differences lie in whether certain stages are combined or treated as separate phases. For instance, Lane and Devin (2018) categorize stakeholder characterization as part of the broader phase of identifying and selecting stakeholders. In contrast, Marais and Abi-Zeid (2021) treat this step as a distinct phase within their stakeholder involvement process.

Ultimately, the distinctions between these frameworks are less about the fundamental steps and more about how comprehensively they are defined and labelled. Regardless of the number of steps, the essence of stakeholder involvement involves systematically identifying stakeholders, understanding their needs, and implementing strategies to engage them effectively.

Author	Steps of the Stakeholder Involvement Process					
Lane & Devin (2018)	*Identify + select SH*	*Secure SH Interest*	*Input Strategy*	*Method*	*Outcome*	
Luyvet et al. (2012)	*SH Identification*	*SH Characterisation*	*Degree of Involvement SH*	*Choice of Participation Technique*	*Implementation of P.T.*	*Evaluation*
Franklin (2020)	*Identifying SH*	*Selecting Participation Techniques*	*Understanding SH Motivations*	*Facilitating SH Participation*	*SH Engagement Outcomes*	
Preble (2005)	*SH Identification*	*Determine Nature of SH expectations*	*Determine Performance Gaps*	*Prioritize SH Demands*	*Organizational Responses*	*SH Monitoring*
Marais and Abi-Zeid (2021)	*Identification*	*Characterisation*	*Levels of Engagement*	*Available Participatory Techniques*	*Participation Plan*	

Table 8 Comparative Overview of Stakeholder Involvement Frameworks with Colour-Coded Phases

Author	Steps of the Stakeholder Involvement Process						
Lane & Devin (2018)	*Identify + select SH*		*Secure SH Interest*	*Input Strategy*	*Method* / *Outcome*	*Implementation of P.T.*	*Evaluation*
Luyvet et al. (2012)	*SH Identification*	*SH Characterisation*		*Degree of Involvement SH*	*Choice of Participation Technique*	*Facilitating SH Participation*	*SH Engagement Outcomes*
Franklin (2020)	*Identifying SH*		*Understanding SH Motivations*		*Selecting Participation Techniques*	*Participation Plan*	*SH Monitoring*
Preble (2005)	*SH Identification*	*Determine Nature of SH expectations* *Determine Performance Gaps* *Prioritize SH Demands*			*Organizational Responses*		
Marais and Abi-Zeid (2021)	*Identification*	*Characterisation*		*Levels of Engagement*	*Available Participatory Techniques*		

Table 9 Categorized Comparative Overview of Stakeholder Involvement Frameworks by Phase and Colour

In this research, I propose a framework based on the six analysed studies, as depicted in Figure 13. This framework organizes the stakeholder involvement process into four key stages: identifying and selecting relevant stakeholders, reaching out to them and securing their interests, implementing effective involvement strategies, and concluding with an evaluation phase. By adopting this structured approach, I aim to provide a clear and systematic analysis of the stakeholder involvement process and its implications for effective engagement.

The initial phase, identifying and selecting relevant stakeholders, forms the foundation by determining which stakeholders are essential to the process. Building on this, the second phase

focuses on engaging these stakeholders by addressing their concerns and ensuring their active participation. This stage ensures that the right individuals are not only identified but also motivated to contribute meaningfully.

The third phase, implementing involvement strategies, is divided into three sub-phases. (1) First, input strategies are considered, (2) based on which secondly appropriate involvement method is selected. This selection then leads thirdly to the (3) implementation of the chosen involvement method, ensuring that tailored strategies align with the stakeholders' specific needs and project goals.

Finally, the process concludes with an evaluation phase, where the effectiveness of the stakeholder involvement strategies is assessed, and lessons learned are identified for future improvement. Each stage builds upon the outcomes of the previous one while shaping the involvement methods and expected results. This ensures a coherent and outcome-oriented approach. By structuring the discussion around this model, we aim to clarify the essential steps and their interdependencies in achieving effective stakeholder engagement

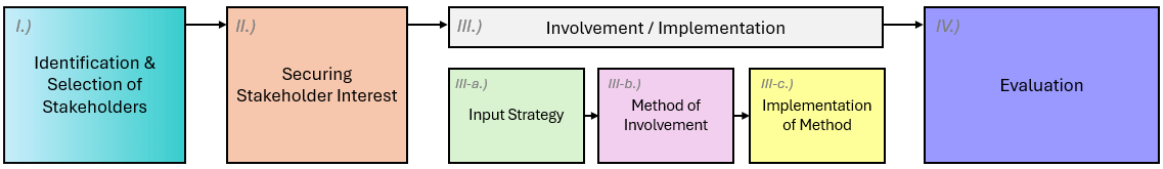


Figure 13 Proposed Framework for Stakeholder Involvement Process

Step I - Identification and Selection of Stakeholders

The first stage of stakeholder involvement is identifying and analysing the stakeholders. This step aims to understand their primary interests, constraints, and the extent to which they are impacted by or have a stake in the process (Reymond & Bassan, 2014; Franklin, 2020). Stakeholder identification and analysis form the foundation of the stakeholder involvement process. Based on this analysis, it is possible to determine which stakeholders are most critical to the process, the so called key stakeholders, with whom the organization needs or wishes to establish contact to ensure meaningful participation (Lane & Devin, 2018).

Furthermore, the selection of strategies for stakeholder involvement is informed by the context and the specific attributes of key stakeholders. Understanding their interests, constraints, and levels of influence ensures that the organization can create tailored involvement strategies that address stakeholder needs effectively and facilitate their active participation (Reymond & Bassan, 2014).

Stakeholders must first be identified and characterized based on various factors to understand power dynamics and specific interests within a project (Luyet et al., 2012; Reymond & Bassan, 2014; Lane & Devin, 2018; Franklin, 2020). There is generally no universally used framework for identifying and characterizing stakeholders (Lane & Devin, 2018; Luyet et al., 2012). However, various models provide steps and criteria to help categorize stakeholders by their interests, power, and relationship to the organization, such as Franklin's. Franklin (2020), a renowned researcher in the field of stakeholder involvement since 2001, outlines a step-by-step process for identifying stakeholders in her book. Drawing on her years of research, she introduces six key

criteria that, along with their possible options, help create a clear picture of stakeholders' characteristics. This process aids in identifying their roles, interests, and potential influence within the project.

The six criteria for identifying stakeholders address key aspects of their relationship with the organization (table 10). The first criterion is about the relationship between the organisation and the stakeholder. It distinguishes voluntary stakeholders, who choose their involvement, from involuntary stakeholders, who are impacted without choice. The second focuses on the level of interest of the stakeholders, with direct stakeholders having immediate involvement and indirect stakeholders being affected by outcomes. The third criterion divides stakeholders based on their location, classifying them as internal (closely connected to the organisation), external (outside the organisation), or mixed (with roles in both). The fourth considers whether stakeholders represent their own interests or those of others. The fifth criterion is about the focus of organisational action and it differentiates between policy changes, which involve broad strategic shifts, and activity changes, which focus on practical, operational adjustments. The sixth and last criterion examines the impact of organizational actions on stakeholders, categorizing outcomes as positive, mixed, or negative, depending on the change (Franklin, 2020).

Characterizing and identifying stakeholders in this way provides an overview that makes it easier to understand who plays which roles and who might be important in deciding which stakeholders to include in the stakeholder involvement process.

Criteria		Options			
1.	Relationship towards the organisation	*Involuntary*	*Voluntary*		
2.	Interests of the stakeholder in the project	*Indirect*	*Direct*		
3.	Location of the stakeholder	*Internal*	*Mixed*	*External*	
4.	Interest Being Represented	*Individual*	*Organisation*	*Group*	*Collective*
5.	Focus on organisational Action	*Policy Change*	*Activity Change*		
6.	Impact of Organisational Action	*Negatively*	*Mixed*	*Positively*	

Table 10 Six Criteria to Identify and Characterise Stakeholders (Visualisation based on Franklin, 2020)

After identifying and characterizing all stakeholders, an organization must determine which stakeholders it intends to engage with. There are several different methods for this. For example, the Power/Interest Grid is used to map stakeholders into four quadrants based on their level of power or influence and their level of interest. Another tool is the Stakeholder Knowledge Base Chart, which maps stakeholders according to how much they know about a project and their attitude towards it. Another widely used tool in stakeholder involvement is the Stakeholder Salience Model by Mitchell, Agle, & Woods (1997). This method will be outlined below and applied in this research. The Salience model is based on three key attributes that can be assigned to stakeholders: the stakeholder's power to influence the organization, the legitimacy of the stakeholder's relationship with the organization,

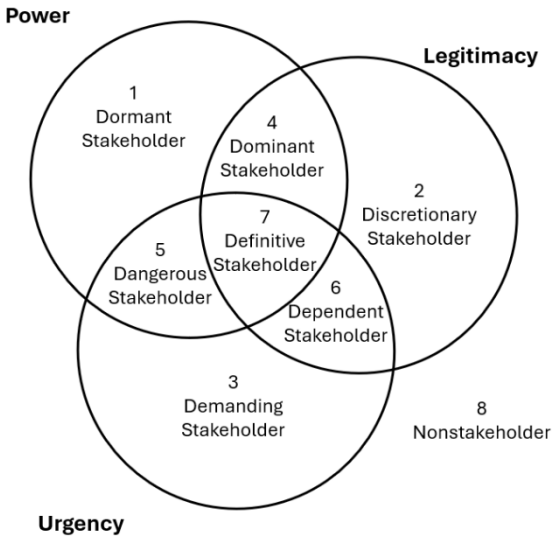


Figure 14 Stakeholder Salience Model (Mitchell et al., 1997)

and the urgency of the stakeholder's claim on the organization (Mitchell et al., 1997).

By assessing these attributes, the organization can prioritize stakeholders and determine their importance. The stakeholder salience model of Mitchell et al. (1997) categorizes stakeholders into eight groups based on the attributes they possess. These categories are divided into three main types: latent stakeholders (one attribute), expectant stakeholders (two attributes), and definitive stakeholders (three attributes). Figure 15 illustrates the eight types of stakeholders derived from this model.

Latent stakeholders are individuals or groups that possess one of the key attributes but are not yet actively involved with the organization. These stakeholders may not be immediately visible or impactful, but they hold the potential to affect the organization if their circumstances change.

The first latent stakeholder is the *dormant stakeholder* (1). This stakeholder does not yet exert power because their claim lacks legitimacy or urgency. They have no immediate reason to act, but when they do, they may have an impact. Next is the *discretionary stakeholder* (2), who has legitimacy but lacks urgency and power. While their claims are legitimate, they cannot influence the organization directly. The last type of latent stakeholder are the *demanding stakeholders* (3). They present urgent claims but lack legitimacy or power. Though their claims are urgent, they cannot directly influence the organization due to the lack of power or legitimacy.

The second group of stakeholders consists of expectant stakeholders, who possess two of the three attributes: power, urgency, and legitimacy. This makes their influence stronger than the latent stakeholders. The *dominant stakeholder* (4) falls into this category, having both power and legitimacy, but lacking urgency. They generally expect a lot from the organization and often receive considerable attention due to their authoritative role and legitimate relationship with the organization. *Dangerous stakeholders* (5) also fit within the expectant category, as they have both power and urgency, but lack legitimacy. Their lack of legitimacy means they may resort to forceful or aggressive actions to get their way. Identifying these dangerous stakeholders is crucial, but meeting their demands may not always be necessary. *Dependent stakeholders* (6) are the last stakeholder in this category. They possess urgency and legitimacy but lack power. These stakeholders rely on others, like dominant stakeholders, to impose their will on the organization.

The last category are the *definitive stakeholders* (7), those who have power, legitimacy, and urgency. These stakeholders are the most critical for the organization to engage with because they possess all three key attributes. Their level of importance makes them central to any engagement strategy.

Finally, there are also *non-stakeholders* (8). These actors do not possess any of the three key attributes. As a result, they do not need to be actively considered in the organization's stakeholder involvement process, as they have no influence on the organization (Mitchell et al., 1997).

Traditionally, those who score high in all three attributes are considered the most critical stakeholders with whom organizations should focus their engagement efforts (Rawlins, 2006; Lane & Devin, 2018). This highlights that the more attributes a stakeholder has, the greater their priority should be. Ultimately, the identification and selection stage of stakeholders concludes with a decision on which stakeholders are most important to involve. These key stakeholders are the ones you proceed with into the second stage.

Step II - Securing Stakeholder Interest

Once an organization has decided which stakeholders to engage with, the next step in the engagement process is to communicate with them to secure their interest in participating (Lane & Devin, 2018). The organization must persuade these stakeholders to collaborate by presenting an invitation or opportunity that is compelling. For stakeholders to respond positively, the offer must be attractive. Stakeholders need to be motivated before they are willing to invest effort in providing preferences or insights to the organization (Franklin, 2020; Lane & Devin, 2018). Of the five papers used for this framework, only Lane & Devin (2018) and Franklin (2020) acknowledge this phase.

Lane and Devin (2018) refer to the AIDA model (Awareness, Interest, Desire, Action) developed by Russ and Kirkpatrick (1982) to explain the process of securing participants' interest through communication. The model outlines how organizations can gradually increase stakeholder engagement by first creating awareness, followed by generating interest and desire, and finally prompting action. Awareness occurs when stakeholders become informed about a project or initiative, typically through promotional campaigns or public announcements. Interest is sparked when relevant and compelling information aligns with stakeholders' needs and expectations. In the next stage, desire is cultivated by emphasizing unique benefits and values, such as social impact, financial gain, or personal development. The final step involves encouraging action, such as participation or support, through clear calls to action or personalized invitations (Russ & Kirkpatrick, 1982).

Franklin (2020) offers in her book a complementary perspective by distinguishing two key factors influencing stakeholder motivation: push and pull factors, which closely align with the stages of the AIDA model. Push factors are intrinsic and correspond to the interest and desire phases of the AIDA model, as they stem from stakeholders' personal needs, interests, and beliefs. For instance, when stakeholders become aware of a project and realize it aligns with their personal goals, they develop an internal motivation to participate. Pull factors, on the other hand, are extrinsic and created by the organization. These factors are particularly relevant in the awareness and action stages of the AIDA model, where external incentives, resources, or targeted communication strategies enhance the attractiveness of participation. The interaction between push and pull factors ultimately shapes stakeholders' willingness to engage. They weigh expected benefits, influenced by both internal drivers and external incentives, against potential costs. If the perceived benefits outweigh the costs, this leads to action (Franklin, 2020), precisely as predicted by the AIDA model.

So, push factors refer to individual characteristics and conditions that can influence stakeholders' willingness to participate in engagement efforts. The first push factor Franklin (2020) mentioned is the stakeholder profile, which includes the stakeholder’s background and interests. Stakeholders with a strong identification with a particular issue are more likely to be motivated to engage. Demographics such as age, gender, and other factors can also affect participation, as certain demographic groups may feel more connected to specific causes. Another key push factor is efficacy, which refers to a stakeholder’s belief in their ability to make a difference. Those who feel their participation can lead to tangible outcomes are more inclined to participate. The concept of group membership is also important; social pressure and support from group members can encourage individuals to participate. When peers or fellow group members are actively involved, it creates a sense of collective responsibility and motivates others to join. Transaction or interaction salience reflects how relevant an issue is to a stakeholder,

meaning the more important the issue, the more likely the stakeholder will participate. Availability of resources, such as time or financial support, is another significant factor. Stakeholders with limited resources might be less likely to engage due to constraints. Finally, stakeholders often perform a cost-benefit analysis, weighing the benefits of participation against its costs. If the perceived benefits outweigh the costs, stakeholders are more likely to participate (Franklin, 2020). These various push factors can also be found in table 11.

Unlikely to Participate	**Push Factor**	*Likely to Participate*
Engaged	**Stakeholder Profile**	*Disengaged*
Limited Involvement	**Demographics**	*Active involvement*
Lack of confidence in successful participation	**Efficacy**	*Belief in the effectiveness of their participation*
Isolated	**Group Membership**	*Connected*
Unimportant issue	**Transaction/issue salience**	*Relevance*
Limited resources	**resources**	*Available resources*
High costs	**benefit-cost analysis**	*Positive cost-benefit analysis*

Table 11 Push Factors for Stakeholder Involvement (Visualisation based on Franklin, 2020)

On the other hand, pull factors focus on external elements that influence stakeholders' motivation to get involved. Franklin (2020) distinguishes seven pull actors, which are also clearly illustrated in table 12. To start with, an invitation from the project management to the stakeholders can serve as a strong pull factor. A direct invitation makes stakeholders feel valued and more inclined to participate. The presence of other active stakeholders can create social pressure, pushing others to join the effort. Stakeholders may also be motivated by the development opportunities that participation offers, whether personal or professional. The more visible and relevant the issue, the more likely stakeholders are to get involved, which is reflected in the issue salience factor. Active locations, or the accessibility and attractiveness of locations for interaction, can also impact participation. Convenient and engaging locations encourage higher turnout. Additionally, incentives, such as financial rewards or other forms of recognition, can act as pull factors, making participation more appealing. Just like push factors, stakeholders will also conduct a cost-benefit analysis to determine if the benefits of engaging outweigh the costs, and a positive outcome of this analysis can motivate them to participate.

Unlikely to Participate	**Pull Factor**	*likely to Participate*
No invitation	**Stakeholder Invitation**	*Active invitation*
Absence of others	**Other Active Stakeholders**	*Social pressure from others*
No development opportunities	**Participant Development**	*Opportunities for growth*
Unimportant issue	**Issue Salience**	*Relevance*
Difficult access	**Active Venues**	*Accessible locations*
No incentives	**Incentives**	*Attractive incentives*
High costs	**Benefit-cost Analysis**	*Positive cost-benefit analysis*

Table 12 Pull Factors for Stakeholder Involvement (Visualisation based on Franklin, 2020)

By understanding and leveraging both push and pull factors, organizations can effectively attract and engage stakeholders. Once stakeholders are identified and motivated, the next step is to convert this interest into active participation, which will be addressed in the third stage of the stakeholder involvement process.

Step III – Involvement / Implementation

The implementation phase of stakeholder engagement builds upon the interest established through organizational communication in Step II. Within this phase, three distinct substages can be identified: the strategies through which stakeholder input is achieved, the methods by which the engaging is undertaken, and the purposes for which the organization uses the interaction (Lane & Devin, 2018).

Step III-a Input strategies

Stakeholder engagement begins with selecting an appropriate stakeholder input strategy. These strategies reflect the level of involvement and the nature of stakeholder contributions to the project. Luyet et al. (2012) identify five degrees of participation, with the first stage being information, where organizations share information with stakeholders while seeking minimal input in return. Lane & Devin (2018) describe this stage as well in their research, but call it the interaction strategy. At this stage, the input received from stakeholders is often limited in value and may be perceived as a symbolic gesture by the organization to engage, rather than as a meaningful form of collaboration (Lane & Devin, 2018).

The second degree of stakeholder engagement is consultation, where stakeholders are presented with the project details, their suggestions are gathered, and decisions are subsequently made - with or without incorporating their input (Luyet et al., 2012). Typically, the organization selects the topics for which stakeholder feedback is sought, limiting the scope of involvement (Lane & Devin, 2018). This stage aligns broadly with the involvement strategy described by Lane and Devin (2018). Although consultation allows for greater stakeholder input than the informational stage, the organization still retains significant control over the decision-making process.

Lane and Devin's (2018) model reaches its highest in the integration degree. However, Luyet et al. (2012) take this concept further by subdividing the integration stage into three distinct phases—(3) collaboration, (4) co-decision, and (5) empowerment—providing a more nuanced understanding of how engagement evolves at higher levels of participation.

The third degree in the model of Luyet et al. (2012) is collaboration. In this degree, stakeholders are presented with the project and their input is solicited, much like in the consultation degree. However, what sets this degree apart is that the stakeholder input is not merely collected but actively incorporated into the organization's decision-making process. This shift reflects a significant increase in the weight and importance given to stakeholder contributions.

In the co-decision degree, the fourth degree of Luyet et al. (2012), stakeholders and the organization work together toward finding solutions and agreeing on their implementation. This phase goes beyond simply considering stakeholder input; it emphasizes collaborative decision-making, where stakeholders have an equal say in shaping outcomes. This deeper involvement

ensures that decisions are not only inclusive but also represent a genuine partnership between the organization and its stakeholders.

Finally, Luyet et al. (2012)'empowerment degree represents the highest level of stakeholder participation, where decision-making authority over project development and implementation is fully entrusted to the stakeholders. This degree goes beyond collaboration or co-decision by prioritizing stakeholder autonomy, marking a complete transfer of control. Empowerment reflects the organization's ultimate confidence in the stakeholders' ability to take the lead and successfully drive the project to completion. Figure 16 illustrates the five degrees of involvement model by Luyet et al. (2012), presented alongside the model by Lane and Devin.

To better structure and define the involvement of stakeholders, the RACI Model (Responsibility, Accountability, Informed, Consulted) can be applied alongside these stages. A RACI matrix is a simple and effective way to define project roles and responsibilities. It provides a chart of who is responsible, accountable, consulted, or informed at each step of the project, making it easier to define the roles and responsibilities of stakeholders and ensuring they are engaged at the appropriate level.

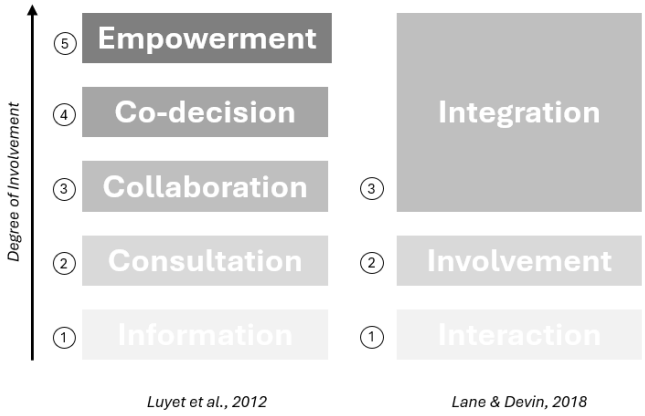


Figure 15 Degrees of Stakeholder Involvement Across Different Frameworks

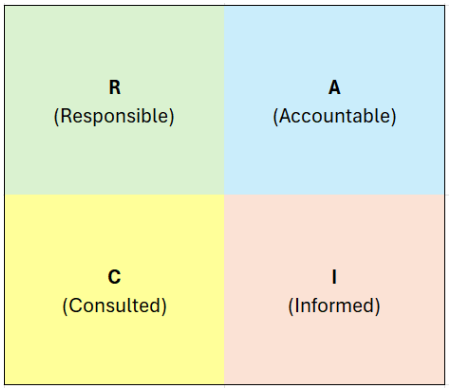


Figure 16 Overview RACI Matrix

The Four Roles in the RACI Model:

1. **Responsible**: These are the people or stakeholders who actually do the work. They are responsible for completing the task or making the decision. Multiple people can be jointly responsible.
2. **Accountable**: This is the person or stakeholder who "owns" the work. They must approve when the task or decision is completed. There should be only one accountable person for each task, as ultimate responsibility lies with them.
3. **Consulted**: These are stakeholders who need to provide input before the work can be done and signed off. They are "in the loop" and actively participate.
4. **Informed**: These stakeholders need to be kept up to date on progress or decisions, but do not play an active role in the process. They do not need to be formally consulted, nor do they contribute directly to the task or decision.

By integrating the RACI model with the stages of stakeholder engagement, organizations can create a clear and structured approach to involving stakeholders at the right level. The RAIC matrix defines roles by identifying who is responsible for tasks, who makes final decisions, who provides input, and who needs to be kept informed. Assigning stakeholders a degree of involvement ensures their roles align with the project's needs. This alignment is critical, as it determines the participatory techniques used and shapes the stakeholder's role in the process.

Step III-b Method of Involvement

Once the degree of involvement for a stakeholder is determined, an appropriate involvement method needs to be chosen. There is no standardized method for selecting the most relevant participatory technique (Luyet et al., 2012). In practice, the experience and skills of the modelers often influence the decision (Voinov et al., 2018). Besides the degree of involvement, factors such as stakeholder type, the nature of the problem for which input is needed, available resources, desired results, cultural norms, past events, timing, and the expertise of the project manager must also be considered when selecting the appropriate engagement method (Luyet et al., 2012; Voinov et al., 2018; Marais & Abi-Zeid, 2021). Choosing the right and appropriate participation technique is crucial for the effectiveness of stakeholder outcomes. Selecting an incorrect technique is considered one of the main risks that can lead to an unsuccessful participation process (Luyet et al., 2012).

Participation technique	Information	Consultation	Collaboration	Co-decision	Empowerment
Newsletter	X				
Reports	X				
Presentations, public hearings	X	X	X		
Internet webpage	X	X			
Interviews, questionnaires and surveys	X	X	X		
Field visit and interactions	X	X	X		
Workshop		X	X	X	X
Participatory mapping			X	X	X
Focus group			X	X	X
Citizen jury		X	X	X	X
Geospatial/ decision support system	X	X	X	X	
Cognitive map	X	X	X		
Role playing			X	X	X
Multicriteria analysis			X	X	
Scenario analysis		X	X	X	X
Consensus conference		X	X	X	X

Table 13 Methods of Engagement based on their degree of Involvement (Luyet et al., 2012)

Step III-c Implementation of Method

Once the method is chosen, it is time to implement it. The entire process may seem clear in theory, but practical challenges arise that require additional attention. This is the phase where stakeholders truly come into play, and careful planning of activities becomes crucial. Planning processes are essential for any activities involving multiple stakeholders, as they help identify and address changes needed to improve system effectiveness and efficiency.

Hamilton et al., (2017) states that there are four main factors that initiators of the stakeholder process must pay close attention to during this phase to ensure a successful outcome . First, it is critical to maintain the commitment of stakeholders throughout the process and its goals. The commitment factors of the stakeholders, including push and pull factors, were established in phase two, but it is important to ensure these commitments remain strong throughout the process. Otherwise, stakeholders may feel compelled to disengage prematurely.

Second, attention must be given to the capacity of stakeholders to actively participate, which requires well-planned engagement strategies. This may include organizing effective meetings, as stakeholders are less likely to return if these gatherings are inefficient or poorly organized.

Additionally, the continued commitment of the initiators to meaningful engagement is essential. If this commitment is lacking, stakeholders may feel undervalued or unheard, which could lead them to withdraw from the process.

The final factor is trust between the initiators of the stakeholder involvement process and the stakeholders themselves, which is fundamental to keeping stakeholders engaged until the process reaches its conclusion. Building trust requires effective communication and transparency about the techniques being used. Inadequate or poorly executed implementation can lead to mistrust and frustration, ultimately resulting in the failure of the process. One important way to foster trust is to begin with a phase that allows both stakeholders and initiators to get to know each other, understand each unique perspective on the issue at hand, and recognize how each individual's contribution adds value to the effort (Goodman & Sanders Thompson, 2017). By ensuring open communication and a clear understanding of each stakeholder's role, the process can establish the trust and commitment necessary for success.

Step IV – Evaluation

The evaluation of a participation process plays a crucial role in improving future applications, increasing the understanding of its impacts on stakeholders, and documenting experiences and outcomes (Luyet et al., 2012). Evaluations typically employ both qualitative and quantitative research techniques, such as surveys, interviews, and case analyses. These methods help assess the effectiveness of stakeholder involvement and provide insights into areas for improvement (Luyet et al., 2012; Preble, 2005).

When evaluating stakeholder processes, three main groups of criteria should be considered: criteria related to the process itself, criteria related to the outcomes, and criteria linked to the political, social, cultural, historical, and environmental context in which the process takes place. These criteria provide a comprehensive framework for assessing the success and challenges of the stakeholder involvement process (Luyet et al., 2012).

In particular, when evaluating the process of stakeholder involvement, it is essential to address three key questions (Preble, 2005). First, it is important to understand what the program was intended to achieve by focusing on the initial objectives and goals of the stakeholder engagement. Next, the evaluation should examine what was actually delivered in reality, assessing whether the outcomes align with the original intentions. Finally, the evaluation should consider where the gaps are between the program design and its delivery, identifying any differences between the planned process and its actual execution, especially in areas where misalignment occurs.

These three questions form the foundation of the Stakeholder Engagement Gap Analysis, which highlights the differences between stakeholders' initial expectations and the actual outcomes achieved (Preble, 2005; Bailey & Grossardt, 2006; Franklin, 2020). By identifying these gaps, the analysis offers valuable insights that can inform and refine future stakeholder involvement processes, ensuring better alignment with stakeholders' needs and expectations.

3.2.5 Conclusion on Stakeholder Involvement

Stakeholder involvement is a dynamic and interactive process aimed at ensuring meaningful participation by addressing stakeholders' needs throughout the project lifecycle. This chapter introduced a structured framework for the process of stakeholder involvement consisting of four key stages: I.) identifying and selecting relevant stakeholders, II.) securing their interest, III.) implementing tailored involvement strategies, and IV.) conducting an evaluation phase. Within each stage, specific activities play a central role in shaping the process, with a corresponding framework assigned to each activity. These frameworks provide structured guidance on how to effectively carry out the activities, ensuring a systematic and efficient approach to stakeholder involvement throughout the project lifecycle. The different phases, along with the corresponding activities and frameworks, are presented in table 14.

The results of each phase serve as input for the next, guiding decisions and ensuring a coherent and adaptive approach. By following this systematic structure, organizations can enhance stakeholder engagement, foster mutual understanding, and improve project outcomes through active collaboration and continuous feedback.

Through conducting a systematic literature review of the five articles, more knowledge and insight have been gained into how a stakeholder involvement process works and the different steps involved. The various steps of the stakeholder involvement process outlined in this chapter will therefore also be used as deductive codes for analysing the interviews in chapter 3.

Step	Name	Activity	Framework	By
I	*Idenification and Selection of Stakeholders*	Idenification Prioritization & Selection	Six Criteria of Stakeholders Stakeholder Salience Model	(Franklin, 2020) (Mitchell et al., 1997)
II	Securing Stakeholder Interest	Secure Interest	AIDA model Push & Pull Factors	(Russ & Kirkpatrick, 1982) (Franklin, 2020)
III	Involvement / Implementation			
a	Input Strategy	Decide on level of involvement of Stakeholder	Degree of Stakeholder Involvement RACI Matrix	(Luyet et al., 2012)
b	Method of Involvement	Choose an appropriate method	Methods of Involvement	(Luyet et al., 2012)
c	Implementation of Method	Implement chosen method	Four implementation factors	(Hamilton et al., 2017)
IV	Evaluation	Evaluate on Stakeholder Involvement Process	Stakeholder Involvement Gap Analysis	(Bailey & Grossardt, 2006)

Table 14 Overview of Stakeholder Process Steps with Corresponding Activities and Frameworks

3.3 Stakeholder Involvement in the creation of Effective Learning Environments

Stakeholder involvement in the creation of effective learning environments contributes to improved engagement (Gatlin, 2021; Pnevmatikos et al., 2020), enhanced collaboration (Gatlin, 2021), and better alignment of the project with user needs (Borri, 2021; Pnevmatikos et al., 2020; Rudman et al., 2018), as discussed in Section 3.2.3. This chapter specifically focuses on stakeholder involvement in the development of effective learning environments. First, the types of stakeholders involved are outlined based on an extensive literature review. Then, the roles and power dynamics among the various stakeholders are examined. Finally, a stakeholder analysis informed by the literature is presented.

3.3.1 Types of Stakeholders involved

Various stakeholders are involved in the creation of learning environments, each playing a distinct role in the process. A literature review of seven selected papers (Borri, 2021; Frelin & Grannäs, 2021; Gatlin, 2021; Könings et al., 2014; Pnevmatikos et al., 2020; Rudman et al., 2018; Victorino et al., 2022) was conducted to identify and analyse these stakeholders. The analysis revealed inconsistencies in the naming of stakeholders, as well as a lack of structured grouping and categorization across the studies.

To bring clarity, the Special Interest Group Learning Spaces (SIG LS) developed a stakeholder framework that categorizes stakeholders into four groups (SIG LS, 2020). A distinction is made between internal and external stakeholders, where internal stakeholders refer to those within the organization, and external stakeholders refer to those outside the organization. Within the institution, there are four internal groups: end-users, strategic decision makers, service units, and the design team. The fifth group consists of external stakeholders. These categories were created to group stakeholders with similar goals and responsibilities, ensuring a more structured understanding of their roles.

Figure 18 provides a comprehensive overview of all stakeholders mentioned in the reviewed literature, organized within these six categories to highlight their unique roles and contributions. This structured approach ensures a comprehensive understanding of stakeholder involvement in the creation of effective learning environments.

	Category	Könings et al. (2014)	Rudman et al. (2018)	Pnevmatikos et al. (2020)	Borri (2021)	Frelin & Grannäs (2021)	Gatlin (2021)	Victorino et al. (2022)
Internal Stakeholders	End-Users	Students Teachers	Practioners Academics	Students Teachers Student Associations in HE	Students Teachers	Student Teacher	Students Teachers Student Government Association	Students Professors Academic Community
	Strategic Decision-makers			School Leadership SH		Head teacher	Associate Provost Faculty Senate Deans Department Chairs	
	Service Units			Liberarians at HE Administrators at HE Museum Representatives		Operations Manager	Registar Facilities Librarians Accesibility Specialist	
	Design Team			IT Experts Eduactional Experts	Eduactional Experts	LE consultant	IT specialist Facility Manager	
External Stakeholders	External Stakeholders	Designers	External advisors	Architect Designer Companies Young Proffesionals Parents Professional Associations Authorities Policy Makers	External Experts	Interior Architect Architect Municipality	University Architect Interior Designer	

Figure 17 Categorisation of Stakeholders involved in the creating of Learning Environments

The first category identified in the analysis is that of the end users. The role of end users is to provide input from their perspective when formulating project goals, the program of requirements, and priorities. This involves the community of people who will use the learning space(s) and those who will facilitate or support its use. In addition to contributing during the planning phase, they also help evaluate the project and its outcomes (SIG LS, 2020). This category includes two key stakeholders: students and teachers. These are the only two stakeholders consistently mentioned across all seven articles (Borri, 2021; Frelin & Grannäs, 2021; Gatlin, 2021; Könings et al., 2014; Pnevmatikos et al., 2020; Rudman et al., 2018; Victorino et al., 2022). Involving end users in the design process of learning environments has been shown to significantly contribute to the creation of spaces that meet the specific needs and preferences of the users. As a result, it is considered crucial to involve end users in the development of such environments, as their input ensures the spaces are functional, effective, and conducive to learning (Borri, 2021; Pnevmatikos et al., 2020; Rudman et al., 2018).

The second category is that of strategic decision-makers. This group of stakeholders often includes the initiators of the project, such as those responsible for starting the creation of new learning environments (SIG LS, 2020). Members of this group are typically in charge of managing the budget, planning, and personnel, and they also oversee the progress of the project (Gatlin, 2021). In the context of universities, this group often consists of department heads, deans, executive boards, and campus real estate managers. (Gatlin, 2021; Pnevmatikos et al., 2020). These strategic decision-makers play a crucial role in ensuring that the project aligns with the institution’s overall goals and objectives, and that it is completed within the allocated budget and timeframe. Their decisions influence the scope, direction, and success of the learning environment's development (Frelin & Grannäs, 2021).

The third category is the service units. These units provide educational support services and are responsible for the operational processes that enable education to run smoothly. The exact responsibilities and composition of service units may vary per institution. Tasks can be distributed across different departments or centralised in a shared service centre (SIG LS, 2020). Stakeholders within this category typically include administration departments, libraries, operational managers, ICT, and AV services, among others. Their primary goal within learning environments is to ensure that all related processes are handled efficiently and professionally. (Frelin & Grannäs, 2021; Gatlin, 2021; Pnevmatikos et al., 2020). Service units play an important role in maintaining the functionality and smooth operation of these spaces, allowing the educational activities to take place without disruption. These stakeholders can provide valuable input regarding these processes, which should be considered when designing learning environments. Their insights can help ensure that the spaces are not only functional but also aligned with the operational needs and support services that contribute to an effective learning experience (Frelin & Grannäs, 2021).

The fourth category is the design team, also referred to as the internal project team. This team is responsible for developing a design that balances the wishes outlined in the program of requirements with the innovative possibilities available. It consists of various specialists, including educational specialists, IT experts, AV technicians, and facility management coordinators. The goal of this team is to create a feasible and functional design that incorporates all stakeholder needs (SIG LS, 2020). Members of the design team often represent other stakeholder categories and may have overlapping roles. For example, IT professionals may be part of both the service units and the design team. However, in the context of the design team, their role is more focused on the integration of their expertise into the physical space. In contrast,

their role within the service units is more aligned with that of an end user or operational supporter. Thus, while there may be overlap in personnel, their function within the project can differ significantly.

The final category consists of the external stakeholders. This group includes all stakeholders outside the organization—in this case, the university—who nonetheless have a vested interest in the project (SIG LS, 2020). The level of involvement among these stakeholders can vary significantly. Included in this category are all external parties involved in the creation of learning environments, such as architects, designers, consultants, contractors, and suppliers. At a broader level, this group may also include companies, municipalities, and other external organizations or communities with a potential interest in the development or use of the learning spaces. Although their engagement is typically less intensive than that of internal stakeholders, external stakeholders can offer valuable perspectives and resources, including funding opportunities, strategic partnerships, and real-world insights. Their contribution helps ensure that the design and use of learning environments are aligned with broader societal, economic, and technological developments, thereby enhancing their long-term relevance and adaptability (Pnevmatikos et al., 2020).

3.3.2 Roles and power of the stakeholders involved

In the previous section, all relevant stakeholder categories were discussed. These stakeholders operate at different levels, each with distinct roles and degrees of influence. SIG LS (2020) purposes that there is a layered structure within the process that consists of the internal project team, advisory board, and working groups. External stakeholders are categorized separately, as shown in Figure 19. It is important to note that not all levels and groups are involved in every project.

The internal project team includes members from the design team as well as strategic decision-makers. This team coordinates the project and is responsible for developing and implementing the design, taking into account requirements and feasibility. It consists of representatives from relevant domains (design specialists) and project owners (decision-makers) (SIG LS, 2020).

To gather input, the internal project team can initiate working groups, made up of representatives from their broader stakeholder base, such as end-users and service units. These groups function as knowledge groups, providing insights and expertise on design and requirements based on their specific experiences (SIG LS, 2020).

When a concept or prototype has been developed, external stakeholders may be engaged to carry out detailed design, provide consultancy, or handle construction. At this stage, the internal project team can also set up advisory boards, often composed of end-users. These user groups provide feedback from a user perspective. Their role is to evaluate and monitor whether the evolving design still aligns with their needs and how user-friendly it is (SIG LS, 2020).

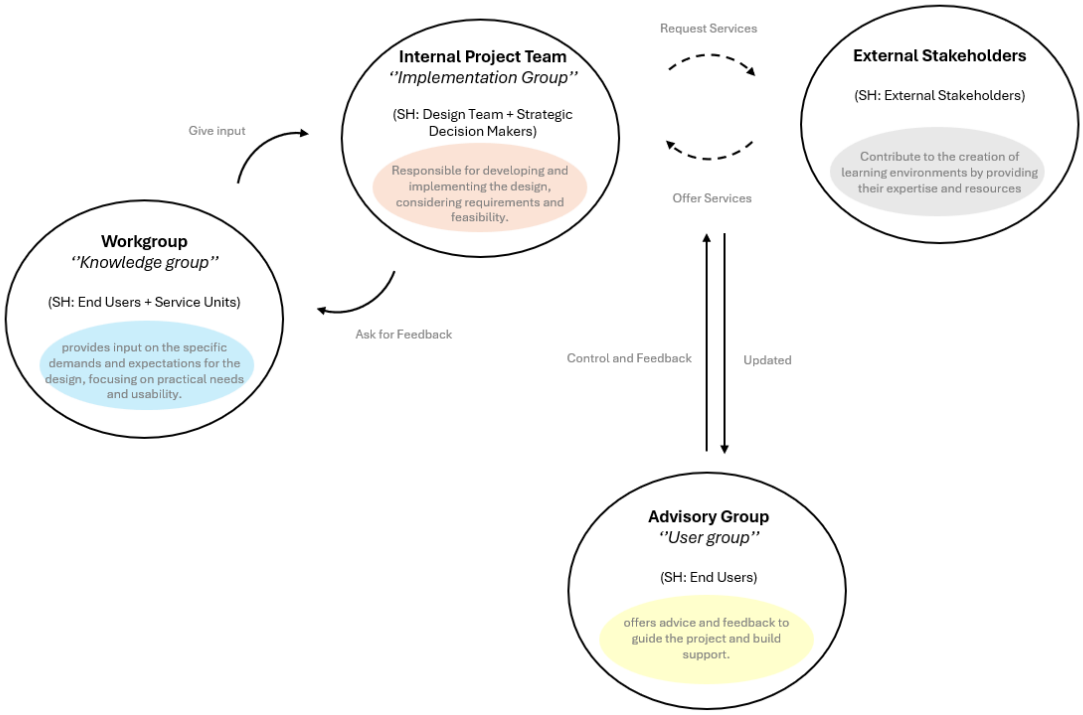


Figure 18 Stakeholder Structure in Learning Environment Projects

3.3.3 Stakeholder Analysis

SIG LS (2020) outlined the roles of the five most common stakeholder groups involved in the creation of learning environments. Based on this, SIG LS (2020) created the first three columns of table 15, in which the stakeholders involved in the cases are listed using the terminology commonly used in practice, as emerged from the cases. The goals and interests of the various stakeholders are outlined, along with their corresponding tasks and actions. This analysis forms the basis for stakeholder identification. Additionally, a column has been added indicating the stakeholder group to which each stakeholder typically belongs, as described in Section 3.3.2.

