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Annelies Huysentruyt

Adoption and diffusion of the remote classroom on three campuses of a large university:

case study exploring factors that impact further adoption and diffusion from a staff viewpoint

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Annelies Huysentruyt
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ABSTRACT

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Three types of learning spaces were developed and installed at a large, multicampus university during an innovative, two-year pilot project. One of these learning spaces was a remote classroom or a synchronous hybrid learning space that allows for two remote groups of students to be connected for teaching activities. During the pilot, eleven faculty members gave lectures in these classrooms and to remote groups of students at other campuses. The project steering committee assumed that the adoption and diffusion of the remote classroom would progress slowly after the pilot project based on anecdotes from the eleven lecturers. The research study for this master's thesis aims to gain insight into the factors impacting the rate of adoption and diffusion of the remote classroom.

Data was collected by means of semi-structured interviews with ten faculty members. The Diffusion of Innovations Theory by Rogers (2003) was used as a foundation for purposive sampling of interviewees and for data analysis. The ten interviewees were categorized into two groups: innovators, characterized by a fast adoption rate; or the laggards, characterized by a slow adoption rate or non-adoption.

The findings show that perceived attributes toward the remote classroom, such as the low relative advantage, the high complexity and the low compatibility of the remote classroom compared to face-to-face teaching, as well as the lack of communication channels used during the pilot and the complexity of the social system were key elements in slowing down the diffusion rate. These factors are named by both innovators and laggards that were interviewed. Strategies, deducted from interview data, that could enhance the diffusion are: persisting in co-creation with faculty members, investing in the technological development of the remote classrooms, installing remote classrooms on other campuses, providing a safe experimenting space for faculty and exploring effective teaching methods in the synchronous hybrid learning space.

Although the methodology used for this case study does not allow for generalizing the results to other contexts in HEIs, findings suggest that the added value of the remote classroom is highly questionable in the current status. In addition, these results shed light on how staff members perceive the remote classroom and which approaches could facilitate a faster diffusion rate.

Keywords: Remote classroom; Synchronous hybrid teaching; Adoption; Diffusion; Edtech; Learning Spaces

PREFACE

The writing of this master's thesis was a pleasant and inspiring, professional journey. More than with the previous theses I wrote in two different areas of healthcare, this process challenged me every step of the way. The way I was able to intertwine my practical know-how in education with evidence-based theory highly inspired me. I hope the findings in my case study will be of use to other institutions who wish to invest in synchronous, hybrid teaching and learning.

My sincere gratitude goes out to everybody who has made this endeavor possible. In the first place the research group ITEC and my colleagues there for inspiring, motivating and enabling me to make this happen, especially Professor Piet Desmet, Professor Fien De Paepe, Mrs. Ine Windey, Dr. Annelies Raes and all other members of the TECOL steering committee.

Secondly but equally important, I would like to thank my family for their unconditional support. My husband and children have sacrificed many hours to allow me to write this master's thesis. They've helped me through the rough patches, and I hope I've been able to show my kids that science takes perseverance and hard work but in the end the reward is great!

Finally, I would like to thank my critical friends for making the time to read my work and provide me with their valuable feedback, you have helped me learn, adapt and enhance! Thanks to Elien Sabbe, Isabelle Vandevyvere, Lieven Huysentruyt. And save the best for last, Dr. Blair Stevenson, thanks for the countless feedback and skype calls, I will truly miss them!

"Difficult roads often lead to beautiful destinations" (Author unknown)

Annelies Huysentruyt
January 5th, 2020

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1 INTRODUCTION

The impact of technology is rapidly changing the way we work, live and interact. Digital transformation is happening in all aspects of society and economy, making it necessary to think about access to and use of technology in the near future (OECD, 2019). In the report 'Going digital: shaping policies, improving lives", the OECD states only 31% of the adults possess the problem-solving skills to thrive in a world in which technology is omnipresent. This implies that a large task lies ahead for educators all around the world, namely making sure that students become digitally literate and ready for the 21st century. But according to the McKinsey Global Industry Digitization index, education as a sector ranks at a mere 14th place out of 22 sectors when it comes to building digital capacity in many forms (Manyika et al., 2015). According to Strong-Wilson (2008) issues with hardware, so-called broken technology, the time necessary to implement technology, problems with curriculum alignment, issues with faculty members' schedule and the availability of technology are a few of the reasons that technology acceptance and usage are problematic in educational institutions.

So although it might be slow, digitalization is a process that is happening in higher education institutes (HEIs), not only for administrative purposes but also within teaching and learning activities (Haywood, Connelly, Henderikx, Weller, & Williams, 2014). The sheer quantity of educational technology applications (edtech) that could be of use in higher education is astonishing. The 2019 Global Learning Landscape is just one source to demonstrate this (Holon IQ, 2019), along with the Hype Cycle for Education below which illustrates the upcoming technologies according to Gartner in 2014 (Lowendahl, 2014).

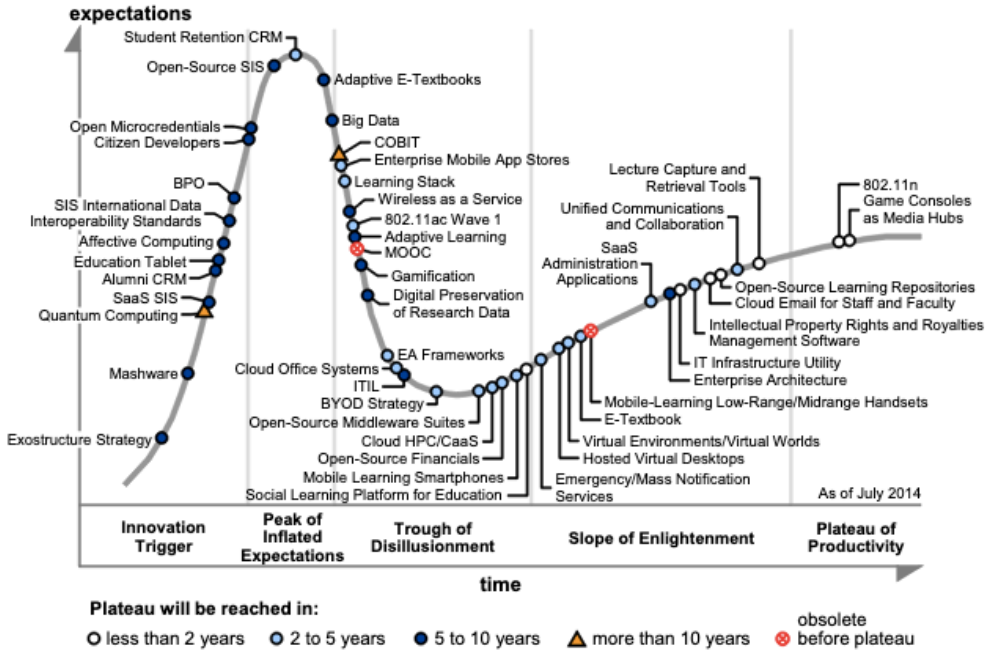

Figure 1:Gartner's Hype Cycle for Education (Lowendahl, 2014)

1.1 The added value of technology-enhanced learning in HEIs

HEIs are faced with the consequences of a fast-changing world, needing to deliver graduates that are 21st century proof and giving students the best learning experience possible. Investing in strong policies on digitalization are necessary. The UNESCO report "Trends in global higher education: tracking an academic revolution" already stated in 2009 that remote teaching and learning has huge potential for future education on a global scale (Altbach, Reisberg, & Rumbley, 2009). The debate has triggered many HEIs all over the world to invest in edtech and to innovate pedagogical approaches. In addition, the inclusion of digital competences in curricula and assessment of undergraduate programs has increased and led to a greater popularity of technology-enhanced learning (TEL) (Scherer, Siddiq, & Tondeur, 2019).

Nonetheless the fact remains that many authors have described their doubts about the impact of different digital tools on instructional practice (Walker, Jenkins, & Voce, 2018). Weller (2018) draws the conclusion that the 'tech' in edtech has been the driving force for the rise in TEL in the past 20 years, which might be the reason for the minor impact of edtech on instructional practice compared to technology in other sectors. Graham, Woodfield, & Harrison (2013) identified key policy issues in the institutional adoption of blended learning in HEIs, for example lack of institutional direction and policy, insufficient physical and technological infrastructure and the need for pedagogical and

technological professional development. Often a mismatch between usefulness and perceived ease of use of a certain edtech tool results in dissatisfaction of its users (Tondeur, van Braak, Siddiq, & Scherer, 2016).

1.2 The implementation and use of technology-enhanced learning in HEIs

Luckily, the lack of alignment between usefulness and ease of use of certain edtech tools has not stopped HEIs from experimenting with the inclusion of different solutions in their educational offerings and teachers have been encouraged to make use of these tools in their teaching. Walker et al. (2018) discovered that in the UK there was an increase in investment for TEL at institutional levels from 2014 to 2016. For instance in 2016, 93% of the responding institutions stated they provide a virtual learning environment for their course delivery (UCISA, 2016). Funding for these types of implementations comes from the institution itself. Although this central pathway to introducing edtech in HEIs is becoming more common, it does not guarantee adoption by staff members. Studies by Birch & Burnett (2009) and de Freitas & Oliver (2005) indicate that top-down strategies based on senior management directives might negatively impact the adoption process when edtech is introduced from a central level (Walker et al., 2018).

Although the body of evidence on companies and educators co-creating an edtech tool together within an educational context, is not convincing (Gu, Crook, & Spector, 2019) it provides an alternative for top-down strategies, namely a bottom-up introduction of technology. For instance, many European countries stimulate entrepreneurship, research and development in the educational space by funding projects that bring together business, education and research to co-create and implement edtech. In Belgium, the Flemish government subsidizes projects where edtech companies, educational and research partners work together to develop, test and implement digital tools that are ready to go-to-market after the project is finished[1]. This type of initiative introduces innovative digital tools to HEIs that are interested in doing effectiveness research and in experimenting in their educational practices, often in the form of pilots. Typically, this is a fast manner of implementing an edtech tool in the higher education space, and although many advantages can be observed, the drawbacks can be just as prominent. For example, the edtech tool might not have been tested adequately scientifically, or the newly introduced edtech

[1] https://www.vlaio.be/nl/andere-doelgroepen/flanders-innovation-entrepreneurship/subsidies-entrepreneurs/subsidies for more information

tool might create a high tension between existing educational practice and the reform necessary to implement the tool in a qualitative way (Berrett, Murphy, & Sullivan, 2012).

1.3 Enhancing the implementation of edtech in HEIs

Piloting or project-based implementation of edtech in HEIs often initially reaches the happy few. Borsheim, Merritt, & Reed (2008) state that a small group of educators usually see the value in specific edtech and start experimenting with it, but this does not necessarily mean that technology gets introduced into the mainstream. Implementation of any edtech innovation takes time and patience to achieve successful outcomes (Looi & Teh, 2015).

Well intended strategies, such as ensuring pedagogical and technological support for staff, diffusing good practices by using different media and in some cases creating a learning community on an institutional level, are often stipulated but don't always do the trick especially for risk-averse faculty (Herckis, 2018). Another important question that arises is: do these strategies really support adoption and diffusion, are they as effective and efficient as they are thought to be? Are more staff using the edtech at hand and, moreover, are they doing so in a pedagogically sound activity? The question of effectiveness and efficiency is not only important for a project team but also for HEIs management allocating budgets to these initiatives to support the adoption of educational technology.

Current research on adoption and diffusion states different factors that may impact implementation of edtech in different contexts of HEIs. There is a vast amount of research that has focused on an individual's adoption of edtech at a certain moment in time, while another strand of research consists of mainly case study research on an institutional level because of the complexity of these processes and the dependence on contextual factors (Birch & Burnett, 2009; Brown, 2016; Porter, Graham, Bodily, & Sandberg, 2016). Herckis (2018), an ethnographical researcher at MIT, suggests that comprehension of the different factors impacting the adoption and diffusion of edtech is still very limited. For example, Vanderlinde & van Braak (2010) identified four conceptual frameworks for studying ICT integration in primary schools but argue that these frameworks fall short in providing concrete measurement scales for factors impacting the adoption and diffusion of ICT.

It is important to take into account that most of these studies refer to the general adoption of technology by lecturers in instruction (Abrahams, 2010), online tools (Brown, 2016), blended learning (Porter, Graham, Bodily, & Sandberg, 2016) or e-learning (Birch & Burnett, 2009) rather than the type of technology that was used to provide the online teaching and learning. From an institutional perspective these authors provide important insights that might guide the process of determining which strategies or interventions can be undertaken to stimulate adoption and diffusion of edtech (Jasperson, Carter, & Zmud, 2005), but the potential transferability of these results to the adoption and diffusion of the remote classroom remains to be clarified. As stated by Herckis (2018) the integration of such innovative tools in teaching is a complex process, and the necessity to understand it is high, to make sure an institution chooses the right strategy mix to attain the adoption goals.

Another element to consider in the complex process of edtech integration is that within a population, not all individuals adopt or continue to adopt a certain tool at the same moment in time (Rogers, 2003). In addition, these individuals might be influenced by different factors, at different times throughout the integration process (Rogers, 2003) making it difficult to account for all factors impacting the adoption and diffusion at one point in time (Sun & Jeyaraj, 2013).

Most adoption research has looked at the implementation of instructional edtech in general or blended learning (Boelens, De Wever, & Voet, 2017; Graham et al., 2013; Herckis, 2018), and research on the remote classroom has focused on how design and implementation factors have impacted student learning activity (Bower, Dalgarno, Kennedy, Lee, & Kenney, 2015; Raes, Detienne, Windey, & Depaepe, 2019), as well as when to make use of the remote classroom in teaching (Zydney, McKimmy, Lindberg, & Schmidt, 2019). There appears to be a research gap in studies that have looked at the adoption and diffusion of the remote classroom on an institutional level and from a staff perspective. The need for this type of research is high since evidence has shown that the way faculty perceive a certain innovation impacts their adoption decision and their perception is subject to change over time (Sun & Jeyaraj, 2013).

This master's thesis intends to fill this identified research gap by gaining insight into a specific case, namely the adoption of technology for synchronous hybrid learning or the *remote classroom* on three select campuses of a large Flemish university. It will aim to provide an answer to the question of which factors are currently impacting the adoption and diffusion of the remote classroom from the viewpoint of staff members in this particular case. The uncovered factors will be compared to

results from similar case studies on the implementation of instructional edtech in general or blended learning, potential similarities and differences will be discussed. Finally, strategies that have been put forward from a staff viewpoint in this case study will be revealed and compared to findings from other research studies.

Chapter two of this thesis will provide the theoretical foundation on the adoption and diffusion of edtech in higher education and the remote classroom. The next chapters describe the research question and the methodology of this case study, the findings of the study, the discussion and conclusion.

The findings from this thesis will serve the overarching goal of this case study, namely to provide the project steering committee of the TECOL project and the management teams of the different campuses with recommendations on an institutional level regarding strategies to facilitate further adoption and diffusion of the 'remote classroom' technology.

2 LITERATURE REVIEW

This chapter lays out the state-of-the-art regarding the prediction of adoption and diffusion of edtech in general and factors impacting adoption and diffusion of edtech in HEIs, more specifically the remote classroom.

