EXPERIENCING CENTERS OF EXPERTISE

An explorative study on the experiences of students at Centers of Expertise at Dutch Universities of Applied Science

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Abstract

'Scientific understanding and practical experience are like two legs without which we cannot walk', is what the Chilean biologist and philosopher Francisco Varela said. From the understanding that science and practical experience cannot work without each other, among other things, the Universities of Applied Science (UAS) have increasingly paid attention to practice-oriented research as one of their spearheads. In 2001 an important step was taken in this respect with the development of lectorates, these are positions that, among other things, intended to close the gap between scientific knowledge and the work field by engaging in practice-oriented research. At a later stage, around 2010, Centers of Expertise (CoE) were established. These CoE have multiple goals, also aiming to further strengthen the research orientation of UAS, among which providing students research-based education. From this perspective one can see the CoE as a new learning environment for students. These CoE are regional knowledge hubs, where public and private parties, such as UAS, local governments and business partners work together in sectors that are important for the region and the Netherlands in general.

As the students are an important element within the CoE, this thesis will focus on them. Concretely, it will focus on the elements of the ARCS Model of Motivational Design of Keller and based on this model I investigate whether the students perceive the CoE as a motivating learning environment. The main research question in this research is: "to what extent are Centers of Expertise a motivating learning environment for students in Universities of Applied Science?" For this, CoE TechForFuture at Saxion Enschede is taken as a case study. The expectation is that when the elements of the ARCS model are present within the learning environment, students will be highly motivated to perform well for their project work within the CoE.

A survey among 28 students has been used to collect data needed for this research. Students believe that the different elements of the ARCS model are present within the CoE, therefore possibly enhancing the motivation to perform well from the students' side. However, because of the low number of respondents and the fact that only one case study has been done, no hard conclusions can be drawn from this research. A recommendation for further research is to do the research with more respondents, including more cases.

Keywords Centers of Expertise, motivation, ARCS model, Universities of Applied Science

Preface

This master thesis, "an explorative study on the experiences of students at Centers of Expertise at Dutch Universities of Applied Science", explores the concept of motivation and of other elements that could possibly be present within the learning environment of a Center of Expertise. This research has been conducted as part of the master's program Public Administration at the University of Twente.

I would like to extend my gratitude to my thesis supervisors Dr. de Boer and Dr. Jongbloed for their guidance, feedback and patience during this process. I would like to thank my family and friends for their support for being there during the difficult moments. Additionally, I would also like to thank the director of TechForFuture, Alexander Jansen, and Pieter Moerman, program leader at Platform Bèta Techniek, together with all the respondents that filled in the survey: without their cooperation I would not have been able to conduct this research and it would not have been possible to complete my thesis.

I hope you enjoy reading this thesis.

Thank you.

Lena Ay
Hengelo, 2018

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1.1. Introduction

The Netherlands can be characterized as a knowledge intensive society with a big demand for a high-educated population. Knowledge institutions such as universities and Universities of Applied Science (hereafter: UAS) have a serious role to play in realizing such a highly educated population. These universities and UAS are seen as the driving force of the modern knowledge economy, not only by discovering and passing along of knowledge to industries or public organizations, but also due to the fact that they deliver graduates for the labor market.

Not only is there a growing demand for graduates in numbers – noticeably in the technical sector (Van der Kaaden & Van der Schrier, 2016) - there is also a growing demand for graduates with the right (start) qualifications for the labor market. The latter is a highly complex issue. Knowledge is changing at a rapid rate (Thijs, Visser & Hoeven, 2014) and the needs of the labor market are also constantly changing, making it difficult to understand what qualifications the modern graduate should have.

One of the answers that currently receives much attention regarding the qualifications of the modern graduate concerns 21st century skills. There has been a consensus that our society is changing from an industrial one to a knowledge society (Voogt & Pareja Roblin, 2010). In order to prepare students for the labor market, they will have to develop qualifications that are necessary to function within a knowledge society as new kinds of jobs arise on the current and future labor market. The amount of manufacturing jobs is decreasing, whereas the jobs where new competencies are needed such as knowledge construction (learning by combining new information and insights with what someone already knows), collaboration, problem solving ability, and creativity, are increasing (Van den Oetelaar, 2012). The focus on the 21st century skills means among other things that students from UAS should become acquainted with doing research. In this respect, the nexus between research and teaching is considered as important (research-based education). Traditionally, most universities have had a strong focus on research-based education, for UAS this is, or at least was, less common or self-evident.

Discussions about the role of research in education at UAS started at the end of the 1990s (Vereniging Hogescholen, 2009). The chair of the Netherlands Association of Applied Sciences (in Dutch: Vereniging Hogescholen) stressed the importance to make UAS education more

focused on developing the 'reflective practitioner': professionals that actively reflect on their own actions, that make implicit knowledge explicitly known, that look critically at their own work and that implement the live-long-learning concept (Lubbers & Bakker, 2015).

Since the beginning of this millennium, the Dutch ministry of Education, Culture and Science, the Netherlands Association of Universities of Applied Sciences (Vereniging Hogescholen), and employers' organizations concluded that, in order to reach this goal of a different orientation in teaching, the research function of UAS should become stronger (De Boer, 2016). The 1986 HBO Act allowed UAS to conduct research for educational purposes, however this component was negligible and UAS remained mostly teaching institutions. After the turn of the millennium, the idea that UAS should have a bigger role in knowledge development and research received more attention (De Boer, 2016). Not only to pass the knowledge from research on to the (regional) economy, but also to strengthen the quality of the education by giving students the chance to receive research related education and thus to create an opportunity to educate the 21st century graduate. Research can also be used for the translation of new insights from practice to education (De Weert, 2011). De Weert & Leijnse (2010) have argued that the term 'practice-oriented research' is commonly used in the UAS sector, as some features are that initiatives for research originate from practice and new knowledge will be valuable to that practice. De Weert & Leijnse (2010) also argued that research should be relevant for the quality and innovation of education, which can culminate in the professionalization of the teaching faculty.

Since 2000 a couple of initiatives have been taken within the UAS sector to enlarge the research function of UAS. The first initiative refers to the lectorates, with a lectorate being coordinated by a lector, a new staff position, sometimes referred to as a UAS professor. The establishment of 'knowledge circles' at the UAS is one of the main tasks of a lector. In 2005, a second initiative in the form of knowledge circulation grants was introduced. These grants were implemented as to improve knowledge development and exchange between UAS and business sectors, and between UAS and public-sector organizations. The knowledge circulation grants are known as the RAAK-subsidies, with separate grants for the UAS for different targets: RAAK-MKB, RAAK-Publiek, and RAAK-PRO (Regieorgaan SIA, 2017). The last initiative to strengthen the research function of UAS was the establishment of Centers of Expertise (hereafter: CoE) in 2010. The CoE are public-private partnerships in which UAS work together

with external partners to enhance knowledge development and knowledge exchange (De Boer, 2016).

1.2. Problem definition

This thesis will focus on one of the initiatives in the UAS sector to strengthen its research function: the CoE, in which lectorates play an important role. CoE are relatively new and ambitious collaborations between knowledge institutions such as UAS, the business sector and government. CoE link higher education, top sectors[1] and focus on social challenges through the networking of lecturers, entrepreneurs, researchers from public and private institutions, and teachers and students. In this thesis I will focus on the last group, i.e. the role and functioning of students in the CoE. For a student there are several ways of being involved within a CoE. A student can be involved through an internship within a CoE, they can do their graduation projects and thesis there, or they can get involved as part of their curriculum through their minor or specialization and working on projects (PBT, 2017).

As it concerns a relatively new phenomenon - the first CoE were established in 2012 - not much is known about the role of the student within a CoE. Questions that can arise from this are: how many students are annually involved within a CoE? In which way are they involved within a CoE? Why did the students choose to follow a part of their education at a CoE? What are their experiences with this new form of education at UAS? What do teachers and representatives from the industry think of the participation of students at UAS? Does student participation in a CoE have added value, and for whom? As far as I can see there has not been a lot of research on these questions. That is why this research will focus on one of these questions in order to have a better understanding of this educational innovation.

In my research I am interested in the experiences of students in CoE activities. Apart from the other goals CoE have, I consider the CoE as an educational innovation, as a new learning environment for students in UAS. Ideally, this new learning environment contributes to the students' motivation. In other words, this new learning environment should have value in the sense that it stimulates students to perform well and to acquire the skills attributed to the 'modern professional' or 'reflective practitioner'. The question is however whether this actually

[1] Top sectors are areas in which Dutch business and research centers (aim to) excel. In these areas, business, universities, research centers and government work together on knowledge and innovation, internationalization, human capital and reducing regulatory pressure to excel on a global level.

is the case. Therefore, this thesis focuses on the experiences of students with respect to this new learning environment that CoE offer. Is this new learning environment an inspiring place to learn? To answer this question, I will use a particular model of motivation, developed by Keller (1986). This model is known as the ARCS Model for Motivational Design, where A means attention, R means relevance, C means confidence and S means satisfaction. This model will be further presented in chapter three.

1.3. Research questions

The abovementioned makes it that this research will focus on the following question:
"To what extent are Centers of Expertise a motivating learning environment for students in Universities of Applied Science?"

To answer this question, I will investigate the experiences of students. For this purpose, I will use the ARCS model. The question is to what extent the factors that are mentioned in this model are perceived by students as being present in the learning environment that the CoE are offering.

The following sub questions have been formulated in finding an answer to the research question:

1. *"What does a CoE as a new learning environment look like?"*
2. *"Which factors produce a motivating learning environment for students according to the ARCS theory?"*
3. *"To what extent are these factors present in a CoE?"*

The intention of answering this research question is to (further) improve the student motivation within a CoE. The goal is to find out to what extent CoE offer, as a new element to the curriculum of (some) UAS, a motivational learning environment. The question is to what extent students feel challenged and motivated to participate within a CoE. As a new learning environment, CoE could form a welcome contribution to the spectrum of educational offerings in the Netherlands. It can be argued that this would be the case when this new learning environment is a learning space that positively impacts the students' motivation.
Point of departure is that students' behavior and their performance is driven by their motivation. The degree of motivation may vary across students and is dependent on several factors. The context within which the student operates, in this case the new learning environment, is one of the factors that affects motivation (e.g. what makes it that the student feels more challenged

within the learning environment and possibly wants to perform more well than during the courses in their 'classical' learning environment). To investigate the impact of context on student motivation, the ARCS Model (Keller, 1986) will be used, which offers good opportunities to answer the research question.

A short description on how the research will be conducted: the ARCS model of Keller distinguishes four factors (attention, relevance, confidence, and satisfaction) that have an influence on the motivation of a student. A case study will be conducted to see which and to what extent these four factors are present. To collect the data, desk research has been conducted and a survey has been established, based on the Course Interest Survey developed by Keller. This survey was distributed among UAS students that are actively participating, through a thesis or project, during their study time in CoE TechForFuture. The research design, data collection and data handling, will be further elaborated upon in the methodology chapter in chapter four. Afterwards, the results from the survey will be set out and eventually this thesis will end with a conclusion and recommendations for possible further research.

"There are three things to emphasize in teaching. The first is motivation, the second is motivation, and the third is (you guessed it) motivation."

Terrel H. Bell, U.S. Secretary of Education 1981-1985

2. Centers of Expertise

In this chapter, an answer will be formulated to the first sub question: 'What does a CoE as a new learning environment look like?"

2.1. Establishment of CoE

Nowadays, we want UAS to educate 'reflective practitioners': professionals that actively reflect on their way of working, that make implicit knowledge explicitly known, and that are known with the idea of life-long-learning that is being promoted by institutes (De Graaf, 2015). UAS feel the need to educate students with a critical attitude that will be active in the work field and can contribute to the further development of the work field they are active in. In order to achieve this, education is necessary that is closely related to the state of the art in the work field. Practice based research within UAS provides for this opportunity. Stakeholders from the business sectors provide projects, that can give an impulse to the development of education within UAS as research can be conducted within the UAS (Vereniging Hogescholen, 2009).