*Table 15 Stakeholder Analysis for creating Effective Learning Environments (*Adapted from SIG LS*, Stakeholders at innovative learning spaces,* 2020*)*

	Stakeholders	Goals / Interest related to the creation of the LE	Tasks / Actions in creating LE	Role / Power in the process	Involved in Literature	Involved in Case Study + Interviewees
1	End User				1. Könings et al. (2014) 2. Rudman et al. (2018) 3. Pnevmatikos et al. (2020) 4. Borri (2021) 5. Frelin & Grännas (2021) 6. Gatlin (2021) 7. Victorino et al. (2022)	Case A: (Interviewee A3) Case B Case C Case D: (Interviewee D2)
A	Students	Providing support in the development of learning spaces that align with their needs and desires.	Providing input based on personal and professional experience (e.g., from the student council).	*Workgroup + advisory group*	1. Könings et al. (2014) 2. Rudman et al. (2018) 3. Pnevmatikos et al. (2020) 4. Borri (2021) 5. Frelin & Grännas (2021) 6. Gatlin (2021) 7. Victorino et al. (2022)	Case A: (Interviewee A3) Case B Case D
B	Teachers	Providing support in the development of learning spaces that align with their needs and desires.	Providing input based on personal and professional experience. Evaluating the results.	*Workgroup + advisory group*	1. Könings et al. (2014) 2. Rudman et al. (2018) 3. Pnevmatikos et al. (2020) 4. Borri (2021) 5. Frelin & Grännas (2021) 6. Gatlin (2021) 7. Victorino et al. (2022)	Case A Case B Case C Case D: (Interviewee D2)
2	Strategic Decision Makers				3. Pnevmatikos et al. (2020) 5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A: (Interviewee A1) Case B: (Interviewee B1) Case C: (Interviewee C1) Case D: (Interviewee D1)
A	Campus facilities	Acts as the delegated client and building owner, overseeing the project's alignment with strategic goals and managing the overall realization of the learning environment.	Gives the order to start the project, coordinates the process, checking the feasibility of the spatial and technical requirements, aligning stakeholders, and ensuring the integration of the learning environment within broader campus development plans.	*Internal Project team*	3. Pnevmatikos et al. (2020) 5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A: (Interviewee A1) Case B: (Interviewee B1) Case C: (Interviewee C1) Case D: (Interviewee D1)
3	Service Units				3. Pnevmatikos et al. (2020) 5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A: (Interviewee A5) Case B Case C Case D
A	AV Services	Ensures that supporting processes related to learning spaces run efficiently and professionally; delivers the associated services on time.	Among other responsibilities, accountable for providing and maintaining audiovisual resources within learning spaces.	*Workgroup*	5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A: (Interviewee A5) Case B Case C Case D
B	ICT services	Ensures that supporting processes related to learning spaces run efficiently and professionally; delivers the associated services on time.	Among other responsibilities, accountable for providing and maintaining technology within learning spaces.	*Workgroup*	5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A Case B Case C Case D
C	Facility Management	Ensures that supporting processes related to learning spaces run efficiently and professionally; delivers the associated services on time.	Providing the requested facilities renovation, lighting, climate control), furniture and furnishings, catering, cleaning, and security.	*Workgroup*	5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A Case B Case D
4	Design Team				3. Pnevmatikos et al. (2020) 4. Borri (2021) 5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A: (Interviewee A2 & A4) Case B: (Interviewee B1 & B2) Case C: (Interviewee C1 & C2)
A	Educational Experts	Providing Input on Educational Concepts and User Experience in Effective Learning Spaces	Participation in a feedback group; contributing ideas during the design phase, possibly in a project team; providing input on teaching support; offering insights from practice and literature	*Internal Project team*	3. Pnevmatikos et al. (2020) 4. Borri (2021) 5. Frelin & Grännas (2021)	Case A: (Interviewee A2) Case C: (Interviewee C2)
B	AV-specialists	Propose potential AV solutions and assess the feasibility of the proposed options.	contributing ideas during the design phase, possibly in a project team, providing input on latest trends and possibilities about the AV.	*Internal Project team*	3. Pnevmatikos et al. (2020) 6. Gatlin (2021)	Case A Case B: (Interviewee B2) Case C Case D
C	ICT-specialists	Contributing ideas regarding IT solutions (linked to audiovisual technology within a learning environment and e-learning possibilities).	Participation in a feedback group; contributing ideas during the design phase, possibly in a project team, providing input on latest trends and possibilities about the technology.	*Internal Project team*	3. Pnevmatikos et al. (2020) 6. Gatlin (2021)	Case A Case B: (Interviewee B2) Case C Case D
D	Facility Management	Ensure the feasibility of what is described in the program of requirements; establish the facility-related preconditions for the use of learning spaces.	Support during the new construction process; assess the feasibility of the program of requirements; set up facility support; contribute ideas and input, as well as stay informed about the latest trends and possibilities.	*Internal Project team*	3. Pnevmatikos et al. (2020) 6. Gatlin (2021)	Case A: (Interviewee A4) Case B: (Interviewee B1) Case C Case D

5	External Stakeholders				1. Könings et al. (2014) 2. Rudman et al. (2018) 3. Pnevmatikos et al. (2020) 4. Borri (2021) 5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A: (Interviewee A6) Case B Case C Case D
A	Designers	Coordination with the project team, receiving feedback on the design, designing the learning environment.	Draws the construction plans and designs based on the requirements program, received input, and feedback from other stakeholders.	*External stakeholders*	1. Könings et al. (2014) 3. Pnevmatikos et al. (2020) 5. Frelin & Grännas (2021) 6. Gatlin (2021)	Case A: (Interviewee A6) Case B Case D
B	Advisors	Provide expert input and guidance to ensure that the design aligns with educational goals, user needs, and current best practices.	providing expert input on educational concepts and spatial design, advising on alignment with learning goals, reviewing plans, and ensuring that the learning environment supports innovative and effective education.	*External stakeholders*	2. Rudman et al. (2018) 3. Pnevmatikos et al. (2020) 4. Borri (2021)	Case A Case B
C	Contractors	Deliver the project according to the agreed design, quality standards, and timelines, based on the specifications provided in the program of requirements.	interpreting the program of requirements, preparing and submitting tenders, coordinating construction or installation activities, and delivering the physical space or elements such as AV, ICT, furniture, and structural components.	*External Stakeholders*		Case A Case B
D	Suppliers	Coordination with the client, receiving feedback on the design, designing the learning environment.	Prepare quotations based on the programme of requirements provided by the client, and provide input on the design. They deliver goods or services, such as AV, ICT, furniture, contractors, etc. There are often preferred suppliers or framework agreements that must be taken into account.	*External stakeholders*		Case C Case D

3.3.4 Conclusion on Stakeholder Involvement in the creation of Effective Learning Environments

This chapter provided a comprehensive overview of the stakeholders involved in the development of learning environments, highlighting their categorization as well as their roles, interests, and influence throughout the process. A review of the literature revealed that stakeholder involvement is highly multifaceted, encompassing a broad range of actors from both within and outside the educational institution. The structured framework developed by SIG LS (2020), in which stakeholders are categorized into five groups—end users, strategic decision-makers, service units, design teams, and external stakeholders—offers clarity by organizing stakeholders into coherent categories. This allows for a more systematic and strategic approach to engagement.

Moreover, it is important to understand that stakeholders hold different roles and degrees of power within the process of creating learning environments. They operate on various levels, resulting in a layered structure of involvement. In general, three internal groups can be distinguished: the internal project team, also referred to as the implementation group, which is responsible for the actual development of the learning environment; the working groups, or knowledge groups, where stakeholders can contribute their expertise in response to specific needs and expectations for the design; and the advisory group, which includes end users who provide advice and feedback on the proposed plans.

3.4 Conclusion literature study and research gap

This chapter concludes the literature study by answering the three sub questions. These sub-questions contribute to answering the research question "How can the stakeholder involvement process be optimised in the creation of effective learning environments in university real estate?''

SQ1: How does the stakeholder involvement process look like in the creation of effective learning environments?

Literature indicates that the stakeholder involvement process in creating effective learning environments typically includes five types of internal and external stakeholders: end-users, strategic decision-makers, service units, design teams, and external stakeholders.

Although academic literature specifically focusing on stakeholder involvement process in the context of creating learning environments is still limited, general frameworks for structured stakeholder involvement can be applied and adapted to this context. In the literature study a structured framework is introduces for the process of stakeholder involvement consisting of four key stages: I.) identifying and selecting relevant stakeholders, II.) securing their interest, III.) implementing tailored involvement strategies, and IV.) conducting an evaluation phase. Within each stage, specific activities play a central role in shaping the process, with a corresponding framework assigned to each activity. These frameworks provide structured guidance on how to effectively carry out the activities, ensuring a systematic and efficient approach to stakeholder involvement throughout the project lifecycle.

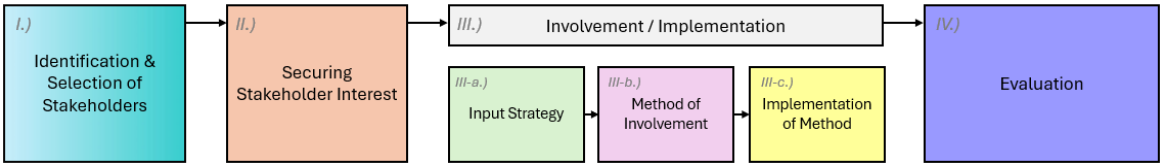


Figure 19 Proposed Framework for Stakeholder Involvement Process

SQ2: How is stakeholder input integrated into the design process of the effective learning environments?

There are different layers within stakeholder types. For internal stakeholders, this includes the internal project team, working groups, and advisory groups, while external stakeholders form a separate category. The level at which a stakeholder is involved influences the amount of power they hold and the type of input that is expected from them. Stakeholder input is integrated into the design process through structured engagement at each level, where input is aligned with the stakeholder's expertise and influence, ensuring that the design reflects diverse needs and perspectives.

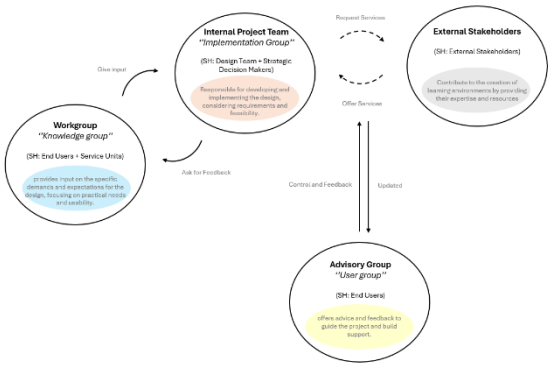


Figure 20 Stakeholder Structure in Learning Environment Projects

SQ3: How do end-users perceive the effectiveness of the learning environment?

According to recent trends in learning environments, end-users perceive these spaces as most effective when they are flexible and centered around their needs. This perspective aligns with the broader shift toward human-centered education, which emphasizes the importance of involving users throughout the design process. In the literature, these aspects are often discussed in terms of three key spatial elements: visibility, mobility, and access to learning resources. When these elements are embedded into the spatial design, they support the realization of effective learning environments that are capable of accommodating diverse learning activities and pedagogical models.

SQ4: To what extent is there alignment between end-user perceptions and stakeholder input regarding the effectiveness of the learning environment?

Stakeholder involvement plays a crucial role in creating a learning environment that encourages collaboration and ensures that design outcomes reflect user expectations. When both stakeholders—including end-users—are involved early and meaningfully in the design process, their perceptions of success are more likely to align. This reduces the risk of dissatisfaction, enhances the sense of ownership, and promotes adaptability of the space over time.

Part 4

Case Study

4.1 Case A: TU Delft

ECHO - Project Rooms CDEF

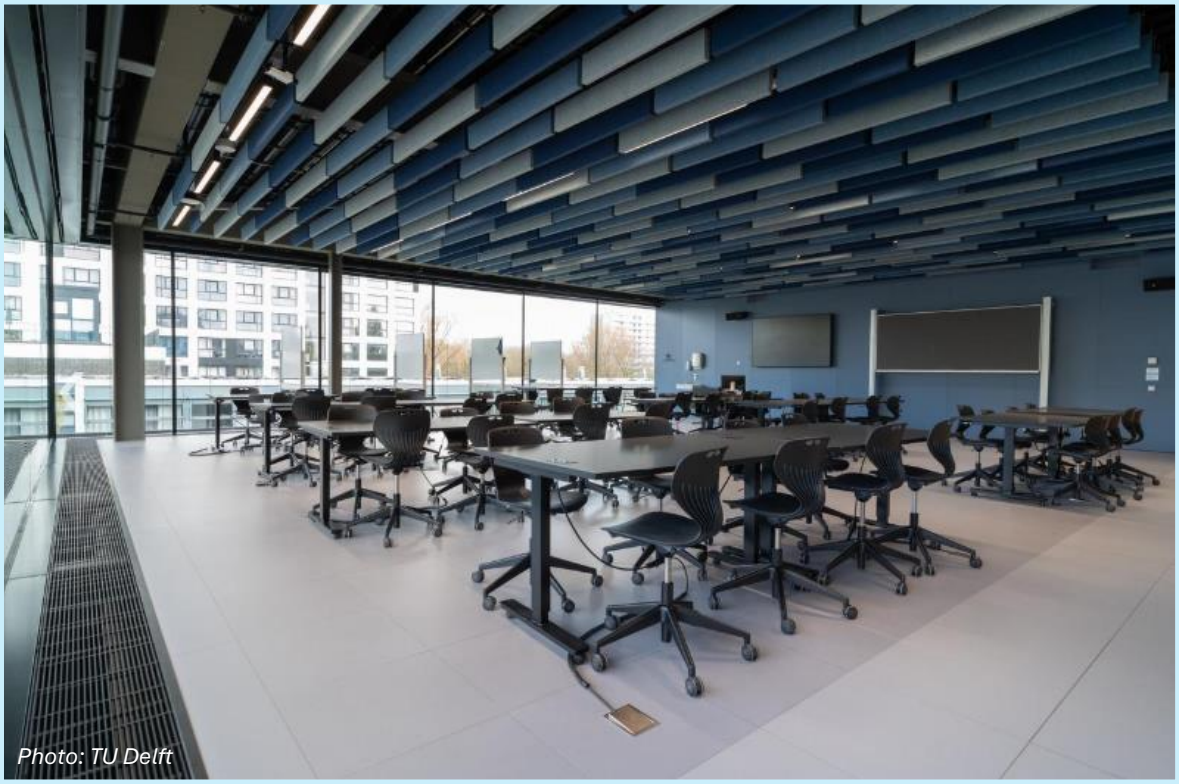
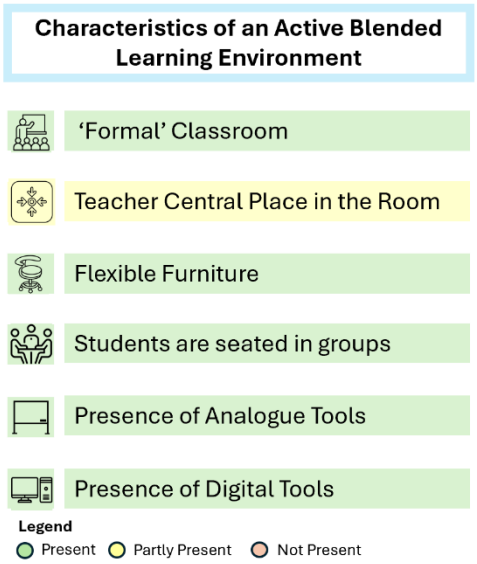


Photo: TU Delft

Project Rooms CDEF

University	TU Delft
Building	ECHO – Building 29
Name of the Room	Project Room CDEF
Building Year	2022
Surface	175 m^2
Seat Capacity	64
Space efficiency	2,73 m^2 / person



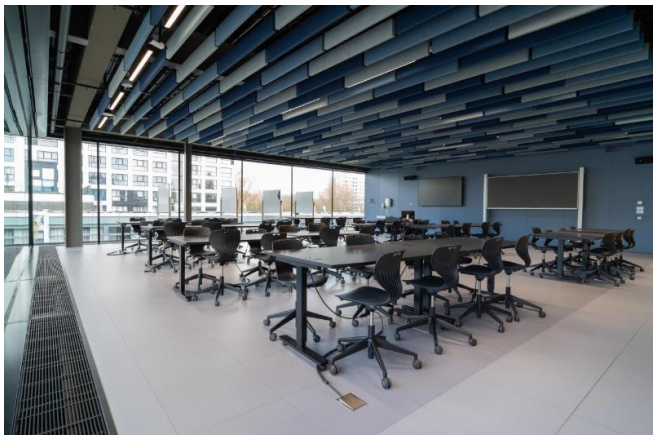
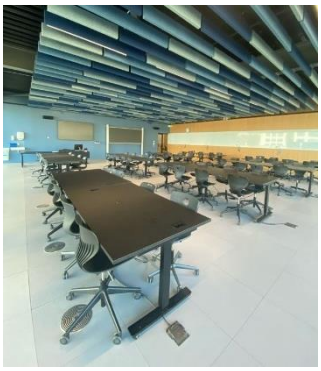


Photo: TU Delft



Formal Classroom	Yes
Teacher central place in the room	No
Flexible Furniture	Yes, Tables and chairs are on wheels
Students are seated in groups	Yes, Groups of 8 people per table
Presence of Analogue Tools	Whiteboard on the wall Moveable whiteboards Chalk Board
Presence of Digital Tools	Single LED Display Power Sockets Possibility to connect hybrid screens on request

Remarks:

- The TU Delft is an on-campus university, meaning the curriculum focuses more on flexibility rather than blended or hybrid learning. As a result, while digital tools are available in the rooms, there is a wider range of analogue tools present.

- The classroom features a LED board and a teacher's desk at the front. However, due to the wide layout and group-based setup, it is both easy and essential for the teacher to adopt a more central position in the room.

4.1.1 Context of the learning Environment

Project Rooms C, D,E, and F are educational spaces located in the ECHO building on the TU Delft Campus. ECHO is a versatile, sustainable, and energy-generating educational building that was completed in 2022. It provides space for education, debates, self-study, collaboration, and office workspaces. The building consists of four floors and features seven flexible lecture halls. Additionally, there are over 350 study spaces for group work and individual study. Facilities such as power outlets are integrated into the floor to allow for easy reconfiguration of spaces. This high level of adaptability also contributes to the building's sustainability, ensuring it remains suited to the evolving needs of future generations of users (TU Delft, n.d.).

On the top floor, there are four identical project rooms: Project Room C, Project Room D, Project Room E, and Project Room F. Together, these are referred to as Project Rooms CDEF. These spaces are active blended learning environments. They are equipped with tables arranged in group setups, flexible and movable furniture, fixed whiteboards on the walls, and additional mobile whiteboards. A large digital screen is mounted at the front of the room for presentations, and additional digital screens can be provided upon request to enable hybrid learning formats.

4.1.2 Stakeholder Involvement Process

This section discusses the stakeholder involvement process in the creation of the Project Rooms CDEF, focusing on: (1) which stakeholders were involved, (2) how the process was organised, and (3) when stakeholders were engaged. It also includes an evaluation of how the involved stakeholders perceived the final result and its effectiveness.

Stakeholders Involved

The creation of the Project Rooms CDEF involved multiple stakeholders, both internal and external. These stakeholders are represented in Figure 22, where the rectangular boxes indicate the stakeholders, and the adjacent circles represent the roles associated with them. Internally, six parties were involved.

The first stakeholder is Campus Real Estate & Facility Management. They were responsible for spatial developments on campus and the accommodation of educational facilities. This also included asset management and the administration of TU Delft's real estate portfolio. In the development of ECHO, the building where the Project Rooms CDEF are located in, they acted as the delegated client (A1, 2025).

The second stakeholder was the Educational & Student Affairs (ESA) department, responsible for ensuring the quality of educational spaces and identifying user needs. They represented the main users of these spaces: teachers and students (A2, 2025). These two groups, teachers and students, together formed the third and fourth internal stakeholders, as they were the end users of the learning environments.

The fifth internal stakeholder was the Facility Management department, responsible for the operational management of the spaces.

Finally, the AV/ICT department was involved, overseeing all audiovisual and technological infrastructure within the learning environments.

Regarding the external stakeholders, three groups were involved. First, the advisors, a group of experts in various fields such as construction, climate control, and all aspects related to the realization of a new learning environment and building. The second group consists of the designers, including the architects and interior designers who were responsible for the design of the spaces. The third group includes the contractors, who were involved in the actual construction of the building and the rooms.

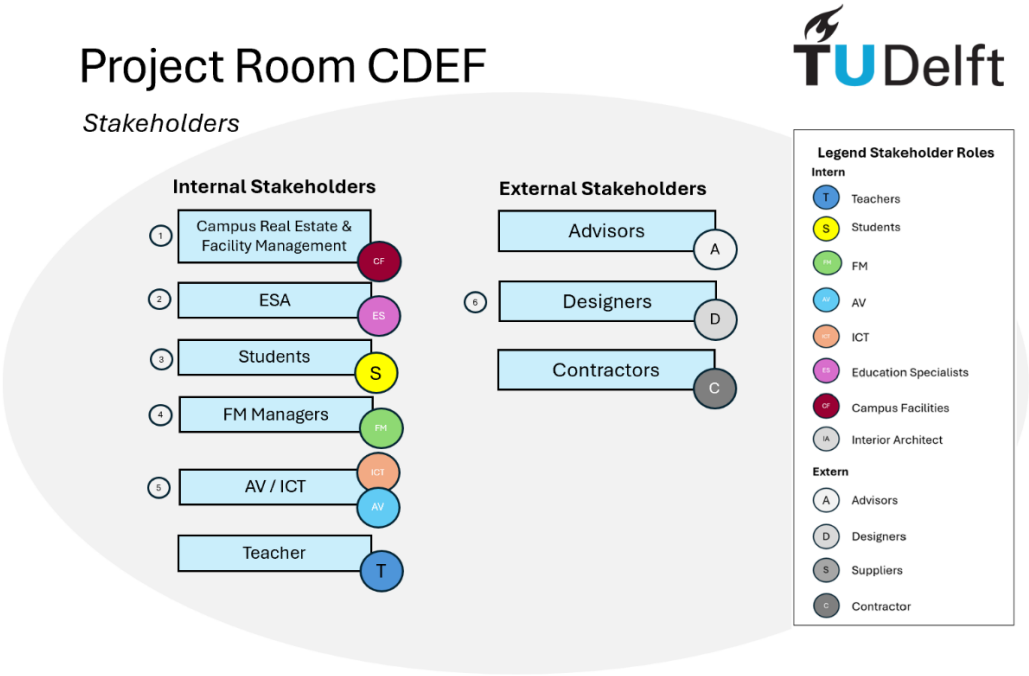


Figure 21 Stakeholders Involved in the creation of Project rooms CDEF

Stakeholder Connections

The initiative for the construction of a new educational building, ECHO, which includes the project rooms CDEF, originated from ESA. ESA gathers input from departments, students, and faculty to determine the need for additional or different learning spaces (A1, 2025). Based on this, ESA approaches Campus & Facilities, as they are responsible for managing the university's real estate. When ESA signals a need for new spaces, Campus & Facilities critically assesses whether there is indeed a mismatch between supply and demand. In the case of ECHO, this mismatch was confirmed, leading Campus & Facilities to draft a decision-making memorandum outlining possible solutions.

This memorandum serves as the foundation for the stakeholder process. From this point, a project team is established, consisting of representatives from all involved departments and stakeholders. For ECHO, this included representatives from ESA, CREFM, Facility Management, and AV/IT. In addition to forming this project team, various working groups were also created. Each working group consisted of different specialists and had a specific focus. The members of the project team were the chairs of their respective working groups. For example, ESA formed a group of students and faculty to determine the requirements for learning spaces. Facility Management set up groups to handle operational aspects such as cleaning and relocations, while AV/IT created groups with specialists knowledgeable about the latest trends and

possibilities in audiovisual technology. The purpose of the working groups is to actively contribute to the design and development of the plan, drawing on their specific knowledge and expertise.

One of the outcomes of the AC/IT workgroup was the creation of the "cookbook," a document containing extensive research on sightlines, acoustic standards, and other key design considerations. AV specialists ensured that this document was included in the tender process, requiring all bidding parties to incorporate its guidelines into their designs (A1, 2025; A5, 2025).

The working groups contributed their expertise on different aspects of the design, and their representatives relayed this input back to the project team, ensuring that each group's interests were represented in the discussions (A2, 2025). Based on these insights, the project team developed the program of requirements, which formed the foundation for the tender.

Once the tender process was initiated, external advisors and designers were brought in to develop designs based on the program of requirements. An advisory group was also established, consisting of members from the educational working group, along with additional faculty members and students. "*The aim of this group was to ensure that the direction taken by us as the internal project team, together with the external stakeholders, remained aligned with the intended objectives.*" (A2, 2025). In other words, they ensured that the input provided by the workgroups and project team was effectively translated into the design by the external designers.

To support this, sessions were organized with the interior architect. During the initial sessions, stakeholders contributed their input, while in the later sessions, the architect presented design drafts and the advisory group had the opportunity to give feedback and suggest possible adjustments (A6, 2025). After finalizing the design, contractors were engaged for the construction phase. Throughout the entire process, the project team remained actively involved to provide feedback and guidance.

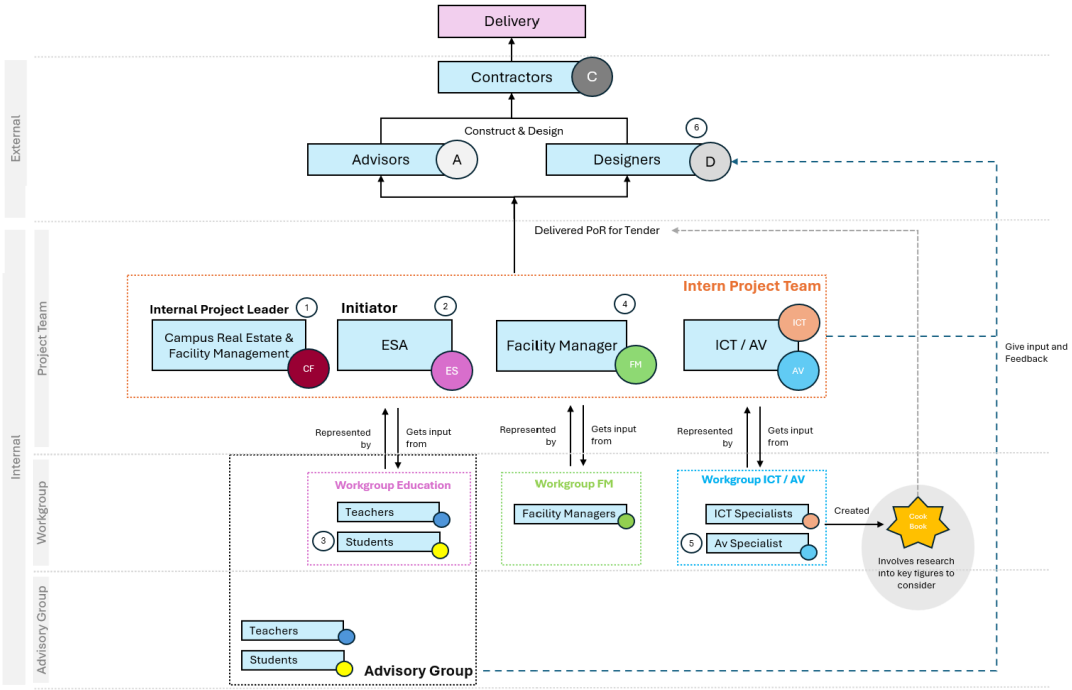


Figure 22 Connections between stakeholders involved in the creation of the Project Rooms CDEF

Timing of stakeholder involvement

In the previous section, the stakeholder involvement process was explained, including how it was initiated and organized. The project timeline is illustrated in Figures 24, detailing when and who was involved at each stage.

The entire project team was involved from the initial phase and, together with the working groups, established the program of requirements. From that point on, an advisory board was formed, with members from the educational working group taking part. While these members remained involved, their role shifted from actively contributing to the design process to reviewing whether the proposed plans aligned with the original vision and providing feedback. In contrast, the FM and AV working groups remained actively involved throughout the design phase in their original form, continuously contributing input and feedback on the evolving plans and designs. The project team also continued its involvement during the construction phase, transitioning into a monitoring and supervisory role.

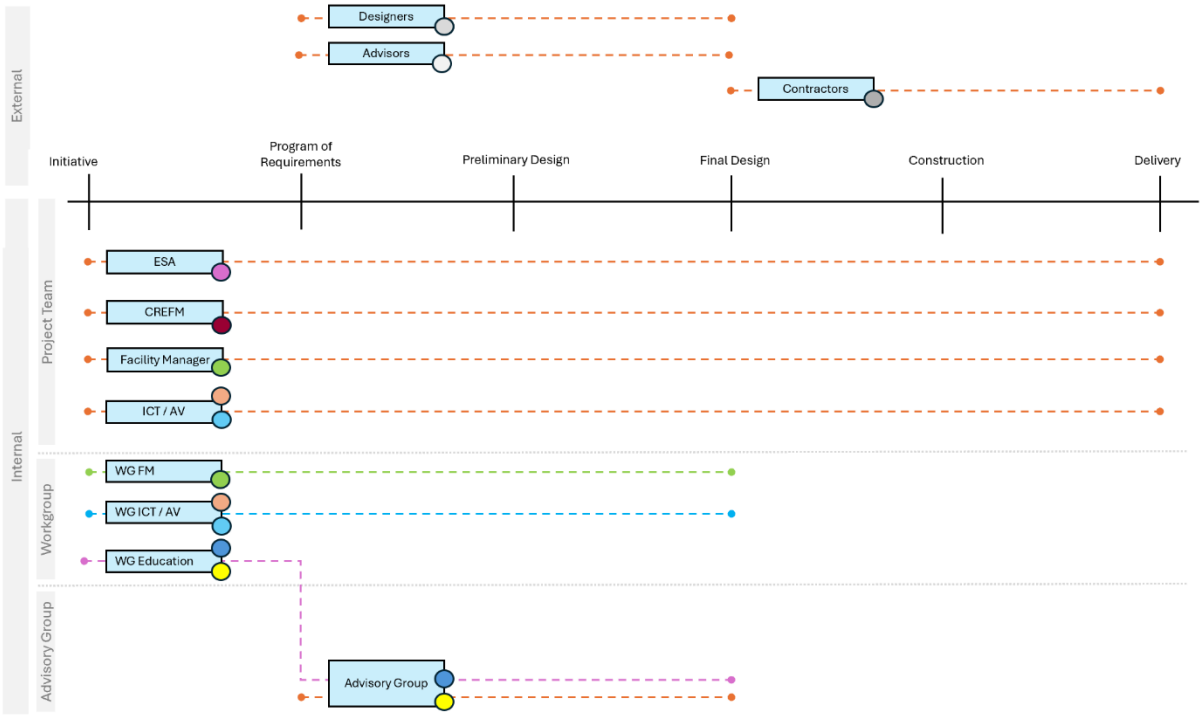


Figure 23 Timing of Stakeholder Involvement in the creation of the Project Rooms CDEF

Evaluation on the Stakeholder Involvement Process

Based on the interviews, a clearer picture has emerged of how the stakeholder process was structured. Stakeholders involved in the project were also asked to reflect on how the process unfolded and to identify areas for improvement. This reflection revealed both strengths and challenges in the approach, offering important lessons for future projects.

At TU Delft, the overall perception of the stakeholder involvement process was positive. According to CREFM, this success can be attributed to three key elements that every stakeholder should ideally possess when contributing to the creation of learning environments: 1.) affinity

with education, 2.) chain-thinking, and 3.) relevant expertise. *"If stakeholders have these three qualities, it enables sharper discussions that help move the project toward success. These are qualities we actively seek out and safeguard during stakeholder selection and identification,"* one stakeholder of CREFM explained (A1, 2025).

Both AV and FM departments echoed this positive sentiment. FM noted: "*If I had to rate the process, I would give it a 9 out of 10. We were involved early on, which allowed us to implement meaningful improvements. The end result may not reflect all our wishes, but the process itself went very well"* (A4, 2025). Similarly, the AV team appreciated being involved from such an early stage, emphasizing how this early participation supported better alignment of needs and expectations (A5, 2025).

However, the process was not without its challenges. From ESA's perspective, the representation of stakeholder groups proved to be a recurring difficulty. "*How do you know if you truly have the right representation?"* they wondered. *"We rely on faculties to appoint someone, but then we're dependent on how much time that person has and how engaged they are. Ideally, stakeholders would not just speak from personal opinion but would reflect the views of their colleagues or even bring questions back to their departments for discussion"* (A2, 2025). Ensuring broader internal consultation and anchoring input in collective views remains a point of concern, particularly in the case of students, where it is often unclear whether they speak for themselves, their program, or a larger body such as a student council.

From the interior architect's point of view, there is room to make the process even more interactive and engaging. *"To improve the quality of discussions and the effectiveness of sessions, we could encourage participants to prepare more in advance,"* one architect suggested. Tools like online whiteboards (e.g., Miro) could support asynchronous input collection and idea generation. *"It would be great to not only have three big sessions, but also set up the first one as a kick-off for ongoing engagement, where participants can brainstorm in advance. That would make the process more dynamic and meaningful"* (A6, 2025).

The student involved in the process described their experience as generally positive. However, they expressed a desire for more feedback and visibility on how their input was used. *"I didn't receive any concrete feedback or evaluations about the choices I made,"* they noted*, "although we did get to do a site visit and were invited to the opening. So, there was a sense of involvement, but not much substantive follow-up"* (A3, 2025).

4.1.3 Stakeholder Input

In this section, the process of how stakeholder input is integrated into the design of the Project rooms CDEF is further explained. First, the types of input provided by stakeholders are outlined, followed by an explanation of the different methods and tools used to gather this input. Next, the decision-making and prioritization process is discussed. The section then explores how the input influenced the final design outcomes. It concludes with an evaluation by stakeholders of the final result, highlighting both positive aspects and areas for improvement.

Types of input provided by stakeholders

The type of input that is collected in Delft focuses solely on the product—the physical space—and not on the process. Input is gathered across multiple layers. Within the project group there are individuals with extensive knowledge of the subject matter, who consult with a working group to discuss topics and gather input. These working groups are represented in the internal project team, and their input forms the foundation of the program of requirements for the space (A2, 2025). This is then developed further by the designers, and their design proposals are again evaluated by the advisory group to assess whether the space truly meets the initial intentions (A6, 2025).

Methods/tools for integrating input

Various tools and methods are used to gather stakeholder input. First and foremost, regular meetings are organized at different levels of the stakeholder process. Within the project group, decision-making meetings are held to develop the program of requirements, with each member representing their respective background and expertise.

Similarly, regular meetings are also held with the working group. As the chair of the Facility Management working group explains: *"We bring together all the FM-relevant stakeholders, and there is simply a project manager who documents decisions and manages the agenda."* (A4, 2025). At the same time, efforts are made to make these sessions more inspiring. The educational project team leader explains: *"For these kinds of sessions, I always think carefully about the location. My strategy is to organize them in actual lecture rooms. Since we're discussing educational spaces, I like to sit right in them. I also deliberately choose different rooms each time. If I want to discuss a certain type of space, I pick a room where that theme plays out. It doesn't have to be the most beautiful room, it can also be one that needs improvement. It helps participants better understand proportions and spatial dimensions, so they know what we're actually talking about."* (A2, 2025).

Once the program of requirements is finalized and the design team is brought in, design workshops are organized with the advisory group. These include a series of three sessions. As the interior architect explains: ''*The first workshop focuses on gathering input. Of course, we already had the Program of Requirements, and part of the advisory group had already helped and integrated their input therein. However, we wanted to know how the stakeholders would like to see these requirements concretely incorporated into different design options. We presented various options and asked for their input on what they wanted. In the second session, we delved deeper. We had translated the input from the first workshop and gave participants the opportunity*

to provide feedback and clarify why they preferred certain options. The third session was more informational in nature. We presented the project and showed how their input had been integrated into the final design." (A6, 2025)

Once the design phase is completed and the actual construction and selection of suppliers begins, trial rooms are used. For example, in Delft, a test room was set up to compare various types of chairs. Students were invited to come and try out different chairs to assess comfort, suitability for taller persons and other factors. Facility Management staff also evaluated aspects such as cleanability and durability. Based on evaluation forms, students could rate different chairs and indicate their preferences across several criteria (A2, 2025).

For simpler topics, written feedback was sometimes collected via email. One student shared: *"I received an email with two options for socket placement: either in the centre of the table or on the side. I gave my input on that via email."* (A3, 2025).

Decision-making and prioritization

An interview with CREFM provides insight into where the prioritization in the design decision-making process ultimately lies. CREFM states: "*We design from the student's perspective. An educational space is meant for students and teachers. We are not the ones who should determine what is best for them; they should decide that themselves. They have the biggest say in it."* (A1, 2025) Therefore, students and teachers, along with their interests, are seen as the most important and influential stakeholders in this context.

The design approach is therefore "from the inside out." This means that the focus is first on the student's experience in the space—how the student sits, what they hear, how the light comes in, and how the student sees the presentation and the teacher. "*When the student is sitting, that's the most important thing for us. Only after that comes the 'box,' the room around it, and once that's done, the shell, the building around it,*" as explained (A1, 2025).

To achieve this, it's important that all involved stakeholders have an affinity for education. As CREFM explains: "*Whether you come from the ICT side, from climate, maintenance, or construction, you need to be willing to listen to expertise from the educational perspective.*" (A1, 2025). The priority is education, and all other interests must be subordinated to that. "*You must be able to set aside your own interests to facilitate the higher goal of providing good education in the space*." (A1, 2025).

This principle is also incorporated into tender processes. External parties are asked to present themselves, not only with their expertise but also with their experience in designing educational spaces. According to CREFM, design choices must always be justified from an educational perspective: *"Education is essentially the guiding principle for everyone involved."* (A1, 2025).

However, this does not mean that the user is always the sole decision-maker. This is evident in a discussion that took place about power outlets. The students strongly believed that it was essential to have power outlets at every desk, considering it a non-negotiable requirement. (A3, 2025). CREFM on the other hand, did not think this was necessary on a 1-to-1 basis, as the outlets are not used extensively and providing them would be very costly. This led to a debate with the students in the working group. (A1, 2025). Eventually, CREFM conducted research, and the data showed that only 30% of outlets in a lecture hall were used simultaneously (A1, 2025). By presenting this data, CREFM was able to demonstrate the actual usage and the investment

required for a 1-to-1 setup. As a result, the students ultimately agreed that a 2-to-1 ratio would be sufficient.

As CREFM explained, this is how they handle conflicting interests: "*You have to give people insight. We do it ourselves as well. And bringing in objective data is always a good idea to support arguments. People can have an idea based on user experience, but this may not necessarily be representative. By bringing in data, you can ensure that the perspective is accurate.*" (A1, 2025).

Influence on the design outcome

The influence of stakeholder input on the final design is clearly visible in various elements of the Project rooms CDEF. The initial idea for the type of rooms to be created, namely project rooms that facilitate blended learning, originated from ESA and CREFM. These two actors provided input indicating a desire for spaces where mixed didactic approaches could be integrated.

Regarding the shape and size of the teaching rooms, this was primarily determined based on input from AV experts and their "cookbook." One AV expert explains: *"In that cookbook, we've listed all our requirements. For example, a room meant for 80 people needs to be a specific depth, width, and height, to ensure the projection screen is large enough. Initially, the architect disagreed, saying, 'It's my building.'. That led to a discussion: 'Whose building is it, really?' Eventually, we won that discussion, and it became a given that the cookbook would be maintained. So, the dimensions of this type of room based on our specified standards for this type of room."* (A5, 2025).

Furniture choices were ultimately based on a combination of input from students and Facility Management, taking into account both user-friendliness and ease of maintenance. One student explains: *"They created a test setup with different tables and chairs. I gave my feedback on that. There was a form with certain factors, and you could vote on a chair based on each factor. I'm not sure if that was the one I voted for at the time but I expect they chose the chair with the most votes. Anyway, the chairs are really chill—they turned out great."* (A3, 2025)

When it came to furnishing the space, flexibility emerged as a key design requirement. As ESA explained, "Because the room is located in a generic university building, it cannot be tailored to one specific type of lesson. That's why we envisioned having mobile tables—so the space could easily be reconfigured to accommodate different teaching settings" (A2, 2025). As a result, the tables needed to be movable, reconfigurable, and rotatable, supporting the ambition to create a truly multifunctional and adaptable learning environment. This demand had a direct impact on decisions regarding the power supply. Since tables could be positioned anywhere in the room, power could not be supplied solely from the walls. As a result, it was necessary to provide access to power from the centre of the room as well, which led to the decision to install floor boxes. However, FM (Facility Management) disagreed with this solution, as they found the steel covers to be quite fragile—"If you're not careful, you can almost cut through a cable," they warned (A4, 2025). This concern turned out to be valid. Ignoring FM's input has led to significant maintenance issues with the floor boxes. Many of them are now taped shut to prevent students from opening them and potentially damaging the wiring. This situation shows how disregarding stakeholder input can also visibly manifest in the final design.

Student input was also incorporated into the placement of the power outlets. As one student shared: *"The question was whether they should be placed in the centre or on the sides of the*

tables. My reasoning was that they should go on the sides, because if you're using a laptop and also writing, they'd be in the way if they were in the middle. That's how it was ultimately implemented." (A3, 2025).

Evaluation of the Learning Environment by Stakeholders

Asking the stakeholders to reflect on the established learning environment, these stakeholders revealed a number of issues that, in hindsight, they were not fully satisfied with.

One recurring point was the choice for floor sockets as the primary power supply. Multiple stakeholders indicated that it would have been more practical to install ceiling-based power options (A1, 2025; A4, 2025). The floor sockets turned out to be problematic: they were often fixed in place, vulnerable to damage, and prone to requiring frequent maintenance. Additionally, the lids of the floor boxes had sharp edges, which resulted in cables being cut when closed. To prevent further damage, the lids were sealed shut,. This was especially frustrating for the FM team, who had already expressed concerns during the design phase, but their input was ultimately ignored.

A second issue was the placement of the whiteboards, which were mounted too high on the walls. However, due to the architect's commitment to a clean, integrated design in which the whiteboards were flush-mounted into the wall, changes were no longer feasible after installation. As a result, the whiteboards are less user-friendly. (A4, 2025).

The choice of furniture materials also posed problems. The chairs were made from recycled and sustainable materials and coated with a protective layer. However, the coating proved to be faulty and began to rub off, damaging users' clothing and leading to the complete replacement of all chairs (A4, 2025; A6, 2025).

Lastly, there were problems related to automated systems such as sunshades and lighting. Because the rooms feature large glass façades, automatic blinds sometimes hinder visibility—for example, making it hard to see projection screens. AV explained that when the lighting and sunshade systems interact, rooms can become too dark, and projectors may shine too brightly, creating an unpleasant experience for students (A4, 2025; A5, 2025).