Since this case study means to explore the adoption and diffusion of the remote classroom in a certain higher education context, a narrative literature review was performed to find key elements and potential barriers in the adoption and diffusion of edtech in HEIs. A narrative literature review is a non-systematic literature review which takes a knowledgeable selection of high-quality research articles to help provide a framework for the following phase in this research study (Coughlan, Cronin, & Ryan, 2007). The search strategy for this literature review was set up to find articles in peer-reviewed journals and 'grey' literature, containing a search in the Web of Science and ERIC electronic database. In addition, references from relevant articles were scanned manually to identify other articles. Keywords that were used for this search were: adoption, diffusion, synchronous hybrid learning, blended learning, videoconference, edtech, educational technology.

This chapter of the thesis is broken down into four sections. The first section describes what adoption and diffusion of technology is and scrutinizes a specific diffusion theory, namely the Diffusion of Innovations theory by Rogers (2003). In addition, this section depicts the theoretical framework that is used in this case study and explains the reasoning behind why this framework was chosen. A second section highlights key elements and potential barriers related to the adoption and diffusion of edtech in HEIs and what has been published on the remote classroom or hybrid synchronous learning specifically.

2.1 Adoption and diffusion of technology

This section starts out with general insights on adoption and diffusion of technology. The Diffusion of Innovations theory (DOI) (Rogers, 2003) is thoroughly described in the first subsection. The rationale behind the choice of this theoretical framework for use in this case study is laid out in the second subsection.

Predicting whether a person will adopt a certain technology has been researched in as many as 22 academic disciplines and thus from many points of view, resulting in numerous adoption and diffusion theories (Sovacool & Hess, 2017; Straub, 2009). Each theory comes with a framework with key determinants that can be used to predict how the adoption on an individual level will take place. What these frameworks show is that adoption and diffusion is complex and very dependent on the context in which it takes place.

The dichotomy between predicting adoption at an individual and organizational level, is reflected in the terminology used within these two levels. Adoption can be described as the choice of an individual to accept a new type of technology and integrate it in their context (Straub, 2009) or as the acceptance or first use of a technology (Rad, Nilashi, & Dahlan, 2018). Therefore, theories on adoption look at independent variables to individual adoption, or the behavior change that takes place with regards to technology.

In contrast to theory on adoption, theory on diffusion looks at the acceptance or rejection of a certain innovation at organizational level. *"Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system."* (Rogers, 2003, p. 5)

Seen as diffusion is an accumulation of individual adoption decision, the terms adoption and diffusion will be used together throughout this case study.

The next subsection looks at one specific theory that focuses on adoption and diffusion of technology at the organizational level, namely the Diffusion of Innovations theory (DOI).

2.1.1 Diffusion of Innovations theory

In 1962, Everett Rogers constructed a theory for the understanding of how an innovation permeates a population making use of know-how from different research fields of sociology, education, psychology, geography and others: Diffusion of Innovations theory (DOI). This theory has been used in empirical studies in an educational context, for instance by Sun and Jeyaraj (2013) who studied individuals' behavioral intentions regarding technology adoption and continuance longitudinally using DOI. While Abrahams (2010) used DOI to identify and prioritize issues and barriers to the adoption of instructional technology. In their review of information technology

adoption, Rad et al. (2018) found 44 recent papers that made use of DOI when researching the implementation of new technology such as mobile technology and e-government tools.

The idea that some innovations take longer than others to spread from when they become available to a mainstream use was originally introduced by Ryan & Gross (1943). This phenomenon provided context for academics to do research on what factors speed up or slow down this process (Rogers, 2003). Diffusion is an accumulation of different individual adoption processes albeit DOI provides a broad theoretical framework to look at factors that influence the adoption of innovations.

DOI states five principles that influence the adoption and diffusion at an organizational level (Abrahams, 2010):

1. The attributes of an innovation influence the adoption and diffusion
2. The process of adoption and diffusion starts when an individual or group contemplates using an innovation
3. Certain characteristics of an individual or group are indicative of when they are likely to adopt an innovation (see figure 2 and table 1 below)
4. The perception that an individual or group has of an innovation impacts the speed of adoption
5. Not everybody adopts an innovation at the same time (see figure 3 below)

The diffusion-adoption curve below illustrates diffusion over time as an accumulation of individuals' adoption decisions. The time at which an individual adopts an innovation, marks the category in which the adopter can be situated. These categories represent groups of adopters with similar characteristics and determines when a person is most likely to adopt a certain innovation (Rogers, 2003).

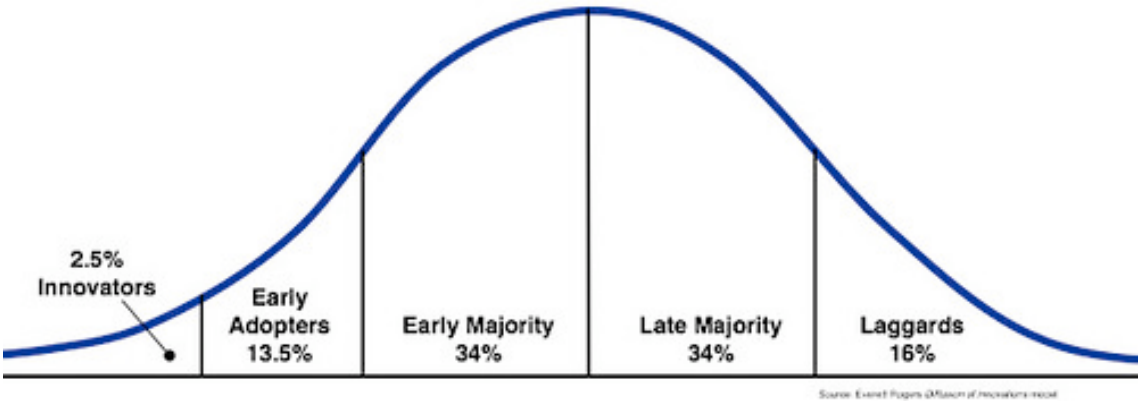

Figure 2: Diffusion curve of product adoption, outlining the percentage of the market who adopt an innovation (Rogers, 2003)

The different characteristics of each category are provided in table 1 below.

Category	Characteristics
Innovators	They are the very first to adopt a new innovation. They represent approximately 2.5% of the adopters. They aggressively pursue new technology products and may make a purchase simply to explore a technology's features. They have substantial technical expertise and maintain connections with sources of innovations.
Early adopters	They are next to adopt new innovations. They represent approximately 13.5% of adopters. They have a level of technical expertise and investigate new technologies; however, they adopt innovations with greater discretion than innovators. Because of their discretion, early adopters serve as examples and opinion leaders for others contemplating adoption.
Early majority	They adopt at varying times after the early adopters but before the average adopter. They represent approximately 34% of adopters. They are fairly comfortable with technology, but they only adopt new innovations when they have compelling evidence of its value and solid recommendations from other adopters.
Late majority	They adopt innovations after the early majority. They represent approximately 34% of adopters. They are typically less comfortable with technology than the early majority and require support. They adopt an innovation only when peer pressure and necessity compel it.
Laggards	They are the last to adopt an innovation. They represent approximately 16% of adopters. They express aversion to technology and resist adopting new innovations even after necessity prompts adoption.

Table 1: Characteristics of Rogers' five categories of adopters taken from Porter et al. (2016)

The ‘S’-shaped curve below in figure 3 shows the diffusion of an innovation over time. On the vertical axes the percentage of the adopters is plotted, while time is situated on the horizontal axis. The lower end of the ‘S’-curve represents the innovators and the early adopters. When an innovation hits the critical mass point, this means that the mainstream adopters accept and use the innovation. Rogers calls it the ‘take-off’ of an innovation or the moment when individuals have the perception that everybody else has adopted the innovation (Abrahams, 2010). Before the ‘take-off’, the rate of adoption is rather slow and adoption decisions are made by innovators and early adopters.

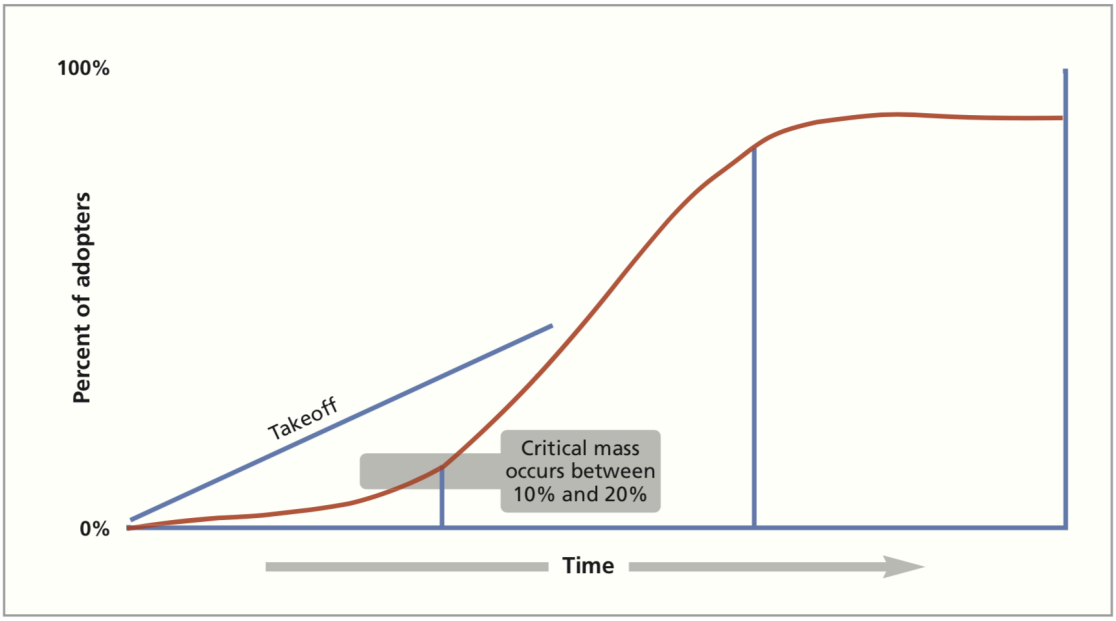

Figure 3: 'S'-shaped curve of adoption adopted from Abrahams (2010)

Rogers defines an individual's adoption process as a five-stage mechanism which an individual goes through when evaluating an innovation. The different stages are described in the table 2 below.

Stage	Definition
Stage 1: awareness	The individual becomes exposed to the innovation but is not inspired yet to find out more about the innovation.
Stage 2: persuasion	The individual is persuaded to seek information about the innovation in order to make a judgement about it.
Stage 3: decision	The individual chooses to adopt or reject the innovation.
Stage 4: implementation	The individual acts on the decision to adopt the innovation and finds out if the innovation is useful.
Stage 5: confirmation	The individual evaluates the implementation of the innovation and decides whether or not to continue using it.

Table 2: the five conceptual stages of the innovation-decision process (Rogers, 2003)

Diffusion is a "special form of communication" according to Rogers, one where new ideas spread from one individual to another across a certain timeframe. Diffusion is impacted by how individuals perceive four key elements, namely the attributes of the innovation itself, the communication channels used to promote the innovation, the social system in which the innovation is introduced and time. In his work, Rogers defined each of these key elements. The following paragraphs outline these key elements.

2.1.1.1 The five attributes of the innovation

Five attributes of the innovation that potentially influence the adoption decision of an individual are the perception of the relative advantage, compatibility, complexity, trialability and observability of the innovation itself. Each of these has the potential to facilitate or to inhibit adoption, for instance a low complexity of an innovation or the fact that the innovation is perceived as easy to comprehend will enhance the chance of a positive adoption decision (Rogers, 2003). It is important to take into account that it is the perception that adopters have of the innovation that potentially influences adoption, not the way these attributes are perceived by experts. Table 3 below contains the five attributes as they were defined by Rogers (2003).

Attribute	Definition
Relative advantage	The degree to which an innovation is perceived as being better than the idea it supersedes.
Compatibility	The degree to which an innovation is perceived as consistent with existing values, past experiences and needs of potential adopters.
Complexity	The degree to which an innovation is perceived as relatively difficult to understand and use.
Trialability	The degree to which an innovation may be experimented with on a limited basis.
Observability	The degree to which the results of an innovation are visible to others.

Table 3: the five attributes of the innovation itself (Rogers, 2003)

These attributes account for 49 to 87 percent of the variance in the rate of adoption or the relative speed with which an innovation is adopted by different people (Rogers, 2003).

2.1.1.2 The communication channels

The communication channels are the means and mechanisms that transfer the innovation between individuals. Different forms of communication can potentially do the trick, for instance direct communication between individuals or communication through social media. Communication is imperative for diffusion because if the idea is not transmitted between people, it will never reach a population.

2.1.1.3 The nature of the social system

The social system is "a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (Rogers, 2003, p. 24). Each individual operates within a context, culture and environment, be it for work, for hobbies, for family. This social system and the potential subsystems have certain social norms that influence the way an innovation diffuses throughout that system.

2.1.1.4 Time

The final key element, time, constitutes the fact that in a system there will be individuals that take little time to adopt the innovation while others will potentially take a long time. This observation inspired Rogers (2003) to categorize adopters into groups based on the amount of time it might take people to adopt the innovation. This pooling eventually led to the discovery of common characteristics in each group regarding personality, socio-economic status and types of communication. The defined groups are innovators, early adopters, early and late majority, and lastly the laggards. The typical presentation of these groups is in a bell curve as illustrated in figure 2. The specific characteristics of each category are outlined in the table 1 above, these are based on the work of different researchers (Geoghegan, 1994; Humbert, 2007; Moore, 2002; Rogers, 2003; Thackray, Good, & Howland, 2010).

DOI is mainly used in qualitative, descriptive studies about adoption and diffusion because the model does not prescribe certain relationships between independent variables potentially influencing diffusion (Straub, 2009). For that reason, using the framework for a single relational or comparative research study is particularly difficult. However, because of the wideness of the framework it is applicable in many contexts and for many different types of innovation. It provides a theoretical lens to look at the diffusion of edtech in higher education for instance. According to Rad et al. (2018) research on the adoption of IT on a group or organizational level should increase even though there seems to be a lack of generally accepted theories for this type of research.

The following subsection provides arguments for using DOI as the theoretical framework for this case study.

2.1.2 Theoretical framework used for this case study

The framework that was chosen as a backbone for drawing up the case study for this master's thesis will be described in this section. The information from the narrative literature review served as a base to choose the framework.

Straub (2009) argued that none of the existing theoretical frameworks for adoption and diffusion on an individual and organisational level could account for all elements impacting the adoption and

diffusion of a certain type of edtech. In addition, similar studies that have identified barriers to the adoption and diffusion of technology have created new frameworks and structures to analyse and inventory the results (Birch & Burnett, 2009; Herckis, 2018). This made it particularly difficult to deduct a framework that would allow for generalizing the results of this case study and comparing them to results of the similar case studies.