Now that many UAS have embraced the idea of practice-oriented research, this also has to become visible within the curriculum of study programs. Practice-oriented research can be regarded as being two-fold: it contributes to highly qualitative education and to the knowledge circulation between UAS and practice. The latter happens by preparing graduates to a world where development and practice come closer to each other, with research that has been conducted within UAS resulting in concrete results that can be used immediately by companies and institutions (Vereniging Hogescholen, 2010). This is all closely linked to a statement formulated by the European higher education ministers in Leuven in 2009: "Higher education should be based at all levels on state of the art research and development thus fostering innovation and creativity in society. We recognize the potential of higher education programs, including those based on applied science, to foster innovation. Consequently, the number of people with research competences should increase."[2]

These developments inspired the minister of Education, Culture and Science of the Netherlands to invite UAS to make up a future plan for practice-oriented research in UAS. The UAS set out their ambitions concerning practice-oriented research. As mentioned earlier, many UAS perceive practice-oriented research as a necessary condition for the development of a more

[2] Communiqué of the conference of European Ministers responsible for higher education, Leuven and Louvain-la-Neuve, 28-29 April 2009, p. 4.

research-oriented student on UAS level. Another ambition is that practice-oriented research is part of the knowledge circulation between UAS and businesses or public institutions (Vereniging Hogescholen, 2010).

UAS do not have a long history of conducting research. Many teachers within UAS do not have much experience with research, with research mostly commissioned in the form of contract assignments, and through internships and thesis projects of students. By implementing practice-oriented research within UAS, UAS have to invest in teachers in order to educate teachers in the field of research. The idea is that by having a stronger bond between education and research, the quality of education will be enhanced, and students will learn competences that are necessary for their future work field (Vereniging Hogescholen, 2010). Their addition will shift to conducting research, which means that teachers need additional competences. To make it possible for teachers to do research within the UAS, lectorates were established in 2001. These lectorates were established to cope with the existing gap between scientific knowledge and the labor market (SKO, 2008). The idea was also that UAS can play an important role in the development of 'communities of practice', where teachers/researchers, professionals from the practice field and students interact to innovate the daily professional practice (Vereniging Hogescholen, 2009).

As practice-oriented research became an increasingly important aspect within the Dutch knowledge- and research landscape, the CoE were established to further close the gap between knowledge and practice and to encourage innovation (Janssen, Roelandt & van der Wiel, 2017). The Commission De Boer (2009) was the first to speak of CoE in their investment plan regarding UAS. It was afraid that the demand for technical highly educated students would exceed the supply. An answer to this challenge was thus the establishment of CoE. These CoE are regional centers where public and private parties, such as municipalities, companies, organizations, universities and UAS work together in a sector that is of great regional importance (Vereniging Hogescholen, 2010). Concretely, CoE can be characterized as action-oriented partnerships, between educational institutions, companies, governments and other public organizations that work together in the sectors that are considered to be important for the economy in the Netherlands (Lubbers & Bakker, 2015). These sectors are in many cases affiliated with the nine top sectors. Top sectors are sectors that are important for the Dutch economy and society and in which the Netherlands wants to retain competitive on a global scale. These nine top sectors are focused on Agro & Food, Chemistry, Creative Industry,

Energy, Hightech, Horti, Life Sciences & Health, Logistics, and Water (Lubbers & Bakker, 2015). The Dutch government considers the Netherlands to be a global leader in those nine sectors (Rijksoverheid, 2018).

The first CoE pilots started in 2011, at the NHL Hogeschool (water technology), Hogeschool Zuyd (chemistry) and Fontys/HAN (automotive). The idea of establishing CoE would be to create a synergy in the field of 1) the creation of a link between the labor market and education, 2) *educating students that are innovative and skilled*, 3) the promotion of re-training and life-long learning, and 4) the enhancement and acceleration of the innovation capacity of companies (Katapult, 2017). It is possible for CoE to establish their own governance structure, creating their own market value and niche (Katapult, 2017). As a result of that, the CoE vary in size, aim and functioning. Apart from the differences, it can be argued that CoE have some principles in common, namely:

- In the area of educational development, by bringing students and lecturers in contact with state-of-the-art knowledge and technology of businesses and by working on multidisciplinary practice exercises or research questions;
- With businesses, and the contribution on enhancing their innovation capacity. Take for example the knowledge that becomes available by working on innovation questions and on the talent education with state-of-the-art knowledge and craftsmanship;
- Matching supply and demand of good qualified people, by contributing to the development to retraining of employees and jobseekers (Vereniging Hogescholen, 2017).

The CoE are being monitored and evaluated by an independent organization: Platform Bèta Techniek (hereafter: PBT). PBT also supported the development of the pilot CoE closely from the beginning. The CoE were being evaluated through midterm reviews, where PBT would give their feedback on the development of the CoE. The 2014 midterm reviews were encouraging. Janssen, Roelandt & van der Wiel (2017) concluded that the development of CoE has given the knowledge economy more depth and impact. The CoE were also evaluated in 2016, and one of the main conclusions was that the concept of public-private partnership worked well.

The figure below gives a summary of the abovementioned.

Figure 1. Definition and characteristics CoE in short (PBT, 2017)

Definition and goals of CoE

CoE are partnerships between businesses and educational institutions, governments and other public organizations. They work on:

- realizing a good connection between education and the job market;
- educating the reflective professional or expert;
- enhancing lifelong learning;
- advancing and enhancing innovation capacity of businesses.

Characteristics of CoE

A CoE:

1. is a public-private partnership between several businesses, UAS and governmental parties that work from the same vision on questions of businesses. Businesses, UAS and government share the ownership of the collaboration and invest in a CoE.
2. focuses on economical and/or societal issues from where a unique focus will be chosen – *a unique selling point* – that contributes to the innovation ability and the Dutch economy. Also, a connection will be sought between the different levels of education, and the regional economy.
3. experiments and innovations within the products and services that the collaborating parties make. All parties learn from each other for the advancement of their entrepreneurship. CoE share knowledge with each other and work together;
4. centers on connecting education and research and between valorization and entrepreneurship. This focuses on knowledge development and the sharing of expertise from the businesses with UAS, and the other way around.

2.2. Most important actors in short

Ministry of Education, Culture and Science and Ministry of Economic Affairs

The two Ministries were the first one to come with the plan of introducing a place where practice-oriented research in UAS could be conducted and to also close the gap between the knowledge economy and education. Their priority was to match the economic top sectors and UAS. Public-private partnerships, in the form of CoE, have been an important aspect in the business policy of the Ministry of Economic Affairs, the strategic agenda for higher education

of the Ministry of Education, Culture and Science and the human capital agendas of the top sectors. The importance and interest of the two Ministries in the CoE became clear, when then Secretary of State Halbe Zijlstra said that "failure is not an option", with the opening of a CoE in Leeuwarden.

Platform Bèta Techniek

PBT was established in 2004 by the Ministry of Economic Affairs and the Ministry of Education, Culture and Science. The goal of PBT was to stimulate qualitative and quantitative beta technicians so as the supply of betas and technical educated students comes into balance with the demand on the labor market. Ever since PBT was established in 2004, it aims to make engineering education and the technical sector more attractive. PBT tries to stimulate education, businesses and other partners to work together on a regional level on making practice-oriented education more attractive. PBT also tries to create an environment where employees can develop themselves, in order for them to keep up with the changing technological pace of the job market. PBT's ultimate goal is to enhance the impact within the engineering sector, working together with ministries, educational institutions, businesses sector, regional governments and other partners. The goal of all the parties involved is to work on a sufficient amount of beta technical educated students for the Dutch economy. PBT is also the coordinator for the ministries regarding the CoE. They keep a close watch on the development of CoE and make performance agreements with the CoE regarding the substantive and financial results.

Universities of Applied Science

UAS are an institution of higher education, which provides tertiary education and grants bachelor, master and sometimes doctorate degrees in a variety of subjects. The UAS have developed from a teaching institution to a more practice-oriented research institution. This shift has made it possible to improve the practical component within education, possibly resulting in an improvement of the quality of education. The idea is that education becomes more attractive with the presence of a CoE, possibly resulting in an increasing intake of students, which the UAS hope will be good for their funding. Before the UAS could start with CoE, they had to make performance agreements with the ministry of Education, Culture and Science regarding the focus of the CoE they planned to begin.

Students

Students may have an interest in the CoE, as the CoE makes it possible for them to participate in state-of-the-art research and projects during their study in collaboration with businesses. Students will then learn new skills and competences (e.g. research competences) and can make relevant contact with potential employers (i.e. for their resume or future job). The role of the students within the CoE in general will be further elaborated upon in section 2.3. A concrete description will be given in section 4.2.

Business sector

Businesses invest in CoE with the goal of having access to research and product development. The CoE offers businesses access to advanced facilities, knowledge and knowhow that, without a CoE, would be (financially) unavailable. Also, businesses have access to an important (and growing) group of highly educated future employees. The businesses are expected to also sit at the steering wheel of the CoE.

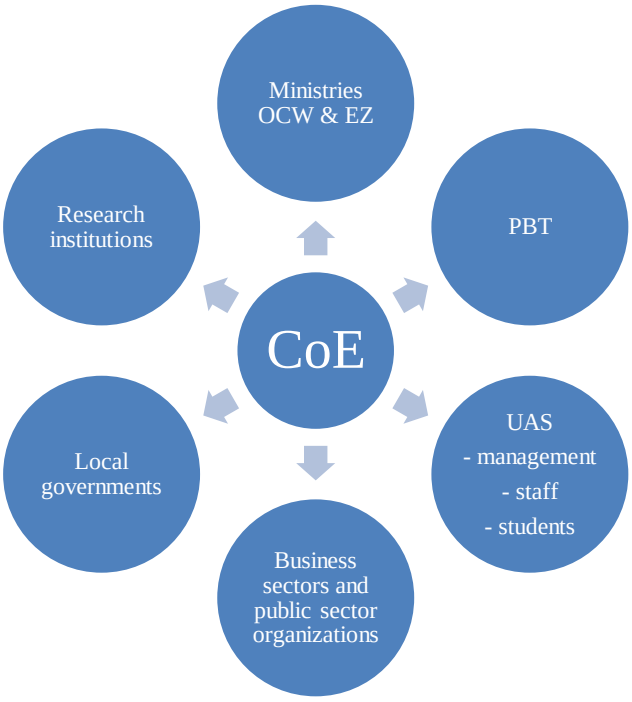
Local governments

The local governments participate in a CoE, so as to strengthen the position of education, research and innovative businesses in the region. The local governments have a more facilitating character and contribute mostly financially within the CoE, keeping their role within the CoE rather small.

Research institutions

Scientific partners have an interest in CoE, in order to close the gap between knowledge and the practice. The research institutions (such as MESA+ at the University of Twente) can make use of the knowledge of the teachers and researchers within the CoE. Also, research institutions can make use of the facilities present within the CoE, and the other way around. This can optimize the knowledge flows between UAS and universities. The CoE also contributes to the strengthening of the image of the region when it comes to the sector that is central within the CoE, enlarging the chances of attracting more research assignments.

Figure 2. Visualization of actors involved in CoE



2.3. Students

Students can be active in different kinds of subjects within the CoE. It is possible to participate as part of the minor, to work on the thesis, or to work on a project. What every CoE has in common, is that they work together with businesses. Thus, every student is able to work directly with potential employers and every project, thesis or minor is focused on real life projects. The students' focus during their time in the CoE is on conducting and participating in research.

2.4. Conclusion

This chapter focused on the new learning environment within UAS, known as the CoE. The CoE all have different goals and one of them is to have motivated students active within their centers, whether this is working on a project as part of their curriculum or whether students are working on their thesis. However, students also have to perceive the learning environment as motivating. The CoE have a different kind of learning environment than the traditional learning environments. The biggest difference is that the 'traditional' education and learning environment has exams after a couple of weeks, while the new learning environment does not have exams but solely focuses on project work, in which students work on real life projects with business partners. This also means that the new learning environment mostly has the focus on doing research, while the 'traditional' setting focuses on educating and not doing research (or at least at a minimum level). As the CoE are relatively new, the question is whether this learning environment is a motivating environment for students to work and learn in and thus to

perform and achieve learning objectives. This is being analyzed with the help of models, which will be elaborated upon in detail in chapter three. However, what can be regarded is that when students are not motivated by the learning environment or being challenged by their lectors/supervisors to perform well, the CoE have not achieved their goal of challenging their students relatively more than in a regular 'traditional' school environment. So, the main question after this chapter is: are students indeed motivated?