Figure 24 sealed floor sockets

Figure 25 The whiteboards are mounted too high, making it impossible to write on the top half.

4.1.4 Evaluation of the LE by end-users

This chapter presents the experiences of end-users with the learning environments. Using a survey, students and teachers were asked to share their experiences with the educational spaces. The questionnaire used is included in Appendix 4 and 5. Data collection took place on March 31, 2025. With the instructor's permission, the survey was shared via a QR code during two classes held that day in the project rooms CDEF. A total of 33 responses were collected, all from students. No responses were received from teachers.

Learning Settings

In the observed lectures in Project Room CDEF, all participating students were physically present in the room. In all cases, the teacher was also present in the room. When asked whether there were also students who joined the lecture online, nearly all students responded that they were not. A few mentioned that some students followed the lecture online, but they were referring to the fact that the lecture was recorded and could be rewatched by students afterwards. There was no simultaneous hybrid component during the sessions.

When asked whether they had previously attended classes in this type of learning environment , prior to this course: 66% of students indicated that they had.

As part of the evaluation, students and teachers were asked to indicate which types of teaching activities took place during the observed session. They could select multiple options. In order from most to least frequently mentioned, students and teachers reported the following six teaching activities:

1. Lecture (31 of 33 respondents)
2. Discussion with the whole class (14 of 33 respondents)
3. Presentation (12 of 33 respondents)
4. Discussion in groups (5 of 33 respondents)
5. Individual assignment (3 of 33respondents)
6. Assignment in groups (1 of 33 respondents)

Although a variety of teaching methods were applied, it is notable that whole-class formats—such as lectures and discussions with the entire class—were the most commonly mentioned. These are relatively traditional and frontal teaching methods, whereas the project rooms were specifically designed to support active learning.

Thus, while the class took place in a space intended for active engagement, the educational format used was not fully aligned with the room's purpose. This mismatch between teaching style and learning environment may prevent the space from optimally supporting the learning process.

Use of Facilities

In the survey, students and teachers were asked about their use of the different tools available in the classroom. A distinction was made between digital tools—such as display screens—and analogue tools—such as chalkboards and whiteboards. Additionally, the responses were categorized based on user type: whether the teacher used the tools, and whether students did.

Teachers generally made optimal use of both the digital classroom facilities (26 out of 33 respondents) and the analogue ones (28 out of 33 respondents). Although both types of tools were used, some students expressed a desire for a greater shift from analogue to digital tools. One student remarked: *"Instead of having a blackboard, a digital board would increase the speed of the lecturer, since they will often be slowed down by the need to clear out the blackboard with water. The chalk can also become a bit messy."*

When students were asked whether they themselves had used the classroom facilities, the results were significantly lower. Regarding the digital classroom tools, 18 students indicated that they had not used them at all. Of those who had, 7 students stated that they had made optimal use of them. Analog facilities were also rarely used by students, with 22 students indicating they had not used them.

This shows that classroom tools were primarily used by the teachers. This finding is consistent with the conclusion in the section on learning settings, where it was noted that the observed lectures mainly followed a traditional, teacher-centred format. In such cases, it makes sense that teachers actively use the facilities for presentations or explanations, while students take on a more passive role and do not interact with the tools themselves.

Still, the underuse of tools doesn't necessarily mean that students are dissatisfied with their presence. As one student commented: *"The whiteboards on the walls are rarely utilised during these lectures, though I'm sure they can be useful under certain circumstances. Nothing in the classroom hinders learning, though, and the whiteboards not being used is pretty nitpicky."*

Figure 26 Whiteboards on the wall of the project rooms are hardly used, although they could be quite useful.

Engagement & Dynamics

The students and teachers were also surveyed about their perceived level of engagement and the dynamics within the classroom and the learning environment. These questions aimed not only to gain insight into the relationship between the physical space and user experiences, but also to explore contextual background information—such as teaching styles and instructional methods—that may also influence the learning process. In Figure 28, the statements and corresponding levels of agreement are shown.

It is clear that the teacher actively encouraged questions from the class. However, there is considerable variation in the responses to the statement *It was difficult for me to be actively engaged with the learning content most of the time*. Despite this, almost none of the students reported feeling unmotivated to learn. This suggests that a lack of intrinsic motivation is not the issue, and that external factors may be influencing student engagement.

The statement *"I spend most of the time listening to my teacher"* received strong agreement. This confirms that the instructional approach was predominantly frontal or lecture-based, with the teacher in a central role. This is somewhat at odds with the design intentions of the project rooms, which are meant to support active learning, where student-centeredness is key and the teacher takes on a more facilitative role. This reflects a potential mismatch between the pedagogical approach and the physical learning environment.

Regarding peer learning, nearly all students reported having learned something from the teacher. When asked whether they learned from each other, most students leaned towards agreement rather than neutrality. This suggests that there was some level of interaction and collaboration, even if it mostly occurred in whole-class discussions rather than group work. One student reflected on this dynamic as being shaped by the classroom setup*: "The way the class tables are kind of grouped together makes the students interact more with each other, with the teacher being the centre of attention. This provides a sort of good dynamic duo. When the teacher asks a question, the students will discuss among themselves. When the teacher asks what the answer could be, everyone looks in one direction to answer the teacher—or the opposite, the teacher answers the question."* When asked whether they had helped one another during class, most students responded neutrally, with a few indicating either yes or no.

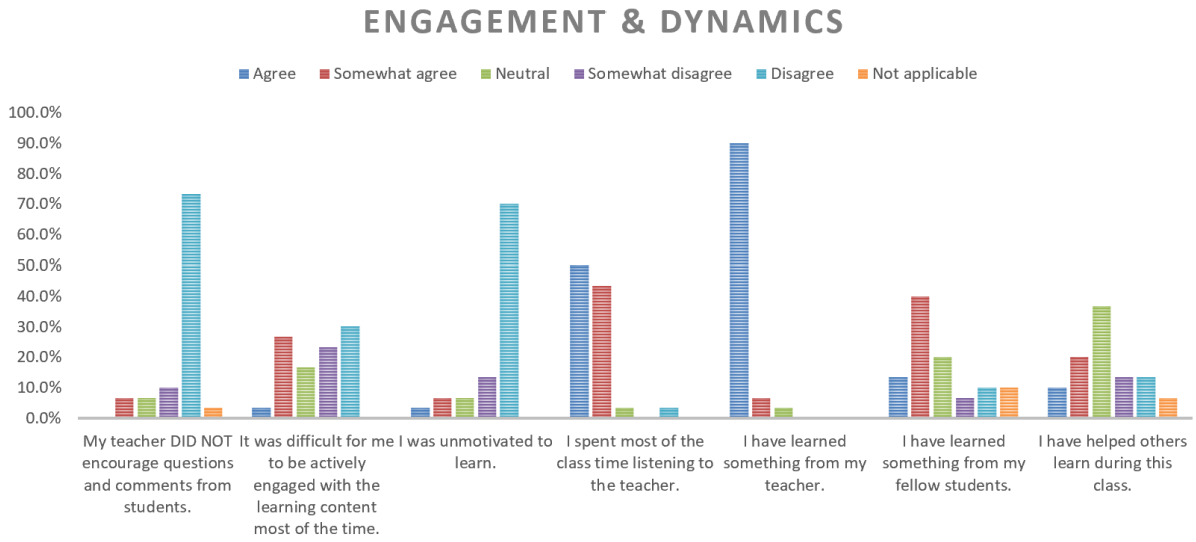


Figure 27 Perceived engagement and dynamics by end-users during lessons in the Project Rooms CDEF

Evaluation of the Classroom Layout

Students and teachers were also asked about the layout of the classroom and how it influenced different aspects of their learning process.

On the statement that the classroom encouraged active participation, students responded mostly with neutral to positive agreement. One student noted, "*The seating position is good for my concentration.*" Another added that the size of the room influenced their level of engagement: "*The smaller size of the room, being closer to the lecturer, gives me the urge to participate. In a large lecture hall no one can see you, so being passive is unnoticed.*" This sentiment was echoed by another student: "*Being close to the teacher makes paying attention easier. Being able to discuss with other students due to the seating in groups makes understanding easier*."

Students also felt that the classroom contributed positively to the overall learning experience. There was a clear peak in disagreement with the statement that the classroom made it difficult to engage in the learning process, suggesting that most students found the environment supportive rather than limiting.

When asked whether the layout of the classroom helped them engage more with the learning content, the average response leaned toward neutral to agree. Many students also indicated that the layout contributed to more interaction with the teacher. As for interaction with fellow students, the response was similarly positive. One student remarked, *"The table arrangement makes it easy to discuss and collaborate with others."* Students also felt that the layout gave the teacher more space to allow students to work together and collaborate during class activities and switch between different types of learning: "*Since the chairs can turn, it's easy to both direct your attention towards the teacher as well as get started working on exercises with classmates. Since the tables are in the room the 'long way' (that is, short side facing front and back of the classroom, long sides facing the walls), it does feel like collaboration/discussion is more encouraged than in a classroom where the long side of the table faces the lecturer."*

Lastly, the majority of respondents agreed that the classroom provided a comfortable learning environment.

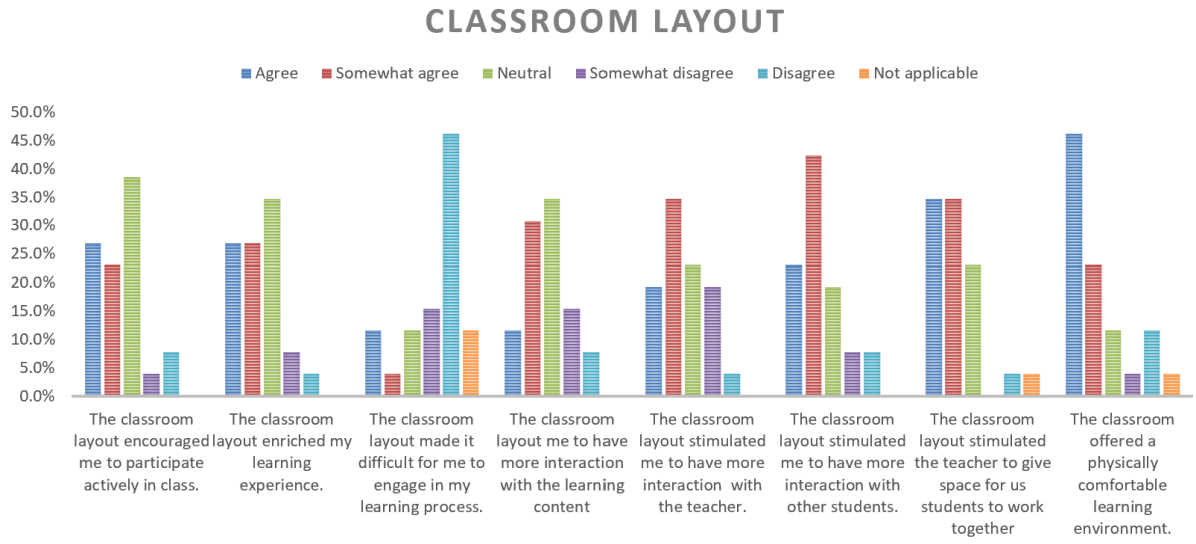


Figure 28 Perceptions of the classroom layout of the Project Rooms CDEF by end-users

Perceived Strengths and Weaknesses

Overall, users are positive about the learning environment. On average, students rated the classroom with a 7.64 out of 10.

There are several aspects of the space that students are enthusiastic about. They mentioned for example spaciousness of the classroom and the flexible character of the furniture. What students appreciated most was the seating arrangement in groups, which makes it easy to switch between teaching styles and encourages collaboration and discussion in small groups. As one student noted: *"Being able to discuss with fellow students easily when necessary (and allowed) because we're sitting in a group."* Additionally, a couple of students mentioned that they were happy with the availability of power outlets in the room: *"I do like it that there are power outlets where I can charge my laptop."*

However, there were also some critical remarks. One respondent gave the space a failing grade, mainly due to the seating position and the need to constantly turn to face the front of the classroom. One student explained: *"Now you have to rotate every time in a lecture, because the teacher is to the side and not to the front of the table, and therefore you can't easily write or take notes."* Another added: *"My neck hurts. The tables in a group are fine, but I have to turn my head 90 degrees in order to see the teacher or board."*

One student also remarked that, while the space itself was comfortable, it may not have matched the teaching style used in that particular class: *"You sit with the table beside you instead of in front of you. A setup where you face your table directly might work better for this lecture, although it doesn't make a huge difference."*

4.1.5 Alignment between end-users perspective and stakeholder input

To assess how the stakeholder involvement process can be optimised, it is first necessary to examine the current relationship between the stakeholder involvement process and how the space is perceived and experienced by end-users. This allows us to trace back which positive and negative experiences can be linked to specific stakeholder input.

In Table 16, all perspectives and opinions shared by students regarding the learning environments are presented. The first three rows represent general experiences, independent of the type of teaching style used in the space.

Firstly, students are satisfied with the spaciousness of the classroom. This is a direct result of stakeholder input from the AV experts, who developed a cookbook specifying that certain room dimensions should be used for specific types of education. These guidelines were followed and have contributed to the effectiveness as perceived by the end-users.

Students are also enthusiastic about the comfort and flexibility of the chairs and tables. Looking back at the stakeholder involvement process, it is evident that a setup room was created in which students could test different types of chairs. This directly informed the selection of the current furniture. Here, we can see a clear alignment between stakeholder input and end-user perception of effectiveness.

Students also express enthusiasm about the availability of power outlets on every table. This feature is a direct result of student stakeholder input: they emphasised that having power access at every table was a necessity and even provided input on the optimal placement within the tables. This is another example of strong alignment between end-user needs and stakeholder decisions.

However, misalignment is observed in the case of the whiteboard functionality. Students report that the whiteboards are mounted too high to be used optimally. This design choice originated from the architect, who insisted on fully integrating the whiteboards into the wall. Although FM (Facility Management) raised concerns, they were overruled. As a result, students now experience reduced effectiveness, indicating a clear misalignment between stakeholder input and end-user perception.

Furthermore, certain observations depend on the type of teaching style employed. Students indicate that when the space is used as originally intended — supporting a more flexible, collaborative learning style — the environment works well. The group seating and flexible furniture enable discussion and interaction. This aligns with the intentions of ESA and CREFM, who aimed to develop a space designed for blended learning and flexibility. ESA specifically identified flexible furniture as essential.

However, surveys also took place in settings where the space was used differently, for instance in a traditional, frontal teaching style. In these cases, students expressed less satisfaction with the group seating arrangement. Constantly turning to see both peers and the teacher resulted in physical discomfort (e.g., neck strain). This misaligns with stakeholder input, which focused on designing the space for blended learning with group seating as a priority. The downsides of this setup in lecture-style formats were underestimated.

Finally, it is noteworthy that when the space is not used as intended, the whiteboard functionality is not perceived as effective by students. They note that in such cases, the whiteboards are simply

not used at all. This misaligns with the stakeholder decision to include whiteboards, as these were considered essential. Stakeholders opted for the inclusion of whiteboards, but without the adoption of active, blended learning strategies, the whiteboards remain unused by end-users.

Table 16 Figure 29 Alignment between end-users perspective and stakeholder input at the Project Rooms CDEF

Theme	Relation to BLE Characteristic	End-User Evaluation	Related Spatial Design Element	Related Stakeholder Input	Alignment?	Conclusion
		SQ 3 / Chapter 4.1.4		SQ2 / Chapter 4.1.3	SQ 4 / Chapter 4.1.5	
General						
Spacious Classroom	Formal Classroom	End-users perceive the room as comfortable and spacious.	Size and shape of the classroom	AV experts have developed a 'cookbook' containing recommended dimensions, which specifies the appropriate room sizes for different types of educational formats.	Yes	The requirements outlined in this cookbook result in large rooms, which are also experienced by end-users as spacious and pleasant.
Furniture comfort	Flexible Furniture	Chairs are experienced as comfortable and promote collaboration	Movable and turnable furniture	Students tested furniture in pilot setups and gave feedback through surveys	Yes	Stakeholders provided input that aligns with how the space is experienced by end-users.
Power access	Digital Tools	Satisfaction with availability of power outlets	Power provided on tables every table	Students stressed the importance of accessible power supply and gave input on outlet placement (sides preferred)	Yes	Stakeholders emphasized the importance of sufficient power sockets and strategic placement, which meets the expectations and needs of end-users.
Whiteboard functionality	Analogue Tools	Whiteboards are mounted to high to use in a nice way	Flush-mounted whiteboards placed high due to architectural constraints	FM advised that placement could hinder usability; input was overruled in favor of aesthetic decisions by the architect	No	Aesthetic considerations were prioritized over functionality, resulting in limited use by end-users.
Only in cases where the space is used with the appropriate teaching method						
Collaboration & layout	Seating in groups + flexible furniture	Positive feedback on group layout: promotes collaboration and discussion	Group setup with flexible, movable tables and chairs	ESA and CREFM emphasized the need for blended learning and flexibility; ESA identified mobile furniture as essential	Yes	Stakeholders expected enhanced collaboration with their input, which aligns with how it is perceived by end-users.
Only in cases where the space is not used with the appropriate teaching method						
Ergonomics during lectures	Seating in groups	Complaints about neck strain and constant turning during lectures	Group oriented furniture	Stakeholders opted for group-oriented furniture; downsides for lecture settings were underestimated	No	Stakeholders designed the space to support active blended learning, but due to low demand, it is mainly used for traditional lectures, for which the space is not optimally supportive.
Whiteboard functionality	Analogue Tools	Whiteboards rarely used despite being present as result of no blended learning teaching method	Whiteboards to use for students	Stakeholders valued having whiteboards, but the usability and placement may not have been well considered.	No	Stakeholders opted for the inclusion of whiteboards. However, without the adoption of active blended learning strategies, the whiteboards remain unused by end-users.

Conclusion

Overall, there is partial alignment between stakeholder input and end-user perceptions regarding the effectiveness of the learning environment. Notably, when stakeholder decisions were informed by direct input from end-users — such as in the selection of chairs and the placement of power outlets — students perceived the space as effective. In contrast, elements perceived as less effective by students, such as the height of whiteboards or the fixed group seating during lectures, were not based on user input.

Furthermore, the teaching method applied in the space plays a crucial role in how effectively the environment is experienced. When the intended active, blended learning approach is implemented, alignment and effectiveness are high. However, when traditional, frontal teaching methods are used, the space is perceived as less effective. This underscores the importance of recognising end-users as key stakeholders and ensuring that both the physical design and the teaching methods are aligned to support flexible, student-centred learning.

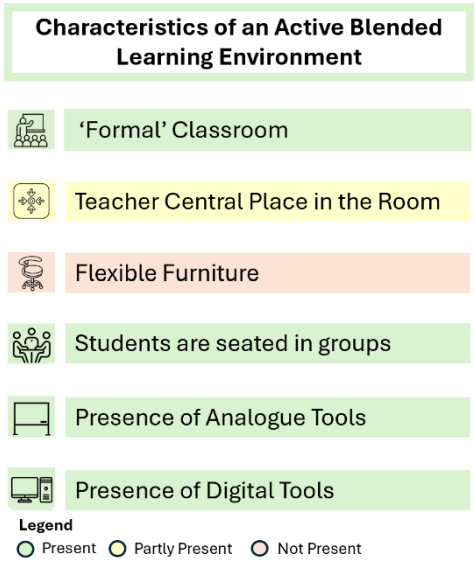
4.2 Case B: Tilburg University

CUBE – Collaboration Room

Photo: Tilburg University, n.d.

Collaboration Room

University	Tilburg University
Building	CUBE
Name of the Room	Collaboration Room
Building Year	2018
Surface	125 m^2
Seat Capacity	40
Space efficiency	3,12 m^2 / person



Photo's: Tilburg University, n.d.

Formal Classroom	Yes
Teacher central place in the room	No
Flexible Furniture	No
Students are seated in groups	Yes, groups of 8 people per table
Presence of Analogue Tools	Whiteboard on the wall Moveable whiteboards
Presence of Digital Tools	LED Displays per table Smart board Power Sockets

Remarks:

- During the design of the building, it was discussed with FM that if power outlets were needed at a table, flexible furniture would not be feasible, as socket units are too fragile and prone to damage. Therefore, power was prioritized over movable furniture.

- The classroom features a LED board and a teacher's desk at the front. However, due to the wide layout and group-based setup, it is both easy and essential for the teacher to adopt a more central position in the room.

4.2.1 Context of the learning Environment

The Collaboration Room is an innovative educational space located in the CUBE, an educational building on the Tilburg University campus. Completed in 2018, CUBE aligns with the Tilburg Educational Profile, which aims to prepare students for their roles in a complex and rapidly changing society. The building offers various study facilities, including numerous group workspaces, digital exam halls, spacious lecture rooms, the latest technologies, and ample study areas (Tilburg University, n.d.).

The Collaboration Room is a specialized lecture hall designed to enhance student interaction and collaboration through advanced technological provisions. The room is furnished with oval tables, each seating up to eight students, and equipped with a fixed LED display mounted at the head of the table to facilitate group discussions. Power sockets are integrated into the tables, ensuring easy access to electricity. However, due to facility management policies at Tilburg University, the furniture is fixed rather than movable. This decision was made to prevent damage to the power supply system, as movable tables with built-in sockets were deemed too fragile. Additionally, a whiteboard and an extra display are available at the front of the room, further supporting interactive learning.

4.2.2 Stakeholder Involvement Process

This section discusses the stakeholder involvement process in the creation of the Collaboration Room, focusing on: (1) which stakeholders were involved, (2) how the process was organised, and (3) when stakeholders were engaged. It also includes an evaluation of how the involved stakeholders perceived the final result and its effectiveness.

Stakeholders Involved

For the creation of the Collaboration Room, four internal stakeholder groups and three external groups were involved. This is presented in Figure 30, where the rectangular boxes indicate the stakeholders, and the adjacent circles represent the roles associated with them.

The first internal stakeholder is the Facility Services department, which includes both Facility Management and Campus Facilities at Tilburg University. They are responsible for the university's real estate and, due to their role in facility management, also manage the spaces (B1, 2025).

The second internal stakeholder is the Information & Library Services department, the internal ICT department of Tilburg University, which also handles audiovisual (AV) expertise. Additionally, the teachers of Tilburg University were involved in ensuring that the space met their academic needs. Finally, the students of the university, as the end users of the Collaboration Room, are an important internal stakeholder.

Regarding the external stakeholders, three groups were involved. First, the advisors, a group of experts in various fields such as construction, climate control, and all aspects related to the realization of a new learning environment and building. The second group consists of the designers, including the architects and interior designers who were responsible for the design of the spaces. The third group includes the contractors, who were involved in the actual construction of the building and the rooms.

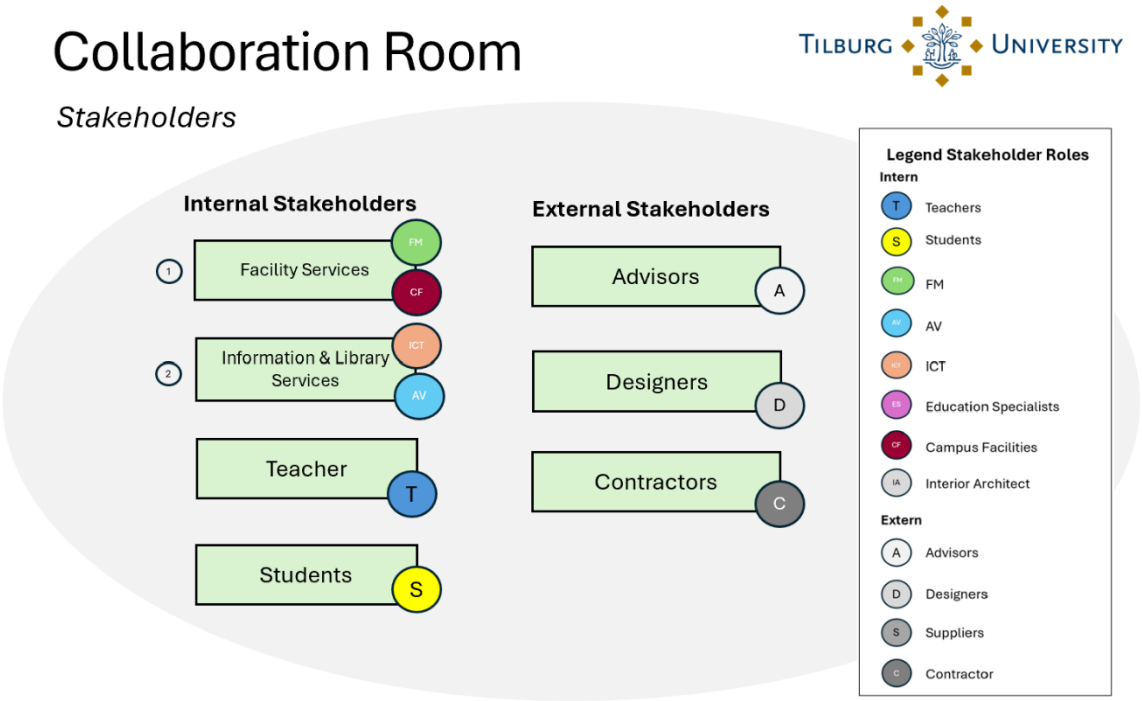


Figure 29 Stakeholders Involved in the creation of the Collaboration Room

Stakeholder Connections

The initiative to construct a new educational building, the CUBE, which includes the Collaboration Rooms, came from Facility Services. As they manage all real estate on campus, they identified the need for a new educational building with additional teaching spaces based on scheduling and occupancy data. Two key components of a successful learning environment are real estate and IT/AV (B1, 2025). Therefore, the Information & Library Services department was involved from the beginning.

These two departments together formed the internal project team. In collaboration, they established a program of requirements outlining their specific needs. To ensure the right elements were included in the project, input was gathered from students and faculty. A stakeholder advisory group was set up, consisting of faculty representatives from different departments and students from the university council factions (B1, 2025). Throughout the process, this advisory group was presented with various scenarios and choices at different stages, providing feedback on specific aspects. This input was then incorporated by the project team into the final program of requirements.

Based on this program of requirements, a tender was issued to external designers, advisors, and contractors. This tender followed a Design & Build (D&B) contract, meaning that while the program of requirements was provided during the tendering process, the contractor was responsible for both the design and construction of the project. This also meant that the client had less influence over the design process and provided limited input after this phase. However, the project team remained involved throughout the design and construction phases in a supervisory role.

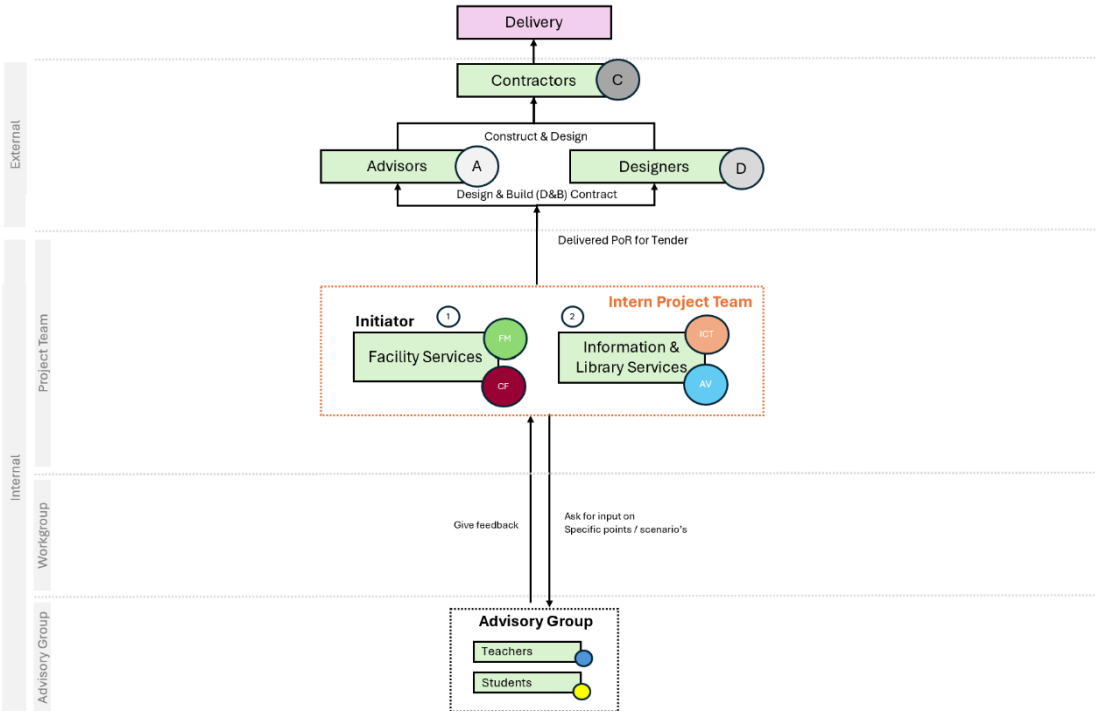


Figure 30 Connections between stakeholders involved in the creation of the Collaboration Room

Timing of stakeholder involvement

The internal project team, consisting of Facility Services and Information & Library Services, has been involved since the initiation phase. They draft the program of requirements and validate it with input from the advisory group. These documents are then forwarded to the tender phase, where external advisors and designers are brought in to develop the design. At a later stage, contractors are appointed for the execution. Throughout both the design and execution phases, the project team maintains a supervisory role (B1, 2025; B2, 2025). The involvement of each stakeholder per phase is presented in Figure 32.

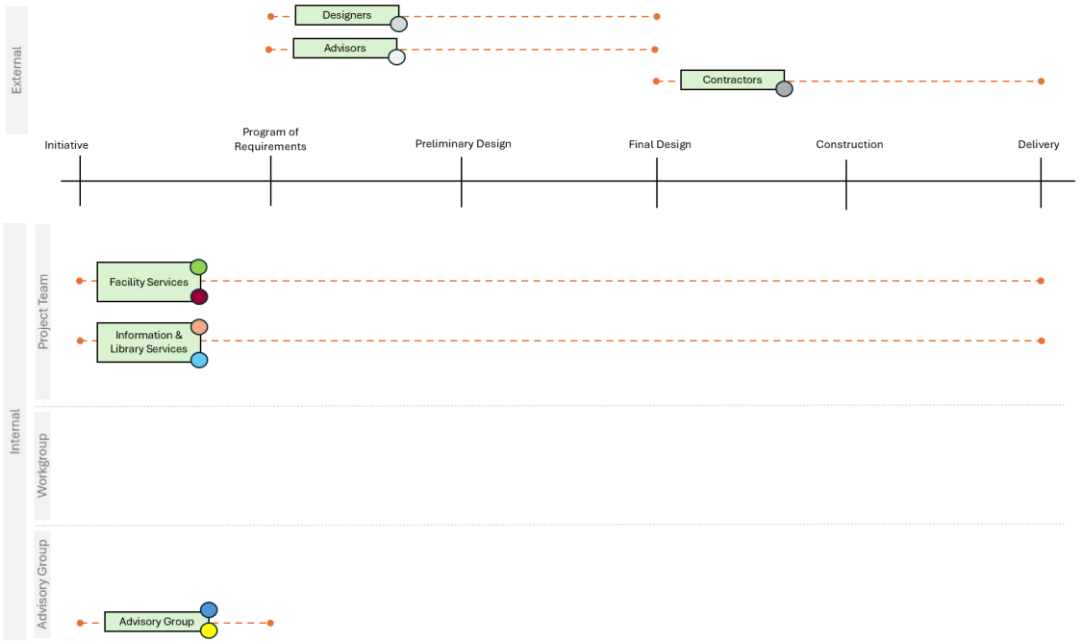


Figure 31 Timing of Stakeholder Involvement in the creation of the Collaboration Room

Evaluation on the Stakeholder Involvement Process

Based on the interviews, a clearer picture has emerged of how the stakeholder process was structured. Stakeholders involved in the project were also asked to reflect on how the process unfolded and to identify areas for improvement. This reflection revealed several bottlenecks that stakeholders encountered along the way, indicating clear room for improvement.

When evaluating the stakeholder process, some aspects could have been done better. One of the biggest challenges remains effectively involving stakeholders. The response to requests for input remains disappointing. As FS points out*: "We get some feedback from students, but much less from faculty"* (B1, 2025). A possible explanation for this is that many faculty are still quite traditional in their approach. FS adds: *"That's not a value judgment, but it does make the use and encouragement of new learning environments difficult"* (B1, 2025).

There is a desire to establish a structural advisory group that works not only on a project basis but also for a longer period and across different projects. However, this proves difficult to achieve, particularly due to the low involvement. On the one hand, faculty are not actively participating, and on the other hand, it's also challenging to obtain input from students (D1, 2025; D2, 2025).

Another issue is the lack of clarity about who the ultimate "client" is when creating a learning environment. This raises the question: who should you really be satisfying? In Tilburg, it is stated: "*The student is the client. We need to listen more to their needs, regardless of whether it's technically feasible*" (B1, 2025). However, this line of thinking brings up new complications, as faculty are often more involved in the process for a longer period than students. Students, in long-term projects, often feel that changes only take place after they've graduated.

Additionally, the question arises as to how representative student input is. With a student population of 19,000, it's difficult to determine whether the opinion of one student reflects the entire group. They often wonder whether their preferences are personal opinions or broadly shared by their course or department. "*Often they say they've spoken with others, but how pure is that input?"* (B1, 2025). Ultimately, it doesn't matter that much, as the process usually results in an average, but the question remains whether that average truly reflects the correct view.

Finally, it is crucial to remain actively engaged in evaluating with end-users. This provides insight into whether the changes made are actually being used, whether they are appreciated, and if any adjustments need to be made. As a project team, you need to actively work on this—you cannot just expect people to come to you with problems (B1, 2025; B2, 2025).

A good example of this is the introduction of new technologies in the rooms. As LIS states: "*The statement 'no news is good news' absolutely does not apply in our field. It's not that if we hear nothing, everything is fine. If we hear nothing, it often means people don't know how things work"* (B2, 2025). Therefore, LIS takes active steps at the beginning of each semester by walking through the rooms. They check if faculty are aware of all the new possibilities and whether the technologies aren't causing them too much stress. *"This is the ultimate chance to gather feedback and gauge how people feel about it, so we can bring this knowledge into future projects,*" says LIS (B2, 2025).

4.2.3 Stakeholder Input

In this section, the process of how stakeholder input is integrated into the design of the Collaboration Rooms is further explained. First, the types of input provided by stakeholders are outlined, followed by an explanation of the different methods and tools used to gather this input. Next, the decision-making and prioritization process is discussed. The section then explores how the input influenced the final design outcomes. It concludes with an evaluation by stakeholders of both the final result and the stakeholder involvement process, highlighting both positive aspects and areas for improvement.

Types of input provided by stakeholders

During the development of the collaboration rooms, most of the input gathered was related to the physical aspects of the space—meaning input on the product itself, such as the layout, interior design, and technology used. This input is gathered from various types of stakeholders. The most substantial content knowledge comes from the project members themselves or colleagues from Information & Library Services (LIS) and Facility Services (FS). For topics outside their area of expertise—such as the experience of the space—active input is sought from faculty and students. This includes aspects like didactic needs, technological provisions, furniture, usability, and aesthetics.

A key principle in the process is that a number of basic needs are already known and established. Things like power supply or known design principles form the core knowledge base of the team. The focus, therefore, is primarily on new developments. Teachers, for example, are explicitly asked: "What really changes in your teaching approach? And what should we as designers take into account?" Students are also consulted, including on which lecture halls they find pleasant—and why (B1, 2025; B2, 2025).

Methods/tools for integrating input

The integration of stakeholder input occurs in several ways. One key approach is through conversations with stakeholders who participate in the advisory group. The project team acknowledges that many stakeholders find it challenging to express their needs in abstract terms. To address this, visual representations—such as sketch designs and other visual aids—are routinely used to support discussions. These tools help to make the dialogue more concrete, understandable, and accessible for all participants (B1, 2025). By presenting tangible visualizations of the design, stakeholders are better able to articulate their preferences and provide meaningful feedback. As one project member noted: *“We can talk a lot with users, but many of our users find it hard to imagine how things work based solely on descriptions”* (B2, 2025). Visualization is therefore considered essential for initiating productive conversations and translating abstract ideas into concrete input (B1, 2025).

In the case of the CUBE project, this principle was taken even further: two full-scale trial rooms were set up with the new AV technology, as envisioned by LIS for the final spaces. Faculty and students were deliberately scheduled into these rooms so they could experience in practice what worked and what didn't. These trial runs provided valuable insights that went beyond the input from the advisory groups alone: "This gave us good insights, enabling us to get practical guidelines aside from the advisory input" (B2, 2025).

Sometimes, things seem perfect on paper but turn out differently in practice. For instance, efficiency: on paper, it's often possible to place more students in a room, but if that leads to a stuffy or claustrophobic feeling, the question is where the limit lies. By testing with end-users in realistic setups, it's clear what is workable—and what isn't. Without this step, a well-thought-out plan could have easily turned into a failed design (D1, 2025).

Also, when there is doubt or resistance regarding certain decisions, additional research methods are used. A notable example is the issue with overhead projectors. Although considered outdated, some faculty still used them regularly. Instead of making an immediate decision, the project team cleverly and simply investigated where and by whom these projectors were still in use: a knot was tied in the cord, and after some time, it was checked in which rooms the knot had disappeared. This allowed targeted contact with the relevant faculty to ask for their input on suitable alternatives (D1, 2025). This approach helped prevent resistance while also providing tailored solutions when necessary.

Decision-making and prioritization

Making design decisions based on input is often a search for balance between different interests and perspectives. Budget plays an important role: "With more money, you can satisfy more people. The stricter you are with the budget, the more critical you must be about decisions" (B1, 2025).

In addition to financial considerations, practical considerations also have a significant impact. A much-discussed topic within the project is the type of furniture: fixed or movable. Movable furniture offers the flexibility desired in modern teaching methods, which focus on adaptable learning environments. At the same time, this flexibility poses challenges in terms of power supply, safety, and maintenance.

Both FS and LIS are critical of movable furniture in combination with power supply. FS states: *"Movable furniture means no fixed power outlets"* (D1, 2025). Cables by movable tables can easily be pulled or damaged, posing risks for users and maintenance. LIS add that power supply via the ceiling can obstruct sightlines in the room, while FS rejects floor outlets due to their vulnerability. Both parties agreed that movable furniture combined with power supply was not an option in their view (B1, 2025; B2; 2025).

The central dilemma was: which weighs heavier? Flexible furniture without power supply, or less flexible furniture with power? Because students repeatedly indicated that access to power was essential to their experience (B2, 2025), a solution was chosen that balanced all interests.

In the Collaboration Rooms, it was decided to run the power supply through the floor rather than the walls, as the group-based layout made wall connections impractical. However, this choice meant that fully movable furniture was no longer an option. To still meet the wishes of faculty and students for group-oriented and interactive work, large fixed round tables were chosen. This arrangement supports collaboration and new didactic methods, while also meeting the technical and maintenance requirements of both LIS and FS. A workable compromise was found, where functionality, safety, and pedagogical needs could coexist.

Influence on the design outcome

The influence of stakeholder input on the final design is clearly visible in various elements of the Collaboration Room. For example, the students' request for power outlets at every seat led to their inclusion in the collaboration rooms. At the same time, this request, combined with considerations regarding safety and maintenance, resulted in a compromise where fixed tables were necessary to accommodate the power points.

Another example is the adjustment of AV technology in the trial rooms, which directly stemmed from feedback from users. Insights from these rooms led to changes in the final AV setup. For instance, it was found that the overhead projectors were primarily used by instructors to not only present slides but also display additional information, such as mathematical formulas, during their lectures. This resulted in the decision to place display screens in the collaboration rooms that can show two sources side by side. This allows something else to be displayed alongside the presentation. Additionally, whiteboards were added so that both instructors and students can write and visualize ideas.

Evaluation of the Learning Environment by Stakeholders

Looking back at the Collaboration Room, the stakeholders are generally satisfied with the final result of both the building and the room itself.

When asked if they would do anything differently regarding the learning environment, LIS pointed to the selection of certain technical elements—mainly because newer and more advanced technologies have since become available. AV explains that this is always a challenge in the technical domain: “Technologies develop so rapidly. You already know that by the time you start designing a space and integrate the latest and most advanced equipment, it will be considered average by the time the building is completed. And just a few years later, it might already be outdated.” (A2, 2025) So, while they would opt for different technology today, they acknowledge that this is an inevitable part of working in a fast-evolving field.

4.2.4 Evaluation of the LE by end-users

This chapter presents the experiences of end-users with the learning environments. Using a survey, students and teachers were asked to share their experiences with the collaboration room. The questionnaire used is included in Appendix 4 and 5. Data collection took place on April 10, 2025. With the instructor's permission, the survey was shared via a QR code during a class held that day in the collaboration room. A total of 9 responses were collected, all from students. No responses were received from teachers.

Learning Settings

In the observed lecture in collaboration room, all participating students were physically present in the room. The teacher was also present in the room. When asked where the rest of their classmates were, all students responded that they were in the same room, and no was following the class online via hybrid connection.

When asked whether they had previously attended classes in this type of learning environment prior to this course, 77,8% of students indicated that they had.

As part of the evaluation, students and teachers were asked to indicate which types of teaching activities took place during the observed session. They could select multiple options. In order from most to least frequently mentioned, students and teachers reported the following teaching activities:

1. Lecture (9 out of 9 respondents)
2. Discussion with the whole class (4 out of 9 respondents)
3. Presentation (1 out of 9 respondents)
4. Discussion in groups (0 of 9 respondents)
5. Individual assignment (0 of 9 respondents)
6. Assignment in groups (0 of 9 respondents)

Three of the six answer options were not selected at all. It is worth noting that the activities selected were whole-class formats, such as lectures and class-wide discussions. These are more traditional, teacher-centred methods, whereas the project rooms were specifically designed to support active learning.

Therefore, despite being in a space designed to encourage active participation, the educational approach employed did not fully align with the room's intended purpose. This misalignment between teaching style and learning environment may hinder the space's potential to effectively support the learning process. One student reflected on this mismatch by stating: *"I don't think in our case the classroom layout really contributed in any way."* Another student emphasized a similar sentiment: *"Only use this room when you want to do an interactive lecture."*

Use of Facilities

In the survey, the students were asked about their use of the different tools available in the classroom. The tools were divided into digital ones—such as display screens—and analogue tools—like chalkboards and whiteboards. Additionally, the responses were categorized based on the user type: whether the teacher or the students used the tools.