Nonetheless, the DOI theoretical framework (Rogers, 2003) was chosen as the framework for this thesis because:

- DOI is a relatively simple framework with four key elements that allows this case study to look at how attributes of the remote classroom itself and other key elements are impacting the diffusion at an institutional level;
- DOI takes into account that a population is not homogenous when it comes to adopting a certain innovation: each category of adopters has specific characteristics and a specific time at which they might adopt an innovation. The assumption in this case study is that innovators and laggards might be influenced by different factors in their adoption decision;
- Unlike other models that focus on individual adoption, DOI includes time, the social system and the communication channels as important elements that may impact the rate of diffusion. Rather than only looking at psychological predispositions of potential adopters (King, Dawson, Batmaz, & Rothberg, 2014), this case study will look at all elements that might impact diffusion including those that are not necessarily related to the nature of individual behavior.

The research objective for this master's thesis was to gain insight in the adoption and diffusion process of the 'remote classroom' technology after the TECOL project, so the adoption and diffusion of this innovation had already started. From an institutional perspective, administrators wanted to know how the adoption curve (see figure 3) would evolve and what they could do to impact this process.

According to DOI, the eleven academics that made use of the remote classroom during the TECOL project could be classified as innovators. This implies that the challenge lies in reaching other adopter groups for further diffusion of the remote classroom. For that reason, the typology of adopters in DOI was used as the framework for purposive sampling of interviewees. The key elements served as themes for the thematic data-analysis in this case study.

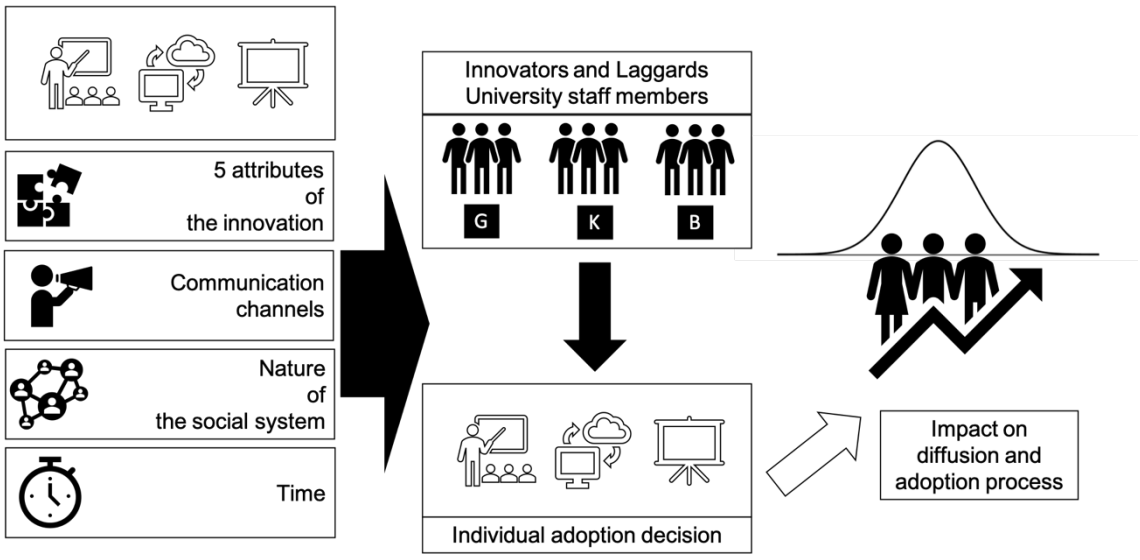

Figure 4: theoretical framework for this case study based on DOI (Rogers, 2003)

In conclusion, this master's thesis makes use of DOI as a theoretical framework by:

- Using the characteristics as formulated in table 1 as a foundation for the purposive sampling of interviewees for this case study because of the assumption that not all staff members will adopt the remote classroom at the same time. In addition, factors impacting different categories of adopters might be different;
- Making use of the key elements of DOI to thematically analyze the interview data and answer the main research question of which factors are impacting the adoption and diffusion of the remote classroom in this case study.

The interview questions in the semi-structured interviews were general, open-ended questions and did not specifically ask for each of the key elements from the theoretical framework. The theoretical framework will be used to portray a comprehensible picture of the situation after the pilot project that was collected in the interviews.

2.2 Edtech adoption and diffusion in HEIs: common barriers and challenges

There has been interest in potential drivers and barriers for adoption and diffusion at an institutional or organizational level, for instance on the uptake of edtech (Moser, 2007) or instructional technology (Abrahams, 2010), of blended learning (Brown, 2016; Graham et al., 2013; Porter et al., 2016) and of e-learning environments (Birch & Burnett, 2009; Herckis, 2018). Forecasting

whether edtech will find its way into the mainstream is important because there's often not a lot of budget for experimenting with new technologies and the complex implementation processes of edtech in HEIs (King et al., 2014). Taking into account the facilitating factors to support the adoption and diffusion, could help administrators develop and execute effective interventions to maximize the use of the digital solution (Jasperson et al., 2005).

This section considers the results from studies that have identified barriers and challenges in the adoption and diffusion of edtech in HEIs. These studies don't look at the implementation of a certain type of edtech, like this masters' thesis does. Even though these studies use their own frameworks to structure their findings, the general ideas about the barriers to adoption and diffusion provide a good starting point for comparison in the discussion section of this case study.

2.2.1 Barriers to the adoption of edtech in HEIs

Moser (2007) introduced the Faculty Educational Technology Adoption Cycle (see figure 5) as a framework to analyze the complex issue of technology adoption for teaching. The framework includes different types of variables impacting the adoption cycle of educational technology: faculty behavior activities such as time commitment and competence development, edtech course design and outside factors/conditions such as student feedback, individual variables, resources and support. From a strategic level, Moser's (2007) idea was that adoption of edtech in HEIs was mainly influenced by the faculty support that is offered and how this support is tailored to the different faculty behavior activities in her framework. The idea behind adequate and timely educational and technological support, was to prevent the emergence of a negative dynamic during the adoption cycle.

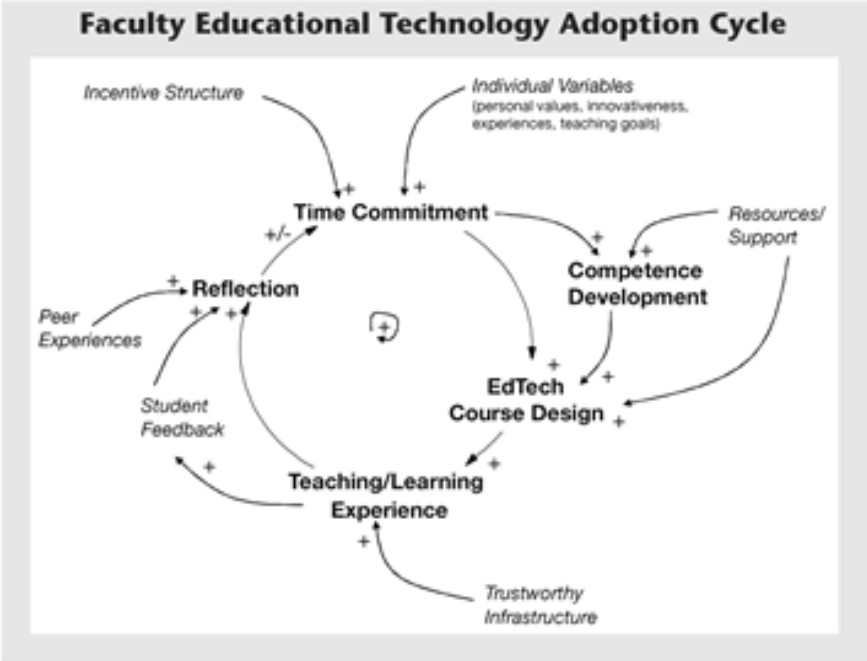

Figure 5: The Faculty Educational Technology Adoption Cycle (Moser, 2007)

2.2.2 Barriers to institutional adoption and implementation of blended learning

Graham et al. (2013) created a framework to identify key issues for institutional adoption and implementation of blended learning in HEI based on six case studies in the United States. The framework provides three broad categories of concerns regarding the implementation of blended learning in HEI: a strong institutional strategy, structure and support.

Based on the framework by Graham et al. (2013), Porter et al. (2016) wanted to discover to what extent strategies in these different categories, would impact the adoption of blended learning by faculty in HEIs. Some of the interventions that are suggested as a result of their case study of a university in the early adoption phase of blended learning are described in the table 4 below.

Strategy
- Highlight the benefits of adopting blended learning for students - Make use of faculty advocates instead of department or university advocates - Set guidelines to establish expectations for blended learning and provide adequate guidance
Structure
- Accommodate increased use of the internet by providing sufficient bandwidth and internet speed - Gather evaluation data from adopters - Use multiple delivery methods for professional development - Provide instructional designers and tailored assistance available to faculty members
Support
- Advertise the technical support resources - Help staff realize they may need know-how on how to integrate and create technology-based learning - Examine the attitudes of faculty towards financial stipends, course load reductions and tenure consideration to assess how this might influence the adoption process

Table 4: Strategies for facilitating the adoption of blended learning (Porter et al., 2016)

Brown (2016) identified six elements that impact the adoption and use of online tools by faculty members in HEI by means of a systematic review on blended instructional practice. The author categorized his findings into two broad categories: external and internal influences on the adoption and use of online tools. External influences include interactions with technology, academic workload, the institutional environment and interactions with students. High access to technology, large course enrollments, strong institutional support and adequate student feedback seem to positively influence the adoption of blended learning. Internal influences comprise instructor attitudes and beliefs, as well as instructor learning. In this category, a high perceived ease of use and usability and a strong professional development and training program enhance the adoption of blended learning.

2.2.3 Barriers in the implementation and diffusion of e-learning technologies

Birch and Burnett (2009) performed a qualitative study to uncover the institutional barriers, individual inhibitors and pedagogical concerns impacting the adoption and integration of educational technology and ICT by academics in a regional Australian university. These researchers found the following barriers as described in table 5.

Institutional barriers	
- Lack of program-wide strategic plans, clear policies, procedures and processes - Lack of leadership - Lack of tailored and specialized training - Lack of mentors, role models and technology champions as well as shared knowledge and access to exemplars	
Individual inhibitors	
- Lack of time to develop e-learning, to experiment, to share experiences, adapt the content and attend requisite training - Lack of adequate workload allocation - Potential reduced time to undertake discipline-based research - Personal characteristics of the academic - Technical capability and required knowledge and skills - Perceived lack of reward and recognition	
Pedagogical motivations and concerns	
- Catering to learning needs of different student groups - Engaging students by making learning more enjoyable	- Potential cognitive overload and information overload - Need for clear instruction and scaffolding on how to use e-learning

Table 5: Barriers in the implementation of e-learning technologies (Birch & Burnett, 2009)

Herckis (2018) identified barriers and affordances to the adoption of TEL tools in an anthropologically grounded research study. The results from this mixed method study in a research university showed that academics perceive the use of e-learning tools as risky for themselves and for their students. Academics rely on prior experience, philosophies of teaching and personal networks when making an adoption decision regarding TEL tools. Some of the unveiled barriers to the adoption of TEL tools are the fact that unfamiliar technologies form a potential threat to the autonomy of the lecturer, the potential loss of time for the lecturer and the loss of educational opportunity for students, the outreach of academics to informal networks and personal support instead of available institutional support and the lack of honest and critical conversations between expert users and potential adopters (Herckis, 2018).

2.2.4 Benefits and challenges of the remote classroom

The innovation studied in this thesis is the remote classroom, otherwise known as a synchronous hybrid learning environment, where students receive simultaneous and synchronous instruction in geographically different locations (Raes et al., 2019). In the remote classroom, the lecturer still teaches a face-to-face classroom but in addition is teaching simultaneously to a remote group of students supported by a web-based platform that facilitates interaction within the lecture.

The remote classrooms in this case study were co-created with lecturers and students as learning spaces for a research and development project funded by the university, namely the TECOL project, on three campuses of the university, each about 50 kilometers apart. The learning spaces were designed through co-creation with users to ensure that typical challenges with remote learning such as good visibility of remote groups or lecturer, optimal sound, tools for interaction were countered (Bower et al., 2015; Weitze, Ørngreen, & Levinsen, 2013). Below a photograph of the remote classrooms.

Figure 6: The setup of the remote classroom

The edtech in these learning spaces allows lecturers to teach in a hybrid, synchronous manner, namely to one group of students in the room and simultaneously to another group of students at geographically, different campus. The idea behind the remote classrooms is to provide flexible teaching activities for elective courses and stimulate the connection between different campuses.

This edtech solution is comparable to the technology used for videoconferencing with added functionalities that allow the lecturer to easily interact with the remote group as videoconferencing is often limited to one-way communication from lecturer to students. Lawson and colleagues (2010) claim that videoconferencing impacts the way students learn and interact, therefore it might only

be useful for certain learning objectives and the setup must be adapted to the learning context. Tools that were included to facilitate interaction include an interactive whiteboard on which students can annotate, polls and quizzes, silent questions and the possibility to share screens in order to create content together.

The systematic literature review completed by Raes et al. (2019) intended to compile benefits, challenges and design guidelines for the remote classroom, as well as to determine existing gaps in the current literature regarding the remote classroom. This review included all research studies that looked at any element with reference to synchronous hybrid education without focusing on a specific population (Raes et al., 2019) unlike this case study which only looks at the viewpoint of faculty.

The benefits of this type of synchronous hybrid learning environment for students and university are:

- Reaching a higher number of students;
- Diversifying course offerings by organizing more electives;
- Reducing teaching time in courses that are offered at different campuses in the same semester;
- Flexibility in the way students attend lectures;
- Promoting continuity in instruction and student retention; and
- Facilitating digital skills by making use of technology.

The key factors that make the remote classroom a challenging learning space to teach in and to follow lectures in, are pedagogical and technological in nature (Raes et al., 2019). Teaching in the remote classroom requires different pedagogical strategies while maintaining high learning standards (Grant & Cheon, 2007; Lightner & Lightner-Laws, 2016). In addition to the potential change in teaching strategies, the environment requires a rather new form of class management because there are two separate groups of students.

From the students' perspective, it is important to acknowledge that following a lecture from a remote setting might be a totally different learning experience than being in the face-to-face class. As a faculty member, activating and engaging the remote group is more difficult, especially in lectures

that are more about knowledge transfer (Cain, 2015). Weitze et al. (2013) found that remote students had more difficulty to indicate that they wanted to answer a question, leaving them with a frustrated feeling. That same study found that remote students seem to have learned less, were more passive and behaved like they were watching a TV-show instead of being present in a lesson (Weitze et al., 2013). Wiles & Ball (2013) claim that following a class remotely requires more self-discipline from students.

The audio component is the most prominent technological challenge in the remote classroom due to the loss of visual and audible cues that go along with face-to-face lectures (Bower et al., 2015). Typically, in this type of innovative learning space there might be some usability issues and a high frequency of software updates which can interfere with the teaching and learning process (Bell, Sawaya, & Cain, 2014). Teaching in the remote classroom and being on camera, could influence the lecturer's teaching style and might make a lecturer feel rather uncomfortable (Nortvig, 2013). Connectivity and potential Wi-Fi-issues could add to the teacher's feeling of awkwardness (Weitze et al., 2013).

The methodology for this case study is outlined in the next chapter. The chapter includes a thorough description of the research context, the research design, data collection methods and analysis, as well as limitations of this study.