3. Theory

This section will discuss the theory that will be used in order to give an answer to the central research question. A couple of researchers did research on the motivation of students within the context of a learning environment, how they experience this learning environment, and how this learning environment is mentioned in the literature. This chapter will first explore the new learning environment and what drives a stimulating learning environment that stimulates the motivation to perform and achieve learning objectives. Then, different motivation theories will be elaborated upon, the ARCS Model of Motivation will be explained and the ARCS model in previous research will be discussed. This chapter will conclude with expectations in the form of hypotheses.

3.1. The learning environment

Every student has his or her own reasons and motivations when it concerns participation within a CoE, either for the thesis or project (as mentioned in chapter two). Motivation refers to what students "desire, what they choose to do, and what they commit to do" (Keller, 2010, 3). Keller (1987c, 2010) also assumes that teachers believe that their responsibility is limited to only teaching the content and skills effectively, and that it is a student's responsibility whether or not he or she wants to learn the content and skills. Keller (2010) has argued that, originally, instructional design is focused on producing effective and efficient instruction. However, efficiency does not have an added value to students' intrinsic motivation (motivation that comes from within, not externally driven), and the element of effectiveness should not focus only on how well people can learn from an instructional event given that they want to learn (Keller, 2010). A shift is noticeable in the research of the field of education, as it has expanded from making learning efficient and effective, to making education more enjoyable as well (Kirschner & Gerjets, 2006).

Teachers would rather have students that are motivated from themselves, i.e. intrinsically motivated, and teachers wish for their students to have or develop a desire to learn and to encourage continuing learning. However, Keller (2010) asks, is this feasible or even possible? If students had the choice, would they want to go to school? And how many of the students who are going to school do so because of intrinsic interest or because of its extrinsic value in helping them to prepare for careers and life in general? It is clear that this is a complex issue. One of the challenges for teachers or lecturers is to build intrinsic interest in the subject that students are following without expecting the students to be entirely motivated by intrinsic

interest and to respect the fact that students have different motivational motives when it comes to learning (Keller, 2010).

Gage & Berliner (1998) have identified motivation as the essential component that stimulates and sustains learning behavior. Study has also shown that intrinsically highly-motivated students outperform intrinsically low-motivated students, and that highly-motivated students are more likely to successfully complete a course (Kelly & Weibelzahl. 2006). Thus, motivation has a key role when it concerns learning and teaching, or, in Moller and Russell's words: "Even with good instruction, students may not learn without sufficient motivation" (1994, p. 55).

The learning environment defines the social, psychological, or psychosocial environment in which learning, or teaching takes place (Cleveland & Fisher, 2014). Wang, Haertel & Walberg (1990) have found out that the learning environment is one of the most important factors of learning, affecting both motivation for learning and learning achievements. Deci & Ryan (1985) for example, looked at the students' perception of the learning environment and the influence on the process of development of intrinsic motivation (Radovan & Makovec, 2015). They carried out studies in which they looked at the development of motivation in differently designed environments and concluded that students have a higher sense of motivation when the learning environment is being perceived as performance-oriented and encouraging with regards to obtaining good grades.

3.2. Motivation theories

There are several models dealing with the abovementioned section regarding the different kinds of motivation, such as the Time Continuum Model of Motivation and Motivational Framework for Culturally Responsive Teaching (Wlodkowski, 1989, 1999). The Time Continuum Model of Motivation is developed in order to increase the motivation among adults and to let them learn new subject material. To increase the motivation, Wlodkowski (1989) believes that one should look at four aspects: value, appeal, perseverance and continuing motivation. This theory is derived from techniques from linguistics, cognitive psychology and motivation research. The Time Continuum Model of Motivation is mostly focused on the role that motivation plays at different stages of the learning process. The Motivational Framework for Culturally Responsive Teaching (Wlodkowsi, 1999) is a blending of his earlier work and an attempt to integrate cultural sensitivity into the process of teaching. With the following four components, Wlodkowski (1989) attempts to establish this: establish inclusion, develop attitude, enhance

meaning and engender competence. These theories all have in common that they want to enhance the motivation of adults through teaching and thereby making use of different aspects or components that can enhance the motivation.

Two other models, that show some overlap with the abovementioned theories, are the intrinsic motivation theory (Malone & Lepper, 1987) and ARCS model theory (Keller, 1987). These theories have been frequently referred to and used in studies of the learning environment. Malone and Lepper (1987) focus on how to make it more interesting and enjoyable to learn. In other words, how can a learning environment add to the motivation of students? They have created four classes of 'individual' motivations: challenge, fantasy, curiosity and control. These classes identify different ways to create an environment that contributes to intrinsic motivations for learning. The four kinds of intrinsic motivation can be present in any learning situation. The ARCS Model of Motivation (Keller, 1987) is based upon the idea that there are four key elements in the learning process, which encourage and sustain learners' motivation. These four elements form the acronym ARCS and stand for Attention, Relevance, Confidence and Satisfaction. This model will be used in this thesis and will be further elaborated upon in the next section. Intrinsic and extrinsic motivation have been minimally mentioned in this thesis, as this thesis will not focus on the difference between these two kinds of motivation.
The four abovementioned models are set out in appendix I. The figure in appendix I will provide a comparison and contract of different motivational aspects. The comparison is done at a surface level.

3.3. ARCS Model of Motivation

Keller's (2010, 23) primary focus is on a motivational design "on people's motivation to learn and refers to strategies, principles, processes, and tactics for stimulating and sustaining the goal-oriented behaviors of learners". Based on extensive review of the motivational literature, Keller found that motivation could be sorted into four categories. The ARCS model (figure 3) shows the major dimensions of human motivation, especially in the context of learning motivation (Keller, 2010, 44).

Figure 3. ARCS Model Categories, Definitions, and Process Questions (Keller, 2010, 45)

Major	Categories and Definitions	Process Questions
Attention	Capturing the interest of learners; stimulating the curiosity to learn	How can this learning experience be stimulating and interesting?
Relevance	Meeting the personal needs/goals of the learner to affect a positive attitude	In what ways will this learning experience be valuable for students?
Confidence	Helping the learners believe/feel that they will succeed and control their success	How can via instruction the students succeed and how can they control their success?
Satisfaction	Reinforcing accomplishment with rewards (internal and external)	What can be done to help the students feel good about their experience and desire to continue learning?

Each category of the ARCS Model has subcategories and these subcategories are useful in diagnosing students' motivational profiles and in creating motivational tactics that are appropriate for the specific motivational problems that can occur during teaching. The first category for students' motivation is attention, which Keller suggests can be obtained by perceptual arousal or by inquiry arousal. In a learning context, the question is to manage and direct student attention (Keller, 2010, 45). Keller (2010) suggests that there are several strategies and tactics to grab and hold students' attention, for instance through active participation. Other options are through games or other types of hands-on practice. The use of humor is also an aspect to increase attention by including short humorous stories. Another technique is to present the students with facts or statements that may be contrary to what the students know or believe to be true. Variety is also a way to grab and hold attention, by making use of different kinds of media, as presenting all information in the same way is boring. Lastly, it is commonly accepted that students' attention will be stimulated if they believe that what they learn has a practical application in real life (Keller, 2010). Keller (2010) argues that when students get more engaged in the learning process, they are more interested in the content, culminating in higher chances of completing the course. In other words, attention in the sense

of capturing the interest of students is a motivational aspect that contributes to a students' performance. Thus, it is important to vary teachers' approaches and to introduce changes of pace at a level that is consistent with the optimal arousal levels, with Zuckerman (1971) calling them 'sensation-seeking needs', of the students.

The second category of the ARCS model is relevance. This category of the model is related to goal-relatedness of a student. 'Why do I have to study this?', 'What is the meaning?', and 'What is the benefit to me?' are questions typically asked by students. Keller (2010) argues that there are several ways in which a lector/supervisor can help to meet the personal needs of learning. It is encouraged to use language, analogies or stories to which a student can relate. One way is to link what a lector/supervisor teaches to students to previous experience. Another way is to actually show a direct connection on how the course that they attend, or follow can equip students with new skills that will help them to resolve issues they currently perceive. Also, the degree to which students believe in how the course will help them in their real lives (i.e. learning skills that can be useful in their future career) is an important determinant of relevance and the level of motivation. Also, having guest lecturers from successful people in their field of potential future work can increase the element of relevance and student motivation. The last strategy within the element of relevance is to give students the choice upon their own learning strategy (Keller, 2010). It is possible for students to have their own preferences on the specific learning methods or media available, that they might find more effective for them compared to other methods.

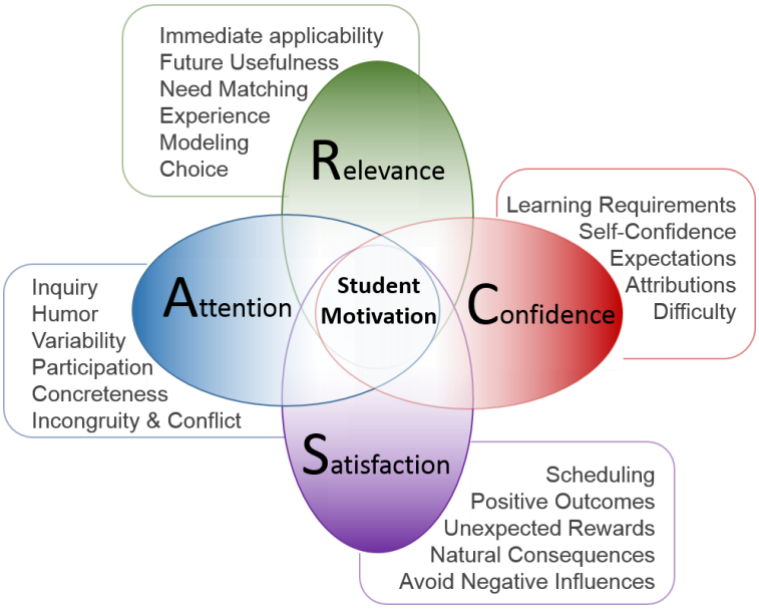
The third category is confidence. Keller (2010, 45) argues that even curious students, acknowledging the relevance of a program, could have a low level of motivation when they have little confidence, or expect not to be successful in finishing the course. There are several strategies and tactics to raise students' degree of confidence, for instance by encouraging them to take small steps, so it will be possible for them to experience their own progress that will culminate in self-growth. It is also important for students to know in advance what exactly they have to achieve and what is expected from them (creating clarity). Another important aspect of the confidence category is feedback, especially constructive feedback as this is essential in order to encourage students to proceed with confidence to the next activity. A last determinant is to give students control over the learning process and make them feel that they are in control of their success (Keller, 2010). The ARCS model assumes that low levels of confidence will lead to demotivation, whilst high levels of confidence contribute to a students' motivation.

The last category of the ARCS model, satisfaction, concerns the students' enjoyment of their learning experiences. By praising or rewarding students, a teacher can produce a higher level of satisfaction among students and will leave students with a sense of achievement and recognition for their efforts. This is supposed to have a positive impact on the motivation of the student and should contribute to the continuation of learning. The learning environment should let the student feel good about his or her activities. A student should have the feeling that his or her skills are useful for in the future. What also motivates students, is to encourage them to use the knowledge and newly required skills in the real world. This will provide students with inner satisfaction, as they will find their effort and time within a course worthwhile (Keller, 2010).

The four categories have been developed by Keller (1986) to better understand the major components of the motivation to learn. They provide a guideline for strategies to enhance the students' motivation, and hence, their performance. There are several factors relevant for explaining student performance, motivation being one of them; this study however does not address student performance. All four components contribute to student motivation, although the specific situation may require emphasizing strategies from one category more than the other (Keller, 2010, 55).

The four categories, together with their subcategories, are visualized by Pollack (2016) in figure 4.

Figure 4. Relationship Among the Categories of the ARCS Model (Pollack, 2016)



3.4. ARCS model in previous research

This chapter will feature a short literature review, in which different studies will be discussed that have made use of the ARCS model and how this model has affected the motivation of students in different settings.

Originally, the ARCS model was designed in order to influence student motivation in a classic learning setting, with the interaction between teacher and students being face-to-face. Nowadays, the model has also been applied to and tested in other learning settings, such as computer-based and distance education, which will be shown below.