According to the students, teachers generally made optimal use of the digital classroom tools, with 5 respondents indicating that these were fully utilized. However, others noted that although the digital tools were used, there was still room for improvement in their application. Regarding the analogue tools, the vast majority of students (8 respondents) reported that teachers used these optimally. When asked whether they personally had used the classroom tools, students' responses were mixed. Regarding digital tools, 4 students stated that they used them optimally, 2 acknowledged using them but noted there was room for more use, and 3 students indicated that they hadn't used the digital tools at all. For analogue tools, 4 students reported having used them, while the other 5 students said they hadn't made use of the analogue tools available in the classroom.

Engagement & Dynamics

The end-users were also surveyed about their perceived level of engagement and the classroom dynamics. These questions were designed not only to understand the connection between the physical learning environment and user experience, but also to explore contextual factors—such as teaching style and instructional methods—that could influence the learning process. Figure 33 displays the statements and the corresponding levels of agreement.

The results show that teachers generally encouraged students to ask questions and make comments. 4 responded with "somewhat agree" when asked whether they felt actively engaged with the learning content during class, one student was neutral and 4 other students responded with "somewhat disagree" or "totally disagree."

Overall, students' intrinsic motivation to learn appeared to be high; most students indicated that they felt motivated to learn in this class. A significant peak in agreement was found for the statement: "I spent most of the time in class listening to my teacher." These findings are consistent with the previously mentioned teaching style—namely, a teacher-centred, lecture-based approach with little to no peer collaboration. This is further supported by the responses to the final three statements in the survey: Students reported having learned from their teacher, whereas significantly fewer indicated that they had learned from one another. Most students stated that they did not help others during the lesson, nor did they gain insights from their peers.

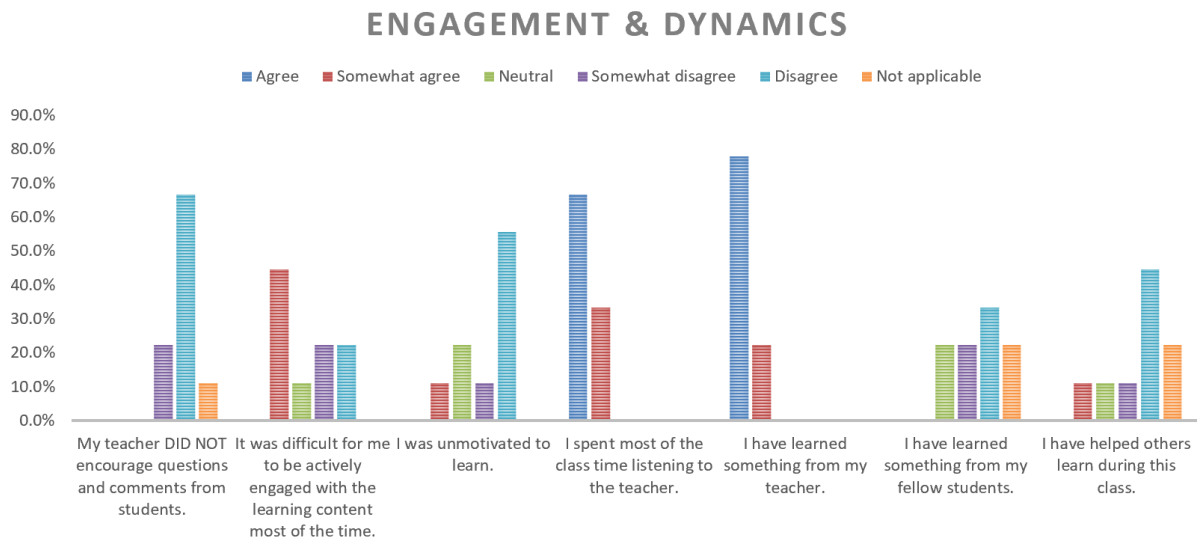


Figure 32 Perceived engagement and dynamics by end-users during lessons in the Collaboration Room

Evaluation of the Classroom Layout

Students and teachers were also asked about the layout of the classroom and how it influenced different aspects of their learning process.

Opinions on whether the classroom layout encouraged active participation were divided. While some students somewhat agreed with this statement, others disagreed, and a large portion remained neutral.

When asked whether the layout made it difficult to be actively engaged in class, the majority of respondents disagreed, suggesting that the layout did not serve as a barrier to engagement.

However, the impact of the layout on interaction scored low across all areas. Most students did not feel that the layout enhanced their interaction with the learning content. In comparison, there was slightly more agreement regarding the layout's contribution to interaction with the teacher, with some students highlighting the ability to face the teacher due to the size of the room as a positive aspect. Still, the majority disagreed with this statement. One of the main reasons mentioned was the seating arrangement, which made it difficult for some to see the teacher and thus engage in interaction. As one student put it: *"Half of the seats are useless as not facing towards the screen."* This made it challenging to follow lectures or teacher-centred instruction.

Similarly, most respondents disagreed that the layout supported interaction with fellow students, though there was a slightly higher peak in agreement for this question compared to others. Those who did agree cited "facing other students" as a positive aspect that encouraged interaction.

On the question of whether the layout stimulated the teacher to give students space to collaborate, there was a noticeable peak in responses marked *"not applicable."* This likely reflects the nature of the class, which did not include collaborative work.

Regarding whether the classroom provided a physically comfortable learning environment, responses were mixed. While most leaned towards agreement, a significant number of students were neutral or disagreed.

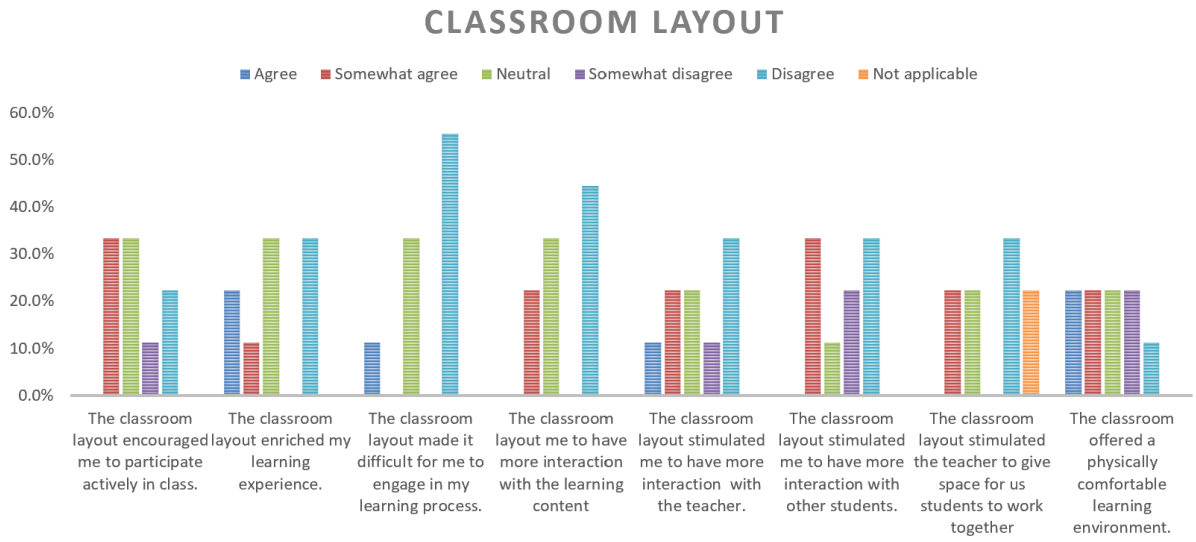


Figure 33 Perceptions of the classroom layout of the Collaboration Room by end-users

Perceived Strengths and Weaknesses

On average, students rated the classroom with a 6.33 out of 10.

There are several aspects of the space that students were satisfied with. Some students appreciated the sightlines — although this was largely dependent on sitting on the "right" side of the table, where chairs were positioned directly facing the board. They specifically mentioned the digital tools and the sightlines: *"The big screen and the fact we are not in strict lines makes it easier to see the screen."* In addition, students also appreciated the presence of power outlets integrated into the tables.

The most commonly mentioned weakness was the seating layout and the fact that it's not possible to see the front of the class from every seat. One student explained: *"Some of the seats are with the back to the screen. Since we don't have high attendance it was not a big problem, but I have had classes where this made it difficult to listen to the lecturer and take notes."* When asked about possible improvements, this issue was raised again. Several students suggested rearranging the seating: *"Group the chairs such that groups can work together but still see the front of the class,"* and *"Make sure all the chairs can face the lecturer,"* are just two examples of similar comments shared by participants.

There were also a few remarks about the number of tables in the room. Some students felt the space was too empty, with one student suggesting: *"I think 1 or 2 more tables would easily fit. It feels really empty now."*

Inclusivity was another topic raised. One student recommended the addition of standing tables to better accommodate diverse physical needs: *"Standing tables for people with disabilities like me, who can't sit for so long."*

Finally, students emphasized the importance of matching the type of lesson to the room layout: *"Some seating is not in ideal position for certain activities such as lectures."* Therefore, it was suggested to only use this classroom when the aim is to facilitate interactive learning, rather than more traditional forms of instruction.

Figure 34 Spacious room with good sightlines to the big screen

Figure 35 From some positions it is not possible to face the teacher

4.2.5 Alignment between end-users perspective and stakeholder input

To assess how the stakeholder involvement process can be optimised, it is first necessary to examine the current relationship between stakeholder input and how the space is perceived and experienced by end-users. This allows us to trace back which positive and negative experiences can be linked to specific stakeholder contributions.

In Table 17, all perspectives and opinions shared by students regarding the learning environments are presented. The first four rows reflect general experiences, independent of the type of teaching style used in the space.

Students also expressed appreciation for the type and size of the digital screens in the rooms. When seated on the correct side of the table, the sightlines to the screen were good and the screen was clearly visible. This is a direct result of input from the AV team, who deliberately chose large screens to ensure visibility and avoided ceiling-based power outlets in order to maintain clear sightlines. These decisions have led to the current setup, which end users consider effective and well aligned with their needs.

Students are also enthusiastic about the availability of power outlets on the tables. This feature was implemented as a direct response to student feedback. The project team acted upon this input, although the condition for including power on every table meant that flexible furniture could not be used. In this case, there is alignment between the stakeholder input and the effectiveness as perceived by students, although it also introduced limitations.

Regarding room capacity and layout, students felt the space was too spacious and that more tables could have been added. This spacious layout aligns with the principles of Active Blended Learning Environments, which emphasise open areas around tables. Therefore, while the design supports the intended learning style, the perception of inefficiency suggests only partial alignment between stakeholder intentions and student experience.

Another point raised concerned inclusive design. Some students would have appreciated standing tables for users with disabilities. Although standing tables fit within the Blended Learning Environment framework, there is no evidence that inclusive design considerations were explicitly addressed in the stakeholder process. This indicates a missed opportunity to include broader user needs.

Finally, notable misalignment occurs when the space is not used as intended — for example, during traditional, lecture-style teaching. In such cases, students criticised the group seating layout, especially due to the lack of flexible furniture. Many students were forced to sit with their backs to the lecturer, making these seats practically unusable. The absence of flexible furniture is directly linked to the earlier stakeholder decision to prioritise power outlets in every table, which made it technically unfeasible to use movable furniture. This resulted in reduced perceived effectiveness and a clear misalignment between end-user experience and stakeholder decisions.

Table 17 Alignment between end-users perspective and stakeholder input at the Collaboration Room

Theme	Relation to BLE Characteristic	End-User Evaluation	Related Spatial Design Element	Related Stakeholder Input	Alignment?	Conclusion
		SQ 3 /Chapter 4.2.4		SQ2 / Chapter 4.2.3	SQ4 / Chapter 4.2.5	
General						
Power Accessibility	Digital Tools	Students appreciated the availability of power outlets at every table	Power outlets integrated into fixed tables	Students requested outlets; FM raised safety/maintenance concerns; resulted in compromise with fixed tables	Yes	End-user needs were met through a design compromise, showing successful integration of multiple stakeholder interests.
Good Sight on the Screen (*note: when positioned at the good side of the table*)	Digital Tools	Students appreciated that, due to the seating arrangement not being in strict lines and the presence of a very large screen, it was easy to see.	Sightlines due to seating arrangement and large screenss	The AV team made a strong effort to ensure good sightlines, including avoiding ceiling-based power outlets and choosing large screens to ensure visibility.	Yes	End users can see the board clearly, which is effective. Stakeholders made deliberate choices to optimize these sightlines by not implementing ceiling-based power infrastructure and by installing large
Room Capacity & Occupancy	Formal Classroom setting	Some students found the room too empty and suggested adding more tables	Amount of tables in the room	In line with the principles of blended learning, the design aimed to provide sufficient circulation space around the tables.	Partially	Design intention supports BLE, but end-users felt underutilization of space — suggests a need to re-balance density
Inclusive Design	Flexible Furniture	Request for standing tables to support students with physical limitations	Only standard seating available	No evidence of inclusive design considerations in stakeholder documentation	No	Inclusivity needs were overlooked in design phase; points to a need for more diverse stakeholder involvement.
Only in cases where the space is not used with the appropriate teaching method						
Seating Layout	Seating in groups + flexible furniture	Students complained that not all seats face the screen; this hindered note-taking during lectures	Group seating layout combined with lack on flexible furniture	Due to the power supply, it was decided by FM not to use flexible furniture.	No	Room layout did not accommodate all teaching styles; insufficient flexibility for lecture-based setups.

Conclusion

This analysis reveals that the degree of alignment between stakeholder input and end-user perceptions varies across different aspects of the learning environment. Where end-user feedback directly influenced design choices, such as the inclusion of power outlet, the space is generally perceived as effective.

The teaching method plays a crucial role as well: when blended learning principles are applied as intended, alignment and perceived effectiveness increase significantly. The group-based furniture layout — a core element of active blended learning — becomes problematic in traditional teaching settings, particularly in combination with the absence of flexible furniture.

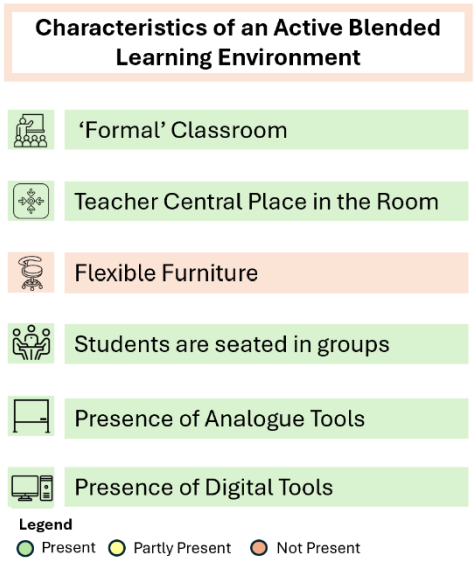
4.3 Case C: Radboud University

Elinor Ostrom Building - OneRoom

Photo: Radboud University, 2023

OneRoom

University	Radboud University
Building	Elinor Ostrom Building
Name of the Room	OneRoom
Building Year	2022
Surface	31,5 m^2
Seat Capacity	12
Space efficiency	2,6 m^2 / person



Photos: Radboud University, 2023

Formal Classroom	Yes
Teacher central place in the room	Yes
Flexible Furniture	No, Tables and chairs are not on wheels
Students are seated in groups	The seating is arranged in a U-shape, but due to the size of the room, it effectively forms one large group of 12 physical persons + online participants
Presence of Analogue Tools	Whiteboard on the wall
Presence of Digital Tools	Multiple LED Displays Smart board Wall with LED Displays for hybrid education

Remarks:

- The tables are arranged in a U-shape, but due to the small size of the room, this formation naturally creates a single group, including those attending online.

- The furniture is not flexible, but due to the small size of the room, there is little need or opportunity to reconfigure the space for different setups.

4.3.1 Context of the learning Environment

The One Room is an innovative educational space in the Elinor Ostrom building at Radboud University in Nijmegen. Delivered in 2023, this specialized learning environment was added later and was not part of the building's original construction.

The One Room is equipped with advanced technology designed specifically for blended education. With eight cameras, six large screens, and advanced audio technology, both in-person and online participants are optimally visible and audible. This setup enables a high level of interaction, ensuring that online participants are just as engaged in the lesson as those physically present. The technology creates an experience where it feels as if online participants are actually in the room (Radboud University, 2023). The room also contains tables arranged in a U shape and a fixed whiteboard on the wall.

4.3.2 Stakeholder Involvement Process

This section discusses the stakeholder involvement process in the creation of the OneRoom, focusing on: (1) which stakeholders were involved, (2) how the process was organised, and (3) when stakeholders were engaged. It also includes an evaluation of how the involved stakeholders perceived the final result and its effectiveness.

Stakeholders Involved

In the OneRoom project, four key stakeholders were involved—four internal stakeholders and two external stakeholder. These stakeholders are represented in Figure 37, where the rectangular boxes indicate the stakeholders, and the adjacent circles represent the roles associated with them.

One of the internal stakeholders was an Educational Innovator from In'to Languages, the language department of Radboud University. This department employs innovators who explore how education can be improved based on the latest trends. From an role perspective, this actor falls under educational specialists.

The second internal stakeholder was Educational & Study Facilities, a department within Campus & Facilities. This stakeholder is responsible for the management and ownership of educational spaces. Additionally, AV activities also fall under this stakeholder. At Radboud University, Educational Services and Audiovisual Services (AV) are both part of the Educational & Study Facilities department. This means that this department ensures that educational spaces are equipped with functional AV systems and sufficient furniture (C1, 2025). As a result, both Campus & Facilities activities and AV-related activities are grouped under this stakeholder.

The third internal stakeholder was ICT, a separate department responsible for all ICT-related activities within the project.

The final internal stakeholders were the teachers from In'to Languages. Since they would be the end users, working with the digital screens, they were involved in the process to provide input and familiarize themselves with the user experience.

As for external stakeholders, there were two AV suppliers: one for software and one for hardware. The hardware supplier strictly handled delivery and installation, while the software supplier took on more of a consultative role, actively contributing to the design and implementation process.

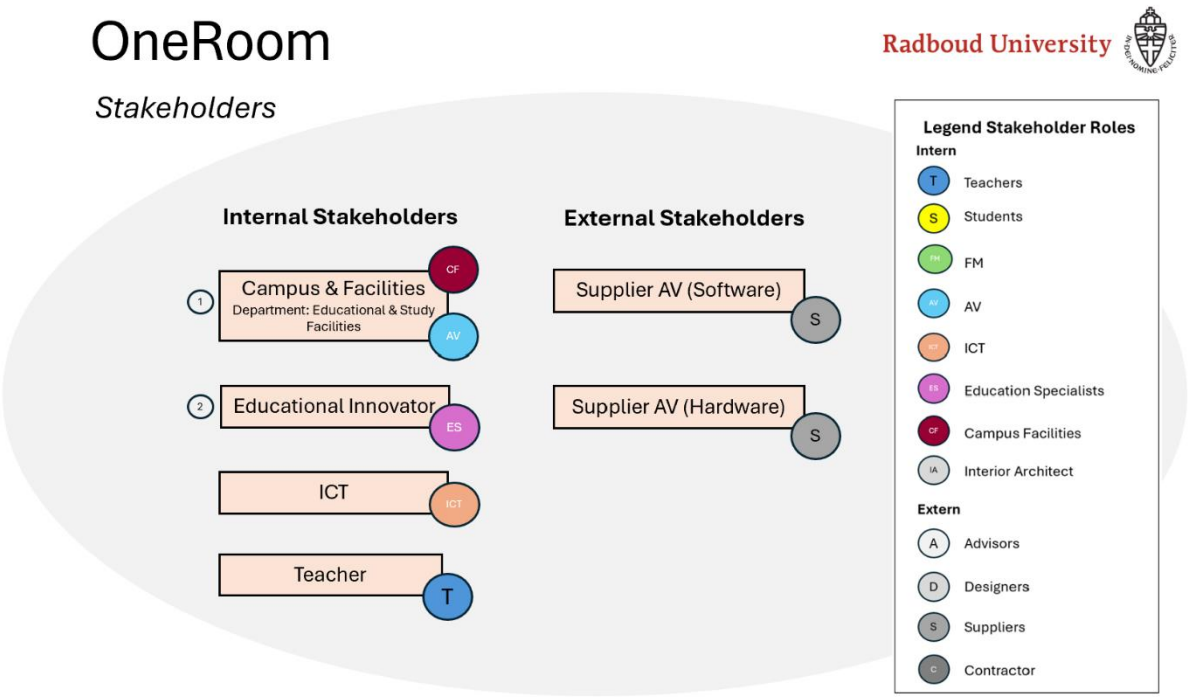


Figure 36 Stakeholders Involved in the creation of the OneRoom

Stakeholder Connections

The OneRoom initiative originated from In'to Languages, the language department of Radboud University. This department offers language courses that can be followed worldwide. However, they encountered challenges in effectively delivering these lessons remotely.

Within In'to Languages, educational innovators work on enhancing education through the latest developments. One of these innovators attended a conference where he met an employee from an AV company specializing in hybrid learning spaces, which provided the software for such environments. Through this connection, he discovered the OneRoom concept—a classroom equipped with large screens and advanced technology, allowing remote participants to appear life-sized in the room. Recognizing its potential to meet their educational needs, he decided to explore the concept further.

Although In'to Languages had the idea, they lacked the resources to implement it. Therefore, the innovator reached out to Campus & Facilities, the division responsible for developing and managing facilities on the Radboud campus. As part of their commitment to educational innovation, Campus & Facilities agreed to support the project and launch it as a pilot. It was eventually decided that Campus & Facilities would provide the space and fund the necessary equipment, while In'to Languages would cover the software costs (C1, 2025).

Subsequently, Campus & Facilities and In'to Languages collaborated on designing the space and defining its specifications. Together, they formed a project team, which included the ICT department, teachers who would later teach in the space. This internal project team then worked with the previously mentioned software supplier to develop the program of requirements and design (C2, 2025). Based on these requirements and the design, an AV supplier was brought on board for the hardware. The selected supplier assessed the necessary screens, audio equipment, and control panels, ultimately overseeing the delivery and installation of the system.

In figure 38, the different networks of connections between the stakeholders and their relationships are displayed.

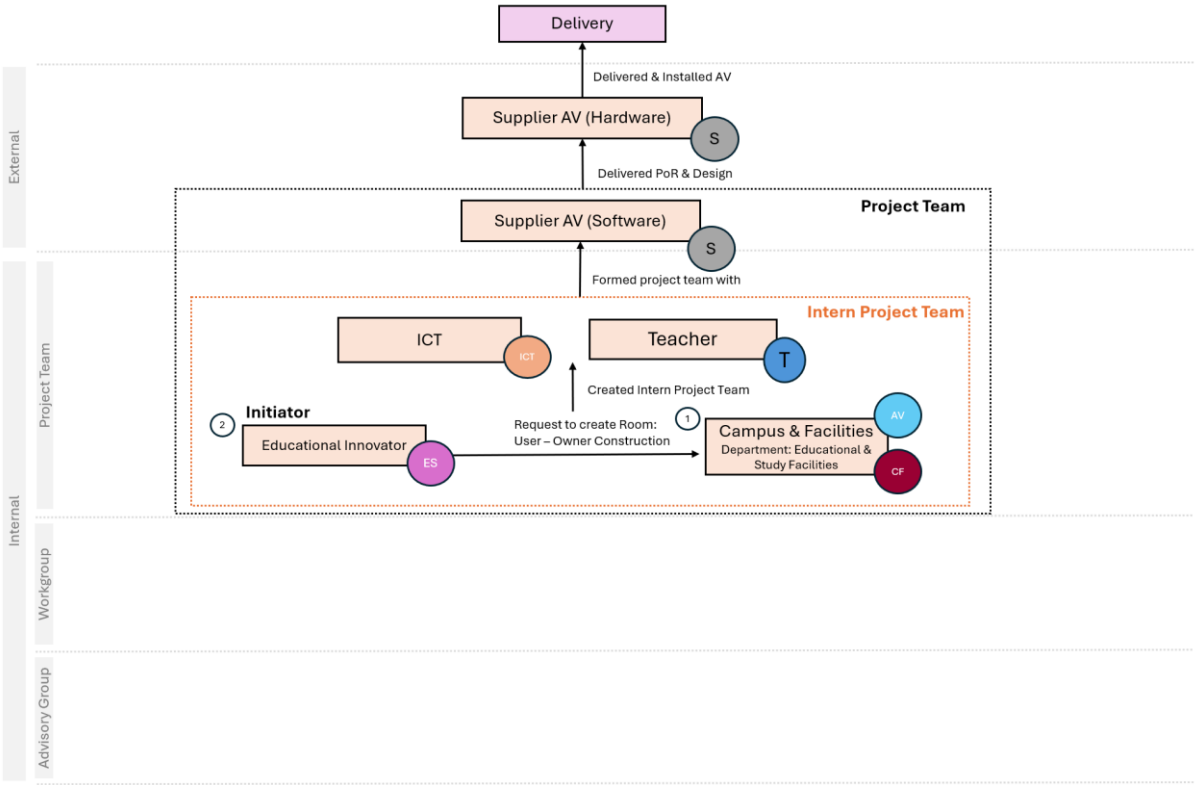


Figure 37 Connections between stakeholders involved in the creation of the OneRoom

Timing of stakeholder involvement

In the previous section, the stakeholder involvement process was explained, including how it was initiated and organized. The project timeline is illustrated in Figures 39, detailing when and who was involved at each stage.

The project was initiated by the Educational Innovator, in collaboration with the AV software supplier. Together with Educational & Study Facilities, they officially launched the project. From that point onward, all key internal stakeholders were brought on board, and a project team was formed. In cooperation with the AV software supplier, they developed the program of requirements and design. During the construction phase, they remained actively involved in a supervisory and quality control role, ensuring that everything was executed as planned.

The AV hardware supplier became involved only from the final design phase onward, playing an active role during the construction and installation process. Their involvement continued until the delivery of the learning environment.

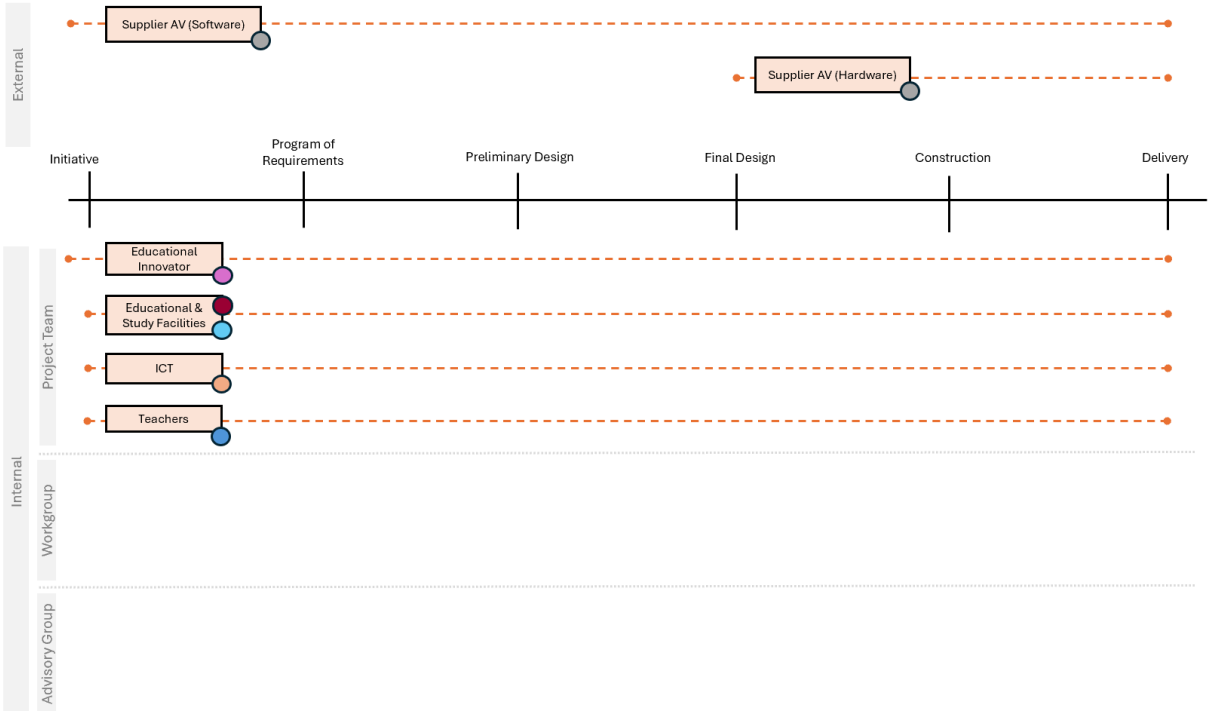


Figure 38 Timing of Stakeholder Involvement in the creation of the OneRoom

Evaluation on the Stakeholder Involvement Process

Based on the interviews, a clearer picture has emerged of how the stakeholder process was structured. Stakeholders involved in the project were also asked to reflect on how the process unfolded and to identify areas for improvement. This reflection revealed several bottlenecks that stakeholders encountered along the way, indicating room for improvement.

The main issue encountered after the delivery of the space is the low usage rate, which turned out to be significantly lower than initially expected. Although the pilot started with In'to Languages, the intention was for the space to be accessible and appealing to the entire university community. However, this broader use never fully materialized. Several reasons contribute to this, including unfamiliarity with the space, it not aligning with the teaching methods of other professors, and a lack of need for hybrid teaching.

This strongly emphasizes the importance of a use case for teachers. As one team member mentioned, *"I think if other teachers had been involved in the process, like the teachers from In' to Languages, there would have been more support, and the room would have been used more."* (C1, 2025)

Opinions on the functionality of the stakeholder process differ. From the perspective of In'to Languages, the feedback is positive, particularly in terms of the involvement of teachers and the

collaboration with the AV software supplier, who successfully integrated all the required features into the system (C2, 2025).

From Campus & Facilities' side, there are some areas for improvement. As one stakeholder of Campus & Facilities shared: *"In larger projects, we are actually better at involving stakeholders. In smaller projects, I notice it's a bit less. This happens because smaller projects often start spontaneously with a request, and then you tend to act too quickly without thinking, 'Do we actually have all the people we need?' And then, when ICT comes into play, you realize, 'Okay, I should involve people from the ICT department.'"* . (C1, 2025)

They also mentioned that if they were to do it again, they would definitely involve students more actively, as they are ultimately the end-users of the space. Their input would be extremely valuable in these types of projects (C1, 2025).

4.3.3 Stakeholder Input

In this section, the process of how stakeholder input is integrated into the design of the OneRoom is further explained. First, the types of input provided by stakeholders are outlined, followed by an explanation of the different methods and tools used to gather this input. Next, the decision-making and prioritization process is discussed. The section then explores how the input influenced the final design outcomes. It concludes with an evaluation by stakeholders of both the final result and the stakeholder involvement process, highlighting both positive aspects and areas for improvement.

Types of input provided by stakeholders

At the OneRoom in Nijmegen, two types of input were collected: input for the setup of the physical space and input for structuring the stakeholder involvement process.
The input on how the room should be designed came mainly from internal and external stakeholders who were part of the project team.

For the stakeholder involvement process, additional input was gathered from another university—the University of Amsterdam—where a similar collaboration room had already been implemented. The project team visited the site and spoke with those involved in its development to collect best practices. While this input did not directly influence the physical design of the room, it provided valuable insights into how the stakeholder involvement process should be structured in order to create an effective learning environment. Two key lessons from these conversations significantly influenced the stakeholder process in the current project.

The first lesson emphasized the importance of involving all relevant stakeholders from the very beginning of the project. This early inclusion was seen as a way to prevent misunderstandings or resistance later in the process and to ensure a more efficient workflow. As one team member reflected*: "You really need to make sure that everyone is on board from the start—then things move a lot faster"* (C2, 2025).

The second lesson highlighted the importance of developing a concrete use case to engage teachers. At the University of Amsterdam, it was noted that some newly implemented spaces were not widely used. This underuse was largely attributed to a top-down approach, where

spaces were designed under the assumption that they would be inherently valuable and innovative, without sufficiently considering whether teachers and students actually needed or desired such environments. The key takeaway was the need to think early on about how to meaningfully involve teachers and ensure they feel prepared and supported in using the space (C2, 2025).

Although teachers were part of the project team from the outset, their main role was not to actively shape the design of the space. Their participation primarily aimed to generate user support and to familiarize them with the new environment, rather than to collect direct input for the design process (C2, 2025). This limited engagement was largely due to the fact that the layout and technology of the existing space had already been predetermined, leaving little room for additional design decisions (C1, 2025; C2, 2025). However, once the space was in use, teachers began to share their user experiences. They were subsequently invited to provide feedback on how the technology functioned in practice. This post-implementation input led to several adjustments in both software and hardware systems, aimed at improving the usability and functionality of the room.

Methods/tools for integrating input

To structure stakeholder involvement, a project team was assembled consisting of members from ICT, Campus & Facilities, the external AV software supplier, end-users (teachers), and support services such as Brightspace. This group met several times, but a shared Microsoft Teams channel was especially central to the collaboration. All stakeholders were added to this online platform, which was used to provide updates and ask for input. This approach made it possible to keep everyone well-informed and collect feedback efficiently within a short timeframe.

In addition, prior to the design phase, a site visit was made to the University of Amsterdam (UvA), where similar spaces were already in use. The insights from this visit provided valuable input for incorporating lessons learned into the current project.

Decision-making and prioritization

The priorities in the design process were largely influenced by the first stakeholder to come forward with a request: the educational Innovator of In'to Languages. Their needs formed the basis of the initial proposal, as they had often already given the idea considerable thought before approaching the university, which in turn shaped how the process was structured and which decisions were prioritized (C1, 2025).

While the educational innovator primarily managed the project and helped shape the stakeholder process—translating the needs of users into actionable steps—one of the most influential stakeholders was the AV software supplier. The software played a leading role in the development of the space, as many decisions and choices depended on its technical capabilities and implementation requirements, which were guided and steered by the supplier (C2. 2025).

Influence on the design outcome

The first stakeholder input that influenced the design was the cautious stance taken by Campus & Facilities at the start of the project. They were hesitant to allocate a large area for the pilot, fearing that the initiative might not succeed (C1, 2025). As a result, the room was ultimately implemented in a relatively small space. In hindsight, Campus & Facilities expressed regret over

this decision, acknowledging that the room might have had greater impact and usability if it had been larger. The limited size now presents a constraint: it is difficult to physically accommodate enough participants in the room, making it unsuitable for holding classes when demand exceeds capacity (C1, 2025; C2, 2025).

In addition, stakeholder input also influenced the choice and integration of technology in the room. Teachers expressed that they found it difficult to work with the complex equipment, especially since there were many different options and buttons on the systems. They also noted that each faculty had different systems, which made usage confusing. As a result, the project team ensured there was coordination with other faculties (C2, 2025). Therefore, two different suppliers were involved: one for the software, which had experience in creating such spaces, and the regular hardware supplier of the Radboud University, which had no prior experience with these types of spaces. Campus & Facilities required that these two suppliers collaborate to integrate the software from one supplier into the hardware of the other. The hardware supplier was also tasked with making the installation as simple as possible, without adding too many additional features (C1, 2025). This was intended to enhance the usability for the teachers and make the space easier to operate.

With regard to the choice of furniture, there was no room for stakeholder input, as existing furniture owned by the university had to be used. However, stakeholders were able to decide on the layout. They expressed a clear preference for a collaborative setup in which online participants would be as well integrated as possible. However, they were limited by the small size of the room. As a result, they opted for a U-shaped arrangement, placing the online participants on the short end of the setup via the wall display.

Evaluation of the Learning Environment by Stakeholders

There hasn't been a single formal evaluation involving *all* stakeholders, but feedback has been shared with them in various ways. Teachers, as the primary users, were included in specific evaluations, and their feedback was relayed to relevant stakeholders—especially when technical issues arose or adjustments were needed (C2, 2025).

Looking back at the space, stakeholders do see room for improvement. Both the initiator and Campus & Facilities stated that, in hindsight, they would have chosen a larger room. The current room is actually too small, as it only accommodates 12 people. This becomes problematic when group sizes increase or when everyone decides to attend physically (C1, 2025; C2, 2025).

When asked to give the space a rating, the innovator said: "*It's a very well-designed system, so I would definitely give the system itself a solid 8. But the challenge lies in its implementation. You see that hybrid teaching is something different—it's also challenging for teachers. Not every teacher feels comfortable with it or knows how to handle it. Some manage well, but there are several who find it difficult. So in practice, I would probably give it more like a 7.*" (C2, 2025)

Campus & Facilities echoed this sentiment: "The main issue is the low usage rate of the room, which is much lower than initially hoped. Although the pilot started with In'to Languages, the intention was for the room to be used university-wide. Unfortunately, that hasn't happened. In that sense, the project is less successful, even though the room itself is of good quality." (C1, 2025).

4.3.4 Evaluation of the LE by end-users

This chapter presents the experiences of end-users with the learning environments. A survey was used to gather feedback from students and teachers about their experiences with the OneRoom. The questionnaire used can be found in Appendix 4 and 5. Data collection took place on April 15, 2025. With the instructor's permission, the survey was distributed via a QR code during two classes held in the OneRoom that day. A total of 8 responses* were collected — 7 from students and 1 from a teacher.

**At the time of the survey, only two courses were being taught in this space, with a total of 12 participants.*

Learning Settings

In the observed lecture in the collaboration room, the teacher and part of the participants were physically present in the room, while another part joined online. These online participants were visible on the screen positioned against the back wall.

When asked whether students had previously attended classes in this type of learning environment, 4 students indicated that they had. For the remaining 3, it was their first time. The teacher had also taught in this room before.

As part of the evaluation, students were asked to indicate which types of teaching activities took place during the observed session. Multiple answers were allowed. From most to least frequently mentioned, the following activities were reported:

1. Lecture (6 out of 7 respondents)
2. Discussion with the whole class (4 out of 7 respondents)
3. Assignment in groups (4 out of 7 respondents)
4. Presentation (3 out of 7 respondents)
5. Discussion in groups (2 out of 7 respondents)
6. Individual assignment (1 out of 7 respondents)

A varied range of teaching methods was thus employed during this session. In addition to traditional lecture-style instruction, several collaborative formats were also used. The number and diversity of the reported activities, as well as the integration of both physically present and online participants, indicate the application of active blended learning approaches during this session.

Use of Facilities

In the survey, both students and teachers were asked about their use of the various tools available in the classroom. However, the teacher did not complete this section of the survey, so only student responses are available. A distinction was made between digital tools—such as display screens—and analogue tools—such as chalkboards and whiteboards. Additionally, the responses were categorized based on user type: whether the teacher used the tools, and whether students did.

All respondents indicated that the teacher made optimal use of the digital tools available in the room. One student elaborated: "*The teacher was in charge of the digital system and that went*

really well. I think that if someone doesn't know how to use the system, the lesson and interaction with the online students would be much less effective."

In contrast, the use of analogue tools by the teacher was reported to be minimal: 6 of 7 respondents indicated that these tools were not used during the session.

When asked to what extent the students themselves used the digital tools, 5 indicated that they made little to no use of them. 2 participants reported having made optimal use of the digital tools.

Regarding the use of analogue tools by students, 5 students indicated they did not use them at all. One student reported using them optimally, while the last student stated they used them but could have made more use of them.

Engagement & dynamics

On the statement *"My teacher did not encourage questions and comments from students,"* all respondents unanimously disagreed. Similarly, the vast majority disagreed with the statement that it was difficult to actively engage with the content. In line with this, none of the students agreed with the statement that they felt unmotivated to learn—respondents either disagreed or somewhat disagreed.

Responses to the statement *"I spent most of the time listening to the teacher"* were more mixed. 5 students agreed, while 2 others disagreed. This variation could be explained by the fact that the survey was conducted across two different sessions—one of which may have been more teacher-centred, while the other included a broader mix of instructional approaches.

All students unanimously agreed that they had learned something from the teacher. Additionally, many students indicated that they had learned from their peers. When asked whether they had helped others to learn, responses varied between 3 votes for neutral, 3 for somewhat agree, and one response for disagree.

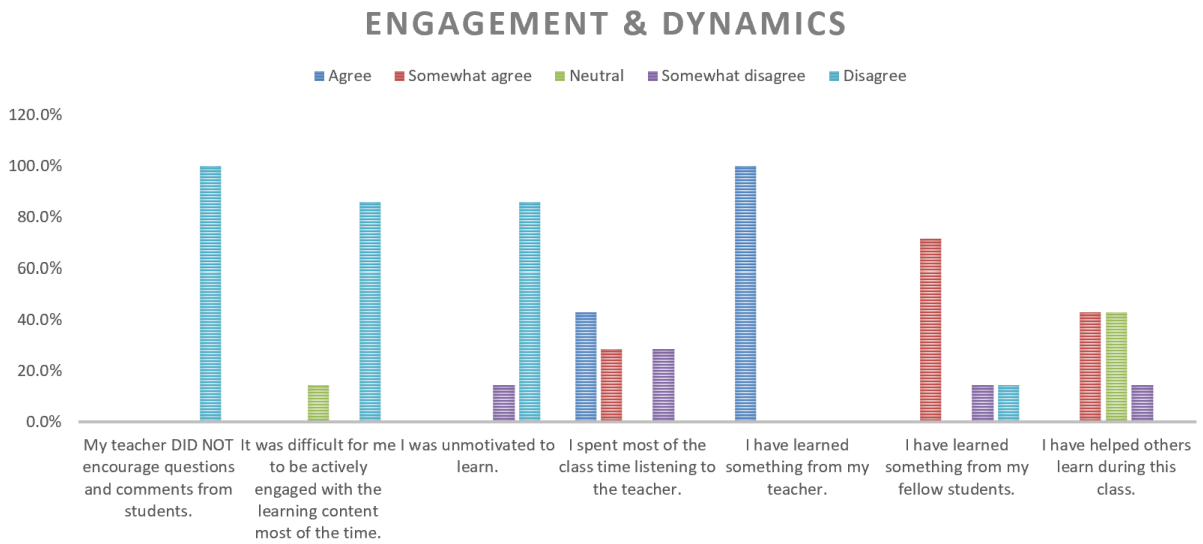


Figure 39 Perceived engagement and dynamics by end-users during lessons in the OneRoom

Evaluation of the Classroom Layout

Most respondents agreed that the layout of the classroom encouraged active participation. Regarding whether the layout enriched their overall learning experience, 4 students agreed, 1 was neutral and 2 disagreed. However, no students agreed with the statement that the layout made it difficult to engage in the learning process.