3 METHODOLOGY

3.1 Research context

3.1.1 Technology-enhanced collaborative learning or TECOL project

The University of Leuven in Belgium stated 'Going Digital' as a strategy from 2018 until 2021. KU Leuven is a large Flemish university with 15 campuses across the region of Flanders. Historically the KULAK campus in Kortrijk in the West of Belgium has always been a part of the university whilst the other remote campuses have joined the university in more recent years due to mergers.

As a precursor of the 'Going Digital'-strategy, a pilot project was conceptualized and implemented from 2016 until 2018 at the KULAK campus: Technology-enhanced collaborative learning or TECOL project. The TECOL project was a research and development pilot project with two main types of project leads, namely the university as research and pedagogical lead and two technology partners as development lead. The university invested in this pilot project to design and install new learning spaces with edtech solutions, as well as to set up different research tracks to evaluate the effectiveness of the edtech solutions. During the two-year project these learning spaces were used as a living lab to experiment with the edtech and pedagogical approaches needed to make qualitative use of the digital solutions. The idea behind the pilot was to find use cases that worked well in these learning spaces and then implement those throughout the university after the project was finished.

The university appointed one of its academic research groups that focuses on edtech as research and pedagogical lead for the project, namely the interdisciplinary research group ITEC at the KULAK campus in Kortrijk. The research group is accommodated in the Edulab of the university, a space that comprises different learning spaces equipped with edtech as well as offices for teaching and research staff. The project steering committee, with representation of all stakeholders, was responsible for the project roadmap and overseeing the day-to-day organization of the project. Stakeholders comprised the academic lead, the educational developer, the multimedia expert and researchers. In addition to the steering committee, there was a resonance group that included faculty members from all faculties. The resonance group was installed to support the co-creation

process of the learning spaces. In order to maintain the link with the larger university context and to prepare for broader implementation of the learning spaces, frequent meetings were organized with the central educational development and ICT-office.

3.1.2 The remote classroom as part of the TECOL project

Three types of learning spaces were installed as part of the pilot TECOL project, namely the virtual classroom, the collaborative learning space and the remote classrooms. The virtual classroom allows for one group of students to participate in class on campus, while individual students follow the class remotely in a synchronous manner through a digital platform (Raes et al., 2020). The collaborative learning space is a room in which students and lecturer can share multiple screens simultaneously. The final type of technology-enhanced learning space that was installed on three campuses of the university was technology to create a remote classroom or a classroom that allows for groups of students at the different campuses to be virtually connected during a lecture. The KULAK campus, the campus in Bruges and the Ghent campus, each about 50 kilometers apart, were the locations where the remote classroom was created.

In the second year of the two-year timeframe of TECOL, lecturers were sought out to experiment within these remote classrooms. Eleven faculty members volunteered to teach one or more of their lectures in the remote classroom during the project period. Each lecture had no more than 30 students spread over the two locations. Lectures were taught within the Faculties of Engineering, of Arts and of Psychology and Educational Sciences.

During the project different stakeholders, described earlier, were responsible for providing support in different ways. For instance, one educational developer was responsible for pedagogical support to the lecturers that made use of the remote classroom.

During the wrap-up of TECOL, the project was evaluated, and a compilation was made of the results of the different experiments. The steering committee was asked to deliver final conclusions and recommendations based on the project for the continued use of the learning spaces in the near future in order to attain a sustainable implementation on the campuses of the university.

The steering committee assumed from conversations with TECOL participants that the eleven faculty members that made use of the remote classroom during the two-year project was a relatively low number compared to the other learning spaces in the TECOL project. Next to this assumption, it was also noted that faculty members who had taught in the remote classroom, did not show tendency to continue using the learning space for future lectures. The steering committee was interested in knowing the reasons behind these assumptions. As a result, the research objective for this thesis was determined, the initiative for this study was taken by the researcher and the steering committee acknowledged that the exploratory study for this thesis would be carried out.

The research objective was to gain insight in the adoption and diffusion process of the 'remote classroom' technology after the TECOL project and the factors impacting this process from the viewpoint of staff.

The research objective for this master thesis is linked to the following research question and sub questions:

- What are the factors impacting the adoption and diffusion of the 'remote classroom' technology on the different campuses from a staff viewpoint?
    - Do these factors align with the current body of evidence on the adoption and diffusion of educational technology in higher education?
    - Which strategies might be used to facilitate the adoption and diffusion of the 'remote classroom' technology on the different campuses of a large, multi-campus university from a staff viewpoint?

To answer these research questions, information was collected through a narrative literature review and an exploratory case study. These insights were gathered to provide the steering committee of the TECOL project and the management teams of the different campuses with recommendations on an institutional level regarding strategies to facilitate further diffusion and qualitative adoption of the 'remote classroom' technology. This case study was not a formal part of the evaluation of the TECOL project, but the steering committee was informed and consented that the study would take place.

3.2 Research design

To investigate barriers to the adoption and diffusion of the remote classrooms on three regional campuses of a large university, a descriptive case study (Hancock & Algozzine, 2011) was set up. The label 'descriptive' is used when a case study aims to outline a phenomenon and the real-life context in which it takes place (Yin, 2003). When applying Stake's (1995) terminology on case study research, this study can also be labeled as 'intrinsic' which suggests that this study was not undertaken to create theory or generalize results to a broader population. The intent of this study, in concordance with the research objective, was to gain insight into the specific barriers to the adoption and diffusion process of a certain type of edtech in a specific context with different locations.

Case study research finds its origin in the constructivist paradigm according to Yin (2003) and Stakes (1995). Constructivists recognize the importance of subjective human creation of meaning although it doesn't reject the notion of objectivity (Crabtree & Miller, 1999). As a researcher it helps to understand humans' actions by capturing and analyzing participants' stories and how they view reality (Baxter & Jack, 1990).

The process of adoption and diffusion of the remote classroom served as the case for analysis, in accordance with the definition of a case by Huberman and Miles (1994, p. 25): *"A phenomenon of some sort occurring in a bounded context"*. This study can be described as a single case study with embedded units because it looks at a single process but in three different campuses of one large university (Baxter & Jack, 1990). This setup might also allow for analysis of within, between and across subunits.

As stated in the research context, the remote classrooms were installed on three campuses during a pilot project with the goal to enable the connection of groups of learners between these different campuses. During the pilot it became clear through observation that finding lecturers to experiment in these learning spaces was particularly difficult. Furthermore, lecturers that actually taught one or more classes in the remote classrooms, did not show the tendency to continue doing this after the project was terminated. This outcome was of special interest during and after the TECOL project and worried the steering committee since it was the ambition of the university to scale-up the use of the remote classrooms throughout the whole university. After the conclusion of the project, questions on how to facilitate the adoption and diffusion process were raised by university

management and the steering committee of the project leading to this case study being chosen for this master's thesis.

3.3 Data collection

This section contains information on the two methods used for data collection, described in the table 6 below. The use of multiple data sources in this case study enhances data credibility and the potential to reach a holistic view of the phenomenon at hand (Yin, 2003).

Timing	Data collection method
September – December 2018	Method 1: Observation in the remote classroom on different campuses and informal interviews with stakeholders in the TECOL project
January – March 2019	Method 2: Semi-structured interviews with innovators and laggards after the TECOL project

Table 6: Timing and data collection methods for the case study

3.3.1 Method 1: Observation, document analysis and informal interviews

During the first four months of the data collection, the researcher built rapport with the individuals associated with the TECOL project and those involved with the remote classroom, as well as with stakeholders within the context in which the project was conceived and executed. This was done by attending meetings with the project steering committee, by visiting the learning spaces on the different campuses, by observing one of the remote lectures and executing informal interviews with lecturers, the educational and technical support staff and students. Field notes were made to document observations and data from informal interviews. Records of meetings were stored.

3.3.2 Method 2: Semi-structured interviews with innovators and laggards

In the second phase of the data collection, ten staff members from the three campuses of the university included as subunits were purposively selected for a semi-structured interview.

Semi-structured interviews are a common method of data-collection in qualitative research (Savin-Baden & Major, 2013). The technique uses an interview protocol, usually with a list of topics and questions to be discussed with the participant, and the interviewer tries to follow participants' ideas

throughout the interview. The interview protocol for this research study was built around the research question of this case study. The central questions for interviews were the following:

- How likely is it that you will make use of the remote classroom for your teaching in the coming year?
- Which factors have an influence on that adoption decision?
- If you were to make use of the remote classroom, which type of support would you need?

The selection of the participants was made based on purposive sampling, namely extreme cases in the DOI bell-curve were targeted: the innovators and the laggards (Rogers, 2003; Seawright & Gerring, 2008). The sampling was done by contacting nineteen faculty members of the resonance group by a standard email, which described the case study, the research questions and the type of interviewees that could potentially contribute to the case study. The typology used to help faculty members select interviewees from their faculty was the following: participants should be exceptional or extreme cases on both ends of the spectrum. Faculty members were asked to provide us with names of innovators, namely interviewees that participated in the TECOL project and had a strong affinity with the use of edtech and names of laggards or interviewees who are potentially risk-averse to edtech and are known for their non-use of edtech in their instructional practice. This typology is based on the characteristics of Rogers' five categories of innovation adopters but does not provide an exclusive distribution of categories. It is an indication of the innovativeness of an individual or the degree to which an adopter is relatively earlier in accepting and using an new idea compared to other members of the social system (Rogers, 2003). The categorization of the interviewees was left to the opinion of faculty members that were addressed, there were no additional measures taken to determine the characteristics of the interviewees.

The aim was to find 12 interviewees spread across all three campuses evenly. Of the nineteen faculty members that functioned as contact person for the TECOL project, six of them responded and this delivered ten potential interviewees. The ten candidates were labeled as innovator or laggard based on the assessment of the faculty member that provided the candidates' contacts. These potential interviewees were all contacted by email with the invitation to participate in this case study. All ten candidates agreed to participate in this case study. The table 7 below offers an overview of the participants that volunteered to do an interview, their adoption categories and their home campus.

	Innovator (I) or Laggard (L)	Campus (K, B, G)
Participant 1	I	K
Participant 2	I	G
Participant 3	I	G
Participant 4	L	G
Participant 5	L	K
Participant 6	L	K
Participant 7	L	K
Participant 8	L	K
Participant 9	L	B
Participant 10	I	B

Table 7: Participants, adoption categories and subunits of phase 2 semi-structured interviews

All interviews lasted between 60 and 90 minutes and were audiotaped for verbatim transcription and analysis. Participants signed an informed consent.

3.4 Data analysis

This section contains the procedure that was followed for the data analysis in this case study. Merriam (2009) describes the goal of qualitative data analysis to be 'making sense out of the data' in order to answer the research questions. The process of data analysis in this case study can be described as inductive, iterative and cyclical.

Ensuring validity and reliability of qualitative data is important in the different phases of case study methods. Tests and techniques to establish the quality of the chosen methods and the obtained results in case study research are recommended by Riege (2003).

Construct validity or confirmability was strived for in this case study by using theoretical framework for data analysis (Rogers, 2003) and data interpretation as well as by the use of key findings from similar case studies published in literature (Abrahams, 2010; Birch & Burnett, 2009; Herckis, 2018; Moser, 2007).

Issues concerning internal validity or credibility need to be stated since this case study was performed by a single researcher which makes the need for the acknowledgement of subjectivity high. The researcher and author of this master's thesis was a project manager at the Edulab at the time of the case study and had limited experience in qualitative research. This implies that subjectivity might have played in the different phases of this case study: during the sample selection, during the interviews and during the data analysis and interpretation. Measures to ensure trustworthiness of the interpretation of the data such as triangulation were not taken, interpretations were not approved by the interviewees (Lincoln & Guba, 1985). One measure that was taken to sustain credibility was peer debriefing to obtain feedback on the research questions and methodology, as well as on the interview protocol.

Transferability or external validity which allows a reader to transfer findings from this case study context to other contexts or settings, is strived for by a thorough description of the data collection and analysis method. In addition, the gathered evidence is compared to results from the narrative literature review. Of course, a limitation to this study was the small sample size, only ten participants were interviewed which does not allow for generalizability of the findings to other contexts.

Reliability or dependability was tackled by a well-documented trail of data collection, interpretation of findings and reporting of results. Rationales behind the choice of methodology and case selection were described in detail.

The specific phases of the analysis are described in detail in the next sections.

3.4.1 Familiarization with the TECOL project

In a first phase of data analysis, field notes with observations and data from informal interviews were read through to understand the context in which the interview data would be acquired and to get an understanding of the remote classroom. The data from this first phase was not included in the thematic analysis and the findings of this case study, it was used solely for familiarization purposes of the researcher.

3.4.2 Analysis of the semi-structured interviews

The second phase of the data analysis was the largest, namely the analysis of the transcribed interviews. Analysis of the collected data involved identifying themes, namely key elements and related issues regarding the adoption and diffusion of the remote classroom, driven by the categories of key elements in the theoretical framework (see figure 4) and the description of those key elements as provided by Rogers (2003).

The data analysis method used for this case study is thematic (Savin-Baden & Major, 2013). Thematic data analysis is not necessarily bound by specific rules of analysis, but it relies on the viewpoint of the researcher. The following steps were undertaken, based on the recommendations of Braun and Clarke (2006): familiarization with the interview data, breaking up the verbatim script into meaningful units or quotes, initial coding by using themes, review of coding, and finally draw up the results. In this analysis the themes are the key elements from the theoretical framework: five attributes of the innovation itself, communication channels, social system and time. The data that was classified as an attribute of the innovation itself, was clustered into subthemes during a second round of this analysis. The five subthemes were those five attributes of the innovation as described by Rogers (2003): relative advantage, compatibility, complexity, trialability and observability.

First all interview transcripts were broken down into meaningful units, consisting of quotes from interviewees that contained a unique theme. The quotes from the innovators and the laggards were kept separate in order to potentially compare them afterwards.

In the first round of analysis all quotes were color coded according to the four key elements in the theoretical framework a first time. This process was repeated until all quotes had a color code. The number of times a quote contained a unique theme per interviewee, as well as the number of interviewees that used quotes with each unique theme were recorded.

Color code	Quote with unique theme
Green	Quotes that depicted a perception of one of the attributes of the remote classroom influencing the adoption decision of the interviewee
Orange	Quotes that spoke of the impact of the used communication channels on the adoption decision of the interviewee

Red	Quotes that were indicative of the influence of the social system on the adoption decision of the interviewee
Blue	Quotes that hinted at time impacting the adoption decision of the interviewee
Grey	Quotes that did not fit the above categories

Table 8: Color coding scheme used in the first round of analysis of quotes

In a second round, all quotes that related to the key element, the attributes of the remote classroom itself, were sorted through and coded by theme again using the five attributes of an innovation as described by Rogers (2003): relative advantage, compatibility, complexity, trialability and observability.

The second round of analysis was only performed on this theme or key element because these elements account for 49 to 87 percent of the variance in the rate of adoption or the relative speed with which an innovation is adopted by different people (Rogers, 2003). The themes or attributes were color coded in the relevant quotes according to the information in the table 9 below. The number of times an attribute was mentioned per interviewee, as well as the number of interviewees that identified each attribute were recorded.