Molaee & Dortaj (2015) used the ARCS Model in their research to define its effectiveness of an instructional-motivational design in order to improve Persian language learning as a second language. They used the instrument of Course Interest Survey to measure students' motivation. In their research, the ARCS Model was successfully used in this study, with teachers and instructors being able to raise the motivation of students. Molaee & Dortaj (2015) have suggested to extend the research to female cases, with different nationalities and even on learning languages other than Persian.

Huett, Moller, Bray, Young & Huett (2006) focused on the element of confidence in their research, with the aim of determining whether confidence could be targeted for improvement and whether these improvements would translate into an overall gain of motivation and performance by students. Huett, Moller, Bray, Young & Huett (2006) have concluded that implementing the components of the ARCS model have the ability to increase learner confidence, even when confidence was not the focus of the researchers' investigation. However, they do argue that confidence may be a more abstract and complicated dimension in the overall realm of motivation than the ARCS Model suggests.

Aşıksoy & Özdamli (2016) studied the effect of the ARCS Model in a flipped classroom setting. The researchers prepared activities, video lectures and simulation suitable for the ARCS Model before each class. The activities were carried out using the four components of the ARCS model of motivation, i.e. arousing students and triggering their curiosity. The researchers concluded that the flipped classroom approach to the ARCS motivation model had a positive effect on the self-sufficiency (for example: lecturers/teachers that won't give all the answers, but to let students figure out the answer themselves) of students. This increase in motivation could have

the effect that students would feel more encouraged to take responsibility for their own learning, actively participate in class discussions, possibly culminating in an enhancement of student motivation.

A study conducted by Feng & Tuan (2005), focuses on the use of the ARCS framework in analyzing students' learning motivational states. Feng & Tuan (2005) consider the ARCS strategy to have had a positive outcome and that improved both the motivation and achievement scores for a group of students with a low level of expectation of achievement in chemistry learning. Feng & Tuan (2005) concluded that it was reasonable to confirm that the use of the ARCS strategy indeed stimulated the student motivation more than when students were to work in a traditional lecture instruction mode. Also, the student time engagement in learning had increased under the implementation of the ARCS strategy.

Keller & Suzuki (2004) concluded in their study that it is possible to identify the motivational requirements of learners in E-learning and to develop motivational enhancements that will improve learner motivation and performance. The use of the ARCS model has helped in establishing a link in improving the learner motivation and performance. Keller & Suzuki (2004) also emphasized the importance of influencing learner motivation, as lecturers and teachers cannot control the motivation of learners. Even though, it is not possible to control the motivation, it is possible to influence – either positively or negatively – the motivation of learners.

While the abovementioned articles discussed the effectiveness of the ARCS model, there are also several articles illustrating that there are no instructional advantages for ARCS enhanced instructional materials. Students from the Katholieke Universiteit Leuven studied the ARCS model in greater detail. They found that the ARCS model has indeed an explanatory nature, and therefore a link can possibly be established between motivation and the use of the ARCS model. However, this study has found three limitations. The first limitation they found was that all strategies that are being presented are effective, but their effectiveness is closely connected to the personality of the instructor, meaning that how an instructor teaches has an influence on the effectiveness. A second limitation is that the model is not a 'behavioral change' model. The model is concentrated mostly on the group and not on the individual and teaching them on how to be self-motivated. Brooks & Shell (2006) elaborate on this limitation, suggesting that successful teachers are only busy with the motivation and identifying of the motivation as an

important process within education. Brooks & Shell (2006) argued that the last limitation in their research is that the ARCS model only works in a class context and that it is not self-evident in other contexts. This means that, according to the authors of the article, the model cannot be applied everywhere.

Klein & Keller (1990) conducted research to find out the effects of the type of control over instructional strategies, student ability, and locus of control on performance and motivational outcome of confidence and satisfaction. His study focused on seventh grade students who were assigned two computer-based lessons, with one lesson being externally (program) controlled. His study did not indicate that there was a relationship between confidence and satisfaction. It does have to be remarked that this study was conducted in the 90's and that with today's technological developments, it is the question whether this study would still hold true.

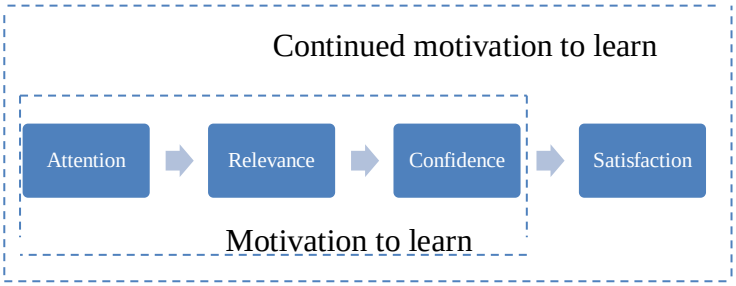
A more recent study (DuPont, 2012) focused on whether the minimal use of high-fidelity simulations in nursing education could be contributed to a lack of motivation on the part of the nursing faculty. DuPont's (2012) study looked at the relationship between faculty motivations (measured by Keller's ARCS Model), and the frequent use of simulation as an instructional strategy in nursing programs. He did not particularly focus on students, wanting to see whether the ARCS strategy would also be applicable to others beside students. The study showed that there was a weak link between the four sub scales of the ARCS model, when correlated with the frequency of use of simulation.

The abovementioned studies all have in common that they used the ARCS model in the educational context and that with the use of this model, the expectation was that the students' motivation would increase. For our research on students in CoE, a theoretical model is developed to find out whether the use of the four elements will also contribute to an enhancement of motivation of students within the new CoE learning environment.

Loorbach (2013) showed in her study that attention, relevance and confidence are necessary in order to establish the motivation to learn. As Keller (2010, 46) assumes "if you are successful in achieving these first three motivational goals (attention, relevance, and confidence) then the students will be motivated to learn". In her study, Loorbach (2013) separated the concepts of attention, relevance and confidence, which are considered to have an impact on motivation in a conditional matter, meaning that attention is needed first, followed by relevance and then

confidence. These three components will then lead to satisfaction. In her study, the separation merely resulted in different focuses in each version, since the categories are hugely interrelated and thus overlap.

Figure 5. Visualization of the abovementioned (Loorbach, 2013)

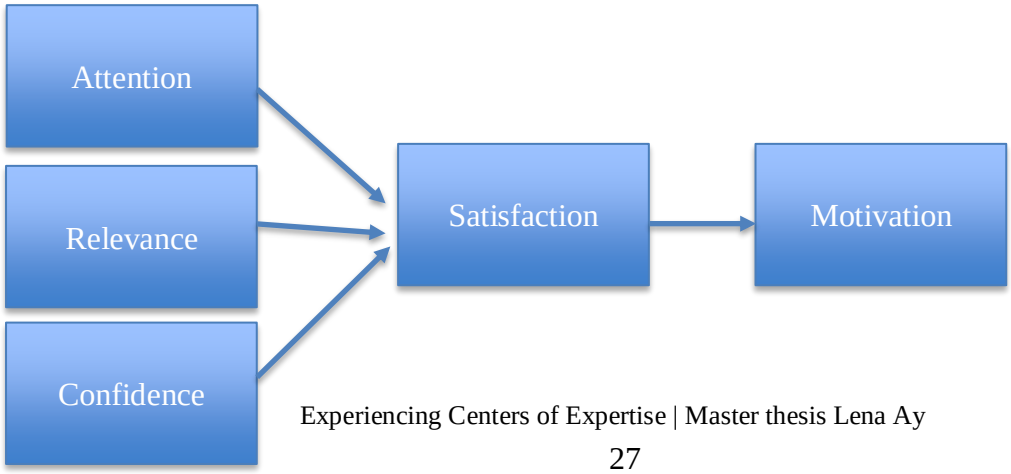


3.5 Theoretical model for this study

The ARCS model is designed for the implementation of a motivated learning environment. The model provides the conditions of when the learning environment should focus on the drivers of motivation, and which strategies need to be handled in order to realize these conditions. The model and the corresponding instruments are less explicit in their definition of student motivation. Motivation is an immensely broad concept with a continuing need for unraveling concerning its working and effect (Loorbach, 2013). That is why this study will measure student motivation on the basis of a different instrument. The next chapter will further elaborate on this.

On the basis of the ARCS model, it will be decided upon to which extent the different conditions – attention, relevance, confidence and satisfaction – are present, how these are perceived by students and subsequently a look will be given as to whether there are differences in student motivation when these conditions are present. The before mentioned ARCS model of Pollack (2016) and the model of Loorbach (2013) show how the four components are related to each other. The model that I use for my research is depicted in figure 6.

Figure 6. Theoretical model



On the basis of this theoretical model the following expectations can be formulated:

- The presence of independent categories – attention, relevance, confidence – has a positive effect on the satisfaction of a student working on a project at a CoE. This means for example that the expectation is that a student, whose curiosity is being triggered during the project, has a higher level of satisfaction than a student whose curiosity is being triggered to a lesser extent.
- A second assumption is that satisfaction of students has a positive impact on student's motivation.

To find out how students perceive the learning environment, a survey has been created for the students active within the CoE. In this survey the students were asked a) whether they feel these four categories are present, and b) how motivated students are in their thesis or project work (see also the next chapter).

4. Methodology

In order to answer the research question and the sub questions, different types of data were retrieved. The central research question has been split into different sub questions to gather the information needed for answering the questions. This chapter will provide an overview of the methods used to collect information and how to analyze the answers to the questions formulated in this thesis.

4.1. Research design and unit of analysis

A case study will be conducted in this thesis in order to answer the research question. The case study will focus attention on a single instance of some social phenomenon, in this case the motivation of students within a CoE. The objective of this thesis is exploratory. As the area is relatively new, an exploratory emphasis will make sense, as it is possible to describe without explaining, however explaining without describing is not really possible (Punch, 2016). There are three purposes for doing an exploratory study: 1) to satisfy the researcher's curiosity about relationships between various concepts and factors and desire for better understanding, 2) to test the feasibility of undertaking a more extensive study, and 3) to develop the methods to be employed in any subsequent study. This study will mostly focus on the satisfaction of understanding the subject and whether students feel the presence of the elements of the ARCS model within the CoE, resulting in – possibly – an enhancement of their motivation.

The units of analysis are the 'what' or 'whom' that are being studied (Babbie, 2010). The units of analysis within this thesis are the students that work on their thesis or a project within a CoE (this will be further elaborated upon in section 4.1.1.), in particular the CoE TechForFuture at Saxion UAS in Enschede. The students that were asked to fill out the survey, were students affiliated with the CoE in the previous or current (2017/2018) academic year.

4.1.1. Sample

A short description of the sample as part of the methodology section will be given below.
28 students were involved in this research. A certain amount of these students argued that they had to motivate their reasons for wanting to participate within the project of their lectorate in the CoE TechForFuture. This was due to the fact that these lectorates were not pleased with the type of students that applied for a spot within their lectorate; the lectorates believed that these students were not motivated (enough). This has meant that not all students were automatically admitted for a spot on the project work within TechForFuture. The lectorates within the CoE were hoping that by using this system for admission, only the more motivated students would

be active within their CoE. The students within TechForFuture participate mostly within Saxion UAS. Even though external organizations are involved within the CoE, the students are not present within these organizations. They are purely active within TechForFuture.

4.2. TechForFuture

In 2012, Dutch government invited UAS to set up new CoE that would fit with the nine top sectors that were designated by the government. These nine top sectors focus on: horticulture and propagation materials, agri-food, water, life sciences and health, chemicals, high tech, energy, logistics and creative industries (Rijksoverheid, 2018). Hightech Systems and Materials (hereafter: HTSM) is one of the top sectors. In the Eastern region of the Netherlands, Saxion UAS and Windesheim UAS decided to collaborate with each other in the CoE TechForFuture and to make HTSM their focus in practice-oriented research. TechForFuture has its focus on three core stakeholders: companies, students and researchers. Its ambition is to give an impulse to applied research in the area of HTSM. For companies, there are four ways to participate within TechForFuture: as business-, program-, research-, or education partner. These companies have invested largely in a financially way within the CoE.

The goal of TechForFuture is to create new opportunities together with high-tech companies. Together with enthusiastic students, trained to do independent practical research within companies, TechForFuture and the students discover and develop new technologies. This way, they contribute to (international) research for and with companies. TechForFuture focuses on six innovative themes: healthcare & wellbeing, sustainability, building & construction, safety & security, mobility and production technology (TechForFuture, 2018).