Many students felt that the classroom setup stimulated greater interaction, both with the learning content and the teacher. Several also indicated that it contributed to the amount of interaction with other students. One student noted: *"The U-shape table setup gave focus to the teacher, but also allowed for interaction between students."*

In response to whether the classroom provided a physically comfortable learning environment, most respondents agreed. However, there was a small number of dissenters. One student who disagreed mentioned: *"It gets very hot sometimes in this room."* This student further explained that the heat seemed to be caused by the numerous screens and equipment in the relatively small space, which generated additional warmth.

Another student commented on the layout-related questions that, while a well-designed space is appreciated, they believed it had limited influence on their learning experience: *"Learning behaviour/process is mainly influenced by the quality of the teacher and my own input. I think the kind of classroom plays a very little role here."*

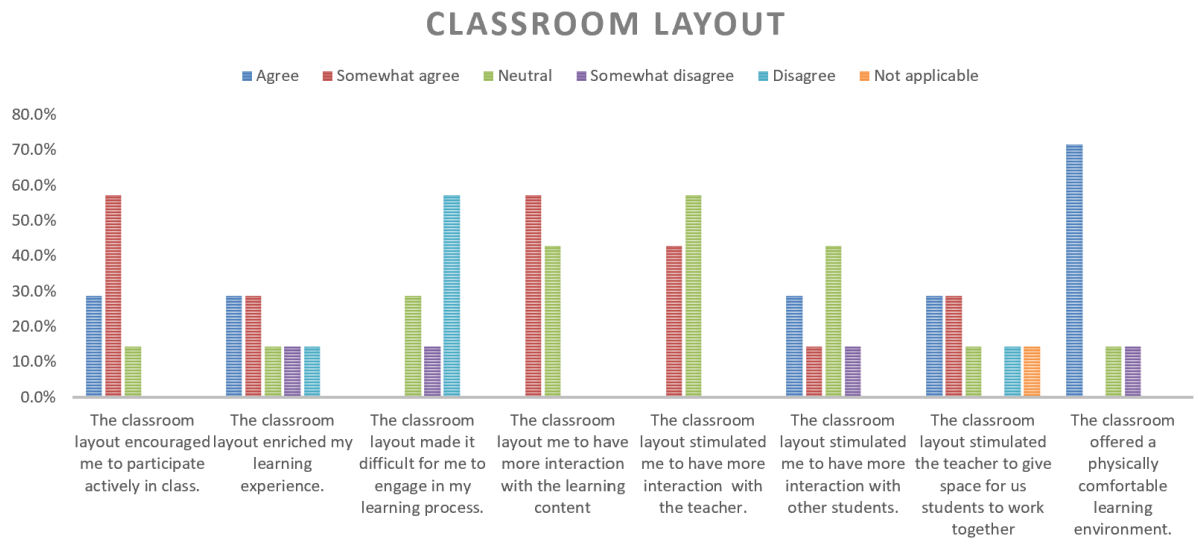


Figure 40 Perceptions of the classroom layout of the OneRoom by end-users

Perceived Strengths and Weaknesses

On average, end-users are quite positive about the OneRoom. The learning environment is rated by them with a score of 8.16 out of 10.

Several aspects of the space received positive feedback from students. One of these was the integration of online participants through the digital tools. As one student explained: *"It was really like the people online were at the table with us, due to the placement. Also, it didn't feel like they were online because the technique worked very well. They could raise their hand and write on the screen to point out things."*

Despite this, a number of students expressed a more neutral stance toward the digital tools and screen system. For instance, one student noted: *"Although the room and the hybrid function is convenient, I don't think it really contributed.''* Another student added: *"The digital people did not really change anything for my experience."*

Beyond enabling online participation, the digital screens also had an added benefit according to another student:*" The ones physically there were also able to use the digital space too, like drawing on the board from your own place and computer."* Figure 42 shows the screen layout as seen by online students. It provides multiple viewpoints of the classroom through strategically placed cameras, alongside the projected presentation. In the lower left corner, participants can draw or click on elements, which are then simultaneously displayed on the classroom presentation screen, making their input visible to everyone in the room.

Another appreciated element was the U-shaped table setup. One student described it as follows: *"Due to the U-shape, in combination with the teacher and the online people, you're basically in a big circle. I liked that because I could see everyone and interact with everyone."* This sentiment was echoed by another student: *"You can look at everyone, also the ones online."*

However, not all students had the same experience. One suggested a change in table position, stating: *"Change table position, directionally to the teacher."* Another remarked: *"I generally didn't look at the digital students as they were on the back wall. I think this reduced possible interaction."*

End-users also noted several points for improvement. One recurring issue was the temperature in the room: *"The room is very hot and becomes very hot. Maybe a bigger room will be better. Or extra ventilation. "*Finally, one student pointed out the effect of the glass walls: *"Sometimes I was distracted by the glass walls and other classrooms that I could look into."*

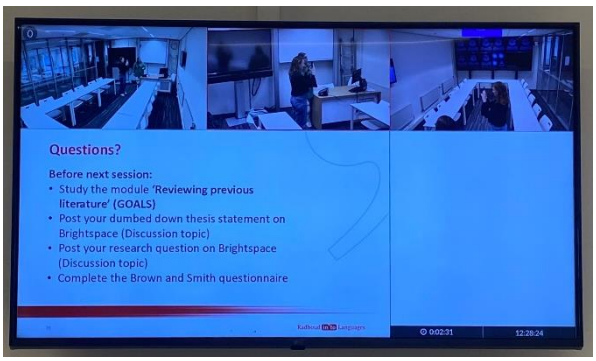


Figure 41 The screen, as seen by online participants.

Figure 42 The room from the perspective of the physically present participants.

4.3.5 Alignment between end-users perspective and stakeholder input

To assess how the stakeholder involvement process can be optimized, it is first necessary to examine the current relationship between stakeholder input and how the space is perceived and experienced by end-users. This allows us to trace which positive and negative experiences can be linked to specific stakeholder contributions. In Table 18, all perspectives and opinions shared by students regarding the learning environments are presented.

The first element praised by end-users is the integration of technology and digital tools, and the seamless way these tools support online collaboration. This success can be attributed both to the technological tools themselves and the way teachers make use of them. It is directly linked to the stakeholder involvement process: teachers were included in the design process as user cases to familiarize them with the new technology and to identify what worked well and what did not. Feedback about the system being too complex and having too many features was shared with the supplier, who then worked together with the team to design a simpler, more user-friendly interface. This resulted in a system that teachers felt confident using, which in turn positively influenced the student experience. This reflects strong alignment between stakeholder input and end-user perception.

Another point raised in the evaluation was the seating arrangement. Opinions here were more divided. Some students appreciated the U-shape layout for its facilitation of eye contact and interaction among participants, including those attending online — who were displayed on a large screen integrated into the U-shape. Others, however, found it challenging to maintain focus due to the format and indicated that online participants were still hard to engage with effectively. Although the stakeholder input that led to this u-shape setup intended to enhance inclusivity for hybrid learning, it did not work equally well for all users, resulting in only partial alignment.

There were also critical remarks about room size. Students reported feeling cramped, and noted that the capacity was insufficient if all participants were to attend in person. This was a result of stakeholder decisions made by Campus & Facilities, who were cautious in assigning a larger room in case the experiment would not be successful. They later expressed regret about this decision. This mismatch between stakeholder choices and end-user needs leads to misalignment.

A similar issue was mentioned regarding room temperature. Due to the heat generated by the screens, the limited space, and poor ventilation, the room could become uncomfortably warm. This again traces back to the stakeholder decision to assign this particular room, which was a pre-existing space with limited capacity for adaptation. The poor indoor climate thus reflects another case of misalignment.

Lastly, concerns were raised about the presence of full glass walls. These allow visibility into the hallway and neighboring classrooms, which can be distracting for students. This design element also resulted from the fixed allocation of the room by Campus & Facilities and could not be changed, leading once again to misalignment between design and end-user experience.

Table 18 Alignment between end-users perspective and stakeholder input at the OneRoom

Theme	Relation to BLE Characteristic	End-User Evaluation	Related Spatial Design Element	Related Stakeholder Input	Alignment?	Conclusion
		SQ 3 /Chapter 3.3.4		SQ2 / Chapter 4.3.3	SQ 4 /Chapter 3.3.5	
General						
Integration of technology	Digital Tools	praised seamless integration for online collaboration	Digital screens and hybrid system setup	Teachers indicated that the technology was too complex. Based on this input, suppliers simplified and integrated the systems, aiming to balance user-friendliness and functionality. Additionally, an end-user case was developed specifically for teachers to support them in learning how to use the technology effectively.	Yes	User-centered tech design approach largely worked—online and in-person users could interact smoothly, though opinions on usefulness vary.
Furniture layout (U-shape)	Seatting Arrangement	Many students appreciated U-shape for eye contact and interaction; a few found it less optimal for engagement with online students depending on placement.	Table configuration	U-shape set up intended to enhance inclusivity for online students and connection with the teacher.	Partially	Layout supported interaction, but position of digital participants could reduce engagement from some students—slight refinements needed.
Room size and capacity	Formal Classroom	Room is experienced as too small when demand is high	Room dimensions	Campus & Facilities decided on small space due to initial cautious attitude; later regretted this as limiting usability.	No	Conservative decision led to space being too limited for comfort and effective group use, reducing flexibility and user satisfaction.
Acoustic and visual distraction	Formal Classroom	Distraction from adjacent rooms due to glass walls.	Glass partition walls	Campus & Facilities decided on one particular room, where no other elements could be adjusted. The glass walls were already in place.	No	The design element did not sufficiently support focus, but was the result of a pre-assigned room by Campus & Facilities, leading to a misalignment.
Climate (temperature/ ventilation)	Formal Classroom	Room is often too warm and lacks proper ventilation, especially given the small size and the heat produced by the many electronic tools and screens.	Lack of ventillation, small room, digital screens	Campus & Facilities decided on a small space due to their initial cautious attitude; as a result, the ventilation could not be properly adjusted or scaled accordingly.	No	Implementing the technology in the small space without additional measures results in heat buildup, van be uncomfortable and does not align with the needs and

Conclusion

This evaluation shows that strong alignment between stakeholder input and end-user experience occurs when end-users, such as teachers, are actively involved in the design process. This is evident in the successful integration of digital tools, where both the choice of technology and the way it is implemented were aligned with the needs of end-users. However, when design choices are constrained by pre-existing conditions, such as fixed room assignments and limited adaptability, misalignment arises. This highlights the importance of critically assessing existing spatial elements at the start of the stakeholder process. It is essential to question whether these elements truly support the intended learning environment and explore whether adjustments can be made to better align the space with its intended function. In this case, there is partial alignment, as the pre-existing limitations partly hindered the effectiveness of the space.

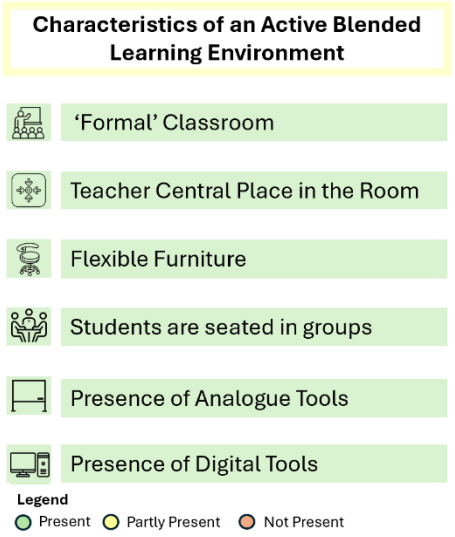
4.4 Case D: Utrecht University

Bolognalaan 101 – Hybrid Active Learning Classroom

Photo: Utrecht University, n.d.

Hybrid Active Learning Classroom

University	Utrecht University
Building	Bolognalaan 101
Name of the Room	Hybrid Active Learning Classroom
Building Year	2022
Surface	120 m^2
Seat Capacity	48
Space efficiency	2,5 m^2 / person



Photo's: Utrecht University, n.d.

Formal Classroom	Yes
Teacher central place in the room	Yes
Flexible Furniture	Yes, Tables and chairs are on wheels, and the desks are adjustable to standing desks.
Students are seated in groups	Yes, groups of 6 people per table
Presence of Analogue Tools	Whiteboard on the wall Moveable whiteboards
Presence of Digital Tools	LED Displays per table Movable LED Displays Smart board Power Sockets

4.4.1 Context of the learning Environment

The Hybrid Active Learning Classroom (HALC) is an innovative workgroup space at Utrecht University, located at Bolognaweg 101. Delivered in 2021, this specialized learning environment was added later and was not part of the building's original construction. It is part of the Future Learning Spaces project, which explores the classrooms of the future by developing various educational spaces based on innovative teaching methods. The project focuses on raising awareness, evaluating effective technologies, and phasing out those that do not significantly enhance education.

One of the first initiatives within this project was the HALC, initially launched as a pilot. After a successful testing phase, its value was recognized, and it has now been officially integrated into Utrecht University's permanent learning environments.

The HALC is designed to support interactive, student-centred learning, with a layout specifically aimed at encouraging active engagement. Students work in groups at one of the eight sit-stand tables, each equipped with its own screen and whiteboard. At the centre of the room is a teaching station that allows the instructor to control what is displayed on each screen—whether it's their own presentation, a specific group's work, or another group's results. This setup places the instructor in a central position within the space, reinforcing a more interactive teaching style. Notably, the room has no defined front, which further supports a dynamic and flexible learning environment where interaction flows in all directions. The flexible setup with group tables, shareable screens, and whiteboards makes it easy to support collaboration within and between groups. The space has also been upgraded with additional screens and communication tools to facilitate hybrid teaching, allowing remote students to actively participate in learning activities alongside those physically present (Utrecht University, 2022).

4.4.2 Stakeholder Involvement Process

In this section, the stakeholder involvement process in the creation of the HALC is discussed. First, who was involved, how this was organised, and at what stages in the process these stakeholders were engaged are examined.

Stakeholders Involved

A total of eight stakeholders were involved in the development of the HALC, including six internal stakeholders and two external ones.

The process was initiated by a teacher who had been actively experimenting with innovative teaching methods at the university's Teaching Lab. Inspired by international concepts of active learning, the teacher became the driving force behind the idea to create a new type of learning environment.

Campus & Facilities, the department responsible for the university's real estate management, was involved early on to help identify and provide a suitable space for the project.

The teacher's students also played a key role as active participants in the classroom experiments. Their experiences and feedback contributed directly to shaping the space according to real educational needs.

To ensure technical quality and functionality, an AV specialist joined the team, bringing in expertise on the latest audiovisual technologies. Additionally, an interior architect was engaged to design a flexible and engaging learning environment, while a facility manager oversaw aspects related to the maintenance and day-to-day management of the space.

Lastly, as external stakeholders, suppliers were involved to deliver and install the AV equipment and furniture in the HALC.

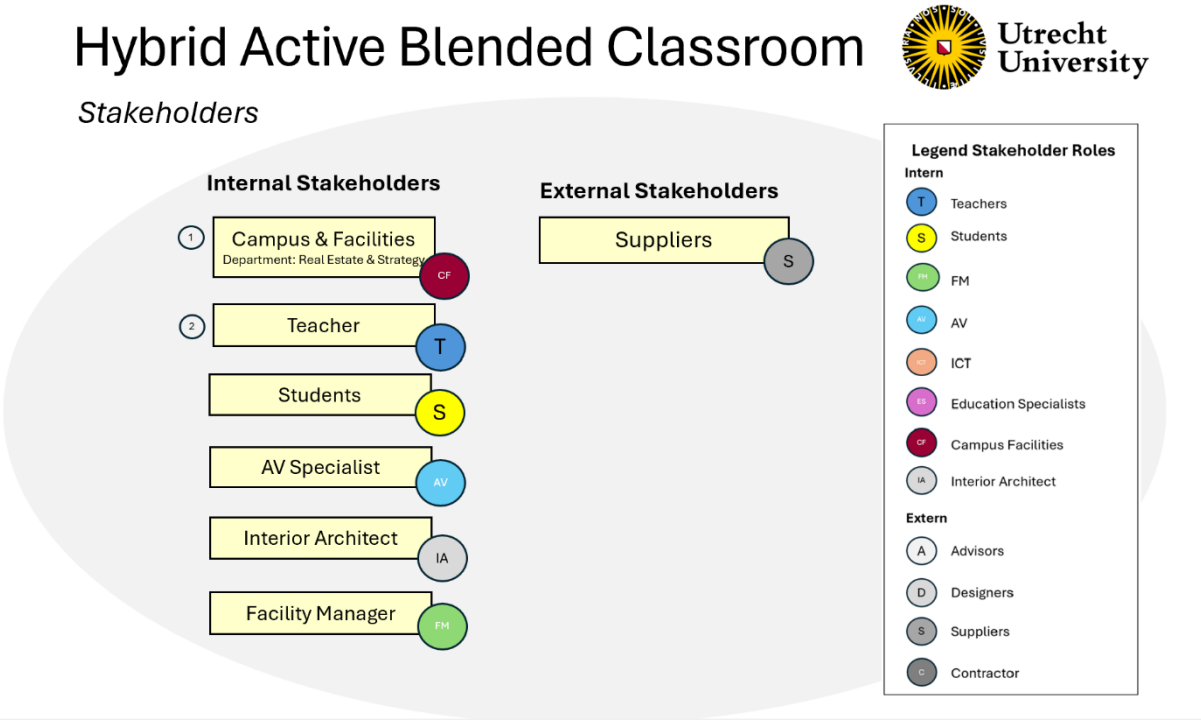


Figure 43 Stakeholders Involved in the creation of the HALC

Stakeholder Connections

The Hybrid Active Blended Learning Classroom was developed in two phases. Initially, an Active Learning Classroom was created, and in the second phase, hybrid functionalities were added to the space (D1, 2025). The initiative for this room came from a teacher who was already involved with the Teaching and Learning Lab, where he experimented with new forms of education and created mock-ups for innovative classroom environments. He was already familiar with the concept of Active Learning from experiences in the United States and Australia. (D1, 2025)

Because he was so engaged in this topic, the teacher decided to attend a conference about new learning spaces. To his surprise, he met several colleagues from Utrecht University—people he had never encountered before—who turned out to share the same interest in learning space innovation. Among them were an interior architect, a facility manager, an AV specialist, and a representative from Campus & Facilities, specifically from the department of Real Estate Strategy. Together, they decided to formalize their collaboration and expressed the ambition to actually realize an Active Learning Room (D1; 2025).

Through Campus & Facilities, they managed to find a space at the university with a semicircular wall that was available. The project team designed the classroom and had it built with the support

of contractors. This space initially functioned as an Active Learning Room, and was later upgraded with hybrid digital elements, transforming it into a Hybrid Active Learning Room (D1, 2025; D2, 2025).

The project was funded by Campus & Facilities. However, due to the success and excitement around experimenting with new forms of education, the initiative eventually led to the establishment of an official organization called "Future Learning Spaces." Since then, they have developed several new rooms beyond the initial Active Blended Learning Rooms and now have their own budget and organizational structure to independently manage and initiate future projects (D1, 2025; D2, 2025).

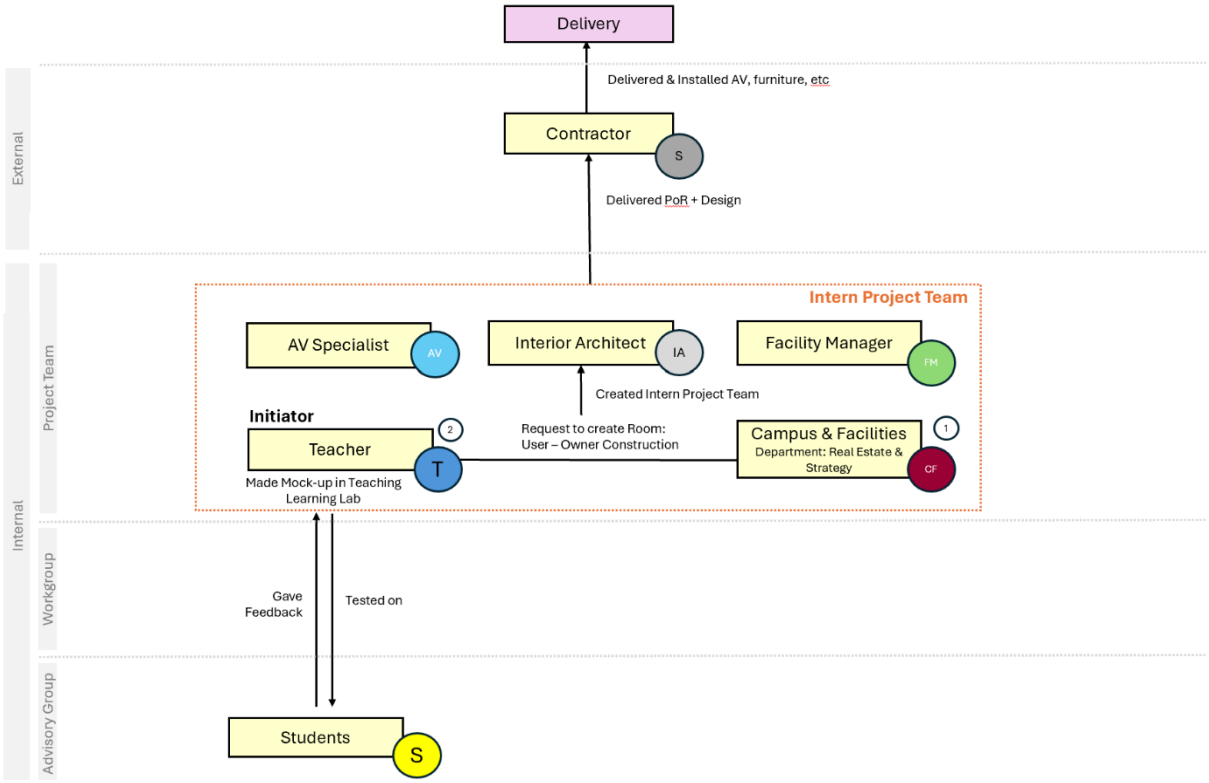


Figure 44 Connections between stakeholders involved in the creation of the HALC

Timing of stakeholder involvement

The involvement of each stakeholder per phase is presented in Figure 46. As shown, the teacher was already active before the official initiative started, conducting experiments with mock-ups in the Teaching Lab. Even at this early stage, the teacher collected feedback from students to inform the development process.

With the launch of the official project, the internal project team was formed. This group remained actively involved throughout the entire design and implementation process. Together, they co-designed the learning environment, and the teacher continued to use the Teaching Lab to test ideas and gather input from students.

During the construction phase, external suppliers were brought in to deliver and install the AV equipment and furniture. These suppliers remained involved until the final delivery. Even in this phase, student feedback continued to play a role in fine-tuning the learning space.

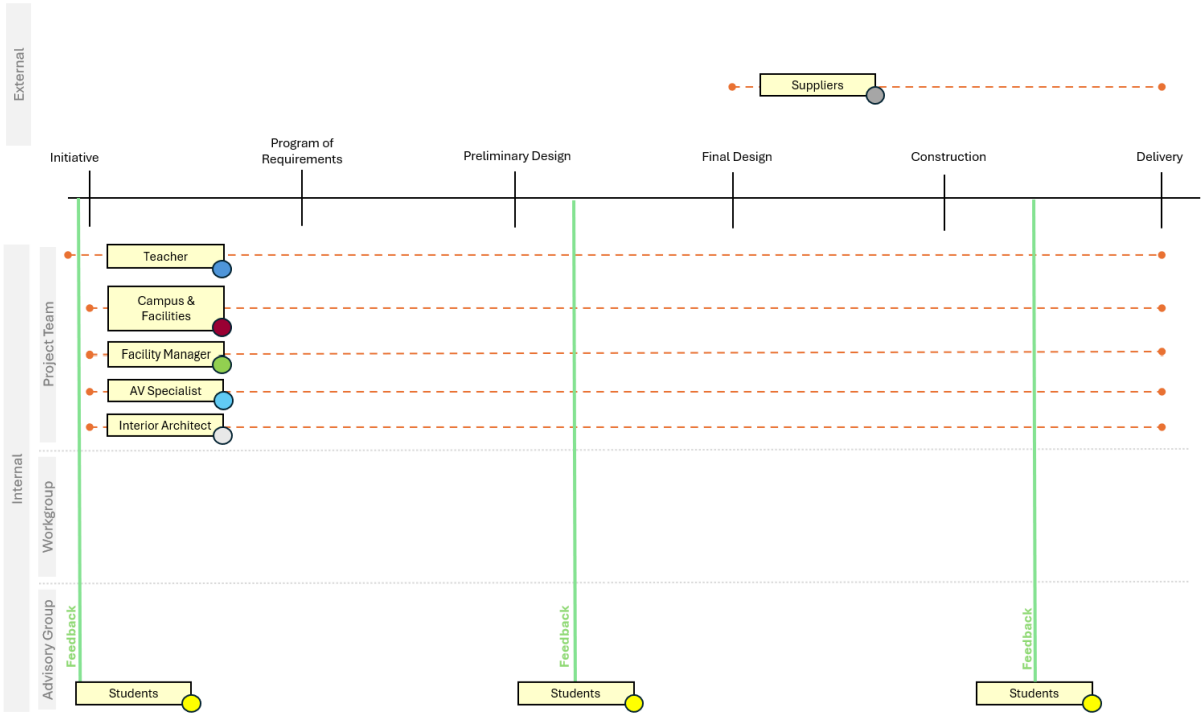


Figure 45 Timing of Stakeholder Involvement in the creation of the HALC

Evaluation on the Stakeholder Involvement Process

Based on the interviews, a clearer picture has emerged of how the stakeholder process was structured. Stakeholders involved in the project were also asked to reflect on how the process unfolded and to identify areas for improvement.

At Utrecht University, it became evident that the creation of the HALC was truly the first step within a broader initiative to develop future learning spaces. As the first of its kind, the process unfolded in a rather organic way, with more and more people becoming involved over time as interest grew. While this approach worked well for that particular moment and project, the process has since become much more professionalized and structured. Importantly, this early project laid the foundation for the improved procedures used today.

Through this process, the university got to know several valuable stakeholders, many of whom are still involved in current projects. Nowadays, the creation of new learning environments is carried out by multidisciplinary teams, led by a project lead, working collaboratively on the co-creation of community learning spaces. Additionally, a multidisciplinary steering committee has been established, which includes many of the same individuals who were part of the original internal project team for this case (D1, 205; D2, 2025).

Looking back, the process was well-suited to the creation of the HALC as an initial pilot project. However, it has since been refined and strengthened to better support future initiatives.

4.4.3 Stakeholder Input

In this section, the process of how stakeholder input is integrated into the design of the HALC is further explained. First, the types of input provided by stakeholders are outlined, followed by an explanation of the different methods and tools used to gather this input. Next, the decision-making and prioritization process is discussed. The section then explores how the input influenced the final design outcomes. It concludes with an evaluation by stakeholders of both the final result and the stakeholder involvement process, highlighting both positive aspects and areas for improvement.

Types of input provided by stakeholders

Stakeholders primarily provided input on how the space should look and function. This input mostly came from stakeholders who were part of the project team, each contributing based on their specific area of expertise. For topics outside their own expertise—such as the user experience of the space—certain elements were tested with students, who then provided feedback.

The HALC was the first project of its kind, and it later served as the foundation for the FLS project. In that sense, it was also a pilot in terms of process. At the time, there was no structured approach to gathering input on how stakeholder involvement should be organized; instead, the process developed organically. Nevertheless, this project laid the groundwork for shaping a more refined stakeholder involvement process in future projects (D2, 2025).

Methods/tools for integrating input

To collect input from the project team, physical meetings were organized. These started very informally: "It began as a sort of chat group with other colleagues who were also interested in developing new learning environments. It wasn't anything official. It was just very casual in the hallway, where we would then go have coffee," the initiating teacher (D2, 2025) explains. This group grew larger, and at a certain point, when Campus & Facilities became involved, it was decided to make it official. From that point on, formal meetings were organized to collect input (D2, 2025).

To test whether the collected input and ideas actually worked, mock-ups of the new classroom settings were built in the teaching lab. The involved teacher would then give their lesson there, with their own students, and in this way, feedback was collected from the students (D2, 2025).

Decision-making and prioritization

The initiating party already had a lot of knowledge about the topic of active blended learning and had already outlined many ideas before the official initiative was launched, during which the creation of the space was put into motion. The initiator discussed all ideas and possibilities with the project team, considering what could be done. This gave the project team a very clear mandate. As a result, most decisions regarding prioritization came from the project team, as they

had the clearest understanding of what needed to be done and were able to create a space that fit within those parameters.

Influence on the design outcome

The project team wanted to create a space that supports active learning, where the teacher takes a central position in the room and where there is no clearly defined "front" of the classroom. At the same time, the university started using a newly acquired building rented from a university of applied sciences. One of the rooms in this building featured unusual semi-circular walls, and initially, there was uncertainty about how to utilize the space. However, this unique shape turned out to perfectly align with the project team's ambitions, which led to the decision to transform this specific room (D2, 2025).

In collaboration with the Teaching Lab and through mock-ups, different teacher positions, classroom setups and tools were tested. These setups were evaluated by students who provided feedback on their experiences. Combined with insights from international best practices and theoretical frameworks from countries like the United States and Australia, this process informed the choice of flexible furniture, the positioning of the furniture and the integration of both analogue and digital learning tools (D2, 2025).

Evaluation of the Learning Environment by Stakeholders

When looking at the HALC, stakeholders expressed satisfaction with the final outcome. The HALC functioned as a pilot space for three years, during which it was thoroughly evaluated and reflected upon by both stakeholders and end-users. These evaluations focused on how the space functioned and how it was used. Eventually, the consensus was that the HALC had proven to be so successful that it no longer needed to operate as a pilot, but could instead serve as a permanent learning space. This change also meant that the space no longer fell exclusively under the umbrella of "Future Learning Spaces."

While it was still considered a pilot, the space was only used by affiliated teachers who were open to adapting their teaching to the characteristics of the room. Since its official integration into the university's general timetable, the space has become accessible to all teaching staff. However, this shift brought new challenges.

Stakeholders noted that the general use of the HALC declined after it was added to the standard scheduling system. As one stakeholder explained: "There was a lack of ownership over the space. As soon as it became part of the regular timetable, it was no longer seen as part of the Future Learning Spaces project—which was actually the intention. However, once it no longer belonged to FLS, there was no one else who really took responsibility for the room. That resulted in a kind of lack of ownership, and for a space like this, that ownership is crucial." (D2, 2025)

The space was still relatively new and required guidance and support, making it less suitable for general use without preparation. This became immediately apparent when the room was added to the regular scheduling system. Suddenly, it wasn't just the teachers who were already involved and familiar with the space who were teaching there anymore. This led to frustration on both sides: on the one hand, teachers who had been closely involved with the development of the room and had adapted their teaching methods accordingly were disappointed to find the room often

unavailable. On the other hand, teachers who were scheduled there unexpectedly entered the room unprepared, without having adjusted their lesson plans to suit the space. For them, it didn't align with their didactic needs, and therefore, it wasn't a successful experience. (D1, 2025; D2, 2025)

For this reason, scheduling responsibilities were eventually returned to the Future Learning Spaces team, even though the original goal was to integrate the room more broadly. This challenge highlights an important lesson: placing teachers in an innovative space without prior experience or a sense of ownership often results in misuse or underuse. To address this, the FLS now offers instructions and training sessions to help teachers effectively use the space (D2, 2025).

Nevertheless, fully integrating such spaces into the broader university remains a work in progress. These insights show that user involvement—especially prior experience with the space or having contributed to its development—makes a significant difference in how successfully the room is used

4.4.4 Evaluation of the LE by end-users

At Utrecht University, the survey was not conducted in the same way as at the other universities involved in this study. Utrecht University has already carried out extensive research into the effectiveness of its learning environments as part of the "Future Learning Spaces" project. One of these studies called '"*Knowledge Development and Teacher Professionalisation in Future Learning Spaces: An Evaluation Study in Co-Creation with Educators*" (Utrecht University, 2022) included an evaluation report of a specific space, in which both students and teachers were surveyed about their experiences. The questionnaire used in that study served as the basis for developing the survey used in the current research.

Because Utrecht University had already collected detailed information about end-user experiences in this particular space, the survey was not repeated in the HALC. Instead, what follows in this chapter is a summary of the published findings from the evaluation report made by Utrecht University (2022). All statements, conclusions, and data presented in this section are therefore derived directly from that report.

The data collection at Utrecht University took place in April 2022. Although the exact number of responses is unknown, the data reflects input from both students and teachers.

Learning Settings

In the HALC, students were present both physically and online, while the teacher was always physically present. The lessons in the HALC were primarily focused on group work. This partially hybrid setup worked well: both students and teachers indicated that especially hybrid group assignments were well supported in this space. This was facilitated by the group tables, group screens, and the large central screen in the HALC. As one student put it: *"It's great to work in groups like this, and if needed you can just use your webcam to connect with students who aren't there."*

During group work, a variety of learning activities were carried out, including answering questions about a video, role plays, and preparing presentations. The physical layout of the room did not

seem to hinder the learning process. Teachers alternated between group work and plenary instruction or discussion. The room layout could be partially modified: the tables are on wheels, and the chairs are mobile as well. However, in most observed lessons, the tables remained at their designated screens and were not moved. In one lesson, students were asked to move their chairs into a circle in the middle of the room

As part of the evaluation of the learning space, students and teachers were asked to indicate which types of teaching activities took place during the observed session. They could select multiple options. In order from most to least frequently mentioned, students and teachers reported the following six teaching activities:

1. Assignment in groups
2. Discussion in groups
3. Discussion with the whole class
4. Presentation
5. Individual assignment
6. Lecture

All teachers, except one, were experienced in teaching in these types of learning spaces. They were familiar with the layout and the available facilities. In contrast, the majority of the participating students had not previously taken classes in this or a similar learning environment prior to this course.

As part of the evaluation study, the participating teachers were asked to design a lesson plan tailored to the specific characteristics of the learning space. All teachers delivered lessons that aligned with the principles of blended and active learning.

Use of Facilities

In the evaluation both students and teachers were asked about their use of the various tools available in the classroom. A distinction was made between digital tools—such as display screens—and analogue tools—such as chalkboards and whiteboards. Responses were also categorized based on user type: whether the tools were used by the teacher or by students.

Teachers themselves made relatively limited use of the analogue tools. Although they encouraged students to use these resources, teachers generally preferred to deliver their presentations via the digital boards—particularly to ensure accessibility for students attending remotely. Nevertheless, teachers aimed to make optimal use of the digital tools. However, technical issues were reported in nearly every lesson. For instance, in the HALC, a video failed to play during a plenary instruction, and technical difficulties sometimes occurred when students attempted to use the hybrid functionality. In one particular session, two group tables had no sound at the start of the lesson, which required assistance from two AV support staff and took approximately 45 minutes to resolve. These examples illustrate that, despite the intention to use digital tools effectively, technical malfunctions occasionally hindered their full potential.

Whether students made use of the available tools and facilities was influenced by several factors, including group composition (e.g., the presence of online students), the nature of the assignment, and students' awareness of how certain tools and media could enhance the group process.

Digital tools, in particular, were widely used and positively received by students. They expressed enthusiasm about the variety and functionality of the digital resources, especially the group displays. One student remarked: *"It's a pleasant, bright space and the screens are a great addition."*. Another commented: *"It's really useful to have your own screen to share findings with your group or with other groups."*

In contrast, student use of analogue tools was more varied. A correlation was found between the extent to which whiteboards were used and the explicit encouragement of teachers. Using whiteboards was not always an intuitive part of the group work process. In one observed session, only those groups that were specifically prompted by the teacher to use the whiteboards did so. Other groups, which received no such encouragement, did not use them

Engagement & Dynamics

The evaluation report from Utrecht University on the HALC offers limited insights into the students' intrinsic motivation prior to entering the class. However, the report does provide observations on student engagement during the sessions—particularly regarding interaction among students and with the learning content.

Students reported that they learned from and supported each other during class activities, especially within their own groups. Peer collaboration was clearly present in the small group settings. There was, however, noticeably less interaction between different groups.

One challenge noted was that when a large number of students were physically present in the room, the working methods sometimes became more analogue. This shift occasionally hindered participation for online students, whose engagement reportedly declined as a result.

In terms of interaction with the learning content, students accessed assignments and course materials through a combination of a digital learning environment and printed resources available in the space. Group screens were used at the start of sessions to display key documents for collective reading and discussion. As group work progressed, students typically continued on their personal laptops. When content was available online, groups were able to collaborate in real-time through their own devices. As one student shared: *"It makes the class really interactive and helps me stay focused."*

Evaluation of the classroom layout

As noted earlier under *Engagement and Dynamics*, the HALC was praised for its positive impact on both engagement and interaction. A significant contributor to this was the physical layout of the space, which played a crucial role in facilitating these dynamics.

The layout of the classroom clearly enhanced interaction. Not only among students, but also between students and the teacher, as well as with the learning content. In the HALC, students were seated (or standing) at group tables arranged around a centrally positioned teacher. This setup reduced physical distance and enabled fluid, natural communication. Teachers could move easily between tables to monitor group work, initiate discussions, ask questions, and provide immediate feedback. From the students' perspective, the teacher's central location made them highly approachable, lowering barriers to engagement.

Interaction among students within groups was equally effortless. Thanks to the group-based arrangement, peer collaboration happened organically. Notably, online students were fully integrated into the physical groups—they were virtually "at the table," with dedicated screens, cameras, and microphones for each group. This allowed for clear visual and audio contact, ensuring meaningful interaction regardless of physical presence. The spacious room layout also supported easy movement between tables, contributing to a relaxed, inclusive, and collaborative atmosphere. As one student put it: *"I like that it's more of a circle, instead of teacher versus students."*

Overall, the HALC was consistently described as a highly comfortable and effective learning environment—one that supported active participation and fostered a rich learning experience. One student even reflected: *"It's the best workgroup space I've ever used. All group rooms should be like this."*

Perceived Strengths and Weaknesses

As part of the evaluation study of the HALC, the strengths and weaknesses of the space were also assessed.

In response to the question about which aspects of the learning environment they were most enthusiastic about, the most frequently mentioned strength was the positioning of students at round group tables. This layout was perceived as conducive to stimulating discussion and collaboration within groups. As one teacher confirmed: *"If you want interaction within groups, this is the setting to go for."*

Participants were also enthusiastic about the large digital screens placed at each group table. According to both students and teachers, working on a large shared screen supported collaboration during group assignments. One student noted: *"It's great to have your own screen to share findings with your own or other groups."* Moreover, the screens made it possible for students to follow the lesson online. This was seen as a positive feature, especially for students who would otherwise not have been able to attend. Teachers specifically appreciated the ability to share screens across the classroom.

A third aspect that was positively highlighted was the central position of the teacher, combined with the spacious layout of the classroom. This arrangement allowed the teacher to have a clear view of the entire class and be physically present in the middle of the learning space. It also gave teachers the freedom to walk around the room, check in with different groups, and provide support when needed. One teacher commented: *"Better interaction, better sense of what your students are working on."*

When asked what could be improved in the space, several suggestions were made by both students and teachers. One of the most frequently mentioned suggestions was to replace the chairs. Multiple students reported the chairs to be uncomfortable, non-adjustable, or even broken.

Another suggestion concerned the availability of analogue and digital tools. Both students and teachers indicated that the classroom could benefit from additional whiteboards and more digital screens to better support collaboration and group work.

Technology and its use by teachers also emerged as a point for improvement. Several students noted that the microphones and audio system could be improved. One student explained: "*The speakers can't be turned off. If no device is connected, they make a buzzing noise.*" Teachers echoed these concerns and added suggestions such as a larger teacher desk, HDMI-to-USB converters, and room dividers. One technical issue mentioned was that students attending remotely could hear their own voices echoing when the system was in central mode

Some students also proposed changes to the room capacity. They expressed a preference for smaller rooms with fewer students to enhance comfort and concentration.

4.4.5 Alignment between end-users perspective and stakeholder input

To assess how the stakeholder involvement process can be optimised, it is first necessary to examine the current relationship between stakeholder input and how the space is perceived and experienced by end-users. This makes it possible to trace which positive and negative experiences can be linked to specific stakeholder contributions. In Table 19, all perspectives and opinions shared by students regarding the learning environments are presented.

The first point where end-user perceptions are clearly visible is the group seating arrangement. Students are enthusiastic about this, as it stimulates discussion and teamwork. This can be directly traced back to stakeholder input. The project team implemented blended learning principles known from the United States and Australia, which were tested through mock-ups in the teaching lab. Students participated in these tests and provided input on the table configurations, resulting in the current setup, which is well-received. There is clear alignment here.

The same applies to the presence of digital tools and their integration into the tables. These elements also originated from the mock-ups and feedback sessions and are perceived as effective by students.

Likewise, the central positioning of the teacher within the space was tested, feedback was collected, and it was then implemented accordingly. This also demonstrates alignment between stakeholder input and user perception.

However, there is some criticism regarding the availability of these tools. While their use is experienced very positively, some students mentioned that there could be more available in each classroom. Stakeholders initially planned for one whiteboard and one digital screen per group. Thus, there is only partial alignment — the available tools are appreciated, but the quantity is seen as insufficient.

Another aspect where partial agreement exists is the furniture. Flexible chairs and tables were introduced, which users find convenient in principle — this was also based on mock-up evaluations. However, the quality of the chairs appears to be lacking: many are broken, uncomfortable, or no longer adjustable. This negatively affects the experience, resulting in only partial alignment.

Additionally, several students noted that the rooms are too large to allow proper focus and that there are too many people present. They would have preferred a smaller room. The choice of room was based on the existing wall that supported the central positioning of the teacher, prioritising this element over other spatial considerations. This led to misalignment.

Finally, one recurring issue reported by students is the disruption caused when digital tools stop working. Although overall enthusiasm for the tools is high, technical failures can significantly hinder the lesson. This scenario was not sufficiently anticipated in the stakeholder process and was not raised as a consideration in early planning. Still, it is a relevant lesson learned.