Color code	Theme/Attribute	Definition
Green	Relative advantage	The degree to which an innovation is perceived as being better than the idea it supersedes.
Orange	Compatibility	The degree to which an innovation is perceived as consistent with existing values, past experiences and needs of potential adopters.
Blue	Complexity	The degree to which an innovation is perceived as relatively difficult to understand and use.
Yellow	Trialability	The degree to which an innovation may be experimented with on a limited basis.
Grey	Observability	The degree to which the results of an innovation are visible to others.

Table 9: Color coding scheme for the second step of interview data analysis

The findings from this data analysis of the semi-structured interviews conducted for this case study are recorded in the next chapter.

4 FINDINGS

In this chapter, findings relating to the main research question, namely which are the factors impacting the adoption and diffusion of the remote classroom, are described and illustrated with quotes from interviewees. A quote is a meaningful unit of text that contains a unique theme as deducted from the verbatim transcripts from the interviews.

The first section gives a summary of the frequency with which quotes containing unique themes or key elements, were recorded across all interviews. In the next section, each key element from the theoretical framework is illustrated with quotes from the interviews: the five attributes of the remote classroom itself, communication channels used, the social context in which the adoption should take place and the element of time in the diffusion of the remote classroom.

4.1 Frequency of quotes containing key elements

The tables below illustrate the findings of the number of quotes that contain unique key elements as uncovered by the thematic analysis of the interview data. These results give a quantitative impression of how many times each key element that potentially impacts the adoption of the remote classroom, is mentioned per participant.

			Frequency of quotes per theme				
	Innovator (I) or Laggard (L)	Campus (K, B, G)	Attributes of the remote classroom	Communication channels	Social system	Time	No category
Participant 1	I	K	20	3	2	1	4
Participant 2	I	G	13	5	0	0	3
Participant 3	I	G	20	1	1	0	0
Participant 4	L	G	10	1	5	0	0
Participant 5	L	K	9	2	2	1	3
Participant 6	L	K	9	5	1	0	2
Participant 7	L	K	2	0	4	0	0
Participant 8	L	K	18	2	3	0	3
Participant 9	L	B	6	0	4	0	0
Participant 10	I	B	15	0	1	0	1
Total number of quotes per theme			122	19	23	2	16

Table 10: number of quotes per theme after the primary analysis

The results after the first round of analysis show that the highest number of quotes relate to how the attributes of the remote classroom are perceived by interviewees (n = 122 quotes), followed by quotes that relate to the social system in which the diffusion of the innovation is taking place (n = 23 quotes). Only 19 quotes were detected pertaining to the communication channels used to transfer ideas about the remote classroom. Two interviewees mentioned a factor that relates to the time dimension that is involved in their adoption process of the remote classroom.

Sixteen quotes did not fit the defined themes and could therefore be categorized as outliers.

The differences in number of quotes per theme according to the type of interviewee are shown in the graph below.

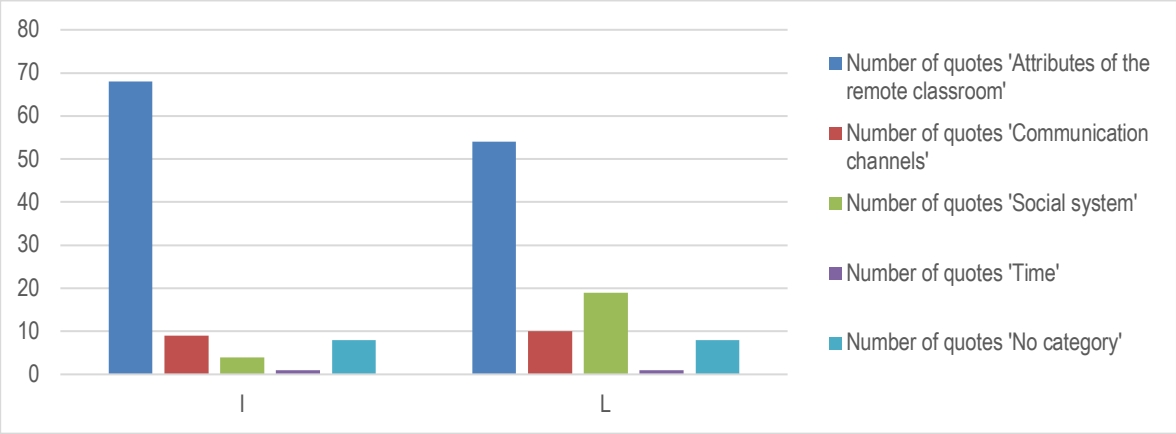

Figure 7: Number of quotes per category and adoption group after the primary analysis

The graph (Figure 9) shows that the absolute number of quotes on the attributes of the innovation itself is higher in the group of innovators. Quotes pertaining to the social system are higher in the group of laggards.

In table 11 the results of the second round of analysis of all quotes that were labeled as a different type of attribute of the remote classroom itself, are depicted.

			Number of quotes per attribute of the remote classroom				
	Innovator (I) or Laggard (L)	Campus (K, B, G)	Relative advantage	Compatibility	Complexity	Trialability	Observability
Participant 1	I	K	9	7	2	2	0
Participant 2	I	G	9	1	3	0	0
Participant 3	I	G	10	6	1	2	1
Participant 4	L	G	4	3	2	1	0
Participant 5	L	K	3	4	2	0	0
Participant 6	L	K	4	3	1	1	0
Participant 7	L	K	1	1	0	0	0
Participant 8	L	K	11	7	0	0	0
Participant 9	L	B	4	1	1	0	0
Participant 10	I	B	4	8	2	0	1
Total number of quotes per attribute			59	41	14	6	2

Table 11: number of quotes per attribute after the second round of analysis

The perceived relative advantage of the remote classroom compared to earlier or similar innovations (n = 59 quotes) and the compatibility of the remote classroom with existing values, past experiences and the needs of the adopters (n = 41 quotes) are communicated the most throughout the interviews and by all interviewees.

The perception of the complexity (n = 14 quotes by 8 interviewees), the trialability (n = 6 quotes by 4 interviewees) and the observability (n = 2 quotes by 2 interviewees) of the remote classroom are least mentioned during the interviews and are not named by all interviewees.

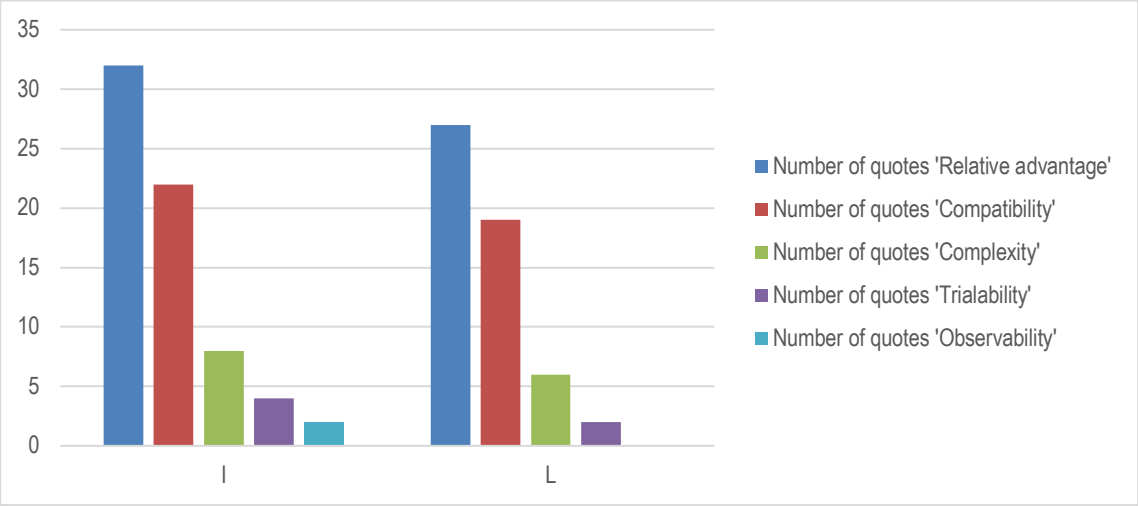

Figure 8: Number of quotes per category and adoption group after the second analysis

Figure 10 above compares the group of innovators that were interviewed to the laggards: all forms of perceived attributes of the remote classroom are mentioned fewer times by the laggards. Observability or the degree to which a result of the remote classroom is visible to others, is only mentioned by two interviewees, categorized as innovators, as a factor impacting the adoption of the remote classroom.

4.2 Qualitative results of the thematic data analysis

The subsections below provide the qualitative results of the first and second round of analysis of the interview data. Perceived attributes of the innovation, communication channels, the social system and time are described and illustrated with relevant quotes. This subsection provides insights on which factors potentially have an impact on the adoption and diffusion of the remote classroom from a staff viewpoint in this case study.

4.2.1 The perceived attributes of the remote classroom

Interviewees mentioned different perceptions of attributes the remote classroom as factors that potentially influence the adoption of the remote classroom. The findings in this subsection are organized by attribute, as found after the second round of data analysis.

4.2.1.1 The relative advantage of the remote classroom

The relative advantage or the degree to which an interviewee believes that the remote classroom is perceived as being better than the idea it supersedes, was mentioned the highest number of times during the interviews. Both innovators and laggards talked about the relative advantage or the added value of the remote classroom in their day-to-day teaching practice or compared to face-to-face teaching and the use of video conferencing software.

The added value of using the remote classroom to connect student groups is questioned in quotes by all innovators and laggards that were interviewed, which means that the adoption of the remote classroom might not be perceived as rewarding from a staff viewpoint. This seems to be an important factor inhibiting the adoption and diffusion of the remote classroom, indicated by the number of times this was mentioned and obvious questioning of the value of the remote classroom. Some unique quotes from both innovators and laggards indicating this include the following:

Innovators	**Laggards**
"Teaching in the remote classroom requires extra effort and time, it is not more efficient than teaching the same class twice." (Participant 3)	"As a teacher you lose the value of the face-to-face contact with your students for instance in practice sessions." (Participant 4)
"What would be the added value of using the remote classroom? The difference with the typical videoconferencing is still not very clear to me. The fact that you can use the platform for interactive teaching methods could be an added value but that isn't convincing enough for me." (Participant 1)	"You almost certainly need automatic production when using the remote classroom, the static image on the screen makes it boring to watch." (Participant 4)
"To me this is not possible at a larger scale, students wouldn't want that" (Participant 10)	"I don't see the added value for the students, for their learning outcomes and their wellbeing. I want to see what the impact is and what the potential losses are for them." (Participant 8)
"Face-to-face classes feel better as a teacher, it's not as easy to get into a flow in the remote classroom" (Participant 3)	"The idea of preserving our campus here is important, professors who come from our main campus in L cannot only start teaching remotely. That would mean a diminishment of teaching for our students here." (Participant 8)

Table 12: Quotes related to the relative advantage of the remote classroom

The loss of face-to-face contact with the remote group, the extra effort that is required when teaching in a hybrid setting, the questions of how this teaching context impacts students and their learning outcomes are factors inhibiting the adoption of the remote classroom.

Another factor that was mentioned twice is that the remote classrooms are not spread far enough geographically (only 50 km apart), making the perceived saving on travel time fairly low according to some interviewees. In addition, two interviewees at campus Kortrijk allude to the fact that preserving the campus as full-fledged entity is important, as well as not diminishing teaching hours due to less parallel classes. Perceiving the remote classroom as a threat to this preservation seems to be another inhibiting factor.

On the other hand, some interviewees see potential value in using the remote classroom in the near future, but the number of quotes that portray this is rather limited. Examples are:

Innovators	**Laggards**
"Cooperation with the campus in G is important, a priority" (Participant 10)	“But I can see added value in the remote classroom to connect students to industrial environments, letting them look at how things work in certain work contexts without actually having to visit the company.” (Participant 9)
“I feel there is a need to cut into travel time of teachers, so this leaves potential for the remote classroom.” (Participant 2)	“You can organize parallel classes, which is an opportunity.” (Participant 4)
“The remote classroom could be used for staff meetings, professional development initiatives and thesis presentations.” (Participant 3)	“The remote classroom could mean a simplification for the class scheduling issues we have today. There's just not enough rooms available for all the classes.” (Participant 5)
“If I had to teach in B, I would prefer teaching remotely.” (Participant 1)	“Remote teaching offers a solution when the distances you have to travel are really large, like in Finland.” (Participant 8)

Table 13: Quotes pertaining to the potential added value of the remote classroom

Two interviewees see potential added value in the remote classroom and the way it was used in the TECOL project, in order to save travel time for themselves. The innovators who state this, do so in a conditional fashion meaning that other inhibiting factors should be resolved for them before they see less travel time as a relative advantage. Others see added value in using the remote classroom for other professional activities next to lecturing or find the idea behind the remote classroom to be a solution for organizational issues such as class scheduling.

4.2.1.2 The compatibility of the remote classroom

The perception of the degree to which the remote classroom is consistent with existing values, past experiences and the needs of faculty members and students, was the second most mentioned factor in the adoption decision about the remote classroom. Most quotes extracted from the interview data had to do with the incompatibility of the remote classroom with current practice, rather than it being compatible with teaching and learning experience and the needs of the potential adopters. The following quotes illustrate this view.

Innovators	Laggards
"Physical contact is better than remote contact because you can read students' facial expressions, the screen of the remote classroom is not large enough, students might not react the same when they are in a remote location." (Participant 10)	"It is not always clear which didactical approaches work well with certain technology." (Participant 9)
"The screen is too small for me to see students." (Participant 3)	"You cannot use this for labs." (Participant 4)
"As a teacher I don't want to occupy myself with the technology but with my teaching and didactics." (Participant 3)	"The learning space is set up as a classical lecturing hall, so lecturing is the most natural activity that can take place in the remote classroom. You cannot walk around and provide feedback to students like in a practice session." (Participant 4)
"I give many courses twice on different campuses, for instance with another campus in M, but they don't always match in planning. For instance, they are in different semesters to start with." (Participant 3)	"My earlier experiences with videoconferencing are not optimal, the sound quality was bad." (Participant 5)

Table 14: Quotes related to the compatibility of the remote classroom

Motivation to change the usual teaching patterns is referenced multiple times during the interviews. Interviewees belonging to the laggard category express a low motivation to change their ways and claim that this is not influenced very easily, which is a factor inhibiting the adoption of the remote classroom.

A different picture is sketched by the innovators, their motivation to change their teaching ways in general is relatively high. One interviewee even says:

> "I like to experiment in my teaching, it puts the fun in my job even though student evaluations of my courses are not always that positive about my innovative interventions." (Participant 2)

But even though these innovators like to experiment with new pedagogical approaches, there seems to be the perception that pedagogical practice in the remote classroom is not compatible with what they want to achieve with their teaching activities.