Concretely, TechForFuture focuses on questions from the HTSM sector. This way an influx of technically schooled people gains knowledge, creativity and work experience, thanks to specific research in the area of HTSM. The research is mostly conducted at the CoE. The CoE argues that it can be beneficial for companies to invest in their CoE, as this is also an investment in the future of the own company. Companies can submit a research proposal at the CoE, which also means that they can meet with interesting engineering workers (TechForFuture, 2018).

4.2.1. Students at TechForFuture

The advantages of TechForFuture is that students have direct access to the expertise of teachers and researchers or lectors within the field of expertise they want to further develop their knowledge in. They also have direct access to knowledge institutions, research labs and

innovation centers. For students, this will mean that they will learn how to conduct practice-oriented research. Students will have the opportunity to work with companies (potential employers), researchers or lectors and other students on actual and relevant societal and economic issues in contributing to innovation and product development.

The incorporation of students within CoE, is two-fold: on the one side, students will be able to get in contact with research (supported and supervised by experts of companies and teachers or lectors), going more in depth about their study topic and possibly get in touch with future employers, on the other side, institutions and the business sectors have access to the knowledge of students, who often are aware of the latest knowledge, and can be considered to be possible future employees. Also, many CoE believe that it is necessary to incorporate a new generation of students in the CoE to implement improvements (PBT, 2017).

TechForFuture used to admit all students that applied for the project work within the CoE. This however, culminated in having non-motivated students. Certain lectorates within TechForFuture have decided to only admit students with good grades, accompanied with a motivation letter. Even though the students within TechForFuture work together with companies and the business sector, the actual work on the projects happens at their respective lectorate. The students mostly only interact with their supervisors/lecturers from the UAS. The students do not have an external relation or partner with people from the business sector. The lectorate is always situated at the UAS, thus students do not actually leave their school and go on location to work on their project. Of two lectorates the projects were established as following: at one lectorate the students work on a project as part of their graduation thesis, while in another lectorate the students continue work on a project for six months as part of their curriculum. The latter concretely means that every six months a new group of students continue working on the same project, culminating in a finished project on which many student groups have had their input.

4.3. Data collection

4.3.1. Survey

Keller (2010) has created two instruments on the basis of the ARCS model, to measure the reactions of students on their education. The first instrument, Course Interest Survey (hereafter: CIS) is focused mostly on courses taught and supervised by an instructor. The second instrument, Instructional Materials Motivation Survey (hereafter: IMMS), focuses on reactions

to self-directed instructional materials (Keller, 2010, 277). The CIS of Keller (2010) fits the situation of my study best and will therefore be used for this study. The reason to use a survey is that students will be questioned in the same way. The CIS is designed to measure students' reactions to instructor-led instruction. The goal of the survey is to find out which of and whether if the four factors from the ARCS model are present within the CoE and subsequently figuring out what CoE can do to incorporate more of the other factors. By using a survey, I was able to ask students to what extent they perceived the categories to be present during their thesis work or project work at the CoE (self-reporting). Self-reporting has the advantages that it has good validity (Sawicki-Luiza & Atroszko, 2017), the data can be both qualitative and quantitative and can be gathered quickly and cheaply from different groups, it can be easily replicated which makes it more reliable and closed questions are more quantifiable as they can be summarized into tables and graphs and then be compared to one another. Nevertheless, the downfall of self-reporting is that it lacks flexibility and forces people to answer. It has a social desirable bias, the responses are set, questions can also be misunderstood which in turn lowers the reliability and the possibility exists of having a low response rate (Stone, Bachrach, Jobe, Kurtzman & Cain, 1999).

Keller's CIS consists of 34 statements, with these questions being divided into four categories: attention, relevance, confidence and satisfaction. Our survey consists of three parts. In the first part questions were asked regarding the background of the students. The second part focused on the four categories of the ARCS model. The third part consisted of questions regarding student motivation. Below the second and third part of the survey will be further elaborated upon.

In regard to the perception of students on the presence of the conditions of a motivated learning environment (the four categories), mostly questions have been used from the CIS, complemented with some questions from De Nationale Studenten Enquête 2018 (hereafter: NSE). I have however chosen not to use all 34 statements from Keller. Some of the statements are vaguely formulated and show some overlap (for instance "you have to be lucky to get good grades on this course" and "it is difficult to predict what grade the instructor will give my assignments"). Moreover, not all the items from the CIS fit the subject central in my study. As Monteiro, Mata and Peixoto (2015, 437) argue: "items can also be removed if they appear redundant or less adapted to the situations under analysis. Moreover, the items are also flexible in formulation, and some may be adjustable to the specific activity of the study". Also, the

mentioned measurement instruments consist of many items and for the sake of response; I have wanted to keep the size of the survey somewhat limited. All in all, 21 statements from the CIS of Keller will be used.

The survey has been adjusted to the specific situation of students in CoE. Items such as "this course" or "this lesson" have been changed to the specific situation and instead "the activities" will be used to point out the activities that are central in the CoE. An example is this statement from Keller: "the instructor knows how to make us feel enthusiastic about the subject matter of this course." This statement has been changed in: "the lector/supervisor makes us enthusiastic about the project."
The survey has been answered/administrated in Dutch and English, with statements of Keller being translated from English to Dutch. The surveys (Dutch and English) can be found in Appendix II.

4.3.2. Case selection

The initial thought was to use two CoE for my research, TechForFuture and Green PAC (a CoE from Zwolle that collaborates with Windesheim). However, from the side of Green PAC there were no students willing and available to fill in the survey, which is why this CoE will no longer be part of the research central in this thesis. What concerns TechForFuture, contact was made with the director of this CoE and a meeting was set up. The different lectorates within the CoE were contacted by the secretary and the survey was handed out to the students, instead of doing it online. The lectors and lectorates were eventually contacted, and the survey was conducted at Saxion in Enschede. I let the students fill in the survey, meaning that I could help them in case there were some difficulties with the statements. The survey was distributed among students at Saxion twice, and surveys were also distributed through e-mail.

4.3.2.1. Response rate

According to the director of TechForFuture, there were about 70 students active within the CoE. These students were divided among several lectorates, with each of these lectorates consisting of approximately 5 students. I contacted 13 lectorates through e-mail, with 6 of them replying to my e-mail. The following lectorates did not respond to my e-mail or did not have any TechForFuture students participating within their lectorates: ICT innovations in healthcare, international water technology, plastics technology, mechatronics, nanotechnology bio and nanotechnology physics. Many of these lectorates have their focus on engineering and technology, which is in line with the lectorates that did respond to my e-mail. And even though

no hard conclusions can be made on the type of students of students that are part of the non-response, when we look at the lectorates it can be slightly argued that the students that did respond and those that did not respond are students from technical studies.

According to Baruch & Holtom (2008) reasons for not responding could be that the survey was not delivered to the target population (e.g. absent from work, wrong address) or the reluctance of people to respond (Baruch, 1999).

There are no exact numbers available of students that are active within TechForFuture, thus I will use the numbers that the director of TechForFuture has given me. If there are approximately five students active within each lectorate, I could have contacted a total of 65 students. Of these 65 potential students (population), I was able to contact 31 students, and of these 31 students, 28 students responded and filled in the survey, which means a response rate of 90% (is 44% of the estimated population of CoE students of TechForFuture).

4.3.3. Measuring Attention, Relevance, Confidence and Satisfaction

As there were five options for answering the statements (1-5), a scale is formed ranging from five to 25. To keep an overview of the data and results, the range was brought back to a 5-pointscale. The intervals had to be declared, to be able to read the results from the survey and to be able to draw conclusions from the answers of the survey. It dependent on the number of items, either five or six, through which the number had to be divided. When the numbers would be divided by five, the following intervals were decided upon:

- scores of 1 would fall in the 1-1.79 category;
- scores of 2 would fall in the 1.8-2.59 category;
- scores of 3 would fall in the 2.6-3.39 category;
- scores of 4 would fall in the 3.4-4.19 category;
- scores of 5 would fall in the 4.2-5 category.

Attention was measured with five statements. The following 5 statements were used:

- Do your lectors/supervisors make you enthusiastic about the project and the activities?
- Is your curiosity being triggered during the execution of the project?
- Do your lectors/supervisors use different instruction- and educational methods during their guidance?
- Do your lectors/supervisors have time for you when you feel the need for it?
- Do the lectors/supervisors stimulate you to work concentrated on the project?

Relevance was also measured with five statements. The following 5 statements were used:

- Are the knowledge and skills you learn during the project useful for later (after graduation)?
- Do your lectors/supervisors give you the feeling that the projects are important?
- Do your lectors/supervisors learn you new knowledge and skills during the project?
- Are the learning goals of the project expressed clearly?
- Does the project meet the expectations you had from it?

Confidence was also measured with the help of five statements. These were the following five:

- Give your lectors/supervisors you the feeling you will complete the project good and on time?
- Do you think that the requirements for the project and its activities, are too high?
- Do your lectors/supervisors show their appreciation for your work in the project and your results?
- Do you receive enough feedback from your lectors/supervisors on the progress of the project?
- Do you receive timely feedback from your lectors/supervisors to improve during the project?

Satisfaction was measured with six statements. The following 6 statements were used:

- Do you, in comparison with other courses, need to work harder for the project to execute this on a sufficient level?
- Does carrying out the project give you satisfaction?
- Do you enjoy working on the project?
- Do you receive, compared to other students, recognition for your part in the project?
- Are you content with what you learn during the project?
- Does the project meet the expectations you had from it?

4.3.4. Measuring motivation

The third part of the survey focused on the motivation of students. Measuring motivation is tough. Several measurement instruments have been developed, however many do not fit the purpose of this thesis. Most standardized surveys, such as the Motivated Strategies for Learning Questionnaire (MSLQ), the surveys used in the Self Determination Theory of Deci & Ryan (1987) or the Intrinsic Motivation Inventory (hereafter: IMI) focus on the factors that give an

explanation for motivation or on finding the different types of motivation. The items of these surveys show many overlaps with the CIS of Keller. For example, the 45 items of the seven subscales of the IMI – interest/enjoyment, perceived competence, effort/importance, pressure/tension, perceived choice, value/usefulness, and relatedness – overlap very much with the items of the CIS[3]. The same applies to the MSLQ. These surveys include questions as the 'why' and 'causes' of motivation and are less focused on determining the total degree of motivation.

Considering the fact that I am interested in the level of motivation of a student, and for instance not to what extent a student is intrinsically or extrinsically motivated, these measurement instruments are not directly useable for measuring the dependent variable. That is why I have chosen for a more practical approach.

I have formulated seven items that are based on my understanding of motivation as a form of commitment to achieve a certain goal (in my case completion of the thesis or project work of the students within the lectorates of the CoE). It concerns the desire, eagerness or commitment to complete a thesis or project, and this motivation may differ among the students. Some students are likely to be highly motivated to complete their task, whilst others are less motivated (again, I am not interested in what drives them to achieve this goal – these could be intrinsic or extrinsic motives). In my view a highly motivated student is a student that is willing to work hard, is not too much disappointed or distracted when things are not going according to plan, and seriously enjoys producing outputs that are valuable to others or him-/herself.
I have selected the following items to measure student motivation:

1. I find it important to perform better than other students on the project;
2. I do not mind putting much time and effort in the project;
3. I think it is important to gain new knowledge and skills;
4. I doubt all activities for the project are necessary (R)[4];
5. I chose this project because I did not have any other choice (R);
6. I think the subject of the project and the activities corresponding with it are interesting;
7. Downfalls during the project keep me from working hard for a good result (R).

[3] See: https://assethub.fso.fullsail.edu/assethub/IntrinsicMotivationInventory_8b9c9880-398f-491b-ad19-45c6007529f2.pdf
[4] Statements with an (R) will be reversed

Motivation will be measured with these seven statements. Of these seven statements, three are reversed. Statements about motivation are formulated with the help of the statements that have been used by Monteiro, Mata & Peixoto (2015). The statements have been altered to the situation that is central in this thesis. These seven items will be measured on a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree) and together they form the index 'student motivation'. This means the scores of the seven statements (after reversing some of the items) will be the indicator for student motivation. The higher the indexed score is, the higher the degree of student motivation, and every item is equally important.