Table 19 Alignment between end-users perspective and stakeholder input at the HALC

Theme	Relation to BLE Characteristic	End-User Evaluation	Related Spatial Design Element	Related Stakeholder Input	Alignment?	Conclusion
		SQ 3 /Chapter 4.4.4		SQ2 / Chapter 4.4.3	SQ 4 / Chapter 4.4.5	
General						
Group Work & Collaboration	Seating in groups	Very positive – round group tables stimulate discussion and teamwork	Round tables; spacious layout	Project team tested setups via mock-ups and student feedback; international best practices and theory were included	Yes	Design strongly supports collaboration; key strength of the space
Digital Tools at Group Tables	Digital Tools	Positive – large digital screens aid group work and allow online participation	Screens per group table	Mock-ups with digital tools were tested in the Teaching Lab with students and teachers; their input informed the final design	Yes	Well-received and enhances blended learning
Teacher Positioning	Teacher Central Place in the Room	Positive – central position increases interaction, overview, and ability to support groups	Central teacher location; open layout	The initiating teacher had a clear vision of an active learning environment without a fixed front, inspired in part by blended learning principles from the United States and Australia. This concept was first tested in a teaching lab and was eventually implemented in practice.	Yes	Input from the stakeholders resulted in good perception among end-users.
Availability of Tools	Digital Tools & Analogue Tools	Mixed – request for more whiteboards and screens	Current number of tools insufficient	Stakeholders assumed that one analogue whiteboard and one digital screen per table would be sufficient to support collaboration	Partly	The presence of tools is appreciated, but needs to be expanded to fully support flexible, active learning.
Chairs & Seating	Flexible Furniture	Flexibility of the chairs is appreciated, but many are uncomfortable, non-adjustable, or even broken	Chairs	Stakeholders emphasized the need for flexible furniture to align with high-standing desks, based on international best practices. No early input regarding ergonomics or comfort; chairs were selected without direct testing by students or teachers.	Partly	The flexibility of the chairs aligns with the end users' needs, but improvements are needed to enhance comfort and support learning more effectively.
Room Capacity	Formal Classroom	They expressed a preference for smaller rooms with fewer students to enhance comfort and concentration.	Classroom size	In the making of the HALC, they were bound to a predetermined space that was chosen due to the circular walls, which supported the non-central positioning. Therefore, there was no input on the size of the space.	No	Space division or smaller rooms could enhance learning experience

Conclusion

The findings indicate that there is a high degree of alignment between stakeholder input and end-user perceptions when stakeholder decisions were directly informed by end-user feedback, particularly during the mock-up phase. This is evident in the positive reception of group seating, digital tools, and the central teacher position — all of which were tested with students beforehand and adjusted accordingly. However, partial alignment arises in areas where implementation fell short of user expectations, such as the quantity and quality of furniture and available tools. In cases where design decisions were based on spatial constraints rather than stakeholder dialogue — like the choice of room size — misalignment is observed. Lastly, certain operational issues, such as tool malfunctions, reveal a gap in anticipatory stakeholder planning. Overall, alignment is strongest when end-users are actively involved in design decisions, and weakest where spatial or technical limitations were overlooked.

4.5 Cross-case analysis

This section assesses the differences and similarities between the four case studies. First, the context of each case is compared. Then, an overview of the case study results is presented and analysed based on the four sub-questions.

4.5.1 Context of the learning Environments

Looking at the context of the four learning environments, several differences and similarities can be observed. First of all, there is a key distinction between whether the learning environment is developed in a new building or within an existing one. In Case A – TU Delft and Case B – Tilburg University, the learning environments are part of new construction projects, meaning they were integrated into the design from the start. In contrast, in Case C – Radboud University and Case D – Utrecht University, the learning environments were implemented within already existing buildings. This often results in more spatial limitations, as the design must adapt to the existing framework rather than being tailored entirely to the principles of the learning environment.

Additionally, Cases A and B are part of larger construction plans, which go hand in hand with more hierarchical governance models. These larger projects are typically governed top-down, with priorities focused on the broader development, making the learning environment just one of many components. In contrast, the smaller projects follow a more bottom-up model, where the initiative often originates from end-users and the primary goal is the creation of one specific learning environment. This results in a more user-driven approach and a stronger alignment between the design and the actual needs of the users.

Table 20 Cross-case analysis Learning Environments

	Location	Building Year	LE realized in Existing building of new building	Part of a broader construction project?
Case A: TU Delft	Delft	2022	New building	Yes
Case B: Tilburg	Tilburg	2018	New Building	Yes
Case C: Radboud	Nijmegen	2022	Existing Building	No
Case D: Utrecht	Utrecht	2022	Existing Building	No

4.5.2 Stakeholder Involvement Process

Stakeholders Involved

In all four cases, various stakeholders were involved in the creation of the learning environments. Figure 47 visualizes the types of stakeholders engaged in these processes. It should be noted that not every role was necessarily filled by a separate individual; in some cases, multiple roles were fulfilled by a single department or person. This was primarily due to the internal division of departments and tasks within the universities themselves, rather than the scale of the project or the number of people involved. The respective case chapters provide further clarification on how these roles were assigned in each context.

More specifically, in all cases, the Campus & Facilities department, AV specialists, and teachers were involved. In many cases, ICT and Facility Management were also part of the process.

Educational experts were involved to a lesser extent, only in Case A and Case C. The reason given in the other cases is that teachers can also act as educational experts, and teachers were involved in all cases.

Students were involved in all cases except Case C. Case D was the only case where an internal interior architect was involved, as Utrecht has this expertise in-house. In contrast, Cases A and B engaged external designers. Additionally, Cases A and B had a more extensive external stakeholder team, whereas Cases C and D only involved suppliers. This difference can be directly attributed to the fact that Cases C and D were implemented in existing buildings. As a result, these projects mainly required integration and delivery rather than full-scale design and construction.

Regarding stakeholder group structures, all cases established an internal project team. In addition, an advisory group was formed in Cases A and B, and Case A also included a working group. Cases C and D had only an internal project team.

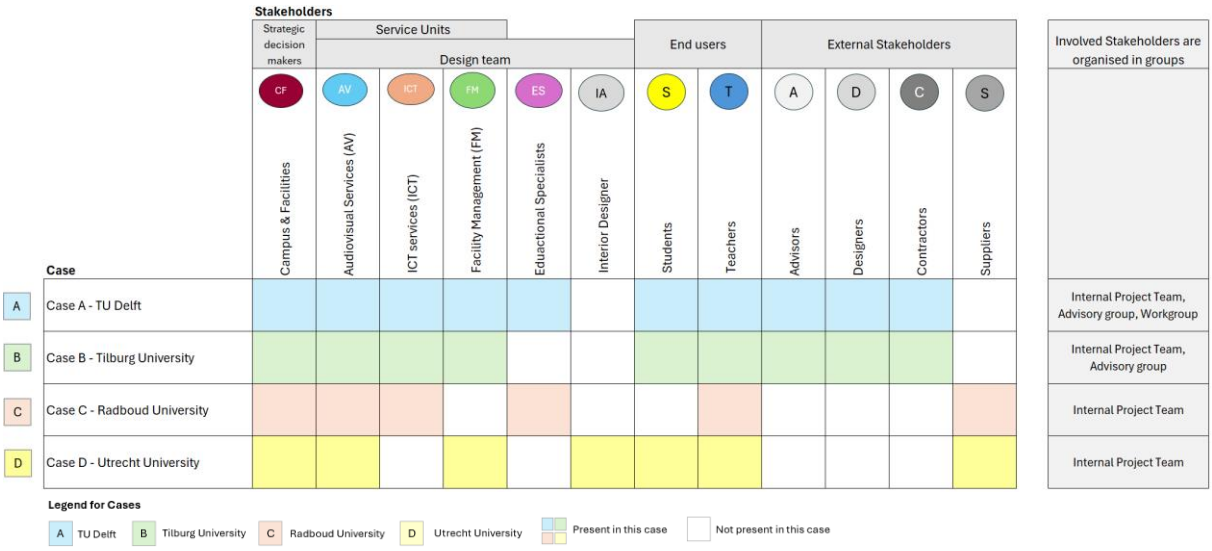


Figure 46 Cross-case analysis stakeholders involved

Stakeholders Connections

In all four cases, an internal project team was appointed, consistently including representatives from Campus Facilities and AV. However, the composition of these teams varied, with roles such as ICT staff, Facility Management, educational specialists, teachers, and an interior architect involved depending on the case. Only Case A formed an additional workgroup alongside the internal team, enabling active co-design with stakeholders based on their expertise and truly steering the process through stakeholder involvement. The other three cases relied on user groups to provide feedback on design ideas, ranging from formal advisory groups to informal student testing sessions, focusing more on stakeholder engagement rather than direct involvement.

Collaboration with external stakeholders was present in every case, but its scope and nature differed. New construction projects (Cases A and B) involved broader collaboration with designers, advisors, and contractors, while renovation projects (Cases C and D) focused

primarily on suppliers. This difference is explained by the scope of the assignment: new construction projects involve many more aspects and therefore require the involvement of more actors. In contrast, the projects in existing buildings did not require new construction and mainly involved the delivery of new materials or equipment.

These variations in stakeholder involvement are largely explained by the project type and the initiative's origin: new construction projects were top-down initiatives led by campus departments, characterized by a more structured and intensive involvement process. The cases in existing buildings were initiated bottom-up by educational staff seeking suitable spaces, following a more informal and limited engagement approach. Consequently, Case A exemplifies the most comprehensive and active stakeholder involvement, emphasizing co-design and multi-perspective feedback.

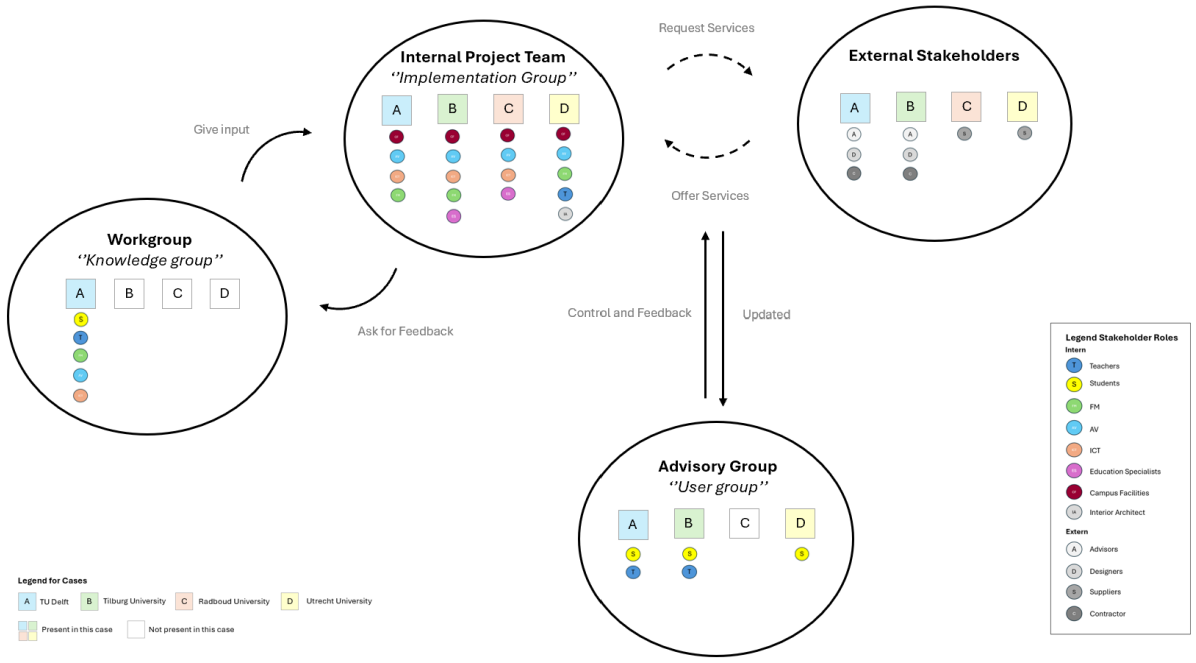


Figure 47 Cross-case analysis stakeholder connections

Timing of stakeholder Involvement

In all four cases, there was an internal project team that remained actively involved throughout the entire process — from the initial idea to the final delivery.

Only in Case A were dedicated working groups established, consisting of both experts and end-users who actively contributed to the design process. These groups were set up during the initiation phase and provided valuable input for the development of the Program of Requirements. Their involvement continued throughout the design phase, making them actively engaged up to the final design stage.

Advisory groups were involved in three of the cases, but the timing of their involvement varied significantly. In Case C, the group was informal, and user input was gathered at three distinct moments throughout the process. These moments primarily focused on collecting feedback,

rather than involving the group continuously. Therefore, on the timeline, their contribution is represented by three short, specific periods, rather than a sustained presence.

The two cases with a formal advisory group—Case A and Case B—differed notably in terms of timing. This difference can partly be explained by the type of construction contract used. In Case B, a Design & Build (D&B) contract was applied. This meant that after the tender phase and the definition of the Program of Requirements, the university handed over much of the process to external parties. As a result, there was little to no opportunity for further input from the advisory group beyond that point. In contrast, Case A did not use this type of contract. The university remained an active player throughout the entire process, enabling continuous input and engagement from the advisory group at each design stage.

Regarding external stakeholders, it is evident that in Cases A and B, external partners became involved from the Program of Requirements stage and remained engaged until the delivery phase. In Case C, the external supplier was involved as an active stakeholder from the initiative phase and even participated in the internal project team. In Case D, external involvement was limited to suppliers who delivered equipment after the final design had been completed. As such, they only became involved at a very late stage of the project.

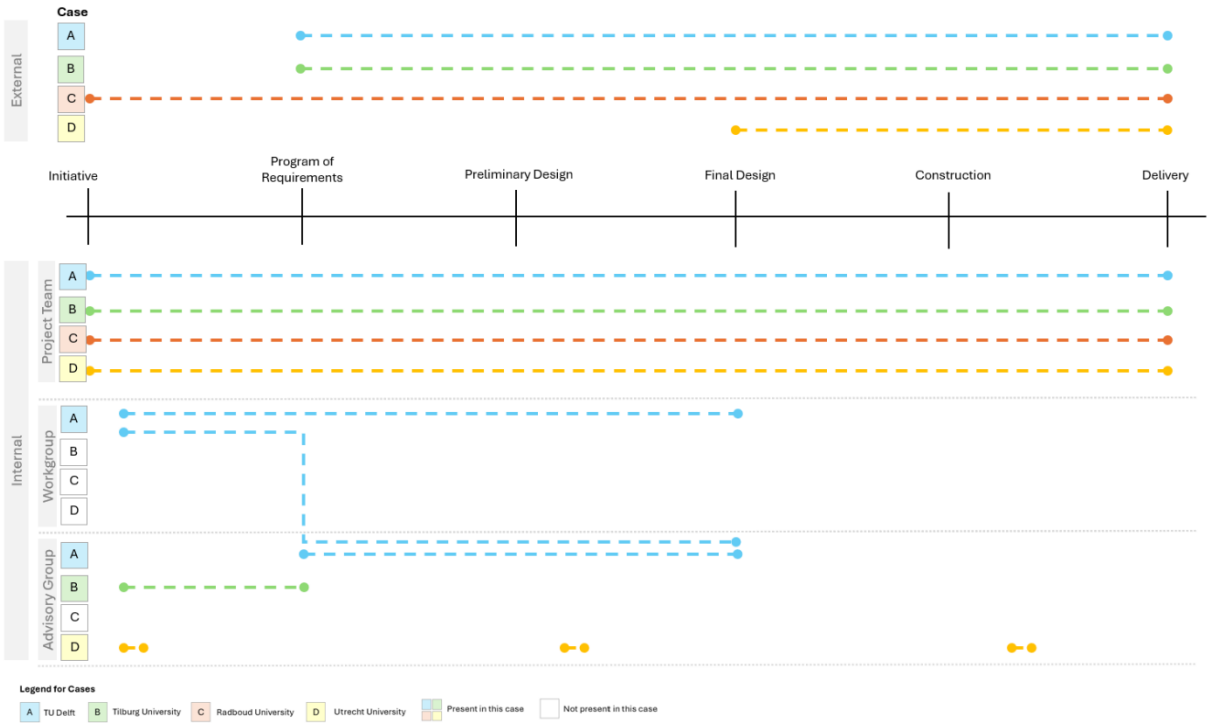


Figure 48 Cross-case analysis timing of stakeholder involvement

Evaluation on the Stakeholder Involvement Process

Case A stands out as the only case where stakeholders unanimously expressed complete satisfaction with the process. This success is attributed to the combination of chain-thinking, early involvement of all relevant experts, and collaboration with individuals who had a strong affinity for education. This case illustrates that when stakeholders are engaged from the start and bring both domain-specific and pedagogical expertise to the table, the result is a highly aligned and satisfying process. Similarly, in Case B, stakeholders were largely positive about the

structure and approach of the process. However, the main limitation noted was the lack of user (student and teacher) input, which they believed would have made the final outcomes more relevant and grounded in lived experience. This suggests that even when procedural steps are well-executed, meaningful user engagement remains essential for optimizing design outcomes.

In Case C, stakeholder opinions were more divided. Some felt the process was effective, while others critiqued the insufficient inclusion of student perspectives. This lack of alignment indicates that not all stakeholders value or perceive user participation equally, or that mechanisms for incorporating user input were either missing or ineffective. The absence of student voices was specifically cited as a missed opportunity, underlining the growing recognition of students as key stakeholders in the design of educational spaces.

Case D presents a different scenario: stakeholders described the process as positive, but they indicated that they would not follow the same approach today. The design trajectory was characterized by a spontaneous and organic origin, without structured stakeholder planning. While not dissatisfied given the context, stakeholders noted that they would not approach a project in this way again. The process has since triggered internal learning and professionalization, demonstrating how early-stage projects can serve as important learning experiences that inform future, more strategic approaches.

Across the four cases, a clear pattern emerges: according to stakeholders, the success of a stakeholder involvement process is closely linked to early involvement, structured collaboration, and the inclusion of user perspectives. Cases A and B demonstrate the strengths of a top-down planning approach supported by technical expertise; however, their limitations reveal the necessity of incorporating bottom-up input to ensure relevance and user alignment. In contrast, Cases C and D, which followed a more informal or spontaneous path, highlight the risks associated with under-structuring participation. At the same time, these cases demonstrate that this spontaneous and informal approach can provide valuable learning opportunities about different stakeholder involvement strategies, based on which universities can develop more structured approaches in the future, grounded in the knowledge gained from these informal and spontaneous processes.

4.5.3 Stakeholder Input

Types of input provided by stakeholders

In all four cases, stakeholder involvement played a role in the creation of the learning environments. Stakeholders provided input in every case, and this input can be divided into two main types. First, in all four cases, stakeholders gave input on the learning environment as a product—specifically regarding how the space should look and function. This included feedback on layout choices and design preferences.

Second, only in Case C did stakeholders also contribute input on how to structure the stakeholder process itself during the creation of learning environments. Based on these insights and lessons learned, a structured approach was developed. This structure subsequently informed the organization of both the team and the project process, after

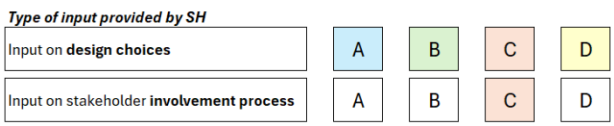


Figure 49 Cross-case analysis type of input provided by SH

which they were set up accordingly. Based on this setup, the process started in which input was collected regarding the product.

Methods/tools for integrating input

In all four cases, input meetings were organized. were formal gatherings where stakeholders came together to engage in discussions and make decisions.

In Cases A and B, these were complemented by workshop meetings. These workshops went beyond standard meetings, often combining discussions with interactive sessions focused on design choices. They aimed to stimulate creativity and encourage brainstorming to generate richer input.

Additionally, trial rooms or mock-ups were used in Cases A, B, and D. These were test spaces set up to allow users to experience and evaluate a proposed design before full-scale implementation, helping the team to understand what worked well and what didn't from a user perspective.

In Case B, smart observations were employed to gather input. This involved targeted observations of space usage, such as tying knots in overhead projector cords to see which ones had been untied—indicating actual usage and providing insights into relevance and necessity.

In Case C, stakeholders also visited a similar learning environment that had already been realized. The goal was to gather best practices and lessons learned from an existing implementation to inform the current design process.

Finally, Case C also utilized online platforms to share updates and request input. These platforms enabled stakeholders to easily leave feedback and suggestions, creating a low-barrier way to stay involved in the process.

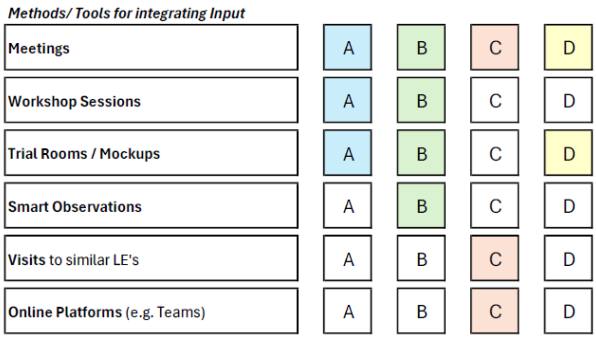


Figure 50 Cross-case analysis Methods/tools for integrating input

When comparing this to the setup and level of structure in the processes, it becomes clear that Cases A and B — which followed a more top-down and structured process — emphasized active involvement through multiple structured and interactive methods. In contrast, Cases C and D — which were more unstructured and followed a bottom-up approach — focused more on engagement through informal and flexible means, reflecting both the scope of the project and the origin of the initiative.

Decision-making and prioritization

In all cases, discussions were held where stakeholders represented their expertise and perspectives. These dialogues often led to compromises, but in situations where consensus could not be reached, the ultimate decision-making authority varied per university.

In Cases B and D, the final decisions were made by the internal project team. While they actively listened to all stakeholder input, they held the decisive power in determining the outcome of key decisions.

In Case A, the situation differed. Here, the end-users were decisive. The project team deliberately designed with and for the user, putting the user experience at the centre of decision-making. This made the experiences and preferences of end-users the most influential factor in the final outcomes.

In Case C, technology was the decisive factor. This is primarily because the most defining feature of this learning environment was its technological systems. As such, the functionality and feasibility of these systems took precedence over other design considerations. Whether a design element could be implemented was ultimately dependent on its compatibility with the technical infrastructure.

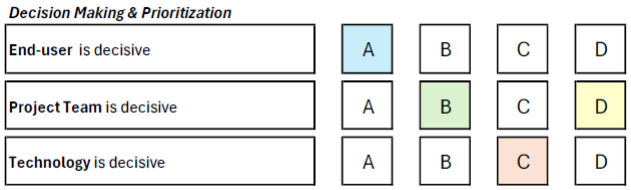


Figure 51 Cross-case analysis Decision Making & Prioritization

Influence on the design outcome

In Cases A and B, stakeholder input played a key role in determining the shape and size of the learning environments, as these spaces were newly built and designed based directly on their wishes. In Cases C and D, there was also input on size and shape, but this took the form of selecting among multiple options for existing spaces within the current portfolio where the learning environment could be placed. Stakeholders evaluated and preferred certain spaces based on characteristics such as layout or size. In all four cases, stakeholders also contributed to decisions about seating arrangements. Additionally, in Cases A, B, and D, stakeholders influenced the choice of furniture, particularly regarding whether it should be flexible and mobile (e.g., on wheels) or fixed. In Cases C and D, stakeholders also discussed the positioning of the teacher within the room, which influenced the overall spatial design.

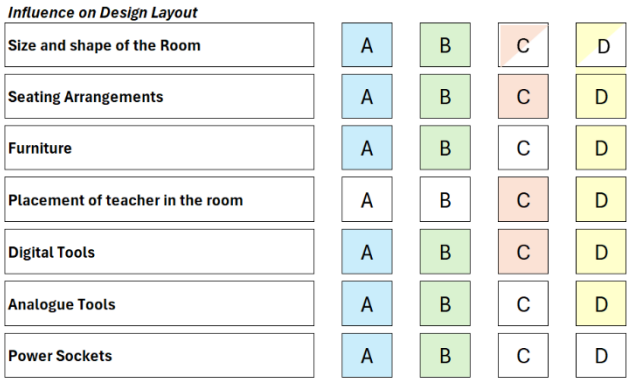


Figure 52 Cross-case analysis influence on design layout

Stakeholders were also involved in decisions about the types of technologies to be implemented, including their quantity and scale. In Cases A, B, and D, this input extended to the selection of analogue tools, determining both their presence and volume within the learning spaces. These decisions were often indirectly informed by advice from AV experts, particularly concerning sightlines. Discussions in case A and B also affected decisions about the power infrastructure. Debates around flexible furniture and visibility led to the decision to install floor boxes as the preferred power solution in both projects.

Evaluation of the Learning Environment by Stakeholders

Overall, the stakeholders involved expressed satisfaction with the final outcomes of the realized learning environments. In all four cases, stakeholders indicated they were pleased with the end result and the overall design of the space.

However, when it comes to how the spaces are actually used, the picture becomes more nuanced. In Case C, for example, stakeholders were highly satisfied with the physical environment and the technology that was implemented. Yet in practice, the space is rarely used. This is largely due to the fact that intended plans for further rollout and adoption by other faculties never materialized. As a result, stakeholders have become more critical of the overall success of the project. It raises an important question: *can a learning space truly be considered successful if it is not actively used?*

A similar, though less severe, situation occurred in Case D. Here, the goal was to integrate the space into the regular course schedule, but this approach proved unsuccessful. Nevertheless, the space continues to be used by a steady stream of lecturers who voluntarily choose to teach there. While the implementation did not go exactly as planned, the space is still actively used, which makes the outcome partially successful.

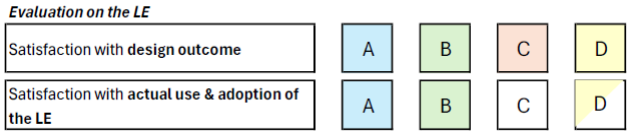


Figure 53 Cross-case analysis evaluation of the LE by SH

4.5.4 Evaluation of the LE by end-users

Learning Settings

In all cases, the teacher was physically present in the room during the lesson. In cases A and B, all students were also physically present, whereas in cases C and D, students attended both on-site and online.

A crucial factor in how positively and effectively a space is evaluated by end-users also appears to be not only whether the physical environment is well-designed, but whether it is used appropriately. This means that the teaching style and instructional methods should align with the space in order to be properly supported by it. The table below provides an overview of the lessons during which surveys were conducted and assesses this alignment.

It became clear that only in Case D the teaching methods fully matched the intended use of the space. This was the only instance where an active, blended teaching method was applied, with students at the center and flexible forms of working.

In Cases A and C, there was partial alignment. Although the dominant style in both cases was frontal teaching, this was occasionally alternated with small group work and collaborative activities.

In Case B, however, the teaching method did not align at all with the intended use of the space. The room was used solely for frontal teaching, without variation in instructional methods or formats.

Table 21 Cross-case analysis learning settings

	Case A: TU Delft	Case B: Tilburg University	Case C: Radboud University	Case D: Utrecht University
Room used as intended?	Partially	No	Partially	Yes

Use of Facilities

All learning spaces were equipped with both digital tools (e.g., LED screens) and analogue tools (e.g., whiteboards or chalkboards). Table 22 summarizes the extent to which these tools were used by both teachers and students.

In all cases, teachers made considerable use of the digital tools. In Case B, however, it was noted that while the tools were used, there was still room for improvement. The use of analogue tools varied more: in Cases A and B, teachers reportedly used these tools optimally. In contrast, in Cases C and D, analogue tools were rarely used by teachers. This is notable, as these latter cases featured more active, blended teaching styles with online student participation. Teachers in these cases explained their preference for digital tools, as they were more accessible to online participants.

Student use of tools followed a different pattern. In Cases A and C, students reported not using either digital or analogue tools themselves. In Case B, students indicated using both types, but also pointed out potential for improvement. The use of analogue tools, however, was more variable. These were adopted more frequently when teachers actively encouraged their use—suggesting that intrinsic motivation to engage with analogue tools was low, and that teacher prompting played a key role in their uptake.

	Teacher		Student	
	Digital	Analogue	Digital	Analogue
Case A: TU Delft	+	+	-	-
Case B: Tilburg University	+/-	+	+/-	+/-
Case C: Radboud University	+	-	-	-
Case D: Utrecht University	+	-	+	+/-

Table 22 Cross-case analysis use of facilities

Engagement & Dynamics

Across all cases, teachers played a crucial role in shaping engagement and collaboration. High intrinsic motivation among students was consistently observed in the survey results, meaning that variation in engagement levels was more closely tied to teaching style and activity design than to students' initial willingness to learn. In all cases, students reported a similar level of intrinsic motivation and indicated that they had learned from their teacher.

Where differentiation occurred, it was in the level of peer-to-peer interaction and how much students had learned from each other. This strongly correlated with the teaching methods used in the learning settings. Simply put, in spaces where more blended learning methods were used, such as in Case D, peer-to-peer interaction was much greater. Engagement with the learning content was generally high, and students indicated learning both from the teacher and from each other. They also it easier to stay engaged during the lesson.

In the spaces where more formal didactic teaching was applied, such as in Case A, B, and C, this was much less the case. In the spaces where more formal didactic teaching was applied, such as in Cases A, B, and C, this was much less the case. Peer learning was much more limited compared to what they learned from the teacher; students primarily indicated that they learned from the teacher rather than from each other.

Evaluation of the classroom layout

Although in Cases A and C it was indicated that there was limited knowledge exchange between students, students did report that the room layout enhanced the interaction they experienced with other students. In Cases A, C, and D, students tended to agree that the layout encouraged active participation and had a positive influence on the level of interaction — both among students, with the teacher, and with the learning content. Especially the group seating positions and U-shaped arrangements, in combination with rotatable and movable furniture, were seen as supportive of discussion and collaboration. Additionally, classroom layouts that allowed teachers to move easily through the space and adopt a central position were cited as contributing factors that enhanced interaction and engagement.

However, in Case B students reported difficulties due to poor sightlines to the teacher and screen, a result of groupings without flexible, movable furniture. As a consequence, half of the class sat with their backs turned toward the teacher, suggesting that seating orientation critically affects engagement. This had a negative influence on the experienced level of interaction and active participation in the classroom.

Across all cases, students emphasized that while a supportive layout can enhance engagement and interaction, the teacher's instructional quality and the students' own efforts remained crucial. Layouts that enabled flexible movement, clear visibility, and peer interaction were consistently associated with better learning experiences, but they were not sufficient on their own to guarantee high engagement without strong pedagogical design.

	Interaction between students and...		
	Learning Content	Other Students	Teacher
Case A: TU Delft	+	+	+
Case B: Tilburg University	-	-	-
Case C: Radboud University	+	+	+
Case D: Utrecht University	+	+	+

Table 23 Cross-case analysis influence classroom layout on levels of interaction

Perceived Strengths and Weaknesses

In the evaluations, various space-specific elements were mentioned that end-users either appreciated or disliked. Table 24 summarizes the key points raised per case, categorized according to the relevant characteristics of a blended learning environment.

Regarding the formal classroom, general comments were rather moderate. In Case A, for example, users were satisfied with the overall layout of the space. In the other three cases, however, end-users did not perceive the selected room as optimally effective and would have preferred either a smaller or larger space. Contributing factors mentioned include poor ventilation and large glass walls, which were perceived as negative.

In Cases C and D, the central positioning of the teacher was appreciated for enhancing interaction. These are also the only two cases where placing the teacher centrally was explicitly mentioned as a strength.

In terms of furniture, users in Cases A and D were particularly positive about the flexibility of the furniture. In Case B, this flexibility was lacking and identified as a weakness, since it negatively affected visibility and spatial dynamics. While users in Case D appreciated the flexible furniture,

they were not satisfied with the type of chairs selected and expressed a preference for more comfortable alternatives.

Group table arrangements were praised in three of the cases. In Cases A and D, students particularly valued being seated at group tables, which promoted collaboration and spontaneous discussion. In Case C, the U-shaped layout was also considered a strength, supporting both peer interaction and integration with online participants. In contrast, in Case B the group arrangement was seen as a weakness, as half of the class could not properly face the front of the room.

Regarding analogue learning tools, they were well received in Case D and considered pleasant to use. However, even in this case, users noted a weakness: the availability of only one per table was apparently insufficient. In Case A, whiteboards were hardly used because they were mounted too high—this was reported as a weakness by end-users.

Finally, digital tools were broadly evaluated positively. Both the tools themselves and the availability of power sockets were appreciated. Different aspects were praised per case: in Case B, the large screen size and visibility; in Case C, the effective use of digital tools; and in Case D, the presence of a screen at each table—although some users mentioned that even more screens would have been ideal.

Table 24 Cross-case analysis Perceived Strengths and Weaknesses

		Case A: **TU Delft**	Case B: **Tilburg University**	Case C: **Radboud University**	Case D: **Utrecht University**
Strenghts		Room spacious			
				Teacher central position in room	Teacher central position in room
		Flexible Furniture			Flexible Furniture
		Seating in groups		Seating Position	Seating in groups
					Whiteboards
			Size of digital screen	Digital Tools	Digital Screen per table
		Power Sockets	Power Sockets		
Weaknesses			Room to spacious	Room to small	Room to big
				Glass walls	
				No ventillation	
			No flexible furniture		Type of chairs
			Seating in groups		
		Height of the whiteboards			Not enough whiteboards
					Not enough digital sceens

The combination of all the perceived strengths and weaknesses led to an average final score for four of the cases. However, for Utrecht, this data is not available because surveys were not conducted here, and this question was not included in their evaluations. Based on the final scores, Case C scored the highest, followed by Case A, with Case B in third place.

End-User rating
(out of 10)

A	B	C	D
7.64	6.33	8.16	N/A

Table 25 Cross-case analysis End-user rating

4.5.5 Alignment between end-users perspective and stakeholder input

Table 26 presents an overview of the design topics for which both stakeholder input and end-user feedback were available. This enables an assessment of how well the design decisions made by stakeholders aligned with how these decisions were ultimately experienced by the end-users in terms of perceived effectiveness.

For each topic, the table indicates whether stakeholders were involved in making the decision. If they were, the corresponding cell is colored; if not, it remains grey. The color of the cell further reflects the degree of alignment between stakeholder expectations and end-user experiences.

Stakeholders consistently expressed satisfaction with the spatial designs they contributed to, implying that they expected their decisions to positively impact the effectiveness of the learning environments. Therefore, it is reasonable to assume that stakeholders anticipated all implemented features to support the intended goals.

The degree of alignment is visually represented through the following color code:

- **Green** indicates full alignment: end-users perceived the feature as effective, in line with stakeholder expectations.
- **Yellow** represents partial alignment: end-users had mixed experiences with the feature.
- **Red** signals no alignment: end-users did not experience the feature as effective, suggesting a disconnect between design intent and lived experience.

Table 26 Cross-case analysis Alignment between End-users Perspective and Stakeholder input

	Case A: **TU Delft**	Case B: **Tilburg University**	Case C: **Radboud University**	Case D: **Utrecht University**
Size and shape of Classroom	+	-	-	-
Place of teacher in the Room			+	+
Seating Arrangement	+/-	-	+/-	+
Furniture	+	-		+/-
Analogue Tools	-			+/-
Digital Tools			+	+/-
Power Sockets	+	+		

+ Alignment +/- Partially Alignment - No Alignment Not discussed by or end-users or no drect link to given stakeholder input

End-users in each case reflected on the size and shape of the classrooms, aspects which could be directly traced back to stakeholder input. However, only in Case A did this result in a spatial design that end-users considered effective. In the other three cases, the room was experienced as either too large or too small, which negatively impacted the perceived effectiveness of the space.

In Cases C and D, stakeholders also discussed the placement of the teacher within the space. In both cases, the teacher was positioned centrally to enhance interaction. This design choice was explicitly mentioned and positively evaluated by end-users, indicating strong alignment between stakeholder intentions and user experiences.

In all four cases, end-users provided feedback on seating arrangements—another topic on which stakeholders had provided input. Each case resulted in group-based seating arrangements. In Case D, stakeholders appreciated this setup because it supported collaboration. A similar view was expressed in Case A, although end-users noted that the effectiveness depended on the teaching method: when frontal instruction was used, the benefits of group seating diminished. In Case C, opinions were divided. While some users liked the setup, others noted that visibility of online classmates was limited. In Case B, the seating arrangement was experienced as largely negative, with half the class facing away from the teacher and a lack of flexible furniture exacerbating the issue.

Flexible furniture was a major topic of discussion in Cases A, B, and D due to its potential to improve collaboration and engagement. It was successfully implemented in Cases A and D, where it was positively received by students. In Case B, however, flexible furniture was not included due to a compromise related to power infrastructure. End-users criticized this outcome, as the fixed group seating combined with inflexible furniture forced students to sit with their backs to the teacher and made it difficult to turn or move.

Feedback on analogue tools was also present in Cases A and D. In Case A, whiteboards were rarely used—partly due to the teaching method, and partly because the boards were mounted too high on the wall. This was the result of a design decision by the architect, who wanted to integrate the boards seamlessly into the wall, thereby making the height unadjustable. In contrast, Case D's whiteboards were appreciated and frequently used, but students felt there were too few. Stakeholders had intended to provide one board per group, which shows partial alignment.

Regarding digital tools, explicit feedback was gathered in Cases C and D. In Case D, the story was similar to the analogue tools: the digital tools were well-received and heavily used, but students wished there were more—again pointing to partial alignment. In Case C, digital tools were praised for their seamless integration and effective use. This success was attributed to user-friendly systems and the involvement of teachers in the design process, including training and familiarization with the tools. This alignment was reflected in the overall perceived effectiveness..

Finally, power infrastructure and outlet placement were topics of stakeholder discussion in Cases A and B. In both cases, stakeholders advocated for power outlets at every table. This decision was also supported by end-users, who emphasized that it contributed to the functional effectiveness of the learning space—indicating clear alignment between stakeholder intentions and user experiences.

4.6 Findings on the Effectiveness of LE

The ultimate goal of this research is to understand how the stakeholder involvement process can be optimised in the creation of effective learning environments in university real estate. To do so, it is first necessary to assess how effective the investigated learning environments actually are.

The effectiveness of the learning environments in this research is assessed from three perspectives: the literature, end-users, and stakeholders (figure 55) . In the cross-case analysis (Chapter 4.5), the perceived effectiveness of the learning environments according to end-users and stakeholders was outlined.

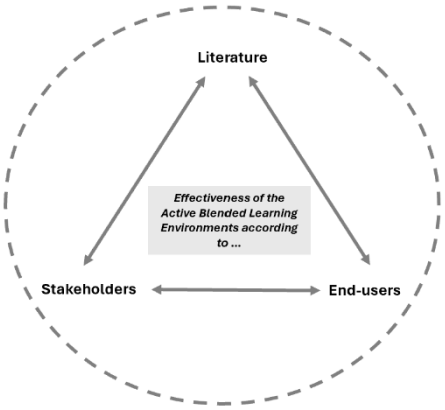


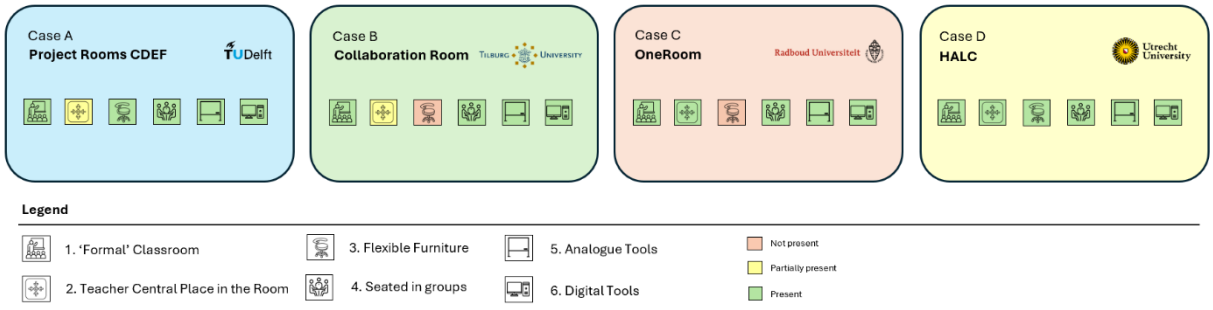
Figure 54 The effectiveness of LE is based on three perspectives: literature, end-users perceptions and stakeholder perceptions

According to the literature, an effective learning environment is defined by *connectedness*, which is achieved through *visibility*, *mobility*, and *learning resources*. These three elements are further translated into six key characteristics: 1.) a formal classroom, 2.) the teacher having a central place in the room, 3.) the presence of flexible furniture, 4.) students seated in groups, 5.) the presence of analogue tools and 6.)the presence of digital tools. The literature suggests that when all six characteristics are present, the environment successfully meets the criteria for visibility, mobility, and access to learning resources — and thus achieves connectedness and can be considered effective.

Figure 56shows to what extent each of the six key characteristics is present in the individual cases. Case D is the only case that fully meets all six characteristics. In Case A, nearly all characteristics are present, except for the one related to the teacher having a central position in the classroom. This characteristic is only partially fulfilled. While the classroom has a clearly defined front (which is not necessarily the intention of this characteristic), the spatial setup and movement space between the group tables still allow the teacher to position themselves centrally and move between tables to provide instruction. The same applies to Case B.

However, both Case B and Case C lack flexible furniture arrangements, which limits adaptability. Based on the literature, it can therefore be concluded that Case D is the most effective learning environment, and Case B the least effective, considering the number of key characteristics present.

Figure 55 Effectiveness based on Literature: Presence of key characteristics per case



In addition to evaluating effectiveness based on the literature, the perceived effectiveness of the learning environments was also assessed through the perspectives of end-users. The results of the surveys revealed two key insights.

First, users frequently referred to the presence — or absence — of the core aspects as part of their learning experience. For example, in Case D, respondents noted that group arrangements supported interaction, the teacher's central position encouraged more movement through the space (which led to more interaction), and that the presence of digital tools such as screens and whiteboards on the tables made it easier to share materials with classmates. On the other hand, the lack of flexible furniture in the same case was mentioned as a drawback, as it made it difficult for a large portion of the class to see the front screen properly. These findings suggest that, from the end-user perspective, the presence of the six key characteristics defined in the literature does indeed contribute to the perceived effectiveness of a learning environment.