Factors that have to do with the technology itself such as small screens, issues with sound but also the classical setup of the furniture in the learning space seem incompatible with what interviewees need for their teaching methods. One of the quotes to illustrate this is:

> "My pedagogical approach does not match with the remote classroom, I let my students collaborate, I use peer instruction and participative dialogue, I feel that the remote classroom will not let me do this." (Participant 1)

One of the interviewees, categorized as a laggard, brings the perspective of previous experience with technology and the digital skills into play. As a faculty member, the interviewee has a background in low-tech teaching environments which has had an important influence on the development of his digital skills. Because of this background, the interviewee identifies the importance of management decisions in the adoption of edtech, claiming that being obligated to make use of certain technology, will make for a higher adoption rate. This is illustrated by the following quotes:

> "I come from a place where technology is not used much, because of that I have a fear to use it, I never use it in my teaching." (Participant 6)

> "If I could choose between staying here and going to another campus, I would choose here but I guess I would only do that if I get direct instructions from my boss." (Participant 6)

4.2.1.3 Complexity of use of the remote classroom

Another potential barrier to the adoption of the remote classroom is the perceived ease of use or the complexity of the remote classroom perceived by staff members, especially amongst the innovators that were interviewed. Of course, the remote classroom was installed and used as a prototype during the TECOL project, making it acceptable to innovators that the use of the

technology was not yet completely free of effort. Some of the quotes illustrate the issues regarding the perceived complexity of the remote classroom.

Innovators	Laggards
"It causes stress, you need more time before class to setup" (Participant 10)	“The use of the interface and platform as of today is still too complex and will prevent the mainstream from adopting the remote classroom.” (Participant 4)
"Priorities to me are class scheduling needs to be coordinated, the learning space on the other campus needs to be available and accessible and the usability of the system for students needs to be improved" (Participant 10)	“I received a demonstration, but I do not remember how everything works, this is not actually part of my job description.” (Participant 5)
“The remote classroom as of today is not self-evident in use and if it stays that way, I will not use it anymore.” (Participant 2)	
“I don't like being supported; I like to do things autonomously. If I can do something on my own, for instance with new technology, and I can't figure it out on my own, then something is wrong. Technology should be self-evident after a certain time; everybody should be able to use it.” (Participant 1)	
“It is unclear for me how you teach in a qualitative manner in the remote classroom, how do you divide your time between your face-to-face group and the remote group?” (Participant 1)	

Table 15: Quotes that have to do with the complexity of the remote classroom

These quotes illustrate that the software, the learning space of the remote classroom and the didactical approach needed in a hybrid setting are factors currently inhibiting the adoption of the remote classroom in this case study. The innovators report that the use of this technology should be self-evident and that guidelines on how you teach in a hybrid setting should be available.

4.2.1.4 Trialability with the remote classroom

Two interviewees talk about the importance of being able to experiment with the remote classroom in a safe environment, which is the exact definition of trialability of an innovation. In the quotes, interviewees also refer to ICT-support that should be available and the need for empathy when

experimenting with technology in a classroom setting. Relevant quotes that illustrate this are given below.

Innovators	Laggards
"We need to create a safe space to experiment with technology, we don't want to look like a fool in front of our students. Administrators need to acknowledge this fear and be aware that being confronted with experts often enhances the idea of feeling foolish. If an expert solves a problem you have in a matter of seconds, you can't help but feeling a little dumb." (Participant 1)	"A safe experimenting environment is necessary for teachers, which implies a fast ICT-support on call so that when something goes wrong this can be tackled immediately." (Participant 4)
"Stimulating teaching staff to do small experiments and have people experience small successes is really important." (Participant 1)	

Table 16: Quotes that illustrate the trialability of the remote classroom

4.2.1.5 Observability of the remote classroom

Only two interviewees talk about the observability of the results achieved with the remote classroom as an important factor to impact the adoption of the remote classroom. The two quotes are the following:

> "Both the local and the remote group performed equally well on the exam, this was important for me to know about the course I taught remotely." (Participant 2)

> "Further efforts should be aimed at those teachers that are interested in using the remote classroom by making results visible." (Participant 3)

The quote given by participant 3 might indicate that results from the TECOL project concerning the remote classroom are currently not visible enough to potential adopters.

4.2.2 Communication channels

The way communication about the remote classroom takes place and the communication channels that are used to do this, were mentioned by some of the interviewees. The ideas pertain to individuals who have knowledge of the remote classroom, individuals who do not yet have that

knowledge and the way these two can exchange information. The following quotes give insight into the communication channels used to exchange information about the remote classroom and how this might impact the adoption decision.

Innovators	Laggards
"I feel the distance between management of the university and our faculty is large, but I understand this because we are a large organization. But this makes it hard for processes to become streamlined, and on the other hand standardization impedes experimenting with new technologies." (Participant 2)	"At the moment we do not proactively provide support and we do not advertise the possibilities of the remote classroom." (Participant 4)
"If the university wants to set out digitalization as a strategy than we should invest a lot more on the further development of the remote classroom. Being open to user feedback is very important for this." (Participant 2)	"A solution might be to exchange good-practices more, talk to each other to reconcile potential differences, especially with people who are using the technology." (Participant 5)
"The technical issues are not being solved and the feedback that we delivered during the project is not being used to further develop the system." (Participant 2)	"Getting to know the remote classroom? I already had a demo, but if you don't use the space, you forget how it works. The available description and instructions when you book the room doesn't seem to be clear for me." (Participant 5)
"Connecting peers from similar disciplines works well, sharing pathways to innovation and good practices works inspiring. Technology has changed the way I teach, and I like to spread that message." (Participant 1)	"Lectures about the importance of technology in education might help to work away negative attitudes." (Participant 6)
"Invest in new colleagues that are entering the university, for instance during their onboarding period, show them what the technology could mean for them; reaching older colleagues to change their teaching might prove to be too challenging." (Participant 1)	"I've never visited the remote classroom, we were invited there before, I heard about the TECOL project vaguely." (Participant 8)
	"I read a lot to find out what I need, newspapers, pedagogical newsletters… I've never gone to centrally organized pedagogical workshops because I don't have time and my research is my priority." (Participant 8)
	"Because the two pioneers come from the same department, communication in our own department works, but less so to other departments." (Participant 4)

Table 17: Quotes about the communication channels used to promote the remote classroom

4.2.3 The social system

A social system is a set of interrelated units that work on similar problem to accomplish a common goal. Factors associated with the social structure of the system, the norms of the social system, the role of administrators and the consequences of the remote classroom were mentioned by nine out of ten interviewees.

Innovators	Laggards
"I was asked to participate in the TECOL project, this was a nice challenge for me" (Participant 10)	“There's a lot of innovative ideas to change teaching in our department but we have a high need for teaching staff that can occupy themselves with this.” (Participant 9)
"Teaching staff is disappearing, research is becoming more and more important which makes it hard for professorial staff" (Participant 10)	“To me autonomy as a teacher is really important, not all things should be instructed top-down.” (Participant 9)
“I feel that we weren't an equal partner in the project, because we were remote from the home campus of the project.” (Participant 2)	“In addition, this type of innovation in teaching is not endorsed or appreciated. Teaching and education are still not a part of the evaluation procedure of professorial staff.” (Participant 9)
“The fact that administrators have initiated the TECOL project, triggered my attention” (Participant 1)	“Top-down we are told to find the spaces to accommodate all students, these learning spaces are not suggested as a possible solution by management.” (Participant 5)
	“The alternative to me is having less staff at the central level of the university and invest more in bottom-up initiatives to create more buy-in from staff who have didactical experience in their field.” (Participant 7)
	“Technology should be introduced bottom-up, according to our needs as a teacher. I often feel that money goes to machines, instead of to people.” (Participant 7)

Table 18: Quotes that illustrate the impact of the structure of the social system on the diffusion of the remote classroom

4.2.4 Time

Two quotes were found throughout the data that pointed to the idea that time also plays a role in the adoption and diffusion of the remote classroom.

Innovators	Laggards
"I don't see myself as a big innovator" (Participant 10)	"I know that the pace at which changes with technology take place are going fast" (Participant 5)

Table 19: Quotes associated with timing in the diffusion of the remote classroom

While participant 10 states not to perceive oneself as an innovator, this interviewee was categorized as one by a faculty member. Participant 5 recognizes that technological changes are moving rapidly which makes it important to keep up with these changes.

4.2.5 Outliers

Sixteen quotes could not be categorized in one of the key elements of DOI as such. Ten of these quotes were excluded from the findings because they did not relate to edtech at all. The following quotes in table 20 seemed to add relevant information referring to the factors that might be impacting the adoption and diffusion of the remote classroom. One cluster seems to be about the amount of time a participant spends on teaching and the experience one has as a lecturer, as well times spent traveling to other campuses. The quotes from participant one and seven have to do with the affinity one has with technology, the innovator seems truly interested in using technology in teaching while the laggard is rather sceptic to investing in technology personally and professionally.

Innovators	Laggards
"I spend 100% of my time on teaching and have about thirty years of experience" (Participant 2)	"I teach two lectures per academic year on 1 campus" (Participant 5)
"I'm curious about the virtual classroom for instance for students who become ill or students who want to follow the class from a distance (Participant 1)	"I go to the main campus about 2 times per week" (Participant 5)
	"I don't own a smartphone" (Participant 8)
	"I do not record my lectures, not everything I say in class can be on tape" (Participant 8)

Table 20: Quotes that were categorized as outliers

5 DISCUSSION

This case study aimed to gain insight into the further adoption and diffusion of a specific type of edtech, namely the remote classroom, at a large university. The qualitative approach to this research study was chosen to record the granularity of key elements impacting this process in light of the fast changing context in which the adoption and diffusion of the remote classroom are taking place (Herckis, 2018).

Although technology acceptance models like TAM have provided understanding of mechanisms behind and factors influencing the individual adoption process, they fail to grasp potential contextual factors that influence the diffusion on an institutional level (Straub, 2009). This case study set out to take into account this institutional perspective by using the theoretical framework Diffusion of Innovations Theory (Rogers, 2003) as depicted below.

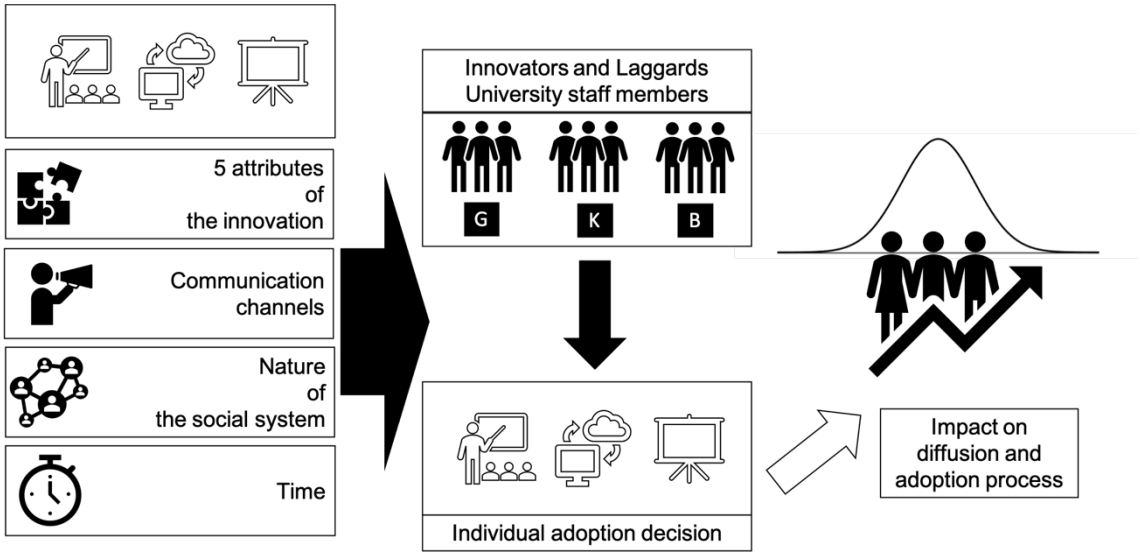

Figure 9: theoretical framework for this case study based on DOI (Rogers, 2003)

This discussion is built around the main research question and the sub questions of this case study. The following sections contain a critical reflection on the findings of this case study, a comparison of these results to the existing body of knowledge from similar case studies in HEIs and recommendations for facilitating the further adoption and diffusion of the remote classroom.

5.1 Key elements impacting the adoption and diffusion of the remote classroom

The data from this study indicates that the key elements impacting the adoption and diffusion of the remote classroom are the **perceived attributes of the remote classrooms** and **the social system** in which the remote classroom was introduced as well as **the communication channels** used to promote the remote classrooms. The findings show that these elements might slow down the adoption and diffusion rate of the remote classroom throughout the university. These findings are in concordance with Rogers' findings (2003) in which key elements impact the adoption and diffusion rate of an innovation. The attributes of an innovation itself accounts for 49 to 87 percent of variance in rate of adoption and the nature of the social system in which an innovation is introduced also impacts the rate of adoption.

While Sun and Jeyaraj (2013) found a distinct difference in key elements that impacted innovators and laggards at a certain point in time in their case study on technology adoption, this case study did not indicate such a clear divergence between the two groups.

The following subsections provide a critical appraisal of the three key elements that seem to be impacting the adoption and diffusion of the remote classroom in this case study. When deemed relevant, the difference between innovators and laggards is indicated throughout the findings about these key elements.

5.1.1 Perceived attributes of the remote classroom

The data from this explorative case study shows that:

- The relative advantage of the remote classroom is perceived as low by interviewees in comparison to face-to-face contact with students;
- The perceived compatibility of the remote classroom is perceived as low compared to standard teaching methods;
- The complexity of the remote classroom is perceived as high by interviewees because of difficult interfaces and setup;

- There are mixed perceptions about the trialability of the remote classroom, the pilot project allowed for safe experiments but with the end of the TECOL project, the idea of testing the remote classroom in a safe environment seems to have vanished;
- The observability of the remote classroom is rather low as perceived by interviewees, as results and outcomes of the TECOL project and more specifically the remote classroom were not visible to them. Interviewees remembered the closing day of the TECOL project and interviewees from campus K reported having had a tour of the Edulab.

The relative advantage or the degree to which staff members recognize that the remote classroom could enhance their job and learning outcomes in the learning process of students, is of primary importance for a positive adoption decision (Rogers, 2003). The added value of connecting two remote groups of students has not been shown and documented well enough for interviewees from the laggard category, while it is also questioned by the innovators that were interviewed. This might relate to the key challenges of synchronous hybrid learning on a pedagogical level. Specifically how does teaching in the remote classroom impact learning of students and which changes in teaching methods are needed to preserve the same effects as teaching in a regular classroom (Raes et al., 2019). This also aligns with the requirement that teachers need to reflect critically on their designs for the remote classroom (Bower et al., 2015). Some interviewees in the innovative category, believe in the potential time-saving value of the remote classroom for themselves because they wouldn't have the teach the same course twice and thus save on travel time, a potential benefit in teaching (Raes et al., 2019). Whereas laggards assess this so-called benefit of saving time as risky because it might cut into their teaching hours. Birch and Burnett (2009) found this to be an individual inhibitor to the diffusion of e-learning environments as well.

Many of the other issues that negatively impact the further adoption decisions of individuals seem to be compatibility issues regarding used teaching methods and students' learning needs. The loss of face-to-face contact with the remote students and the incompatibility of the setup of the remote classroom with interactive teaching methods such as practical sessions or labs, collaborative sessions are mentioned by at nine staff members.