4.3.2. Records and documents

Not many documents were available on the CoE themselves. It was difficult to collect information about the role of the students within the specific CoE. This information was therefore mostly collected through the interview I had with the director of TechForFuture and when I did the surveys among the students. The only documents that could be used, were documents from Katapult and the Rijksoverheid. These documents focused mostly on how the CoE were established, what the reasons were for setting up CoE and numbers about the companies and students involved in the CoE. Information on motivation and in particular student motivation, were collected through relevant journals and written documentation in order to answer the research question and the sub questions.

4.4. Operationalization

4.4.1. Scoring Guide for the CIS

The survey consists of 28 statements and the following values will be used for a student to give its response: (1) strongly disagree, (2) disagree, (3) moderately agree, (4) agree, and (5) strongly agree. This scoring guide is based on the Likert scale (1932). The Likert scale was not only developed to measure attitudes, but also opinions or personalities. In this research, statements have been formulated that are being measured with the Likert scale, with respondents being asked to give ratings about each statement.

The statements have been put randomly in the survey to avoid sequence effects (Dettori, 2010). The scores will be added per category, keeping in mind that some statements are reversed. These statements have been formulated in a negative way, which means that the responses have to be reversed. This means that a (5) strongly agree becomes (1) strongly disagree and the other way around (Keller, 2010). I will make use of an index scoring, adding up the scores and

dividing it by the amount of statements (Babbie, 2010). As it was possible to choose from five options, the numbers were re-coded in order to divide the results in categories and to be able to read the results. This meant that scores of 1 could fall in the new value of 1-1.79, 2 could fall in the new value of 1.8-2.59, 3 could fall in the new value of 2.6-3.39, 4 could fall in the new value of 3.4-4.19 and scores of 5 would fall in the value of 4.2-5 (as discussed in section 4.3.3).

4.4.2. Data handling

The surveys were completed manually or by e-mail. The survey was filled in by 28 students from CoE TechForFuture. This resulted in 28 scores between one and five for each of the 33 statements. A score of one is regarded as strongly disagree and a score of five is regarded as strongly agree. The scores were imported in SPSS, a statistical analysis program. The scores have been determined by summing the responses from each subscale. To recapture, attention is referring to the engagement and maintaining the interest and curiosity of the student, relevance focuses on relating the course content and the objectives to a students' interest and its needs. The confidence factor is referring to how a students' confidence can be enhanced, satisfaction refers to the enhancement of satisfaction of a student and motivation is referring to the amount of motivation a student feels during participation in the project. The results have to be interpreted with care, considering the small number of students that have filled in the survey.

4.4.3. Internal and external validity

The internal validity of the study refers to the confidence that results of the study accurately depict whether one of the variables is or is not a cause of another variable. In this research that would mean that satisfaction is a result of attention, relevance and confidence and that the satisfaction variable has an impact on the motivation variable. A survey is used to measure the presence of certain elements on the satisfaction of students and whether this satisfaction would culminate in a higher degree of motivation of students. The questions measuring the variables have been formulated by using the CIS of Keller (2010). During the personal handing out of the surveys, the students had the opportunity to ask questions regarding the statements in order to better understand them and to answer the statements. I would therefore argue that the internal validity seems good.

Regarding the generalizability, this can prove to be difficult. This research was conducted at CoE TechForFuture and because CoE programs can differ, it is unknown whether the results of this research also apply to other CoE.

4.4.4. Reliability

The reliability is paid attention to by clearly stating which theory to use in order to provide an answer to the central research question. Also, the data collection procedures can be checked or repeated; the surveys will be clear for the researcher. The survey from Keller (2010) has been used repeatedly and can therefore be regarded as a reliable measure to indicate whether factors from the ARCS model are present within CoE. However, reliability does not have to ensure accuracy as there is also the chance of having respondents that give social desirable answers (Babbie, 2010).

5. Results

This chapter will describe the results from the surveys that have been conducted to find out to what extent the factors from the ARCS model of motivation are present within the CoE.

5.1. Attention, Relevance, Confidence, and Satisfaction of CoE students

First, a short description of the students that filled out the survey. The survey was filled out by 28 students affiliated with the CoE TechForFuture. Of these 28 students, 21 were male and seven of them were female. Most of the students, 17, started with their project work in February 2018. As some surveys were handed out personally, the first thing that I noticed was that these students asked me what to fill in as their CoE. Surprisingly, many of the students did not know that their lectorate and their project work was affiliated with the CoE TechForFuture. It indicates that students do not consciously choose for the CoE itself, but more for the project work itself.

Attention (index) has been measured with five statements. The results are presented in the table below, appendix II shows the data output of all categories more in detail.

Table 1. Attention during the project according to students (in numbers, N=28)

	1	2	3	4	5	Mean	Sd
Lectors/supervisors make me enthusiastic about the project	0	2	4	20	2	3,79	0,69
My curiosity is being triggered by the lectors/supervisors	0	1	8	14	5	3,82	0,77
Lectors/supervisors make use of different instruction methods	3	15	8	2	0	2,32	0,77
Lectors/supervisors have time for me during the project	1	4	7	12	4	3,50	1,04
Lectors/supervisors stimulate me to work concentrated on the project	0	4	7	15	2	3,54	0,84
Legend: 1= strongly disagree, 2= disagree, 3= moderately agree, 4= agree, 5= strongly agree							
Attention (index)	0	2	9	16	1	3,39	0,50

Legend: 1= very low level of attention, 2= low level of attention, 3= moderate level of attention, 4= high level of attention, 5= very high level of attention

From the table the following can be stated. The students believe that they receive a high amount of attention during their project work in the CoE. Of the 28 students. 17 students believe that they receive a high level of attention. Most students argue that their lectors/supervisors make them enthusiastic about the project and that these lectors/supervisors also tend to trigger the students' curiosity during the project work. Also, the students feel stimulated to work in a concentrated way on the project by their lectors/supervisors and lastly, students believe that lectors/supervisors have time for their students. However, there is a large group of students that argues that their lectors/supervisors do not make use of different instruction methods.

Table 2. Relevance during the project according to students (in numbers, N=28)

	1	2	3	4	5	Mean	Sd
The knowledge and skills learned during the project were useful	0	3	4	16	5	3,82	0,86
Lectors/supervisors highlighted the importance of the project	0	2	5	17	4	3,82	0,77
Lectors/supervisors taught us new skills	0	4	13	9	2	3,32	0,82
The learning goals were clearly expressed	0	5	10	11	2	3,36	0,87
The project lines up with actual developments in society	1	1	5	10	10	4,00	1,04
Legend: 1= strongly disagree, 2= disagree, 3= moderately agree, 4= agree, 5= strongly agree							
Relevance (index)	0	1	4	16	6	3,66	0,55

Legend: 1= very low level of relevance, 2= low level of relevance, 3= moderate level of relevance, 4= high level of relevance, 5= very high level of relevance

Students believe that the project work that they are doing is relevant. Of the 28 students, 22 agree with this. The majority of the students argue that the knowledge and skills they learn during their project work are useful and that their lectors/supervisors also highlight the importance of the project itself. Also, the majority of students feels that the work on the project and the project itself lines up with actual developments within society.

Table 3. Confidence during the project according to students (in numbers, N=28)

	1	2	3	4	5	Mean	Sd
Lectors/supervisors gave the feeling that the project would be completed on time	0	4	11	11	2	3,39	0,83
The requirements for the project are too high, compared to other courses	0	14	12	2	0	2,57	0,63
Lectors/supervisors showed their appreciation during the project	0	2	10	13	2	3,56	0,75
Lectors/supervisors gave enough feedback on the project progress	0	3	9	16	0	3,46	0,69
Lectors/supervisors gave feedback for improvement	0	1	11	12	4	3,68	0,77
Legend: 1= strongly disagree, 2= disagree, 3= moderately agree, 4= agree, 5= strongly agree							
Confidence (index)	0	0	13	14	0	3,33	0,43

Legend: 1= very low level of confidence, 2= low level of confidence, 3= moderate level of confidence, 4= high level of confidence, 5= very high level of confidence

Of the 28 students, 14, believe that their confidence is being strengthened during their time working on the project within the CoE, and 13 of them report moderate levels of confidence. The majority of students feel that their lectors/supervisors have given them enough feedback on the project progress and enough feedback for improvement during the project work. Also, the students felt that their lectors/supervisors showed their appreciation towards the students during their work on the project and gave them the feeling that the project would be finished on time. Almost no students felt that the requirements for the project work were too high, compared to their other courses in their study program.

Table 4. Satisfaction during the project according to students (in numbers, N=28)

	1	2	3	4	5	Mean	Sd
The project needs more work than other courses to be well executed	0	3	15	9	1	3,29	0,71
Working on the project gives me satisfaction	0	2	10	15	1	3,54	0,69
I enjoyed working on the project	0	0	8	14	6	3,93	0,72

Lectors/supervisors show their recognition for my part in the project	0	2	12	12	2	3,50	0,75
I am content with what I learn during the project	0	2	9	14	3	3,64	0,78
The project meets the expectations I had about it	2	6	5	14	1	3,21	1,07
Legend: 1= strongly disagree, 2= disagree, 3= moderately agree, 4= agree, 5= strongly agree							
Satisfaction (index)	0	1	10	15	2	3,52	0,60

Legend: 1= very low level of satisfaction, 2= low level of satisfaction 3= moderate level of satisfaction, 4= high level of satisfaction, 5= very high level of satisfaction

Of the 28 students, 17 reported that working on the project in the CoE has given them a (very) high level of satisfaction and 10 report a moderate level of satisfaction. A majority of the students stated that they enjoyed working on the project. Students also agree that their lectors/supervisors show their appreciation towards them for their part in the project and that the students are satisfied with what they have learned during their project work in the CoE. However, there is still a group of 15 students that feels that the project has not lived up to their expectations.

A short conclusion based on the factors/opinions above: in general, students have a positive attitude towards their project work within the CoE. They get attention from their lectors/supervisors, they find the project work relevant, it gives many of them confidence as well as satisfaction.

Table 5. Motivation during the project according to students (in numbers, N=28)

	1	2	3	4	5	Mean	Sd
I want to perform better than other students in the project	0	6	12	9	1	3,18	0,82
I do not mind putting much time and effort in the project	0	0	7	18	3	3,86	0,59
It is important to gain new knowledge and skills	0	0	3	14	11	4,29	0,66

I have no doubt that all activities for the project are necessary* (R)	1	7	6	11	3	3,29	1,08
I chose this project, because I wanted to* (R)	0	3	3	10	12	4,11	0,99
The project subject and activities are interesting	0	0	5	16	7	4,07	0,66
Downfalls do not keep me from working hard for a good result in the project* (R)	0	3	11	13	1	3,43	0,74
Legend: 1= strongly disagree, 2= disagree, 3= moderately agree, 4= agree, 5= strongly agree							
Motivation (index)	0	0	5	19	4	3,74	0,47

Legend: 1= very low level of motivation, 2= low level of motivation, 3= moderate level of motivation, 4= high level of motivation, 5= very high level of motivation

Most students (23) have a (very) high level of motivation. A majority of the students does not mind putting much time and effort into their project work and also find it important to gain new knowledge and skills during their project work within the CoE. The project subject is being regarded as interesting by the students and most students want to perform better than their peers during the project work. Three statements have an (R) behind them, these statements had to be reversed[5]. Almost all students working on the project, work on the project because they want to and not because they did not have any other choice. Also, downfalls do not keep students from working hard on the project. However, a number of students doubts whether the activities that are part of the project are necessary. They might not see the added value of all activities related to the project work.

5.2. Expectations

According to our model, satisfaction is supposed to be explained by three variables – attention, relevance and confidence. My expectation, formulated in chapter three, was that these three variables positively relate to satisfaction: for example, the higher the level of attendance of a student, the higher the level of satisfaction. In table 6, I present the outcomes of the bivariate correlations between the various variables of my model. It shows, as expected, that attention

[5] The statements with a *, were reversed as they were originally stated in a negative way. The original statements were: I doubt all activities for the project are necessary; I had no other choice than to choose for this project; Downfalls keep me from working hard for a good result in the project.

and relevance positively correlate with satisfaction. The table also shows that there is a relationship between attention and relevance. This is an important fact to take into consideration when estimating a multivariate model (see below). There appears to be a relationship between these variables. Confidence, the third explanatory variable, however does not (significantly) correlate with satisfaction.