Second, the surveys revealed an additional factor influencing perceived effectiveness that is not explicitly emphasised in the literature: how the space is actually used. In Cases B, C, and D, several participants mentioned that the spaces were being used (at least partially) in ways that differed from their intended design, which affected how effective they were perceived to be. In Case B, for instance, one respondent noted: *"This seating position is not ideal for certain activities such as lectures."* Similar feedback was heard in Cases A and C, such as: *"Change table position, directionally to teacher,"* and *"A setup where you face your table directly might work better for a lecture."* Survey data further revealed that in Cases A, B, and partially C, traditional frontal lectures were still being held, rather than the blended learning methods for which the spaces were designed. In contrast, Case D did implement blended learning methods as intended. This demonstrates that the way a learning environment is used can significantly impact how effective it is perceived to be.

These findings underline the twofold nature of learning environment effectiveness: On the one hand, effectiveness is determined by the spatial and functional design — specifically, the presence of the six key characteristics. On the other hand, the intended pedagogical use of the space must also align with how it is actually used. When this alignment is lacking, and alternative teaching methods are applied instead, the effectiveness of the space may even be compromised.

This is also reflected in the responses from stakeholders when asked about the effectiveness of the spaces. In all four cases, stakeholders expressed satisfaction with the design of the learning environments. In some cases, certain key elements were not implemented, but this was always the result of a conscious trade-off in favour of other elements deemed to offer more added value. However, when these trade-offs are compared with end-user experiences, it becomes evident that in all cases, the absence of specific key elements is mentioned as a point of improvement that could enhance the space's effectiveness. This suggests that stakeholders should, in future projects, aim to include all key elements rather than sacrificing some in favour of others.

Despite the overall satisfaction with the functional design, there are also mixed opinions among stakeholders when it comes to the actual use and adoption of the learning environments. In Cases C and D, a dedicated booking system was implemented to ensure that the rooms would be used intentionally and in alignment with the appropriate teaching methods. In practice, however, stakeholders noted that the number of booking requests remained low, and the spaces were often left unused or underutilised.

In contrast, Cases A and B were integrated into the standard scheduling system, meaning the rooms were assigned automatically without requiring a specific request from teachers. Although this meant the rooms were in frequent use, survey results indicated that they were often not used as intended — that is, not in line with the pedagogical principles for which they were designed. In these cases, the rooms were typically used for traditional teaching methods rather than blended learning.

This raises a critical issue: either the demand for these innovative learning spaces is insufficient, or the spaces are being misused simply because they are available, not because they meet a specific educational need. This mismatch in use can significantly impact the perceived effectiveness of the space.

Overall, based on the analysis of the four cases, it can be concluded that Case D provides the most effective learning environment. This is due to the presence of all key characteristics identified in the literature — which are known to support an effective learning environment — combined with the fact that the space is used in alignment with its intended purpose.

Case B, on the other hand, scores the lowest in terms of effectiveness. This is due, on the one hand, to the absence of several essential design elements, which hinder the intended use of the space and, in some cases, even result in negative experiences. On the other hand, the misalignment between the design and the actual use of the space further reduces its effectiveness. The inappropriate use of the space thus emerges as a key factor contributing to its poor performance.

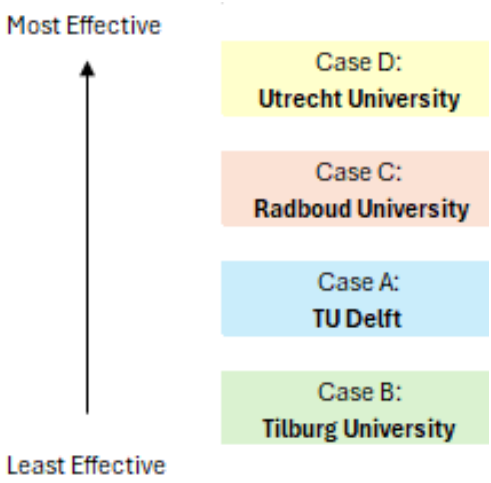


Figure 56 Ranking of the LE's based on effectiveness

4.7 Link with Stakeholder Involvement Process

When comparing the different cases in terms of their stakeholder involvement processes and the overall success of the resulting learning environments, clear correlations emerge between the quality and structure of stakeholder involvement and the perceived effectiveness of the spaces. These correlations point to opportunities for optimising the process in order to create more effective learning environments.

The literature broadly emphasizes the importance of involving end-users in the creation of effective learning environments. End-users are the only stakeholder group consistently identified across all reviewed studies as essential to achieving an optimal design process (Frelin & Grannäs, 2021; Könings et al., 2014; Pnevmatikos et al., 2020; Rudman et al., 2018; Victorino et al., 2022). Their involvement is crucial to ensure alignment between actual user needs and the design of appropriate and effective spaces.

However, the case studies show that end-users are often insufficiently involved in practice. While teachers are present in all cases, they often only take on a passive role — for instance, as members of an advisory board, as seen in Cases B and C. The involvement of students is even more limited: in Case C, students were not included at all, and in Cases B and D, their role was minimal and mostly passive. These forms of engagement reflect more of a token presence than true involvement. This is particularly problematic, as the evaluations of these environments indicated that reduced usability often stemmed from a disconnect between the design and how the spaces are actually used — a gap that could have been addressed through more active user participation.

To improve the stakeholder involvement process, greater emphasis must be placed on the end-user perspective. When comparing the proposed framework stakeholder involvement process described in the literature (figure 58) with the reasons behind the limited end-user involvement observed in practice, three key causes can be identified:

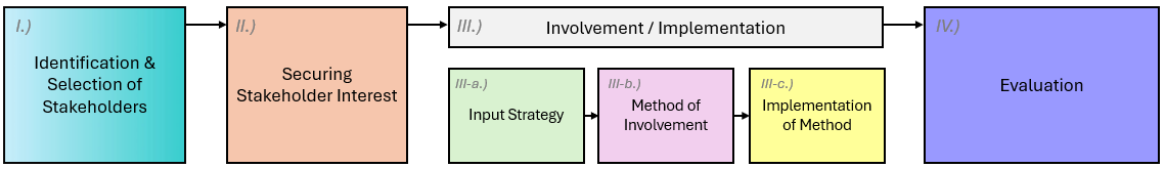


Figure 57 Proposed Framework for Stakeholder Involvement Process

A first cause lies in the first phase of the process, *Identification & Selection of Stakeholders*, where stakeholders are identified and selected. In Case C, for example, end-users were not involved at all. The project team admitted that they had not really considered including them and assumed that the educational department "would know what students need." Moreover, due to time pressure and funding constraints, this step was skipped altogether. This illustrates that although literature clearly emphasizes the value of involving end-users to create spaces that align with actual usage patterns, this knowledge is not always applied in practice. When end-users are not identified as relevant stakeholders at the start, they are simply not included in the rest of the process — even though their involvement could have significantly improved the usability of the final environment.

A second cause can be found in Phase II: Securing Stakeholder Interest. In Case B, for example, the interviewed stakeholders indicated that they wanted to involve end-usersin a more active way in the creation of the spaces but were unable to do so because they could not find end-users willing to participate. Although end-users were correctly identified as important stakeholders, the process failed at securing their interest. Teachers in particular were reported as a difficult group to engage — even more so than students. The main reasons given by these end-users for not participating were a lack of time, competing priorities, and a limited sense of urgency or importance.

Franklin (2020) explains that stakeholder motivation depends on a combination of push and pull factors. Universities have more influence over the pull factors — the external conditions that make stakeholders willing to participate. However, while these pull factors are well-known in theory, they are often underutilised in practice.

One interviewee pointed out that effective involvement requires more than simply sending out invitations. It is a skill that involves communication, empathy, and strategic planning. Well-managed involvement processes generate more valuable input. They suggested appointing a dedicated person to lead the stakeholder involvement process — someone enthusiastic and skilled in engagement. This person could actively promote the value of participation, communicate its importance clearly, and organise the process in ways that reduce barriers to entry. For example, meetings could be held at times and locations that fit into stakeholders' existing schedules, such as during lunch breaks at the faculty, and include incentives like lunch or other amenities. Appointing such a stakeholder manager could be a enhance the pull factors and significantly increase the willingness of stakeholders to engage, thereby improving the success of Phase II and the entire stakeholder involvement process.

A third cause can be identified in Phase III-a: Input Strategy. In Cases B and D, end-users were included, but only in a passive role — for example, as members of an advisory board. In these settings, they were given the opportunity to provide feedback on already developed plans, but they were not actively involved in the design process itself. They were not part of internal project teams or dedicated working groups where they could have contributed more substantially. This reflects a form of stakeholder engagement rather than genuine stakeholder involvement.

However, the literature states that for the creation of truly effective learning environments, it is crucial to involve end-users in a more active and co-creative capacity — not simply to inform or consult them, but to include them directly in shaping the spaces. Their insights ensure that design decisions align with actual user needs, resulting in environments that are functional, effective, and conducive to learning (Borri, 2021; Pnevmatikos et al., 2020; Rudman et al., 2018).

Phase III-a is the moment in the stakeholder process where decisions are made about the form and degree of involvement for each stakeholder group, including their responsibilities and decision-making power. However, end-users are often assigned a passive role at this stage, despite the evidence that earlier and more active participation leads to better alignment with actual user needs. It is therefore crucial to reconsider how end-users are positioned in this phase, and to actively explore whether more collaborative involvement would benefit the project.

A positive example of this can be found in Case A. In this case, end-users were included from the beginning in active design sessions and working groups. The alignment analysis showed that the elements for which end-users had given input were later evaluated in the user surveys as particularly pleasant and effective. This reinforces the argument that active involvement of end-

users leads to learning environments that are better received and more suited to actual usage patterns.

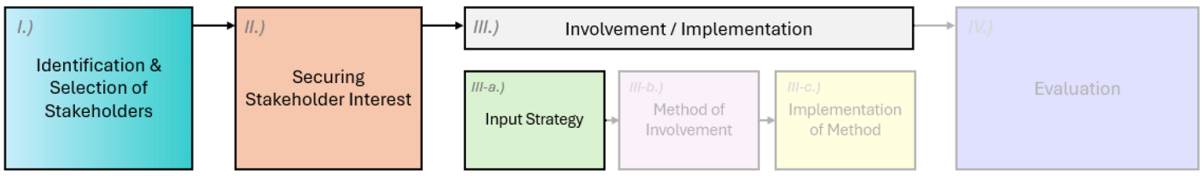


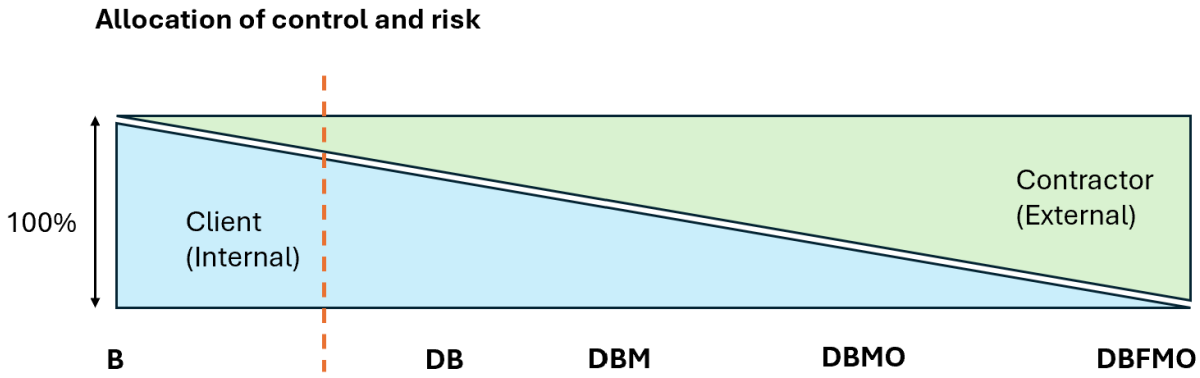
Figure 58 Critical Phases Limiting End-User Involvement: Points for Improvement and Optimisation

While the previously mentioned causes relate to the structure and execution of the involvement process itself, another important factor influencing the effectiveness of learning environments is the duration and timing of stakeholder involvement. Pnevmatikos et al. (2020) argue that the most successful outcomes occur when stakeholders — particularly end-users — are involved throughout all phases of a project. Continuous involvement allows them to contribute meaningfully at different stages and ensures that the evolving design remains aligned with their needs. Although this principle is widely acknowledged in theory, its practical implementation is often constrained by project-specific conditions — especially the type of contract chosen. Certain contract types limit flexibility and early input opportunities, making it harder to sustain meaningful involvement throughout the entire process.

Case B — which scored the lowest in terms of effectiveness — illustrates this issue clearly. In this case, stakeholders were only involved up to the program of requirements phase. After that, the project was procured under a design-and-build contract, which transferred responsibility to external parties. Although such contracts can offer certain technical and procedural benefits, they present a major limitation from a stakeholder perspective: once the contract is awarded, internal stakeholders are no longer able to provide input or request design modifications. This is particularly problematic for long-term projects, where early decisions are effectively set in stone and cannot be adapted as new insights emerge.

In contrast, Case A followed a more traditional contract structure, which allowed for stakeholder engagement across all project stages. This continuous involvement facilitated iterative feedback, enabling adjustments to be made during the entire design phase—contributing to the perceived success of the space. In Cases C and D, there was no formal tendering process, as the projects involved internal redesigns of existing spaces. As a result, only a limited number of external suppliers were involved, and the projects were not formally outsourced. This meant internal control remained intact and stakeholder involvement could remain flexible and ongoing throughout.

The key lesson from this comparison is that the ability to involve stakeholders across all stages of a project is crucial for creating effective learning environments. This requires that responsibilities stay internally manageable. Therefore, when a project is large enough to necessitate formal procurement and the involvement of external partners, opting for a more traditional contract type — one that enables continuous stakeholder feedback — to support adaptability during design and implementation which increases the likelihood of creating effective learning environments.



B	Build (Traditional Contract)
D&B	Design and Build
DBM	Design, Build, Finance
DBMO	Design, Build, Finance, Maintain
DBFMO	Design, Build, Finance, Maintain, Operate

Figure 59 Overview of contract types and the distribution of control and risk. The optimal choice for learning environments lies left of the red line, where the client retains more control. (Adapted from Brink Group, Bouworganisatievormen, 2013)

Part 5

Discussion and Conclusion

5.1 Discussion

Regarding the findings, several points of discussion were identified. These include questions about who the learning environment is being designed for and to what extent there is a genuine demand for blended learning environments. Additionally, the research process is reviewed, including the choice of method, reliability, and validity. Lastly, the limitations of the study are acknowledged.

5.2.1 For who do you design a Learning Environment?

A central question raised by many stakeholders during this research was: *"For whom are you actually designing a learning environment?"* This question lies at the heart of stakeholder involvement in educational spaces and reveals a fundamental ambiguity. Who is the actual 'client'—the one whose needs and expectations must ultimately be fulfilled?

On one hand, it can be argued that the client is the institution financing the project, such as the university or the campus real estate department. On the other hand, considering the highly functional nature of learning environments, one could claim that the true client should be the end-user. Yet even then, the question remains: is the end-user the teacher who delivers the content, or the student who must absorb it? If we accept the end-user as the primary client, then the design must align closely with how the space is used in practice.

In many cases studied, end-users were only involved late in the process, primarily to help them get familiar with the space and provide final input. However, if such extensive support is required for users to understand and adapt to the space, one might question whether there is genuine demand for these types of environments at all. If neither students nor teachers know how to use the space effectively, this suggests a top-down implementation driven by the real estate department rather than a response to user needs.

A potential solution to this misalignment is to place end-users even more centrally within the design process—not just as sounding boards at later stages, but as active participants from the very beginning. Their needs and preferences should be thoroughly explored and mapped before any design decisions are made. Working more intensively with user groups and implementing co-design processes closely aligns with the principles of *User-Centred Design* (UCD). UCD rejects subjective assumptions and demands evidence that design choices truly serve user needs. Unlike traditional design approaches that often reflect the designer's vision, UCD places users at the core of the process, with a focus on adapting the design to fit the users—rather than the other way around (Kwon & Remøy, 2021).

Given the strong dependence of learning environments on user experience, UCD appears to be an especially relevant and beneficial approach. In theory, this user focus should be embedded in the stakeholder involvement process through working groups and internal project teams. However, across the cases studied, we observed that working groups were rarely utilised, and end-users were almost never included in the internal project team. Despite its potential, UCD remains largely underused in the development of educational spaces. More consistent and meaningful integration of UCD principles could greatly improve the alignment between design outcomes and actual user needs, and should be prioritized in future projects.

5.2.2 To what extent is there a genuine demand for Active Blended Learning Environments?

There is a clear correlation between how end users perceive the space and the teaching methods used, with blended learning methods leading to more positive experiences. This suggests that the effectiveness of the space is closely tied to the teaching approach. In some cases, traditional frontal teaching was even hindered by the design of the space compared to conventional classrooms. However, in the cases studied, only one instance involved a totally blended learning approach, while the rest primarily relied on frontal teaching. This raises an important question: is it simply a coincidence that the lessons where the surveys were conducted did not involve blended learning, or is there a deeper issue—namely, the lack of blended learning implementation? If the spaces are not being used for blended learning, their overall effectiveness and the demand for such spaces are called into question—especially if they show a negative impact when used for traditional teaching methods. After all, is a space that lacks demand ever truly effective?

This issue ties back to the origin of the initiative: Is the demand for spaces that support blended learning driven by a genuine need within the educational community, thus reflecting a bottom-up strategy, or is it simply a trend pushed by university decision-makers, in a top-down approach? In cases where projects were led by a top-down strategy, the success rates were generally lower. In contrast, projects initiated through a bottom-up approach, where the need for specific learning spaces arose from the educational methods themselves, tended to be more successful.

This suggests that the design and implementation of learning environments should be driven by the actual teaching and learning needs, not just by the desire to create a new, trendy space. When the physical environment aligns with pedagogical goals and the real needs of users, its effectiveness increases. Thus, it's crucial to consider the role of the space not as the goal itself but as a tool to enhance the educational process.

5.2.3 The role of the university in institutionalising Active Blended Learning

The lack of use of the Active Blended Learning environments brings us to a broader and highly relevant topic: the role of the university as an organisation in facilitating and institutionalising the shift toward Active Blended Learning . If a university truly aims to adopt new teaching styles and promote the effective use of innovative learning spaces, simply providing these spaces is not enough. The change must be embedded in the institutional organisation. This is where change management becomes essential.

Change management is a complex field, with many different strategies and models available to guide organisational transformation. A research by Phillips & Klein (2023) examined a set of change management strategies found across several models and frameworks and identifed how frequently change management practitioners implement these strategies in practice. Here was found that one of the most widely recognised and applied strategies—both in theory and practice—is the alignment of the intended change with the overall vision of the organisation. In other words, the entire institution must embody and promote the change, starting from top-level leadership.

This insight also surfaced during a panel session at the *Campus NL Congres 2025,* organized by the Universiteiten van Nederland (2025), where one of the central questions was how to effectively engage end-users in the purposeful use of learning environments. A key takeaway from this discussion was that meaningful change within universities is nearly impossible without a centralised, top-down approach initiated by institutional leadership. It requires a careful balance: on the one hand, clearly articulating ambitions from above, and on the other, supporting and empowering educators at the grassroots level. Change must be enacted across all layers of the organisation, and therefore, all levels must be actively involved.

In the case of learning environments, this means that providing flexible and modern learning spaces alone does not automatically lead to changes in teaching practices—certainly not at scale. To achieve real transformation, universities must be intentional, proactive, and strategic.

One way to embed this shift into the institutional vision is for the university's executive board to explicitly include educational innovation in its strategic goals. For example, the board could mandate that all educators adopt new teaching approaches aligned with broader ambitions for innovation and quality in education. By framing Active Blended Learning as a strategic priority, the university sends a clear signal that this change is not optional—it is a shared mission.

A practical example, as mentioned during the Campus NL panel discussion, is that if a university wants to transition from traditional to innovative learning environments, it should not develop just one pilot space—but several at once. This communicates that the university is serious about the shift—it transforms the new learning environments from a rare experiment into a new standard. When educators are consistently placed in these environments, and when traditional teaching methods no longer align with the space, it creates a natural incentive for pedagogical change (Universiteiten van Nederland, 2025).

However, while it is important that changes are supported by the top levels of the organisation, simply declaring that change is necessary is not enough. Transformation must be implemented and supported at all levels—especially at the level of the educators, who are ultimately responsible for enacting these changes in practice. That is why another widely supported change management strategy is to ensure that staff are adequately trained for new initiatives. Support during the implementation phase is critical to success (Phillips & Klein, 2023).

Universities could, for example, organise large-scale, mandatory training sessions for educators shortly after new spaces are delivered. These sessions should demonstrate how to use the spaces effectively, explain the underlying pedagogical principles, and highlight the tools and possibilities the spaces offer. Familiarising educators in this way—at scale and with intention—builds confidence and increases the likelihood of regular and meaningful use. Ultimately, this type of support is what enables real pedagogical transformation to take root.

In conclusion, the implementation of new learning environments cannot be seen as a purely spatial change—it must be treated as an organisational transformation. The successful adoption of Active Blended Learning requires strategic change management. While this section has highlighted only a few key strategies, there are many more available in the field of change management. It is therefore crucial that universities not only invest in physical spaces but also embed change management approaches into the process. By doing so, they can ensure that new environments truly lead to pedagogical innovation and lasting impact.

5.2.4 Reliability

The reliability of a research study refers to the extent to which the results can be reproduced when repeated under the same conditions. In my research, several measures were taken to improve the reliability of the findings. The literature review was guided by specific search terms, ensuring that the information was gathered systematically, a standardized interview guide was used for the interviews and and codes for analysing of the interviews were also communicated.

The selection criteria for the cases and types of stakeholders also played a vital role in the reliability of the research. By carefully defining the selection criteria, the research aimed to ensure that the findings were applicable to this type of learning space. Stakeholders were not only selected based on their job titles but also according to their role levels, which helped create consistency and generalizability across the cases. This approach acknowledged that even within the same institution, the role of a stakeholder may vary, even if their job title is the same. Through these careful considerations, the selection of participants was made in a way that would ensure reliable and consistent data collection.

One of the major factors that could jeopardize the reliability of the study is the dependent variable of space usage, which emerged as a significant factor influencing how the space is experienced. This variable is thoroughly documented in the report, and a clear distinction was made between lessons that align with the space's design and those that do not. By addressing this variable, the reliability of the findings has been strengthened, ensuring that the influence of space usage on the results is properly accounted for.

In summary, the methods employed in this research were designed with reliability in mind. The standardized interview approach, careful selection of cases and stakeholders, use of software for data analysis, and attention to the influence of space usage all contribute to making the findings more reproducible and consistent. By addressing potential sources of bias and ensuring a structured, systematic approach, the research has increased the reliability of the results, making them more robust and credible.

5.2.5 Validity

Another important aspect of evaluating this research is its validity, which refers to the extent to which the study accurately measures what it intends to measure. To enhance the validity of the findings, triangulation was applied by cross-referencing interview insights with data from the literature and case study analyses. This approach helped verify the consistency and credibility of the results, strengthening their overall validity.

The research adopted a qualitative approach, placing stakeholder interviews and end-user surveys at the core of the methodology. This allowed for the collection of in-depth insights into their experiences, expectations, and perceptions regarding the learning environments. By incorporating multiple perspectives, the internal validity of the research was improved, as the diversity of viewpoints enriched the data and helped reduce the risk of bias.

In the surveys, the effectiveness of the learning environments was evaluated based on stakeholder experiences. However, it was recognized that these experiences could be influenced by external factors, such as teaching style, individual teachers, or the intrinsic motivation of students. To mitigate the effect of these confounding variables, additional questions were

included in the interviews and surveys to specifically address these aspects. This helped to isolate the influence of the physical environment, allowing for a more accurate understanding of its impact.

One limitation that potentially affects validity is the use of snowball sampling in some cases. While this method was effective in reaching relevant participants, it may have led to a narrower range of perspectives, as interviewees sometimes referred others from similar professional backgrounds or viewpoints. This potential sampling bias should be taken into account when interpreting the conclusions of the study.

With regard to external validity, or the generalizability of the findings, it is important to note that the studies were conducted within specific cases and particular contextual settings. As such, the results may not be directly transferable to all learning environments or educational institutions. However, the findings do offer valuable insights that can inform comparable contexts—especially where similar educational models or stakeholder dynamics are present. Moreover, by conducting a cross-case analysis, an effort was made to extract broader lessons and recurring patterns that transcend individual case boundaries, thereby enhancing the potential relevance of the conclusions for a wider range of settings.

5.2.5 Limitations

To properly contextualise the findings, it is necessary to acknowledge the limitations of the research.

Literature

The literature review was sometimes limited by the availability of relevant sources; in certain cases, only one suitable publication could be found to support specific arguments. As a result, some elements of the theoretical framework had to be based on a single source, which may affect the depth and robustness of the underlying theory.

Cases

Identifying appropriate case studies proved challenging. Suitable cases had to be found within existing universities, and participation depended on the willingness of the institutions involved. Therefore, it was not possible to select cases entirely freely, and as a result, not all selected cases fully matched the predefined characteristics. For example, the OneRoom at Radboud University could be argued to function more as a hybrid learning space than a purely blended environment. To still ensure the relevance of the selected cases, all included learning spaces were assessed against the six key characteristics of active blended learning environments. If a space (partially) lacked one of these characteristics but still clearly aimed to support flexible blended education, it was considered sufficiently aligned with the overall typology and included in the study. This ensured that, despite minor deviations from the ideal types, the selected cases still provided meaningful and relevant insights for the research.

Some of the findings are inevitably context-specific, as they are based on learning environments within a limited number of institutions. Variations in spatial design, educational culture, and user groups influence how these environments are experienced and evaluated. While this limits the

ability to generalise the results to all university contexts, efforts were made to enhance the relevance and robustness of the findings. By including four different cases from diverse institutional settings, the research allowed for comparison across a range of contexts. This cross-case analysis helped to identify recurring themes and shared challenges that transcend individual settings. As such, although the findings are rooted in specific contexts, the consistent patterns observed across cases suggest that several insights may hold relevance more broadly.

Interviews

While a range of stakeholders were interviewed, it was sometimes difficult to include all relevant groups. Stakeholders who were part of the internal project team were generally accessible, but end-users such as students who had participated in early-stage workgroups or advisory committees were harder to locate. Many of these students had already graduated and did not clearly recall the meetings or processes, as their involvement may not have left a lasting impression. As a result, it was often challenging to find these individuals for interview, and a fully complete picture of the stakeholder process and its impact could not always be obtained for every case. To compensate for this, interviewees were asked to reflect not only on their own involvement but also to elaborate on key discussions and to describe the positions and contributions of other stakeholders they had worked with. This approach enabled the research to reconstruct a more complete narrative of the stakeholder process, even when certain actors could not be interviewed directly.

Surveys

The number of survey responses, especially for the cases at Radboud University and Tilburg University, was relatively low. At Radboud, at the time of survey distribution, only two courses were being taught in the OneRoom, leading to a maximum of 12 potential respondents. Ultimately, nine completed surveys were collected. In Tilburg, despite efforts to reach out to multiple teachers, it was only possible to conduct the survey during one lecture, where attendance was low, again resulting in nine responses. Due to these small sample sizes, no generalizable conclusions can be drawn about the spaces as a whole. However, the surveys still provided valuable input, particularly through the open-ended questions. These qualitative responses offered rich, experience-based reflections that helped to identify recurring themes, user needs, and areas for improvement. In that sense, while the data is not statistically representative, it meaningfully contributed to the understanding of how these learning environments are perceived and used.

It is important to acknowledge that end-user evaluations of the learning environments were likely influenced by external contextual factors, such as the teaching method used during the lesson or the students' intrinsic motivation. Although the survey instrument included questions aimed at capturing these contextual elements to improve interpretability, the risk of bias could not be entirely eliminated. To mitigate this, surveys were distributed across at least two different lessons per case, aiming to gather a broader and more balanced perspective on how the space was experienced under varying conditions. Additionally, lesson scheduling data was reviewed to identify classes categorized as working groups, and invitations to participate were preferably sent to teachers whose sessions were expected to involve more active teaching methods. This approach was intended to ensure that the evaluation focused on spaces being used as designed — for active, blended learning — and not solely in traditional or passive settings.

The surveys were intended to gather input from both students and teachers. However, participation from teachers was significantly lower than that of students, partly due to the naturally smaller number of teachers compared to students. This led to an absence of the teacher perspective, particularly in the cases of TU Delft and Tilburg University. Interestingly, these were also the two cases in which a top-down approach was applied, suggesting a link between the project's governance model and stakeholder engagement. Since the initiative came from higher levels rather than from the teachers themselves, they may feel less connection with the space—unlike in the bottom-up cases, where teachers initiated the project. This could suggest that teachers in cases C and D felt more connected to the learning environments—precisely because they initiated the spaces themselves—and were therefore more willing to contribute to the research evaluating them.

Efforts were made to actively involve the teachers by reaching out to them after classes via email, encouraging them to complete the survey. Despite these attempts, this did not result in a significant increase in responses. As a result, the analysis of end-user experiences is primarily based on the student viewpoint, rather than a full comparison between students and teachers. Although teacher input is limited, the data gathered from students still provide valuable insights that contribute to a better understanding of the effectiveness of the learning environments.

5.2 Conclusion

This research aimed to answer the question: *"How can the stakeholder involvement process be optimised in the creation of effective learning environments in university real estate?"*

Based on the case studies, it becomes clear that while stakeholder involvement is widely used to enhance the quality and functionality of university learning environments, there is still significant room for improvement—particularly when it comes to aligning the design with actual use. The effectiveness of a learning environment has two critical dimensions. First, a space should meet functional and spatial criteria, such as visibility, mobility, and access to learning tools, which are commonly recognized as core characteristics of effective blended learning environments. These features contribute to the physical and conceptual quality of the space. However, this alone is not sufficient. True effectiveness also depends on how the space is used in practice. This practical aspect of use is often overlooked during the design phase, yet it plays a decisive role in whether the learning environment succeeds.

To optimize the rooms, alignment between how the space is designed and how it is ultimately used must be ensured. There are three opportunities connected to the stakeholder involvement process where optimization can be achieved to guarantee this alignment:

First, involve end-users more active in the design of the rooms. Many environments are developed based on assumptions or expert-driven perspectives, particularly from internal project teams. While these teams often include stakeholders with a lot of expertise, they frequently lack end-users. As a result, the final space may theoretically meet design criteria but fail to match the actual usage patterns and needs of those who use it daily.

To optimise the stakeholder involvement process, the key lies in placing greater emphasis on the perspective of the end-user. A shift towards user-centred design (UCD) could help bridge the gap where misalignment occurs. UCD avoids making assumptions about user needs and instead grounds design decisions in direct input and observed behaviour. In this approach, students and teachers are not merely informants but active co-creators of the learning environment.

Designing from the user's perspective means creating spaces that are not only well-equipped but also truly supportive of educational practices and everyday use. This was clearly reflected in the case studies: whenever end-users were directly involved in the process, the resulting environments included elements that were positively experienced in practice. This enhances both user satisfaction and the long-term usability of the environment.

While widely acknowledged in the literature, in practice stakeholder involvement is often not fully realised. There are three specific phases in the stakeholder involvement process where the root causes of limited involvement can be identified:

First, in the *Identification and Selection* phase, end-users are sometimes not selected or even considered as relevant stakeholders. Optimising the process begins here: all actors involved should recognise end-users as crucial stakeholders for creating usable and effective environments. This awareness should lead to their consistent inclusion from the outset.

Second, the *Securing Stakeholder Interest* phase is frequently overlooked in practice, resulting in a lack of motivation or willingness among stakeholders to contribute. Universities could improve this by placing more emphasis on strengthening the pull factors that encourage participation.

These include removing practical barriers, providing incentives, and clearly communicating the value of involvement.

Third, during the *Input Strategy* phase, end-users are often given a passive role. To optimise this phase, a shift is needed: end-users should take on a more active role as co-designers, where their input is taken seriously from an early stage and is continuously worked with. This ensures genuine involvement, rather than superficial engagement.

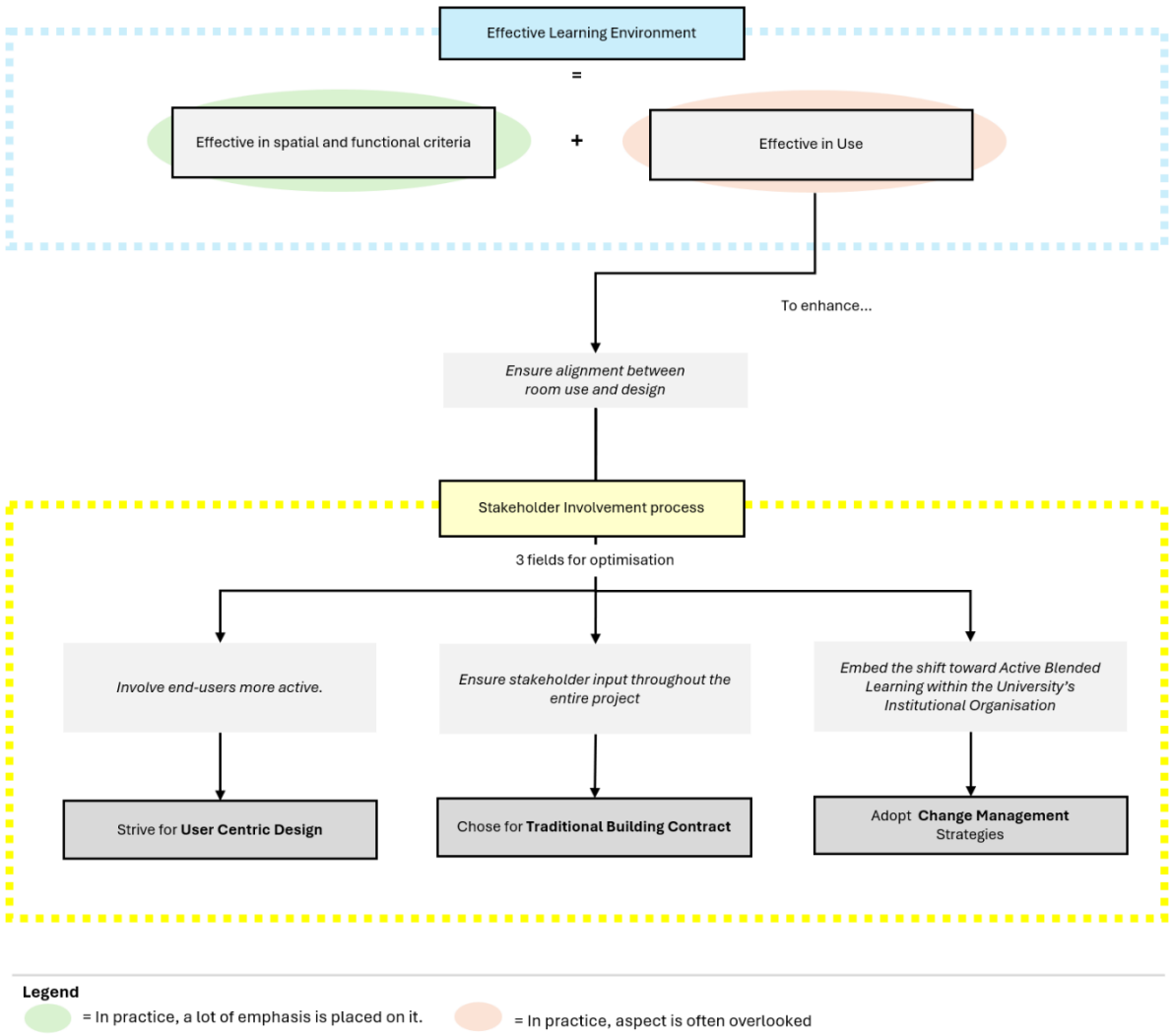
When this user-centric design approach is combined with collaboration from other key stakeholders, it results in spaces that function well from multiple perspectives and, crucially, align with the actual needs of end-users — increasing the likelihood that the spaces will be used as intended.

A second key aspect of optimisation is ensuring that stakeholder involvement occurs throughout all phases of the project. Although continuous involvement is often an ambition in practice, it can be hindered by the choice of contract type. When responsibilities are transferred too early to external parties — as is often the case with design-and-build contracts — meaningful involvement is no longer possible. To ensure effective stakeholder input throughout the process, responsibilities and decision-making power should remain with the internal team for as long as possible. This translates into a preference for traditional contract forms, which allow for ongoing input and adaptability during the design and implementation stages — both of which are essential for creating truly effective learning environments.

The final aspect for optimization is ensuring that the shift toward Active Blended Learning is embedded within the university's institutional organization. This means the university must actively communicate and commit to this educational transformation, rather than merely providing new learning spaces. Change must be driven top-down, with clear signals from leadership that these new environments are integral to the university's vision. At the same time, bottom-up initiatives are essential to promote the actual use of these spaces, including ensuring that staff are adequately trained and supported in adopting new teaching approaches.

In conclusion, to optimise stakeholder involvement in the creation of effective university learning environments, the process must shift from assumption-based, expert-driven design to a user-centred approach in which end-users are recognised as key stakeholders and engaged as active co-designers. This requires early and continuous involvement, ensuring their input is taken seriously and reflected in the final outcome. Universities should focus on improving three critical phases in the involvement process: identifying and including end-users from the start, securing their interest through motivation and clear communication, and empowering them with real influence during the design process. Additionally, internal teams must retain decision-making power long enough to allow meaningful participation, which is best supported by more flexible contract forms. Lastly, universities must not only provide the physical learning spaces but also implement change management strategies that actively encourage and motivate the use of these spaces effectively. Only then can learning environments be created that are not only well-designed in theory but effective and usable in practice.

Figure 60 Conclusion on how the stakeholder involvement process could be optimised to create effective learning environments



5.3 Recommendations

Based on the findings and limitations of this study, several directions for future research can be identified. In this chapter these recommendations are presented.

Another type of Learning Environment

While this research focused on Active Blended Learning Environments, literature also highlights the growing importance of Hybrid and even Fully Online Learning Environments. Future studies could investigate stakeholder involvement processes in these other types of learning environments to identify whether different approaches are required. This would also contribute to a more complete and generalizable understanding of stakeholder involvement across the full spectrum of contemporary learning environments.

Learning Environments Designed with User-Centric Approaches

The discussion and conclusions indicated that a major opportunity lies in better integrating actual user experiences into the final design. Many ineffective spaces seem to result from a lack of attention to the real needs and usage patterns of end-users. Future research could focus on learning environments that have been developed using user-centric design methodologies, where users are positioned even more centrally as active participants throughout the design process. Investigating whether user-centric design leads to greater perceived and actual effectiveness of learning spaces could provide highly valuable insights for universities and design teams.

Long-term Perspective on Stakeholder Involvement Outcomes

This study captures stakeholder involvement at a single point in time or shortly after implementation. Future research could conduct longitudinal studies to follow learning environments over several years, assessing how the success of stakeholder decisions evolves and whether spaces remain effective as user needs and teaching methods change.

Cultural differences in Stakeholder Involvement in LE

Stakeholder engagement processes might vary significantly between different cultural or national contexts (e.g., Dutch universities vs. universities in Asia or North America). Comparative studies could explore how cultural factors affect stakeholder involvement, communication styles, decision-making processes, and ultimately the design outcomes.

Part 6

Reflection

6.1 Reflection

This chapter reflects on the product an process of this graduation thesis, besides it describes the researcher's personal view.

Reflection on the product

Positioning within the Master Track

This research was conducted at the master track Management in the Built Environment, positioned in the Faculty of Architecture, Urbanism and Building Sciences at the TU Delft. The topic of my graduation project, *"Optimising Stakeholder Involvement in the Creation of Effective Learning Environments in University Real Estate,"* directly aligns with the studio theme, "Adding Value in Public or Corporate Real Estate." My research focuses on stakeholder involvement as a means to enhance the effectiveness and value of learning environments in public real estate, such as university campuses.

My topic is also really relevant within my master track, Management in the Built Environment (MBE), which emphasizes value-driven decision-making, stakeholder engagement, and strategic management in the built environment. By investigating how collaborative processes can lead to spaces that better meet the needs of both stakeholders and end-users, my research contributes to understanding how to optimize value creation in complex real estate projects.

At the program level, the MSc in Architecture, Urbanism, and Building Sciences (AUBS) encourages interdisciplinary approaches to address societal and environmental challenges in the built environment. My project reflects this by integrating insights from design, management, and user experience to propose strategies that align stakeholder processes with desired spatial and operational outcomes.

Scientific Relevance

This research is scientifically relevant as it addresses the current gap in systematic knowledge regarding stakeholder involvement processes in the creation of university learning environments. It examines not only how, when, and which stakeholders should be involved but also how these processes can be optimised to enhance their effectiveness. By focusing on both the structure and optimisation of stakeholder involvement, this study aims to contribute to the development of processes that lead to the creation of more effective and user-centred learning environments.

Moreover, this research explores the optimisation of stakeholder involvement processes, shedding light on how these processes can be structured to enhance the quality and functionality of learning spaces. By situating its findings within the context of higher education, it expands existing theoretical frameworks on stakeholder involvement, integrating learning environment-specific objectives. This evidence-based approach contributes to the development of more effective and adaptive learning environments that respond to the evolving needs of contemporary education.

Social relevance

The social relevance of this research lies in its potential to enhance the quality and effectiveness of learning environments within university real estate by focusing on stakeholder involvement.

Involving stakeholders in the design and development of learning spaces ensures that these environments better reflect the needs and preferences of their users =====.

Furthermore, by examining the perceptions of stakeholders and end-users, this research can provide insights into how these groups define and experience the success of learning environments. Optimizing this involvement process and gaining a better understanding of the needs and preferences of stakeholders who benefit from an effective learning environment can lead to spaces that are more inclusive, accessible, and conducive to collaboration. Ultimately, this can improve user satisfaction, educational outcomes, and the overall campus experience.

Ethical Considerations

Ethical considerations are a fundamental aspect of conducting research, and great care is taken to ensure the protection of participants throughout the study. As emphasized by Blaikie and Priest (2019), the protection of human participants is a primary concern, and it is crucial to prevent any harm during or after the research process. That is why I sought ethical approval from the Human Research Ethics Committee (HREC) for conducting this study, which involved submitting the HREC checklist, data management plan, and informed consent forms for review.