Zooming in on the loss of face-to-face contact with the remote group, interviewees talked about how hard it is to observe students and be responsive to their classroom behavior through the screen, making interactive lecturing much harder than is often already the case in face-to-face

teaching. These factors are related to the required changes in pedagogical methods in the synchronous hybrid classroom as found by Raes et al. (2019). Three interviewees also mentioned that not seeing your students come into class and not being available after class as great pitfalls for the remote group. This relates to the need to establish connectedness between remote learners and the lecturer as found in the preliminary results of Ramsey, Evans, & Levy (2016).

Interviewees, both innovators and laggards, claimed in the interviews that not all types of classes can be held in the remote classroom that connects two groups synchronously. One example that clarifies this viewpoint is illustrated by one of the participants:

> "We make use of collaborative learning for our labs, students are challenged to complete exercises and we walk around the class to provide immediate feedback. I don't see how I could translate this to a system in which one group of students would be in a remote location."

Another faculty member, who has already used the remote classroom, is skeptical about the classroom setup in the remote classrooms.

> "We need to interact with are students, ask questions, walk around and not just be in front of the classroom reciting knowledge, but the fact is that the furniture and screens in the remote classroom don't allow this. The design of the learning space is fairly old-fashioned in that way."

> "There's no one-size-fits-all approach when it comes to implementing edtech. Each academic discipline has their own didactic strategies and competencies to achieve. I cannot imagine that the remote classroom can be introduced top-down, it will only work if the edtech provides the answer to a certain need."

This last statement highlights the idea that pedagogical factors are strong drivers in the adoption decision of the individual faculty member, or in groups of staff members from a similar discipline.

Another barrier that is broached by interviewees is how attending lectures in the remote classroom impacts student learning outcomes. Interviewees who have already used the remote classroom utter a certain hesitation about impairing the remote group to achieve the same learning outcomes as the group which is taught face-to-face. Maintaining equal learning standards in the synchronous hybrid learning context might indeed prove to be challenging due to the idea that the lecturer needs to adapt the approach to teaching (Grant & Cheon, 2007; Lightner & Lightner-Laws, 2016). This relates closely to the questions that some of the laggard interviewees have about the added value

for students who attend the class remotely and in group. One interviewee claims that lecturing or time with the lecturer is valuable because of interaction and feedback on the learning process, providing structure for students and explaining difficult parts, but most of the interviewees are not convinced that you can achieve those things in a high quality manner when you're teaching in a hybrid setting.

Two participants from the laggard category suggest that the remote classroom could be used for specific student groups such as students who combine work and study, who might have little time to attend lectures. This flexibility for students is named as a benefit of the synchronous hybrid setting by Raes et al. (2019). Other suggestions to make use of the remote classroom by interviewees include using the learning spaces for staff meetings or the guidance of master students in their thesis writing. Related to this, four participants categorized as innovator, reflect on differences between the remote classroom technology and videoconferencing software such as Skype for Business® widely used at the university for all types of communication. The question arises why, from a pedagogical perspective, the remote classroom technology should be chosen over other types of available videoconferencing software, potentially inhibiting further adoption of the remote classroom because this undermines the added value of the new learning spaces.

In contrast to Bower et al. (2015) who claim that the audio component is the greatest technical barrier to the synchronous hybrid setting, the biggest challenge of the remote classroom in this study seems to be the size of the screens and the lack of automated direction in video images. The adoption decision of the innovators tends to lean towards non-adoption of the remote classroom in the near future unless the technological development of the innovation continues. This is a group of staff members, who typically like to experiment with new technology but also quickly form an attitude towards that new technology if the experimenting goes wrong and potentially jeopardizes the learning outcomes or added value for students.

One innovator points out that it is not clear yet what the added value is of connecting one group of students to another, compared to letting individual students connect to the class remotely. To this interviewee, evidence for the value of bringing students together to attend a lecture from a geographically different location is lacking.

Quotes referring to the perceived complexity of the remote classroom are mentioned the highest number of times by interviewees who have already used the remote classroom in this case study.

The interface and setup of the software platform in the remote classroom are described as too complex and not self-explanatory. Looking at this factor through the lens of the DOI theory in which Rogers describes the innovation itself as an influencing factor of diffusion, this could mean that individuals who have already used the innovation might reevaluate their adoption decision and stop using the remote classroom (Rogers, 2003). The complexity might be a key inhibiting element in the further adoption and diffusion process of the remote classroom. This is confirmed by at least three interviewees who will discontinue or diminish their use if there is no extra technological development after the TECOL project.

Classes in the remote classroom are perceived to require more preparation and to be tougher to teach according to the innovators. These perceptions have a strong potential to be inhibitors to further adoption decisions. One of the innovators talks about the extra work that was needed to get ready for teaching in the remote classroom and the stress it caused to perform class management for both groups of students at once. This serious mental stress is referred to as hyper-zoom or hyper-focus (Bower et al., 2015) and is considered a pedagogical challenge of the remote classroom (Raes et al., 2019). The fact that there are no clear guidelines available yet on how to teach in the remote classroom only added to the stress and presumably caused the feelings that it's like going into a classroom blindly.

Another cluster of answers to the question of what impacts the adoption and diffusion of the remote classroom, is what the DOI specifies as trialability or the way an individual perceives experimenting with the remote classroom is possible. The idea that professional development initiatives need to be differentiated and personalized according to specific groups such as innovators and laggards or based on teacher beliefs and motivation to change teaching strategies, is not new (Herckis, 2018). Educational developers and other support staff should be able to meet faculty members "where they are" when providing support (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010; Gillespie, Robertson, & Bergquist, 2010) and be aware that offering support might have the opposite effect of what was intended (Brownell & Tanner, 2012). Two interviewees in this case study confirmed this, one by stating to not want any help at all, the other by illustrating that current professional development initiatives are not adapted to their own needs. Potentially changing the services that are currently offered to facilitate the usage of the remote classroom could counter these inhibiting factors.

5.1.2 The social system and communication channels

The interview data from this case study and its subunits shows that:

- The nature of the social system potentially has a negative impact on the further diffusion of the remote classroom as perceived by interviewees;
- The communication channels currently used are not speeding up the adoption rate of the remote classroom.

The fact that the remote classroom was introduced on three campuses or subunits of this case study through means of an innovation project was perceived as a facilitating factor for the innovators, and more as a barrier for the laggards. Digging into the interview data, it becomes clear that organizing the TECOL project across three campuses that historically do not have intensive connections is perceived as challenging by some of the interviewees. The mere availability of remote classrooms isn't enough to create interaction between campuses even though working together would be highly appreciated by interviewed staff members.

Some of the quotes in the interview data show that geography is an element in the further adoption and diffusion of the remote classroom. One of the geographical issues relates to the perceived usefulness of the remote classroom, academics tend to connect with friends and colleagues whom they've worked with closely (Herckis, 2018). Rogers (2003) states that transfer of ideas usually takes place between two people who share comparable attributes like beliefs or education. This could mean that if technology is to facilitate connecting remote groups it might work best between campuses that are home to similar programs and research groups because the communication between these would be more effective (Rogers, 2003). Interviewees in this case study point out that current remote classrooms were not installed according to this logic, thus making it harder to make use of the learning spaces. On the other hand, some interviewees believe that the positioning of the remote classrooms on these specific campuses, provides potential to think about a broader use of the remote classrooms, for instance for staff meetings.

Although this case study did not intend to make a distinction between the three campuses, the interviews did uncover inhibiting factors that were potentially different per campus. Interviewees perceived one campus as the main hub and the potential leader of the TECOL project, while the other two campuses were perceived as less involved with the setup and the execution of the project.

This discrepancy and the feeling of inferiority were named by two of the interviewees and might be important to take into account for the further implementation process.

In one campus, two innovative staff members feel disappointed about the end of the TECOL project because to them the further development of the technology is necessary to speed up the rate of adoption and diffusion. Not knowing what will happen in the near future and the idea that as project participants they have little impact on the next steps, frustrates them.

Another interviewee has ethical concerns about the remote classroom because due to the TECOL project, a large company has set foot in the university and has possibly acquired a strong monopoly as a supplier.

Communication and promotion need to be put in place according to certain innovative interviewees. This is supported by data from the laggard category who know very little about the remote classroom and what it could mean for their teaching. Some of the interviewees attended the closing day of the TECOL project, but that wasn't enough to give them a clear image about the remote classroom and how it could translate into their daily practice.

Finally, practicalities such as lesson planning and ICT support and helpdesk influence the adoption of the remote classroom. During the TECOL project the remote classroom was used to give identical classes one time, synchronously, instead of twice on two locations. This type of intervention requires careful analysis and planning in a cross-campus manner as described by this participant:

> "It's not enough to find a course that's given twice, once in G and once in B. They have to be given in the same semester and we have to find a matching timeframe for our student groups in both campuses. And after all those conditions are fulfilled, the remote classrooms need to be booked at least one hour in advance for the setup. It's very complex and requires new processes to be installed." (Participant 3)

At least three interviewees point out that ICT support should be really accessible to enhance further adoption. One quote to illustrate this:

> "Knowing that you can call an ICT-expert when something goes wrong in the remote classroom, is extremely important. As a teacher I don't want to lose time with the technical stuff, my job is to teach." (Participant 3)

The next section provides strategies stated by interviewees to facilitate the adoption and diffusion of the remote classroom in the large university of this case study.

5.2 Strategies to facilitate the adoption and diffusion of the remote classroom

This case study discovered potential key elements that are impacting the adoption and diffusion of the remote classroom. Interviewees were asked which strategies might positively influence their adoption decision on the remote classroom. While innovators that were interviewed, provided some concrete ideas, it was clear that the interviewees from the laggard category could not spell out what would change their non-adoption decision in the near future.

The group of laggards is characterized by decision-making pathways in which teacher beliefs and motivation to change seem to be key elements impacting the adoption decision on the remote classroom. Communication about the innovation and time are important elements to help this group even consider the remote classroom as an option, some even state very firmly that they will never make use of this learning space. Participants from the laggard category also point out that in general the university still has a very research-based mindset, in which teaching and educating students just isn't as important as research. An inhibiting element is derived from this, namely decentral departments do not possess enough budget to invest in education and innovation. Staff members that can spend their time on education are limited which means less adoption of technology to them.
To gain a better insight into this group, more research is needed to figure which strategies or interventions might work best.

The following subsections contain possible strategies that were mentioned in the interviews with innovators.

5.2.1 Persist in co-creation and dialogue with faculty members

Devoting time to continuous needs analysis seems to be a necessary strategy, not only for developing edtech like the remote classroom, but also for facilitating the implementation of the tool. This relates to the key element time in DOI (Rogers, 2003) and the fact that different groups of faculty members will adopt an innovation at different times. Innovators in this case study were

mainly focused on the perception of the remote classroom itself, while laggards seemed more concerned with issues regarding the nature of the social system. This is supported by the knowledge that innovation attributes influence adoption decision more during early and later stages of diffusion, and contextual factors impact mainly individual decisions in later stages (Sun & Jeyaraj, 2013). Regardless of the characteristics of faculty members, persisting in dialogue about the remote classroom will enhance the knowledge about potential barriers and support needs.

5.2.2 Invest in continued technological development

The TECOL pilot project has established a strong collaboration between the university and the developers of the remote classroom, but the end of the project leaves interviewees with questions on how the remote classroom will be optimized to meet their needs.

A potential strategy suggested by the group of innovators that were interviewed, is the continued technological development of the remote classroom in co-creation with its users. This aligns with the findings of Zydney et al. (2019) who conclude that simplifying the technology of the remote classroom is an important strategy deducted from their case studies. As stated before, for some of the innovators, this is even a prerequisite for them to continue using the remote classroom. Continued technological development should focus on providing larger screens for both local and remote locations, one interviewee claims that screens should even depict life-sized students.

Another important issue to be resolved is the automated video direction process in which a built-in system is responsible for showing the most important image minute-to-minute. This is comparable to what some of the current videoconferencing software does by automatically showing the talking person as the largest on screen. The lecturers that have used the remote classroom compare it to watching a well-directed TV-show, changing angles and images, invites the student watching to stay engaged throughout the class.

And lastly, problems with reciprocal sound should be completely solved to ensure proper interaction between both locations, remote and face-to-face.

Investing in continued technological development is in agreement with the suggestion of Venkatesh & Bala (2008) to invest in minimizing initial resistance during the early phase of an implementation of digital technology.

5.2.3 Install remote classrooms on other campuses

While continued technological development could be a necessary condition to be fulfilled for facilitating higher use of the remote classroom in the current campuses, equipping other campuses with a remote classroom might also enhance more frequent use of the technology. Innovators that were interviewed, claim that their teaching activities are spread across other main campuses that host programs from their faculties. These campuses are often further away from their home campus, causing extra travel time when teaching at remote campuses. Installing other synchronous hybrid learning spaces might resolve these issues.

5.2.4 Conduct effectiveness research on teaching methods in the remote classroom

Even though the remote classrooms were co-created with lecturers and students, this case study has brought to light that the learning space challenges current teaching methods which are mainly used in face-to-face lectures. Interviewees from the innovator category state that teaching in the remote classroom is more tiring and stressful because of the two groups of students that need to be attended to. In agreement with Raes et al. (2019), more research is needed to see what works in the remote classroom, and this for lecturers as well as students.

Conducting effectiveness research could positively impact the relative advantage of the remote classroom since this case study has revealed that staff members have a difficult time to see the added value of these learning spaces. Showing results of studies in these types of learning environments could uncover benefits that will convince innovators and early adopters to make more use of it.

5.2.5 Communication, professional development and innovation experiments

A personalized and differentiated approach to communication, professional development and educational support, a safe organizational environment to experiment with innovation in teaching

and more budget and staff for education and teaching at faculty level are prominent elements drawn from the different interviews.

The needs for professional development initiatives and educational support, vary greatly according to the interview data: from no needs at all to very basic workshops on digital skills. Similar results were found in a case study by Zydney et al. (2019) when participants got trained to use the remote classroom beforehand, were provided with technological support during the first session and then not supported after that. Faculty in that case study reacted in different ways, some were satisfied with this approach, others wanted more support. A common suggestion by participants in this case study is to unlock the potential of sharing good practices more. Half of interviewees seem to interact well and often with 'peers' in their department or other functional unit and often look for support and advice in those immediate circles. Herckis (2018) found similar results in her case study. The following quotes illustrate this phenomenon clearly:

> "As an older employee I am aware that technology is evolving really fast and I want to keep up because I interact with students on a daily basis. I don't want to seem foolish and not know what I'm doing, but most professional development initiatives are organized at the central campus in Leuven which is quite a hassle." (Participant 5)

> "When I get advice from an educational developer, they make it all feel so simple…this potentially makes me insecure. I like to talk to colleagues who have used the technology and ask them for advice." (Participant 1)

Perfect demonstrations as well as champion users of the remote classroom could facilitate further adoption according to at least three innovators that were interviewed.

Experimenting with technology in the classroom can backfire, it puts the faculty member at risk, but it also has the potential to help you change your pedagogical approaches as a faculty member according to one participant. The important thing is that there's a supportive organizational culture for this experimenting, a culture in which making mistakes is allowed and the autonomy of the faculty member is respected. One interviewee goes even further and states that a culture in which innovation is promoted will facilitate the adoption of edtech and the remote classroom. Strategies that allow these safe experiments for lecturers might potentially enhance the diffusion of the remote classroom, just as Bower et al. (2015) conclude from their case studies that edtech can be an incentive to enhance teaching and learning.