Table 6. Bivariate correlation analysis attention, relevance, confidence and satisfaction

Correlations

		attention	relevance	confidence	satisfaction
attention	Pearson Correlation	1	,281	,629**	,521**
	Sig. (2-tailed)		,156	,000	,004
	N	28	27	27	28
relevance	Pearson Correlation	,281	1	,396*	,733**
	Sig. (2-tailed)	,156		,045	,000
	N	27	27	26	27
confidence	Pearson Correlation	,629**	,396*	1	,242
	Sig. (2-tailed)	,000	,045		,223
	N	27	26	27	27
satisfaction	Pearson Correlation	,521**	,733**	,242	1
	Sig. (2-tailed)	,004	,000	,223	
	N	28	27	27	28

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 6 also shows that the independent variables attention and relevance not only correlate with satisfaction (as theoretically expected), but also with the variable confidence. A potential problem is that these three explanatory variables correlate with each other. This implies that there is multicollinearity if we specify a multivariate regression model that includes the three variables.

As the next step, I conducted a multivariate regression analysis including the three explanatory variables from my theoretical model to test their impact on satisfaction. The results further indicate that both attention and relevance explain the level of student satisfaction. The level of confidence however, does not explain the level of student satisfaction. This means that the level of satisfaction of the Saxion UAS students involved in the CoE TechForFuture related thesis projects, is explained by the degree of attention that they experience and to the degree to which they find their thesis work relevant. Here I also address the issue of multicollinearity. The

consequence of multicollinearity is that the estimate of the coefficient in a multivariate model will be biased (because the independent variables are correlated, one is not completely sure to what extent these independent variables exert impact on the dependent variables).

In a multiple regression, one can determine the seriousness of multicollinearity by calculating the Variance Inflation Factor (hereafter: VIF), which each explanatory variable has (or in other words, the level of tolerance defined as 1/VIF). The VIF indicates how much the extent to which a coefficient is biased due to multicollinearity in the model. Although there is not an exact cut off point, as a rule of thumb multicollinearity is a serious problem when the VIF is bigger than 10 (or the tolerance level is lower than 0.10).

Table 7. Multivariate regression analysis attention, relevance and confidence

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,860[a]	,739	,704	,28205

a. Predictors: (Constant), confidence, relevance, attention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	,683	,504		1,356	,189		
	attention	,515	,142	,507	3,618	,002	,603	1,658
	relevance	,705	,114	,738	6,176	,000	,830	1,205
	confidence	-,445	,173	-,370	-2,577	,017	,573	1,744

a. Dependent Variable: satisfaction

Table 7 shows the outcomes of the multivariate regression analysis. There is multicollinearity but within an acceptable level, with the tolerance levels varying from 0.83 to 0.57. This implies that I will treat the explanatory variables as being independent from each other.

Table 8. Correlation between satisfaction and motivation

Correlations

		satisfaction	motivation
satisfaction	Pearson Correlation	1	-,089
	Sig. (2-tailed)		,652
	N	28	28
motivation	Pearson Correlation	-,089	1
	Sig. (2-tailed)	,652	
	N	28	28

The second expectation, formulated in chapter 3, was that student satisfaction has a positive impact on the students' motivation. This however is not the case. Table 8 shows that there is no correlation between satisfaction and motivation. There is no relationship between satisfaction and motivation.

5.3. Conclusion

The abovementioned results mean the following for the hypotheses that were formulated in this research:

H1: will not be rejected. Attention and relevance seem to correlate with satisfaction, this however cannot be said on confidence with satisfaction. Although attention and relevance seem to correlate with each other, possibly a problem of multicollinearity, the tolerance levels seem to be within an acceptable level. Implying that the three variables, attention, relevance and confidence, can be treated as independent from each other and having a positive impact on satisfaction.

H2: will be rejected. There is no relationship between satisfaction and motivation, which means that satisfaction does not have a positive impact on motivation.

6. Conclusion

This chapter will draw a conclusion based on the analysis presented in the previous chapter. The aim of the research was to investigate whether the categories of the ARCS model are present within the new learning environment of the CoE and whether the presence of these categories correlate with the motivation of students working on projects within the CoE. The expectation was that when the three independent variables would be present within the learning environment, this would have a positive impact on the students' satisfaction. The other expectation is that satisfaction will correlate with higher student motivation within the learning environment of a CoE.

Three sub questions were formulated in order to answer the main research question: *"to what extent are Centers of Expertise a motivating learning environment for Universities of Applied Science students?"* The first sub question focused on what the CoE as a new learning environment looked like. This question was answered by means of a literature review in chapter two. The second sub question answered the following: *"which factors produce a motivating learning environment for students according to the ARCS theory?"* This question was answered in chapter three of this thesis and the ARCS model of motivation by Keller was used as a starting point. Based on this model, attention, relevance, confidence, satisfaction and motivation are the variables that need to be analyzed.

The third sub question was formulated as follows: *"to what extent are these factors present in a CoE?"* and focused on the extent that attention, relevance, confidence, satisfaction and motivation are present within the CoE. A case study was done, with 28 students from TechForFuture, based in Saxion UAS, filling out the survey. The results of the survey were analyzed, and we concluded that many students believe that they receive a high amount of attention during their time at the CoE. Also, many students believe that their work on the project or thesis within the CoE is relevant. However, no correlation is present between confidence and satisfaction. This results in the finding that that confidence does not enhance the satisfaction, while attention and relevance do. Satisfaction and motivation are not correlated with each other.

At this point, the main research question *"to what extent are Centers of Expertise a motivating learning environment for Universities of Applied Science students?"* can be answered. The new learning environment appears to have the main components (attention, relevance, confidence and satisfaction) of a motivating learning environment. What is as expected, is that attention

and relevance correlate with satisfaction, though confidence does not (significantly) correlate with satisfaction. Confidence is, however, correlated to the variables attention and relevance, which could explain why a students' confidence enhances when the students perceives a high amount of attention during a students' time at the CoE TechForFuture. The same might hold for relevance; if the students perceive their project work as being relevant for their (school)career, this can also enhance their confidence on their project work. To further increase the levels of attention, relevance, confidence and satisfaction, CoE TechForFuture can implement the following: under the assumption that a variety in the instruction methods can enhance the attention of students, this aspect might be enhanced more to further the level of attention. Also, the students stated that they moderately believe that their lectors/supervisors taught them new skills and that the learning goals were clearly expressed. These two aspects might be enhanced more, to – possibly – further the level of relevance. Assuming that meeting the expectations of students when it concerns their project work in the CoE can enhance the satisfaction of students, this aspect might be enhanced even more to further the level of satisfaction.

All in all, both attention and relevance explain the level of student satisfaction, confidence does not. The expectation was that satisfaction would have a positive impact on the students' motivation, however this research showed that the level of satisfaction does not explain the level of student motivation. When it concerns motivation; a number of students question in the survey whether the activities within the project work are necessary. The students do not see the added value of all activities related to the project work. This might be a last aspect for CoE to focus on, perhaps enhancing the level of student motivation more.

6.1. Limitations and recommendations

This thesis studied the new learning environment of CoE and the possible presence of the elements of the ARCS model within this learning environment and what effect the presence of these elements would have on student satisfaction and motivation. This research found some noteworthy results, and also gave more insights into the motives of students working on projects within the CoE. However, this study also has some limitations.

The small sample size (the number of students and the fact that only one CoE was the subject of this thesis) can be regarded as a limitation of this research. Small sample sizes make it generally more difficult to conduct a statistical analysis that has high quality (Figueiredo Filho

et al., 2013). It is a possibility that the quality of the results from this research could be improved significantly by increasing the sample size. That only one case study has been done, on TechForFuture, makes it impossible to make a comparison with other CoE and to generalize to other CoE. I would therefore recommend doing research with more and different CoE, to find out whether differences between the CoE can be found and whether these differences say or explain anything about the CoE.

Another recommendation is to do interviews with the staff working in a CoE (i.e. the lectors, supervisors and business representatives). The staff can have a different perception on the CoE, which can make for interesting results. By including staff in the research, the research has more dimensions as the perception of students and staff are known and can be compared.

Further research could also focus on comparing the CoE with the 'traditional' learning environment within UAS. This could give an insight in the type of students that are active within the two learning environments and whether there are noticeable differences between the two types of students. This can also show a difference in student motivation, which can lead to a different kind of study.

Another limitation of this study is the way the research was conducted, namely by survey. A mixed method approach was more preferable. By making use of this kind of approach, the power of both sorts of research will be combined, which can increase the validity and reliability of the results. The survey could be accompanied by interviews or observations, leading to more detailed/deeper insights.

Some questions from the survey overlapped with each other, leading to the aforementioned multicollinearity. This could potentially result in some sort of bias in the outcome of the survey, making it harder to draw conclusions. I would recommend using the questions from the CIS from Keller as a guideline and transforming the questions in such a way that they fit the research and won't show any signs of overlap with each other.

A last recommendation can be to do the research over a certain time period. It could be a possibility to make a comparison within the period that students are active within the CoE. A study could focus on the difference between the first month and the last month of participating within the CoE and whether any changes can be regarded then. By following the students over

a longer period of time, the possible effects and presence of these elements could be investigated to a more precise nature. As all CoE in the Netherlands are different and all activities for students within the CoE are different, I believe that it is impossible to generalize the outcomes of this research.

Despite the limitations, there are also interesting developments noticeable. This research has made it clear that students have a positive attitude towards the learning environment at the CoE in UAS. The UAS are a positive learning environment for the students and the CoE offers them the opportunity to work on real life projects with companies that could possibly be future employers. This experience is almost unique in its kind and the CoE should continue to develop themselves, become more known among students in UAS and attract more projects for students and lectors/supervisors to work on.

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Appendix I.

(Table derived from Bixler, 2006)

ARCS (Keller)	Time Continuum (Wlodkowski)	Culturally Responsive Teaching (Wlodkowski)	Intrinsic Motivation (Malone & Lepper)
• Attention – Obtaining and sustaining	• Appeal – How stimulating is the learning? • Provide a variety of activities and different presentation techniques		• Provide optimally – challenging activities • Change sensory conditions to arouse curiosity
• Relevance – Meet the needs of the learning • State goals	• Value – Is the learning important? • State goals • Continuing motivation – use what was learned outside the learning experience	• Establish the relationship of instruction to learner's lives • State goals • Create an understanding that learners will learn about something that they want to learn about • Develop attitude by ensuring personal relevance and choice	• State goals or allow goals to emerge
• Confidence – Develop an expectancy for success	• Use clear examples • State criteria for evaluation • Provide performance feedback • Reduce or remove failure – causing components	• Establish inclusion of learner with teachers and other students • Indicate and demonstrate your commitment to helping students learn • Cleary state the rules and procedures of the class/course	• Provide an optimal level of challenge • Provide performance feedback

• Satisfaction – How good do people feel about their accomplishments? • Give learners control over reaching goals that are intrinsically motivating		• Enhance meaning by creating challenging experiences that include learner's values and perspectives	• Provide control over the learning environment
			• Use fantasy to help the student experience power, success, fame, and fortune. Also helps the learners relate new learning to a past experience

Appendix II.

ENQUÊTE OVER ERVARINGEN BINNEN CENTERS OF EXPERTISE

Om mijn studie Public Administration aan de Universiteit Twente te kunnen afronden, voer ik een onderzoek uit naar Centers of Expertise van hogescholen. Ik ben vooral geïnteresseerd in de ervaringen van studenten over het onderwijs dat binnen deze Centers of Expertise wordt gegeven.
Om deze ervaringen in kaart te brengen, heb ik voor studenten die betrokken zijn bij een Center of Expertise een vragenlijst opgesteld met 28 vragen. Bij iedere vraag wordt gevraagd in hoeverre je het met het gestelde eens bent (op een schaal van 'in het geheel niet eens' tot 'in zeer grote mate eens'). Het invullen van de vragenlijst zal naar verwachting niet meer dan ongeveer 10 minuten duren. **De vragenlijst telt twee pagina's!**

Geslacht:
Welke studie volg je:
Wanneer verwacht je je studie te hebben afgerond:
Wanneer (maand en jaar) ben je binnen het Center of Expertise begonnen:
Bij welk Center of Expertise ben je actief:

Graag vraag ik je aan te geven in hoeverre je het eens bent met de onderstaande stellingen. Omcirkel het nummer dat het meest met jouw mening overeenkomt. Indien online ingevuld, graag het nummer vet gedrukt maken of een kruisje plaatsen in het vakje.