Before conducting interviews, all participants were provided with an introductory email explaining the purpose of the research. Along with this, they received an informed consent form, which they were required to sign, granting permission to participate. The consent form detailed the potential risks involved, ensuring that participants were fully informed before agreeing to take part (Millum & Bromwich, 2021). Furthermore, participants were asked for permission to record each interview. These recordings were transcribed, anonymized, and securely destroyed after use.

For the surveys, an informed consent form was also included at the beginning, with detailed information about the study. Participants were explicitly asked to agree to participate before proceeding with the survey. These steps ensure that participants are well-informed about the study, their privacy is safeguarded, and any potential risks are minimized.

In conclusion, the academic and societal value of this research lies in its contribution to addressing a gap in the current understanding of stakeholder involvement in the creation of university learning environments. By examining both the structure and optimisation of stakeholder processes, this study provides valuable insights that can enhance the quality and functionality of learning spaces. The social relevance is equally significant, as the findings can lead to more inclusive, user-centred environments that improve educational outcomes and user satisfaction. The ethical considerations, which were followed throughout the research process, ensure that participants were well-informed and protected. This comprehensive approach underscores the potential impact of this research, both in advancing academic knowledge and in providing practical strategies for improving learning environments in higher education.

Transferability of project results

I think that the transferability of my project results is high. All the stakeholders I interviewed, especially the strategic decision makers, have shown great interest in my findings. They also confirm the research gap I identified, which aligns with their own experience: "We’re also just

doing what we think is best, but there is no standard step-by-step guide available. We actually have no idea if we're doing it right, apart from our own experiences. And we're very curious about how other universities are approaching this and whether we can learn from each other or improve our own methods" (A2, 2025).

This feedback underscores the relevance of my research, as institutions are truly facing the challenges I aim to address. The lack of standardized approaches and the desire to learn from others highlights the applicability of my findings in broader contexts, allowing other universities or organizations to adopt similar strategies to optimize stakeholder involvement and improve their learning environments. This indicates a high potential for transferability across different institutions.

Reflection on the process

Method & Data collection

At the beginning of my research, finding suitable case studies was quite challenging. It took a while before I received responses from universities about whether they were willing to participate. Eventually, I received feedback from three universities: Utrecht, Delft, and Tilburg. During the research, I realized that the cases from Tilburg and Delft were quite similar because they both involved new buildings. However, the case from Nijmegen was different because it focused on a single room in one building. At the same time, I discovered that Utrecht had also developed new active blended learning environments and had conducted extensive research and evaluations on them. They had also used surveys for evaluations. As a result, I decided to include Utrecht as a case study, but only for the stakeholder involvement part, while incorporating their evaluation data from their publications.

My research was designed to be threefold: firstly, a case study to map out the stakeholder involvement processes, secondly, interviews to understand how involved stakeholders provided input in the realized learning environments, and thirdly, surveys with end-users to understand how they experienced the spaces and whether their perceptions aligned with the input from stakeholders.

During the execution of the research, I found that very little documentation existed at the universities regarding how the stakeholder process was structured. Therefore, I had to adjust my approach. I decided to focus on the interviews with stakeholders to try and map out the process based on their input. This was challenging because everyone used different terminology, and it was difficult to convert verbal accounts into a clear process map. To address this, I created process drafts and sent them back to the interviewees for validation. This approach worked well, and I received useful feedback on aspects that still needed adjustment.

The interviews about stakeholder input went well and yielded interesting insights. It was sometimes difficult to identify the right stakeholders and determine how to contact them, especially since there was no documentation available regarding the involved people and processes. I relied on the snowball effect, asking interviewees if there were any other important stakeholders I should contact and whether I could obtain their contact details. This method helped me establish good connections.

The interviews themselves took a lot of time, but I noticed that I became more efficient as I progressed. Initially, I had a lengthy questionnaire, but I later left that behind and conducted more semi-structured interviews, allowing participants to speak freely. I noticed that this approach led to more valuable stories, and I could follow up with deeper questions. Each interviewee kept surprising me with new information and examples that reinforced previous statements made by others. This reminded me of the importance of approaching every interview with curiosity and an open mind. Sometimes it took a while for interviewees to provide detailed answers, but I learned to be patient. Since I had multiple questions about the same topic, people often returned to previously discussed points with more depth. It also happened that after an interview, during casual conversation, interviewees suddenly shared revealing details. I recorded the interviews and transcribed them using a Python script, which saved a lot of time and made it easier to code the data in Atlas.ti.

For the surveys, I gained access to the schedules of the specific rooms. Based on this, I emailed the professors teaching in those rooms to ask if I could observe the space during their classes. This worked well, and they were often positive. The only challenge was that sometimes there was only one class per day, so I had to travel to different cities on different days. This was quite time-consuming, especially in Tilburg, where I had planned to go, but due to strikes, lessons were suddenly cancelled. This made it even more time-intensive.

Looking back on it now, I believe I have gathered very valuable and comprehensive data. I also noticed during the data collection process that I was able to hypothesize answers and ask follow-up questions on specific topics based on what I had learned from earlier interviews. The survey was also based on findings from the interviews. Personally, I believe the value of my working method is high, and the information I have gathered through it is equally valuable.

Personal Experience

At the beginning of my graduation period, I actually had no idea where I wanted to graduate. It really helped me to revisit the entire master's program and think about which courses I enjoyed and where I found joy. Eventually, I ended up with Real Estate Management (REM) and chose my studio based on that. I quickly realized that I always found stakeholders interesting, but the application of this was still uncertain. With the help of my graduation supervisor, who introduced me to the research group Campus NL, I was able to realize that applying stakeholder involvement in learning environments could be fascinating. This was a perfect fit for me, considering I had also been involved in the student council for a year and had a great interest in education and campus management.

Gradlab and my graduation supervisor helped me a lot with clear guidance and setting up a literature study, which ultimately led to me passing my P2 without any issues.

Through my supervisor, I was encouraged to gain experience by graduating at a company, which led me to Aestate, where I started directly after my P2. I had a great time there and learned a lot. It was amazing to be in an environment with many people who had expertise in the field, sparring partners, and other fellow graduates. Through Campus NL and partly through Aestate, I was able to get in touch with people for executing cases and interviews, which was incredibly helpful.

Over the past six months, I've continued my graduation project relatively independently, but of course, with check-ins and discussions with both my university and Aestate supervisors. I feel like I've been on schedule throughout the entire period. I've worked hard and put in many hours.

I've really enjoyed it. I still have a lot of interest in the subject, and that definitely helped me get through the process. I've also noticed that I've gained significant knowledge about learning environments and stakeholder processes, which makes it even more enjoyable. I've had a lot of fun conducting the interviews, especially speaking with people who were truly helpful. They are often very interested and willing to assist, and I've heard many interesting things. I've also had the chance to visit some special places and situations, such as a behind-the-scenes tour of the building ECHO, or for example, at one of the learning environments I was invited to attend and even actively join a Russian class to experience firsthand how a lesson feels in that space, which was very fun and a great opportunity. Overall, I found the graduation process to be incredibly enjoyable, with interesting people, great supervisors, and a lot of knowledge gained on various topics.

References

Aaltonen, K., & Kujala, J. (2010). A project lifecycle perspective on stakeholder influence strategies in global projects. *Scandinavian Journal of Management*, *26*, 381–397. https://doi.org/10.1016/j.scaman.2010.09.001

Asino, T., & Pulay, A. (2018). Student Perceptions on the Role of the Classroom Environment on Computer Supported Collaborative Learning. *TechTrends*, *63*. https://doi.org/10.1007/s11528-018-0353-y

Bailey, K., & Grossardt, T. (2006). *Addressing the Arnstein Gap: Improving Public Confidence in Transportation Planning and Design through Structured Public Involvement (SPI)*.

Benade, L. (2019). Flexible Learning Spaces: Inclusive by Design? *New Zealand Journal of Educational Studies*, *54*(1), 53–68. https://doi.org/10.1007/s40841-019-00127-2

Blaikie, N., & Priest, J. (2019). *Designing Social Research: The Logic of Anticipation* (3rd ed.). Polity. https://www.perlego.com/book/1536380/designing-social-research-the-logic-of-anticipation-pdf

Borri, S. (2021). *From Classroom to Learning Environment* (pp. 51–55). https://doi.org/10.1007/978-3-030-77040-2_7

Bozkurt, A. (2022). A Retro Perspective on Blended/Hybrid Learning: Systematic Review, Mapping and Visualization of the Scholarly Landscape. *Journal of Interactive Media in Education*, *2022*, 1–15. https://doi.org/10.5334/jime.751

Brink, H. W., Krijnen, W. P., Loomans, M. G. L. C., Mobach, M. P., & Kort, H. S. M. (2023). Positive effects of indoor environmental conditions on students and their performance in higher education classrooms: A between-groups experiment. *Science of The Total Environment*, *869*, 161813. https://doi.org/10.1016/j.scitotenv.2023.161813

Brooks, D. C. (2012). Space and consequences: The impact of different formal learning spaces on instructor and student behavior. *J. Learn. Spaces*, *1*(2), 1–16.

Chapman, A., Randell-Moon, H., Campbell, M., & Drew, C. (2014). Students in Space: Student Practices in Non-Traditional Classrooms. *Global Studies of Childhood*, *4*, 39. https://doi.org/10.2304/gsch.2014.4.1.39

Cresswell, John. W., & Plano Clark, V. L. (2017). *Designing and Conducting Mixed Methods Research—International Student Edition*. SAGE Publications Ltd. https://uk.sagepub.com/en-gb/eur/designing-and-conducting-mixed-methods-research-international-student-edition/book258100

Demetriadis, S., & Pombortsis, A. (2007). e-Lectures for Flexible Learning: A Study on Their Learning Efficiency. *Journal of Educational Technology & Society*, *10*(2), 147–157.

den Heijer, A., Arkesteijn, M., de Jong, P., & de Bruyne, E. (2016). *Campus NL: Investeren in de toekomst*. Delft University of Technology, Faculteit Bouwkunde. http://resolver.tudelft.nl/uuid:3a2d0cfd-6ed0-4f7d-bc88-b2253641ebb6

Franklin, A. L. (2020). *Stakeholder Engagement*. Springer International Publishing. https://doi.org/10.1007/978-3-030-47519-2

Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Pitman.

Frelin, A., & Grannäs, J. (2021). Designing and Building Robust Innovative Learning Environments. *Buildings*, *11*(8), Article 8. https://doi.org/10.3390/buildings11080345

Fuchs, I., Dolfing, R., Dijstelbloem, L., & Frijns, T. (2024). *Designing Active Learning Spaces, what to consider?* University Utrecht. https://www.uu.nl/en/education/future-learning-spaces/designing-active-learning-spaces-what-to-consider

Gatlin, A. R. (2021). *Successful at scale: 500 faculty, 39 classrooms, 6 years: A case study*.

Gil, E., Mor, Y., Dimitriadis, Y., & Köppe, C. (Eds.). (2022). *Hybrid Learning Spaces*. Springer International Publishing. https://doi.org/10.1007/978-3-030-88520-5

Goodman, M. S., & Sanders Thompson, V. L. (2017). The science of stakeholder engagement in research: Classification, implementation, and evaluation. *Translational Behavioral Medicine*, *7*(3), 486–491. https://doi.org/10.1007/s13142-017-0495-z

Hajer, M. (2011). *De energieke samenleving*.

Hamilton, A. B., Brunner, J., Cain, C., Chuang, E., Luger, T. M., Canelo, I., Rubenstein, L., & Yano, E. M. (2017). Engaging multilevel stakeholders in an implementation trial of evidence-based quality improvement in VA women's health primary care. *Translational Behavioral Medicine*, *7*(3), 478–485. https://doi.org/10.1007/s13142-017-0501-5

Harvey, E. J., & Keyton, M. C. (2013). Classroom seating considerations for 21st century students and faculty. *Learn Spaces*, *2*(1), 1–13.

Hester, P., Baggett, K., Shauger, J., & Haynes, A. (2010). Developing stakeholder incentives to encourage effective governance. *31st Annual National Conference of the American Society for Engineering Management 2010, ASEM 2010*, 574–582.

Khamitova, A. (2023). Innovative Learning Spaces of Higher Education: A Systematic Mapping Review of Themes. *TechTrends*, *67*(5), 830–842. https://doi.org/10.1007/s11528-023-00892-4

Könings, K. D., Seidel, T., & Van Merriënboer, J. J. G. (2014). Participatory design of learning environments: Integrating perspectives of students, teachers, and designers. *Instructional Science*, *42*(1), 1–9. https://doi.org/10.1007/s11251-013-9305-2

Krismadinata, K., Verawardina, U., Jalinus, N., Rizal, F., Sukardi, S., Sudira, P., Ramadhani, D., Lubis, A. L., Friadi, J., Arifin, A. S. R., & Novaliendry, D. (2020). Blended Learning as Instructional Model in Vocational Education: Literature Review. *Universal Journal of Educational Research*, *8*(11B), 5801–5815. https://doi.org/10.13189/ujer.2020.082214

Kwon, M., & Remøy, H. (2021). User-centred design thinking: Application of UCDT theories to workplace management. In *A Handbook of Management Theories and Models for Office Environments and Services* (pp. 184-193). Routledge.

Lane, A. B., & Devin, B. (2018). Operationalizing Stakeholder Engagement in CSR: A Process Approach. *Corporate Social Responsibility and Environmental Management*, *25*(3), 267–280. https://doi.org/10.1002/csr.1460

Lo, C. K., & Hew, K. F. (2020). A comparison of flipped learning with gamification, traditional learning, and online independent study: The effects on students' mathematics achievement and cognitive engagement. *Interactive Learning Environments*, *28*(4), 464–481. https://doi.org/10.1080/10494820.2018.1541910

Loon, P. M. (2021). *Flexible learning: A literature review 2016—2021*.

Luyet, V., Schlaepfer, R., Parlange, M. B., & Buttler, A. (2012). A framework to implement Stakeholder participation in environmental projects. *Journal of Environmental Management*, *111*, 213–219. https://doi.org/10.1016/j.jenvman.2012.06.026

Marais, A., & Abi-Zeid, I. (2021). *A Method to Identify, Characterize and Engage Relevant Stakeholders in Decision Processes*. https://doi.org/10.13140/RG.2.2.23890.89287

Millum, J., & Bromwich, D. (2021). Informed Consent: What Must Be Disclosed and What Must Be Understood? *The American Journal of Bioethics*, *21*(5), 46–58. https://doi.org/10.1080/15265161.2020.1863511

Mitchell, R. K., Agle, & Woods. (1997). *Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts*.

Moos, R. H. (1984). *Context and Coping: Toward a Unifying Conceptual Framework - ProQuest*. https://www.proquest.com/openview/3f4910484d24d7bb74477b16cef75101/1?pq-origsite=gscholar&cbl=1821511

Moran, & Myringer, B. (1999). Flexible learning and university change. In *Higher Education Through Open and Distance Learning* (pp. 77–91). Routledge. https://doi.org/10.4324/9780203018569-12

Noordam, S. J. (2021). *Visualisation tools in hospital real estate*. https://repository.tudelft.nl/record/uuid:3e9235a2-ef05-41b9-85da-a864a0c45455

Park, E. L., & Choi, B. K. (2014). Transformation of classroom spaces: Traditional versus active learning classroom in colleges. *High. Educ.*, *68*(5), 749–771.

Patino, C. M., & Ferreira, J. C. (2018). Inclusion and exclusion criteria in research studies: Definitions and why they matter. *Jornal Brasileiro de Pneumologia*, *44*, 84–84. https://doi.org/10.1590/S1806-37562018000000088

Pedrini, M., & Ferri, L. (2018). Stakeholder management: A systematic literature review. *Corporate Governance: The International Journal of Business in Society*, *19*. https://doi.org/10.1108/CG-08-2017-0172

Phillips, J., & Klein, J. D. (2023). Change management: From theory to practice. *TechTrends*, *67*(1), 189-197.

Pnevmatikos, D., Christodoulou, P., & Fachantidis, N. (2020). *STAKEHOLDERS' INVOLVEMENT IN PARTICIPATORY DESIGN APPROACHES OF LEARNING ENVIRONMENTS: A SYSTEMATIC REVIEW OF THE LITERATURE*. 5543–5552. https://doi.org/10.21125/edulearn.2020.1454

Preble, J. (2005). Toward a Comprehensive Model of Stakeholder Management. *Business and Society Review*, *110*, 407–431. https://doi.org/10.1111/j.0045-3609.2005.00023.x

Radboud University. (2023). *OneRoom: De lesruimte die fysiek en online écht samenbrengt | Radboud in'to Languages*. https://www.ru.nl/radboud-into-languages/nieuws/oneroom-de-lesruimte-die-fysiek-en-online-echt-samenbrengt

Rawlins, .L. (2006). *[PDF] Prioritizing Stakeholders for Public Relations | Semantic Scholar*. https://www.semanticscholar.org/paper/Prioritizing-Stakeholders-for-Public-Relations-Rawlins/977999db0ed4c09109296af8be9d3d0427e13f1d

Reymond, P., & Bassan, M. (2014). *Faecal Sludge Management: Systems Approach for Implementation and Operation*. IWA Publishing.

Rudman, H., Bailey-Ross, C., Kendal, J., Mursic, Z., Lloyd, A., Ross, B., & Kendal, R. L. (2018). Multidisciplinary exhibit design in a Science Centre: A participatory action research approach. *Educational Action Research*, *26*(4), 567–588. https://doi.org/10.1080/09650792.2017.1360786

Russ, F. A., & Kirkpatrick, C. A. (1982). *Marketing*. Little, Brown.

Rusticus, S. A., Pashootan, T., & Mah, A. (2023). What are the key elements of a positive learning environment? Perspectives from students and faculty. *Learning Environments Research*, *26*(1), 161–175. https://doi.org/10.1007/s10984-022-09410-4

SIG LS. (2020). *Stakeholders bij innovatieve Learning Spaces*. www.surf.nl/learning-spaces

SURF. (2023). *Trend Report Future Campus*. https://www.surf.nl/themas/futuring/future-campus-project-scenarios-voor-de-campus-van-morgen

Talbert, R., & Mor-Avi, A. (2019). A space for learning: An analysis of research on active learning spaces. *Heliyon*, *5*, e02967. https://doi.org/10.1016/j.heliyon.2019.e02967

Tilburg University. (n.d.). *Learning spaces (concept) | Tilburg University*. Retrieved 2 April 2025, from https://www.tilburguniversity.edu/nl/over/onderwijs/innovatie/learning-spaces

TU Delft. (n.d.). *Echo*. TU Delft. Retrieved 20 March 2025, from https://www.tudelft.nl/backstage/echo

Universiteiten van Nederland (2025, 23 May). *Paneldiscussie: lessen voor toekomst, onder leiding van Jan Lintsen*. [Paneldiscussion]. Campus NL Jaarcongres 2025, Delft.

Utrecht University. (n.d.). *Future Learning Spaces Universiteit Utrecht*. https://www.youtube.com/watch?v=ajO18ofpuwU

Utrecht University. (2022). *Kennisontwikkeling en docentprofessionalisering in Future Learning Spaces*.

Van Bueren, E. (2020). *Inzicht—Academische vaardigheden voor bouwkundigen*.

Victorino, G., Bandeira, R., Painho, M., Henriques, R., & Coelho, P. S. (2022). Rethinking the Campus Experience in a Post-COVID World: A Multi-Stakeholder Design Thinking Experiment. *Sustainability*, *14*(13), Article 13. https://doi.org/10.3390/su14137655

Voinov, A., Jenni, K., Gray, S., Kolagani, N., Glynn, P. D., Bommel, P., Prell, C., Zellner, M., Paolisso, M., Jordan, R., Sterling, E., Schmitt Olabisi, L., Giabbanelli, P. J., Sun, Z., Le

Page, C., Elsawah, S., BenDor, T. K., Hubacek, K., Laursen, B. K., … Smajgl, A. (2018). Tools and methods in participatory modeling: Selecting the right tool for the job. *Environmental Modelling & Software*, *109*, 232–255. https://doi.org/10.1016/j.envsoft.2018.08.028

Wannarka, R., & Ruhl, K. (2008). Seating arrangements that promote positive academic and behavioural outcomes: A review of empirical research. *Support for Learning*, *23*(2), 89–93. https://doi.org/10.1111/j.1467-9604.2008.00375.x

Winn, W. (2002). Current Trends in Educational Technology Research: The Study of Learning Environments. *Educational Psychology Review*, *14*(3), 331–351.

Wong, L.-H., & Looi, C.-K. (2011). What seams do we remove in mobile-assisted seamless learning? A critical review of the literature. *Computers & Education*, *57*, 2364–2381. https://doi.org/10.1016/j.compedu.2011.06.007

Xu, Y., Chiu, C. K., & Ye, X. (2019). *Understanding the use of technology-enhanced learning spaces in Hong Kong: An exploratory study*. https://www.researchgate.net/publication/344958555_Understanding_the_use_of_technology-enhanced_learning_spaces_in_Hong_Kong_an_exploratory_study

Yang, X., Zhou, X., & Hu, J. (2022). Students' preferences for seating arrangements and their engagement in cooperative learning activities in college English blended learning classrooms in higher education. *Higher Education Research & Development*, *41*(4), 1356–1371. https://doi.org/10.1080/07294360.2021.1901667

Appendices

Appendix 1 – List of Interviews

The table below provides an overview of all stakeholders involved in each case and indicates which of them were interviewed. A colored cell means that the stakeholder group was actively involved in that case. A number and letter within the cell indicate that a representative from this group was interviewed; this corresponds with the list below the table.

Note: Some stakeholders represented multiple roles. In such cases, the same label may appear under multiple roles in the table. The list below the table clarifies which stakeholder fulfilled which role(s).

	Case 1: TU Delft	Case 2: Radboud University	Case 3: Tilburg University	Case 4: Utrecht University
Campus Facilities (CF)	A1	B1	C1	D1
Audiovisual Services (AV)	A4	B2	C1	
ICT Services (ICT)	A4	B2		
Facility Management (FM)	A5	B1		
Educational Specialist (ES)	A2		C2	
Student (S)	A3			
Teacher (T)				D2
Advisors (A)				
Designers (D)	A6			
Contractors (C)				
Suppliers (S)				

Case A – TU Delft:

Interviewee **A1**. (12/03/2025). Interview with Asset Manager

SH Role: CF; case A (J.M. Tazelaar, Interviewer)

Interviewee **A2**. (18/03/2025). Interview with Educational Real Estate Advisor

SH Role: ES; case A (J.M. Tazelaar, Interviewer)

Interviewee **A3**. (17/03/2025). Interview with Student

SH Role: S; case A (J.M. Tazelaar, Interviewer)

Interviewee **A4**. (21/03/2025). Interview with AV-IT Expert

SH Role: AV + ICT; case A (J.M. Tazelaar, Interviewer)

Interviewee **A5**. (18/03/2025). Interview with Coordinator FM

SH Role: FM; case A (J.M. Tazelaar, Interviewer)

Interviewee **A6**. (01/04/2025). Interview with Interior Architect

SH Role: D; case A (J.M. Tazelaar, Interviewer)

Case B – Tilburg University:

Interviewee **B1**. (24/03/2025). Interview with Policy Officer Facility Services

SH Role: CF + FM; case B (J.M. Tazelaar, Interviewer)

Interviewee **B2**. (24/03/2025). Interview with Information & Library Services

SH Role: AV + ICT; case B (J.M. Tazelaar, Interviewer)

Case C - Radboud University:

Interviewee **C1**. (12/03/2025). Interview with Specialist Educational & Study Facilities

SH Role: CF + AV; case C (J.M. Tazelaar, Interviewer)

Interviewee **C2**. (03/04/2025). Interview with Educational Innovator

SH Role: ES; case C (J.M. Tazelaar, Interviewer)

Case D - Utrecht University:

Interviewee **D1**. (21/03/2025). Interview with Program manager Facility & Campus

SH Role: CF; case D (J.M. Tazelaar, Interviewer)

Interviewee **D2**. (21/03/2025). Interview with Initiating Teacher

SH Role: T; case D (J.M. Tazelaar, Interviewer)

Appendix 2 – Informed Consent Interview

Opening Statement

You are being invited to participate in a research study titled *Creating Effective Learning Environments: The Power of Stakeholder Involvement* his study is being done by Julie Tazelaar from the TU Delft and Aestate

The purpose of this interview is to explore your experience as a stakeholder involved in the creation of a new learning environment. Specifically, we aim to gain insights into how the process unfolded, how your input was considered, and the overall collaboration and decision-making between stakeholders. We will also discuss your satisfaction with the final outcome and whether you feel your contributions have been reflected in the realized environment. The interview will take approximately 45 minutes and will consist of two parts: first, open-ended questions to gather a broad understanding of your experiences, followed by more focused questions on the stakeholder involvement process. Your feedback will help us understand the effectiveness of the stakeholder involvement process and contribute to the optimization of future learning environment projects. Your responses will be used for research purposes and may be included in research publications.

As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by keeping the questionnaires anonymous, no IP addresses are saved. Some personal data is collected but this data will remain anonymous and is stored on the secured Project Storage of the TU Delft.

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any questions.

For any questions or comments, please use the contact information of the researcher below.

Clicking through to the survey constitutes agreement with the Opening Statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the study information dated 14/02/2025, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	☐	☐
3. I understand that taking part in the study involves: an audio-recorded interview. The audio recording will be transcribed pseudonimised. Only these pseudonimised transcription will be used in the research. The audio recordings will be destroyed afterwards.	☐	☐
4. I understand that the study will end one month after the research has been published		

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
5. I understand that taking part in the study also involves collecting specific personally identifiable information (PII) (Participants' name, gender, email, work address, company name, mobile number) and associated personally identifiable research data (PIRD) (profession & geographic location) With the potential risk of my identity being revealed as a result of re-identification, especially if specific roles or environments are detailed.	☐	☐
6. I understand that the following steps will be taken to minimise the threat of a data breach, and protect my identity in the event of such a breach : pseudonymization of the transcript, limited access to stored data, secure data storage.	☐	☐
7. I understand that personal information collected about me that can identify me, such as my name, gender, email, work address, company name and mobile number will not be shared beyond the study team.	☐	☐
8. I understand that the (identifiable) personal data I provide will be destroyed one month after the project had been published.	☐	☐
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
9. I understand that after the research study the de-identified information I provide will be used for publicatons of this thesis.	☐	☐
10. I agree that my responses, views or other input can be quoted anonymously in research outputs	☐	☐

Signatures

_____ _____ _____

Name of participant [printed] Signature Date

[Add legal representative, and/or amend text for assent where participants cannot give consent as applicable]

I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

_____ _____ _____

Name of witness [printed] Signature Date

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Julie Tazelaar _____ _____

Researcher name [printed] Signature Date

Appendix 3 – Interview Questions

First here are the questions in Dutch, below in English

Introductie

Hallo, bedankt dat u de tijd neemt voor dit interview. Mag ik eerst vragen of het goed is dat ik ons gesprek opneem?

Mijn naam is Julie Tazelaar, en ik ben student aan de Technische Universiteit Delft, waar ik de master *Management in the Built Environment* volg. Deze master richt zich op het ontwikkelen, beheren en optimaliseren van vastgoed, met een focus op hoe gebouwen waarde kunnen toevoegen aan organisaties en gebruikers.

Voor mijn afstudeeronderzoek onderzoek ik nieuwe *effective learning environments* en het proces waarin deze worden gecreëerd. Ik kijk specifiek naar de rol van stakeholders in dit proces: hoe zij betrokken zijn geweest, welke ervaringen zij hebben opgedaan, hoe tevreden zij zijn met het uiteindelijke resultaat, en of zij het gevoel hebben dat hun bijdrage goed is gehoord en terugkomt in de gerealiseerde omgeving. Het doel van dit interview is om uw ervaringen te begrijpen en inzicht te krijgen in hoe u het proces van samenwerking en besluitvorming heeft ervaren.

De interview bestaat uit drie delen. Eerst zal ik enkele algemene vragen stellen. Daarna zal ik me richten op het proces van stakeholderbetrokkenheid. Ten slotte zal ik vragen stellen over de resultaten en de effectiviteit van de leeromgeving.

Achtergrond en rol in Project

1. Kunt u uzelf introduceren en iets vertellen over uw rol en betrokkenheid bij de ontwikkeling van deze learning environment?
2. Hoe bent u betrokken geraakt bij dit project?
3. Wat was uw rol binnen het project?
4. Wat waren de belangrijkste doelen of uitgangspunten die jullie als projectteam trachtte te realiseren?

Stakeholder Proces

5. Hoe zag de projectstructuur er uit?
6. Hoe werd u tijdens het project betrokken?
7. In welke fase van het project was u betrokken?
8. Welke middelen, tools of activiteiten werden er ingezet om uw betrokkenheid te ondersteunen (bijvoorbeeld workshops, visualisaties, of digitale platforms)?

9. Heeft u met andere stakeholder samengewerkt? Zo ja, welke en kunt u dit proces van samenwerking en communicatie met andere stakeholders beschrijven?
10. Waren er momenten waarop u uitdagingen ervoer in de samenwerking? Zo ja, kunt u daar een voorbeeld van geven en hoe werd daarmee omgegaan?

11. Waren er specifieke momenten waarop uw inbreng werd gevraagd? Zo ja, hoe verliep dat?
12. Hoe werden beslissingen genomen binnen het project? Voelde u zich daarin gehoord?
13. Zijn er dingen die u graag anders had zien gaan met betrekking tot het stakeholder involvement proces.
14. Wat vond u het meest waardevol aan uw betrokkenheid in dit proces?
15. Heeft u aanbevelingen voor hoe het stakeholderproces verbeterd kan worden in toekomstige projecten?

Beoordeling van het resultaat

16. Hoe tevreden bent u met het uiteindelijke resultaat van de learning environment? Had u graag iets anders gezien?
17. Denkt u dat het ontwerp en de functionaliteit aansluiten wensen en behoeften van de eindgebruikers?
18. Vindt u dat uw bijdrage terugkomt in het eindresultaat? Waarom wel/niet?

Afsluitende vraag

Dat waren alle vragen vanuit mij. Is er iets dat we nog niet besproken hebben, maar wat u belangrijk vindt om te delen over uw ervaringen met dit project?

Dan wil ik u bedanken voor uw tijd en medewerken. Het was een erg interessant gesprek. Als u wilt, kan ik u wanneer mijn afstudeeronderzoek is afgerond, de resultaten opsturen?

Introduction

Hello, thank you for taking the time for this interview. May I first ask if it's okay to record our conversation?

My name is Julie Tazelaar, and I am a student at the Delft University of Technology, where I am pursuing a Master's in Management in the Built Environment. This master's program focuses on the development, management, and optimization of real estate, with an emphasis on how buildings can add value to organizations and users.

For my thesis research, I am studying new effective learning environments and the process in which they are created. Specifically, I am looking at the role of stakeholders in this process: how they were involved, what experiences they had, how satisfied they are with the final outcome, and whether they feel their contributions were heard and reflected in the realized environment. The purpose of this interview is to understand your experiences and gain insight into how you have experienced the collaboration and decision-making process.

The interview consists of three parts: First, I will ask some general questions. Then, I will focus on the stakeholder involvement process. Finally, I will ask about the outcomes and effectiveness of the learning environment.

Background and Role in the Project

1. Could you introduce yourself and tell us about your role and involvement in the development of this learning environment?
2. How did you become involved in this project?
3. What was your role within the project?
4. What were the main goals or expectations for this project, in your opinion?

Stakeholder Process

5. What did the project structure look like?
6. How were you involved throughout the project? Was this through formal or informal means of communication?
7. At what stage(s) of the project were you involved?
8. What tools, methods, or activities were used to support your involvement (e.g., workshops, visualizations, or digital platforms)?
9. Did you collaborate with other stakeholders? If so, which ones, and how would you describe the communication and cooperation during that process?
10. Were there moments when you experienced challenges in the collaboration? If so, can you give an example and explain how it was addressed?
11. Were there specific moments when your input was requested? If so, how did that process go?
12. How were decisions made within the project? Did you feel heard during this process?
13. Are there things you would have liked to see done differently regarding stakeholder involvement?
14. What did you find most valuable about your involvement in this process?
15. Do you have any recommendations for how the stakeholder process could be improved in future projects?

Evaluation of the Outcome

16. How satisfied are you with the final outcome of the learning environment? Is there anything you would have liked to see done differently?
17. Do you think the design and functionality meet the needs and preferences of the end users?
18. Do you feel that your contribution is reflected in the final result? Why or why not?

Closing Question

That concludes my questions. Is there anything we haven't discussed that you think is important to share about your experiences with this project?

I would like to thank you for your time and cooperation. It has been a very interesting conversation. If you'd like, I can send you the results of my thesis research once it's completed.

Appendix 4 – Survey Questions Students

Student Survey Active Blended Learning Environment

This survey aims to gain insight into your experience with the active, blended learning space you are currently in. All questions relate to this specific space where you are in right now and your experiences within it.

You are being invited to participate in a research study titled *Creating Effective Learning Environments: The Power of Stakeholder Involvement* his study is being done by Julie Tazelaar from the TU Delft and Aestate.

The purpose of this research study is to explore your experiences with the learning environment and gather your insights on how it supports your educational needs. The survey will take approximately *7* minutes to complete. The data will be used for research purposes. We will be asking you to provide feedback on various aspects of the learning space that you are in right now, including its design, functionality, and how well it meets your needs.
Your responses will help us understand the effectiveness of the environment and contribute to the optimization of future learning spaces. As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by keeping the questionnaires anonymous, no IP addresses are saved. Some personal data is collected but this data will remain anonymous and is stored on the secured Project Storage of the TU Delft

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any questions. For any questions or comments, please use the contact information of the researcher below.

Clicking through to the survey constitutes agreement with the Opening Statement.

- I agree *

Q1.1which university are you at right now?

- TU Delft
- Radboud University
- Tilburg University

Q1.2 Where do you attend the lesson from?

• In the classroom (on location) (1)

• online (remotely) individually (2)

• online (remotely) in a classroom with other students (3)

• otherwise (4)

Q1.3 Where was your teacher?

• in the classroom (on location) (1)

• online (remotely) individually (2)

• online (remotely) in a class with other students (3)

• otherwise (4)

Q1.4 Where were your classmates?

• all in the classroom (on location) (1)

• all online (remotely) (2)

• partly in the classroom, partly online (hybrid) (3)

• otherwise (4)

Q1.5 What type(s) of education were used during this class time? (multiple answers possible)

• Lecture (1)

• Presentation (2)

• Assignment in groups (3)

• Individual assignment (4)

• Discussion with whole class (5)

• Discussion in groups (6)

• Otherwise, namely (7)

Q1.6 Prior to this course, have you ever taken a class in a~~n~~ room like this?

• No (1)

• Yes (2)

End of Block

Start of Block: **Use of Facilities**

These questions focus on the availability and use of digital and analog facilities in the classroom by both the teacher and students.

Q2.1 The teacher made use of the digital classroom facilities (like the display screens)

- Yes, used optimally
- Yes, but could be utilized more
- No, limited use
- No, not used at all

Q2.2 I made use of the digital classroom facilities (like the display screens)

- Yes, used optimally
- Yes, but could be utilized more
- No, limited use
- No, not used at all

Q2.3 The teacher made use of the analogue classroom facilities (like whiteboards)

- Yes, used optimally
- Yes, but could be utilized more
- No, limited use
- No, not used at all

Q2.2 I made use of the analogue classroom facilities (like whiteboards)

- Yes, used optimally
- Yes, but could be utilized more
- No, limited use
- No, not used at all

End of Block

Start of Block: **Evaluation of the Room**

Engagement & Dynamics

For the following questions: Please fill in to what extent, you agree or disagree with the statements about this specific class time.

Q3.1 I have learned something from my teacher.

Q3.2 I have helped others learn during this class.

Q3.3 I have learned something from my fellow students.

Q3.4 My teacher DID NOT encourage questions and comments from students.

Q3.5 I was unmotivated to learn.

Q3.6 I spent most of the class time listening to the teacher.

Q3.7 The teacher made use of the digital classroom facilities (like the display screens)

Q3.8 I made use of the digital classroom facilities (like the display screens)

Q3.9 It was difficult for me to be actively engaged with the learning content most of the time.

Classroom Layout

For the following questions: Please fill in to what extent, you agree or disagree with the statements about this specific class time.

Q3.10 The classroom layout stimulated me to have more interaction with other students.

Q3.11 The classroom layout stimulated me to have more interaction with the teacher.

Q3.12 The classroom layout me to have more interaction with the learning content

Q3.13 The classroom layout encouraged me to participate actively in class.

Q3.14 The classroom layout stimulated the teacher to give space for us students to work together

Q3.15 The classroom offered a physically comfortable learning environment.

Q3.16 The classroom layout enriched my learning experience.

Q3.17 The classroom layout made it difficult for me to engage in my learning process.

End of Block

Start of Block: **Open Questions**

Q4.1 Which aspects of the classroom lay-out contribute the most to your learning behaviour/process? Why? Provide as many details as possible.

Q4.2 Which aspects of the classroom lay out did not contribute to your learning behaviour/process? Why? Provide as many details as possible.

Q4.3 Would you recommend participating in this class in this classroom to your fellow students?

• No (1)

• Yes (2)

Q4.4What improvements to the classroom would you suggest?

Q4.5 On a scale from 1 to 10, where 1 is the lowest and 10 is the highest, how would you rate the classroom - How would you rate this classroom?

End of block

Appendix 5 – Survey Questions Teachers

Teacher Survey Future Learning Spaces

This survey aims to gain insight into your experience with the active, blended learning space you are currently in. All questions relate to this specific space where you are in right now and your experiences within it.

You are being invited to participate in a research study titled *Creating Effective Learning Environments: The Power of Stakeholder Involvement* his study is being done by Julie Tazelaar from the TU Delft and Aestate.

The purpose of this research study is to explore your experiences with the learning environment and gather your insights on how it supports your educational needs. The survey will take approximately *7* minutes to complete. The data will be used for research purposes. We will be asking you to provide feedback on various aspects of the learning space that you are in right now, including its design, functionality, and how well it meets your needs.
Your responses will help us understand the effectiveness of the environment and contribute to the optimization of future learning spaces. As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by keeping the questionnaires anonymous, no IP addresses are saved. Some personal data is collected but this data will remain anonymous and is stored on the secured Project Storage of the TU Delft

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any questions. For any questions or comments, please use the contact information of the researcher below.

Clicking through to the survey constitutes agreement with the Opening Statement.

- I agree *

Q1.1 At which university are you

- TU Delft
- Radboud University
- Tilburg University

Q1.2 Where were you?

• In the classroom (on location)

• online (remotely) individually

• online (remotely) in a classroom with other students

• otherwise

Q1.3 Where were your students?

• all in the classroom (on location) (1)

• all online (remotely) (2)

• partly in the classroom, partly online individually (hybrid) (3)

• partly in the classroom, partly online from another classroom (hybrid) (4)

• otherwise (5)

Q1.4 What type(s) of education did you use this class time? (multiple answers possible)

• Lecture (1)

• Presentation (2)

• Assignment in groups (3)

• Individual assignment (4)

• Discussion with whole class (5)

• Discussion in groups (6)

• Otherwise, namely (7)

Q1.5 Prior to this course, have you ever taught in a room like this?

• No (1)

• Yes (2)

End of block

Start of Block: **Use of Facilities**

These questions focus on the availability and use of digital and analog facilities in the classroom by both the teacher and students.

Q2.1 The teacher made use of the digital classroom facilities (like the display screens)

- Yes, used optimally
- Yes, but could be utilized more
- No, limited use
- No, not used at all

Q2.2 I made use of the digital classroom facilities (like the display screens)

- Yes, used optimally
- Yes, but could be utilized more
- No, limited use
- No, not used at all

Q2.3 The teacher made use of the analogue classroom facilities (like whiteboards)

- Yes, used optimally
- Yes, but could be utilized more
- No, limited use
- No, not used at all

Q2.2 I made use of the analogue classroom facilities (like whiteboards)

- Yes, used optimally
- Yes, but could be utilized more
- No, limited use
- No, not used at all

End of Block

Start of Block: **Evaluation of the Room**

Engagement & Dynamics

For the following questions: Please fill in to what extent, you agree or disagree with the statements about this specific class time.

Q3.1 Students have learned something from me.

Q3.2 Students have helped others learn during this class.

Q3.3 Students have learned something from their fellow students.

Q3.4 I DID NOT encourage questions and comments from students.

Q3.5 Students were unmotivated to learn.

Q3.6 Students spent most of the class time listening to me.

Q3.7 I made use of the digital classroom facilities (like the display screens)

Q3.8 The students made use of the digital classroom facilities (like the display screens)

Q3.9 I made use of the analogue classroom facilities (like the whiteboards)

Q3.10 The students made use of the analogue classroom facilities (like the whiteboards)

Q3.11 It was difficult for students to be actively engaged with the learning content most of the time.

Classroom Layout

For the following questions: Please fill in to what extent, you agree or disagree with the statements about this specific class time.

Q3.12 The classroom layout stimulated students to interact with each other.

Q3.13 The classroom layout stimulated interaction between me and the students.

Q3.14 The classroom layout stimulated students to have more interaction with the learning content

Q3.15 The classroom layout encouraged students to participate actively in class.

Q3.16 The classroom layout stimulated me to give more space for active student participation/contribution.

Q3.18 The classroom offered a physically comfortable learning environment.

Q3.19 The classroom layout enriched the students' learning experience.

Q3.20 The classroom layout made it difficult for students to engage in their learning process.

Q.3.21 It is easy to change the lay-out of this classroom to another setting

End of Block

Start of Block: **Open questions**

Q4.1 Which aspects of the classroom layout contribute the most to an effective way of teaching, and thus your students' learning behavior/process? Provide as many details as possible.

Q4.2 Which aspects of the classroom lay out did not contribute to an effective way of teaching, and thus your students' learning behavior/process? Provide as many details as possible.

Q4.3 Would you recommend giving a class in this classroom to your fellow teachers?

• No (1)

• Yes (2)

Q4.4 What improvements to the classroom would you suggest?

Q4.5 On a scale from 1 to 10, where 1 is the lowest and 10 is the highest, how would you rate the classroom - How would you rate this classroom?

End of Block

Campus NL