6 CONCLUSION

The Diffusion of Innovation theory outlines those key elements which impact diffusion of an innovation throughout a social system: the of the innovation itself, the communication channels used to promote the innovation, the nature of the social system and time (Rogers, 2003). According to DOI, not all individuals adopt an innovation at the same moment in time: innovators are the group the adopt an innovation the fastest while laggards seem to be the slowest. This theoretical framework was used to underpin the analysis and interpretation of the exploratory case study for this master's thesis. This thesis aimed to gain insight into the diffusion rate of a specific type of edtech, namely the remote classroom or technology for synchronous hybrid teaching, as well as find out which key elements were impacting this diffusion rate. Research on this type of learning space is still in a beginning stage (Bower et al., 2015), the current study adds to the know-how on how faculty perceives teaching in the remote classroom. In addition, this case study indicates that future research on scaling up the remote classroom in different contexts in HEIs is necessary.

The main research question in this study was to discover key factors influencing the adoption and diffusion of the remote classrooms by faculty members in a large, multicampus university. In addition, this study wanted to explore if these key factors align with the current body of evidence on adoption and diffusion of edtech and which strategies could facilitate the adoption and diffusion of the remote classrooms. Ten semi-structured interviews with staff members, classified as innovators or laggards, were completed, transcribed, thematically analyzed and interpreted.

The findings in this study confirm that three of the four key elements in the theoretical framework seem to impact the adoption and diffusion of the remote classroom. The main issues appear to be the perception of the remote classroom itself, the communication channels used in the TECOL project and the nature of the social system in which the remote classrooms were installed.

Strategies that could facilitate the diffusion of the remote classrooms throughout the large university are facilitating co-creation and dialogue with faculty for needs analysis regarding the remote classroom, improving the technology itself to make up for the loss in face-to-face contact with remote students, investigating which teaching methods work in the remote classrooms, installing remote classrooms in strategically chosen campuses of the university and investing in safe and

small-scale innovation experiments. These strategies were deducted from the innovators that were interviewed for this case study.

This case study adds to the body of knowledge on diffusion of remote classroom or synchronous hybrid space as an innovative learning space in HEIs. The benefit of the methodology that was used is that the complexity of the pathway to the adoption decision by faculty members was documented and for that reason more understandable. The pitfall is that generalizing these findings to other contexts is challenging and that prioritizing next steps is difficult. The results do reveal that a one-size-fits-all approach will not work in the further diffusion, as illustrated by the differences in responses between innovators and laggards. The needs and the decision pathways of innovators and laggards seem to be different, confirming the value of a differentiated, multiple strategy approach. At the time of this case study, the critical element for enhancing the diffusion rate of the remote classroom is the continued technological development for innovators while laggards are not ready to make a positive adoption about the remote classroom at all.

Future efforts to enhance the diffusion of the remote classroom throughout the university should take into account these preliminary findings. In addition, research should continue to close the research gap on the use of the remote classroom in HEIs by focusing on effective teaching methods in this innovative learning space. Since faculty still seem to prefer face-to-face teaching methods even if they are already engaging in online instruction for their students, this case study ultimately concludes similarly to Galanek & Gierdowski (2019) that the added value of teaching to remote groups needs to be explored more profoundly.

REFERENCE LIST

Abrahams, D. (2010). Technology adoption in higher education: a framework for identifying and prioritising issues and barriers to adoption of instructional technology. *Journal of Applied Research in Higher Education*, *2*(2), 33–49.

Altbach, P. G., Reisberg, L., & Rumbley, L. E. (2009). *Trends in global higher education: Tracking an academic revolution*.

Ambrose, S., Bridges, M., DiPietro, M., Lovett, M., & Norman, M. (2010). *How Learning Works: 7 Research-Based Principles for Smart Teaching*. San Francisco, CA: Jossey.

Baxter, P., & Jack, S. (1990). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *The Qualitative Report*, *13*(4), 544–559.

Bell, J., Sawaya, S., & Cain, W. (2014). Synchromodal classes: Designing for shared learning experiences between face-to-face and online students. *International Journal of Designs*, *5*(1), 68–82.

Berrett, B., Murphy, J., & Sullivan, J. (2012). Administrator insights and reflections: Technology integration in schools. *Qualitative Report*, *17*(1), 200–221.

Birch, D., & Burnett, B. (2009). Bringing academics on board: Encouraging institution- wide diffusion of e-learning environments. *Australasian Journal of Educational Technology*, *25*(1), 117–134.

Boelens, R., De Wever, B., & Voet, M. (2017). Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review*, *22*, 1–18. https://doi.org/10.1016/J.EDUREV.2017.06.001

Borsheim, C., Merritt, K., & Reed, D. (2008). Beyond technology for technology's sake: Advancing multiliteracies in the twenty-first century. *The Clearing House*, *82*(2), 87–90.

Bower, M., Dalgarno, B., Kennedy, G. E., Lee, M. J. W., & Kenney, J. (2015). Design and implementation factors in blended synchronous learning environments: Outcomes from a cross-case analysis. *Computers and Education*. https://doi.org/10.1016/j.compedu.2015.03.006

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brown, M. (2016). Blended instructional practice: A review of the empirical literature on instructors' adoption and use of online tools in face-to-face teaching. *Internet and Higher Education*, *31*, 1–10.

Brownell, S. E., & Tanner, K. D. (2012). Barriers to Faculty Pedagogical Change: Lack of Training, Time, Incentives, and…Tensions with Professional Identity? *Life Sciences Education*, *11*(4), 339–346. https://doi.org/10.1187/cbe.12-09-0163

Cain, W. (2015). Technology Navigators: An Innovative Role in Pedagogy, Design and Instructional Support. In *Educational Innovations and Contemporary Technologies* (pp. 21–35). London: Palgrave Macmillan UK. https://doi.org/10.1057/9781137468611_2

Coughlan, M., Cronin, P., & Ryan, F. (2007). Step-by-step guide to critiquing research. Part 1: quantitative research. *British Journal of Nursing*, *16*(11), 658–663.

Crabtree, B. F., & Miller, W. L. (William L. (1999). *Doing qualitative research*. Sage Publications.

de Freitas, S., & Oliver, M. (2005). Does E-Learning Policy Drive Change in Higher Education? A Case Study Relating Models of Organisational Change to E-Learning Implementation. *Journal of Higher Education Policy and Management*, *27*(1), 81–96.

Galanek, J., & Gierdowski, D. (2019). *ECAR Study of Faculty and Information Technology, 2019*. Louisville, CO.

Geoghegan, W. (1994). Whatever happened to instructional technology? In *Proceedings of the 22nd Annual Conference of the International Business Schools Computing Association*. Baltimore, MD: Electronics and Computer Science.

Gillespie, K. H., Robertson, D., & Bergquist, W. (2010). *A guide to faculty development*. San Francisco, CA: Jossey-Bass.

Graham, C., Woodfield, W., & Harrison, J. (2013). A framework for institutional adoption and implementation of blended learning in higher education. *Internet and Higher Education*, *18*, 4–14.

Grant, M., & Cheon, J. (2007). The value of using synchronous conferencing for instruction and students. *Journal of Interactive Online Learning*, *6*(3), 211–226.

Gu, X., Crook, C., & Spector, M. (2019). Facilitating innovation with technology: Key actors in educational ecosystems. *British Journal of Educational Technology*, *50*(3), 1118–1124.

Hancock, D., & Algozzine, B. (2011). *Doing Case Study Research* (Second). New York: Teachers College Press.

Haywood, J., Connelly, L., Henderikx, P., Weller, M., & Williams, K. (2014). *The changing pedagogical landscape: New ways of teaching and learning and their implications for higher education policy*. *Executive summary*. Luxembourg.

Herckis, L. (2018). Passing the Baton: Digital literacy and sustained implementation of eLearning Technologies. *Current Issues in Emerging ELearning*, *5*(1), 29–44.

Holon IQ. (2019). 2019 Global Learning Landscape | HolonIQ. Retrieved January 12, 2020, from https://globallearninglandscape.org/

Huberman, M., & Miles, M. (1994). *Qualitative data analysis: an expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.

Humbert, M. (2007). Adoption of blended learning by faculty. In *The challenges of educating people to lead in a challenging world* (10th ed., pp. 423–436). Dordrecht: Springer. https://doi.org/10.1007/978-1-4020-5612-3_21

Jasperson, J., Carter, P., & Zmud, R. (2005). A comprehensive conceptualization of the post-adoptive behaviors associated with IT-enabled work systems. *MIS Quarterly*, *29*, 525–557.

King, M., Dawson, R., Batmaz, F., & Rothberg, S. (2014). The need for evidence innovation in educational technology evaluation. *Global Issues in IT Education*, 9–23.

Lightner, C., & Lightner-Laws, C. (2016). A blended model: simultaneously teaching a quantitative course traditionally, online and remotely. *Interactive Learning Environments*, *24*, 224–238.

Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry*. Beverly Hills: Sage.

Looi, C.-K., & Teh, L. W. (2015). *Scaling Educational Innovations*. *Springer*. Singapore: Springer Singapore: Imprint Springer. https://doi.org/10.1007/978-981-287-537-2

Lowendahl, J.-M. (2014). *Hype Cycle for Education*.

Manyika, J., Ramaswamy, S., Khanna, S., Sarrazin, H., Pinkus, G., Sethupathy, G., & Yaffe, A. (2015). *Digital America: a tale of the haves and have-mores*.

Merriam, S. (2009). *Qualitative research: a guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Moore, G. (2002). *Crossing the chasm: Marketing and selling disruptive products to mainstream customers*. New York: HarperCollins.

Moser, F. Z. (2007). Faculty adoption of educational technology. *Educause Quarterly*, *30*(1), 66–69.

Nortvig, A. (2013). In the Presence of Technology-Teaching in Hybrid Synchronous Classrooms. In *Proceedings of the European Conference on E-Learning* (pp. 347–353). Retrieved from http://search.proquest.com/openview/2616f896b4618dbaf4721b5ded0301d6/1?pq-origsite=gscholar&cbl=1796419

OECD. (2019). *Going Digital: Shaping Policies, Improving Lives*. Paris.

Porter, W., Graham, C., Bodily, R., & Sandberg, D. (2016). A qualitative analysis of institutional drivers and barriers to blended learning adoption in higher education. *Internet and Higher Education*, *28*, 17–27.

Rad, M., Nilashi, M., & Dahlan, H. (2018). Information technology adoption: a review of the literature and classification. *Universal Access in the Information Society*, *17*(2), 361–390. https://doi.org/10.1007/s10209-017-0534-z

Raes, A., Detienne, L., Windey, I., & Depaepe, F. (2019). A Systematic Literature Review On Synchronous Hybrid Learning: Gaps Identified. *Learning Environments Research*.

Raes, A., Vanneste, P., Pieters, M., Windey, I., Van Den Noortgate, W., & Depaepe, F. (2020). Learning and instruction in the hybrid virtual classroom: An investigation of students' engagement and the effect of quizzes. *Computers & Education*. https://doi.org/10.1016/j.compedu.2019.103682

Ramsey, D., Evans, J., & Levy, M. (2016). Preserving the Seminar Experience. *Journal of Political Science Education*, *12*(3), 256–267. https://doi.org/10.1080/15512169.2015.1077713

Riege, A. M. (2003). Validity and reliability tests in case study research: A literature review with "hands-on" applications for each research phase. *Qualitative Market Research: An International Journal*, *6*(2), 75–86. https://doi.org/10.1108/13522750310470055

Rogers, E. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Ryan, B., & Gross, N. (1943). The diffusion of hybrid seed corn in two Iowa communities. *Rural Sociology*, *8*(1), 15.

Savin-Baden, M., & Major, C. (2013). Interviews. In *Qualitative research: the essential guide to theory and practice*. London: Routledge.

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education*, *128*, 13–35. https://doi.org/10.1016/J.COMPEDU.2018.09.009

Seawright, J., & Gerring, J. (2008). Case selection techniques in case study research. *Political Research Quarterly*, *61*(2), 294–308.

Sovacool, B. K., & Hess, D. J. (2017). Ordering theories: Typologies and conceptual frameworks for sociotechnical change. *Social Studies of Science*, *47*(5), 703–750. https://doi.org/10.1177/0306312717709363

Stake, R. (1995). The art of case study research. In *Data gathering* (pp. 49–68). Thousand Oaks, CA: Sage. https://doi.org/10.1108/eb024859

Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of Educational Research*, *79*(2), 625–649. https://doi.org/10.3102/0034654308325896

Strong-Wilson, T. (2008). Gathering in the Dusk: Circling Back to Literacy Formations as Teachers 'Learn with Laptops.' *Changing English*, *15*(2), 211–222. https://doi.org/10.1080/13586840802052443

Sun, Y., & Jeyaraj, A. (2013). Information technology adoption and continuance: A longitudinal study of individuals' behavioral intentions. *Information and Management*, *50*(7), 457–465. https://doi.org/10.1016/j.im.2013.07.005

Thackray, L., Good, J., & Howland, K. (2010). Learning and Teaching in Virtual Worlds: Boundaries, Challenges and Opportunities. In *Researching learning in virtual worlds* (pp. 139–158). London: Springer. https://doi.org/10.1007/978-1-84996-047-2_8

Tondeur, J., van Braak, J., Siddiq, F., & Scherer, R. (2016). Time for a new approach to prepare future teachers for educational technology use: its meaning and measurement. *Computers & Education*, *94*, 134–150.

UCISA. (2016). *2016 survey of technology enhanced learning: case studies*. Oxford.

Vanderlinde, R., & van Braak, J. (2010). The e-capacity of primary schools: Development of a conceptual model and scale construction from a school improvement perspective. *Computers & Education*, *55*(2), 541–553. https://doi.org/10.1016/j.compedu.2010.02.016

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences*, *39*(2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Walker, R., Jenkins, M., & Voce, J. (2018). The rhetoric and reality of technology-enhanced learning developments in UK higher education: reflections on recent UCISA research findings (2012–2016). *Interactive Learning Environments*, *26*(7), 858–868.

Weitze, C., Ørngreen, R., & Levinsen, K. (2013). The Global Classroom Video Conferencing Model and First Evaluations. In *Proceedings of the 12th European Conference on E-Learning: SKEMA Business School, Sophia Antipolis France, 30-31 October 2013*. Reading, UK: Academic Conferences and Publishing International.

Weller, M. (2018). Twenty years of edtech. *Educause Review Online*, *53*(4), 34–48.

Wiles, G., & Ball, T. R. (2013). The Converged Classroom. In *120th ASEE Annual Conference and Exposition*. Atlanta: American Society for Engineering Education.

Yin, R. K. (2003). *Case study research: designs and methods* (Third). Thousand Oaks, CA: Sage.

Zydney, J. M., McKimmy, P., Lindberg, R., & Schmidt, M. (2019). Here or There Instruction: Lessons Learned in Implementing Innovative Approaches to Blended Synchronous Learning. *TechTrends*, *63*(2), 123–132. https://doi.org/10.1007/s11528-018-0344-z