In hoeverre:	Mate van overeenstemming				
	In het geheel niet eens	Niet eens	Enigszins mee eens	Mee eens	In zeer grote mate eens
weten jouw lector(en)/begeleider(s) je enthousiast te maken over het project en uit te voeren activiteiten?	1	2	3	4	5
zijn de kennis en vaardigheden die je opdoet tijdens het project bruikbaar voor later (voor na je studie)?	1	2	3	4	5
geven jouw lector(en)/begeleider(s) je tijdens het project het gevoel dat je het project goed en op tijd zult afronden?	1	2	3	4	5
word je nieuwsgierigheid geprikkeld tijdens het uitvoeren van het project?	1	2	3	4	5
geven jouw lector(en)/begeleider(s) je het gevoel dat het project belangrijk is?	1	2	3	4	5
vind jij dat de eisen die aan het project en de bijbehorende activiteiten worden gesteld, te hoog zijn?	1	2	3	4	5
moet je, in vergelijking met andere vakken, harder werken voor het project om dit op een goed niveau uit te kunnen voeren?	1	2	3	4	5
brengen jouw lector(en)/begeleider(s) je tijdens het project nieuwe vaardigheden en kennis bij?	1	2	3	4	5
spreken jouw lector(en)/begeleider(s) hun waardering uit voor het door jou geleverde project en resultaten?	1	2	3	4	5
gebruiken jouw lector(en)/begeleider(s) verschillende instructie- en onderwijsmethoden (bijv. media, kahoot) bij hun begeleiding en ondersteuning?	1	2	3	4	5
krijg jij voldoende feedback van jouw lector(en)/begeleider(s) over de voortgang van het project?	1	2	3	4	5
geeft het uitvoeren van het project jou voldoening?	1	2	3	4	5
zijn de leerdoelen (dat wat je moet bereiken) van het project duidelijk kenbaar gemaakt?	1	2	3	4	5
vind jij het leuk om te werken aan het project?	1	2	3	4	5

hebben jouw lector(en)/begeleider(s) tijd voor je als jij daar behoefte aan hebt?	1	2	3	4	5
krijg jij, in vergelijking met andere studenten, van jouw lector(en)/begeleider(s) erkenning voor je deelname aan het project?	1	2	3	4	5
krijg jij tijdig feedback van jouw lector(en)/begeleider(s) om je tijdens het project te verbeteren?	1	2	3	4	5
ben jij tevreden met wat jij leert tijdens het project?	1	2	3	4	5
voldoet het project aan de verwachtingen die je er vooraf van had?	1	2	3	4	5
sluit het project aan bij actuele ontwikkelingen in het bedrijfsleven en de samenleving?	1	2	3	4	5
stimuleren jouw lector(en)/begeleider(s) jou om geconcentreerd te werken aan het project?	1	2	3	4	5

Opvattingen over het project	**Mate van motivatie**				
	In het geheel niet eens	**Niet eens**	**Enigszins mee eens**	**Mee eens**	**In zeer grote mate eens**
Ik vind het belangrijk om tijdens het project beter te presteren dan andere studenten	1	2	3	4	5
Ik vind het niet erg om veel tijd te steken in het project	1	2	3	4	5
Ik vind het belangrijk om nieuwe kennis te vergaren en nieuwe vaardigheden op te doen	1	2	3	4	5
Ik betwijfel of alle activiteiten die ik moet verrichten in het kader van het project de moeite waard zijn	1	2	3	4	5
Ik heb voor het project gekozen omdat ik eigenlijk geen andere keuze had	1	2	3	4	5
Ik vind het onderwerp van het project en de bijbehorende activiteiten boeiend	1	2	3	4	5
Tegenslagen tijdens het project weerhouden mij ervan om heel hard te werken voor een goed resultaat	1	2	3	4	5

Bedankt voor de medewerking!

SURVEY ON STUDENT EXPERIENCES IN CENTERS OF EXPERTISE

In order to graduate for my study Public Administration at the University of Twente, I am doing research to the Centers of Expertise within Universities of Applied Science. I am mostly interested in the experiences of students on the education that is being given within these Centers of Expertise.
To have a clear view of these experiences, I have set up a survey for students with 28 questions. Every question will ask to what extent you agree with the statement (on a scale of 'total disagree' to 'totally agree'). It will take approximately 10 minutes to fill out the survey. **The survey has 2 pages!**

Sex:
What study program do you follow:
When do you expect to graduate (year):
When (year & month) did you start at the Center of Expertise:
At what Center of Expertise are you active:

I would like to ask you to point out to what extent you agree with the below mentioned statements. Circle the number that corresponds most with your opinion. If you fill in this survey online, I would like to ask you to make the number bold or to place an 'x' in the box.

To what extent:	Correspondence				
	Strongly disagree	Disagree	Moderately agree	Agree	Strongly agree
do your lectors/supervisors make you enthusiastic about the project and the activities?	1	2	3	4	5
are the knowledge and skills you learn during the project useful for later (after graduation)?	1	2	3	4	5
give your lectors/supervisors you the feeling you will complete the project good and on time?	1	2	3	4	5
is your curiosity being triggered during the execution of the project?	1	2	3	4	5
do your lectors/supervisors give you the feeling that the projects are important?	1	2	3	4	5
do you think that the requirements to the project and its activities, are too high?	1	2	3	4	5
do you, in comparison with other courses, need to work harder for the project to execute this on a sufficient level?	1	2	3	4	5
do your lectors/supervisors learn you new knowledge and skills during the project?	1	2	3	4	5
do your lectors/supervisors show their appreciation for your work in the project and your results?	1	2	3	4	5
do your lectors/supervisors use different instruction- and educational methods during their guidance?	1	2	3	4	5
do you receive enough feedback from your lectors/supervisors on the progress of the project?	1	2	3	4	5
does carrying out the project give you satisfaction?	1	2	3	4	5
are the learning goals of the project been expressed clearly?	1	2	3	4	5
do you enjoy working on the project?	1	2	3	4	5
do your lectors/supervisors have time for you when you feel the need for it?	1	2	3	4	5
do you receive, compared to other students, recognition for your part in the project?	1	2	3	4	5

do you receive timely feedback from your lectors/supervisors to improve during the project?	1	2	3	4	5
are you content with what you learn during the project?	1	2	3	4	5
does the project meet the expectations you had from it?	1	2	3	4	5
does the project line with actual developments in the labor market and society?	1	2	3	4	5
do the lectors/supervisors stimulate you to work concentrated on the project?	1	2	3	4	5

Project	**Motivation**				
	Strongly disagree	**Disagree**	**Moderately agree**	**Agree**	**Strongly agree**
I find it important to perform better than other students on the project	1	2	3	4	5
I do not mind putting much time and effort in the project	1	2	3	4	5
I think it is important to gain new knowledge and skills	1	2	3	4	5
I doubt all activities for the project are necessary	1	2	3	4	5
I chose this project because I did not have any other choice	1	2	3	4	5
I think the subject of the project and the activities corresponding with it are interesting	1	2	3	4	5
Downfalls during the project keep me from working hard for a good result	1	2	3	4	5

Thank you for filling out the survey!

Appendix III.

Computing attention – table 9

Statistics

attention

N	Valid	28
	Missing	0
Mean		3,3929
Median		3,4000
Std. Deviation		,50327

attention

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,20	1	3,6	3,6	3,6
	2,40	1	3,6	3,6	7,1
	2,60	1	3,6	3,6	10,7
	2,80	1	3,6	3,6	14,3
	3,00	2	7,1	7,1	21,4
	3,20	5	17,9	17,9	39,3
	3,40	5	17,9	17,9	57,1
	3,60	4	14,3	14,3	71,4
	3,80	4	14,3	14,3	85,7
	4,00	3	10,7	10,7	96,4
	4,40	1	3,6	3,6	100,0
	Total	28	100,0	100,0	

Statistics

attention_total

N	Valid	28
	Missing	0
Mean		3,5714
Median		4,0000
Std. Deviation		,69007

attention_total

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,00	2	7,1	7,1	7,1
	3,00	9	32,1	32,1	39,3
	4,00	16	57,1	57,1	96,4
	5,00	1	3,6	3,6	100,0
	Total	28	100,0	100,0	

Computing relevance – table 10

Statistics

relevance

N	Valid	27
	Missing	1
Mean		3,6667
Median		3,6000
Std. Deviation		,55192

relevance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,40	1	3,6	3,7	3,7
	2,80	3	10,7	11,1	14,8
	3,00	1	3,6	3,7	18,5
	3,40	3	10,7	11,1	29,6
	3,60	7	25,0	25,9	55,6
	3,80	1	3,6	3,7	59,3
	4,00	5	17,9	18,5	77,8
	4,20	3	10,7	11,1	88,9
	4,40	2	7,1	7,4	96,3
	4,60	1	3,6	3,7	100,0
	Total	27	96,4	100,0	
Missing	System	1	3,6		
Total		28	100,0		

Statistics

relevance_total

N	Valid	27
	Missing	1
Mean		4,0000
Median		4,0000
Std. Deviation		,73380

relevance_total

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,00	1	3,6	3,7	3,7
	3,00	4	14,3	14,8	18,5
	4,00	16	57,1	59,3	77,8
	5,00	6	21,4	22,2	100,0
	Total	27	96,4	100,0	
Missing	System	1	3,6		
Total		28	100,0		

Computing confidence – table 11

Statistics

confidence

N	Valid	27
	Missing	1
Mean		3,3333
Median		3,4000
Std. Deviation		,42607

confidence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,60	2	7,1	7,4	7,4
	2,80	3	10,7	11,1	18,5
	3,00	4	14,3	14,8	33,3
	3,20	4	14,3	14,8	48,1
	3,40	3	10,7	11,1	59,3
	3,60	4	14,3	14,8	74,1
	3,80	5	17,9	18,5	92,6
	4,00	2	7,1	7,4	100,0
	Total	27	96,4	100,0	
Missing	System	1	3,6		
Total		28	100,0		

Statistics

confidence_total

N	Valid	27
	Missing	1
Mean		3,5185
Median		4,0000
Std. Deviation		,50918

confidence_total

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3,00	13	46,4	48,1	48,1
	4,00	14	50,0	51,9	100,0
	Total	27	96,4	100,0	
Missing	System	1	3,6		
Total		28	100,0		

Computing satisfaction – table 12

Statistics

satisfaction

N	Valid	28
	Missing	0
Mean		3,5179
Median		3,5833
Std. Deviation		,49967

satisfaction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,50	1	3,6	3,6	3,6
	2,67	1	3,6	3,6	7,1
	2,83	1	3,6	3,6	10,7
	3,00	4	14,3	14,3	25,0
	3,17	2	7,1	7,1	32,1
	3,33	2	7,1	7,1	39,3
	3,50	3	10,7	10,7	50,0
	3,67	4	14,3	14,3	64,3
	3,83	4	14,3	14,3	78,6
	4,00	2	7,1	7,1	85,7
	4,17	2	7,1	7,1	92,9
	4,33	2	7,1	7,1	100,0
	Total	28	100,0	100,0	

Statistics

satisfaction_total

N	Valid	28
	Missing	0
Mean		3,6429
Median		4,0000
Std. Deviation		,67847

satisfaction_total

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,00	1	3,6	3,6	3,6
	3,00	10	35,7	35,7	39,3
	4,00	15	53,6	53,6	92,9
	5,00	2	7,1	7,1	100,0
	Total	28	100,0	100,0	

Computing motivation – table 13

Statistics

motivation

N	Valid	28
	Missing	0
Mean		3,2143
Median		3,2857
Std. Deviation		,28703

motivation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,71	1	3,6	3,6	3,6
	2,86	6	21,4	21,4	25,0
	3,00	3	10,7	10,7	35,7
	3,14	2	7,1	7,1	42,9
	3,29	7	25,0	25,0	67,9
	3,43	3	10,7	10,7	78,6
	3,57	5	17,9	17,9	96,4
	3,71	1	3,6	3,6	100,0
	Total	28	100,0	100,0	

Statistics

motivation_total

N	Valid	28
	Missing	0

motivation_total

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3,00	19	67,9	67,9	67,9
	4,00	9	32,1	32,1	100,0
	Total	28	100,0	100,0	