A case study on the use of digital learning environments in higher education

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Master thesis in

Informatics: design, use, interaction

60 credits

Department of informatics

The faculty of mathematics and natural sciences

Aug 2020

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http://www.duo.no

Printed: Reprosentralen, Universitetet i Oslo

Abstract

This master thesis describes a case study of the use of digital learning environments at a higher education organization in Norway. The study is part of UDFeed, a pedagogical, qualitative project of the Department of informatics at the University of Oslo. Two research questions guided this thesis. The first research question aims to describe how students use digital learning environments. The second research question aims to describe some of the implications of digitally mediated communication.

I answered to my two research questions from a Computer-Supported Cooperative Work perspective through the common information space theoretical construct. From this perspective, the digital learning environments are seen as platforms where students and other staff of the higher education organization cooperate actively. The common information space focuses on how information is actively shared and interpreted by its users. Also, I considered the emotions of the students, focusing on when they receive feedback via digital learning environments from the course instructors.

This master thesis is an interpretive qualitative case study. This type of inquiry is an attempt to understanding the case of interest and its complexities. To generate knowledge about students' use of digital learning environments, I conducted several interviews and a diary study. Data collected consists of students' mediated construction of reality, which are interpreted from my perspective on the case.

I have gathered data on different perspectives and aspects of the student's use of digital learning environments. I recognized two main findings among these. The first,

is that students argue that it takes too much effort to understand the shared information they need in digital learning environments. The second, is that they experience communication through digital learning environments lacking support for their emotions.

I argue in this thesis, the extra effort to understand the information on the digital learning environments is seen as a hindrance to the negotiations of the shared meanings of the common information space of the higher education organization. I argue that further research must generate knowledge of how the different perspectives of the users of the common information space of the higher education organization can be accommodated via technology. Also, the lack of empathy in digital mediated communication triggers negative emotions, creates exclusion, and negatively influences the learning experience. Therefore, I argue that supporting students' emotions in the common information space and exploring alternative forms of digital interaction have to be considered.

Keywords:

Computer-Supported Cooperative Work (CSCW), common information space (CIS), articulation work, emotions, digital learning environments (DLE)

Acknowledgement

In memory of my father, Andrea Vannini, who has always supported me for my studies abroad in Norway. This has been a demanding educational process and, even though you are gone suddenly during this project, your belief in me has made this journey possible.

A big thank you to my supervisors, Diana Saplacan for her precious guidance and Jo Herstad whose positive attitude motivated me during the process.

Thanks to the participants of this study, without your involvement this thesis could not have been possible.

A special thanks to all my family that, despite we all live in different country, was able to support me and my friend Luca Fiorentino who motivated me during the last writing sessions of this work.

Contents

1. Introduction

The use of digital technologies is increasingly popular and ubiquitous in our society, and it is undeniable that this constitutes a topic of global interest. We use every day uncountable technologies that weave themselves into the fabric of our lives. Technology also pervaded education and learning. All students deal today with plenty of different digital systems that have become rapidly essential to their journey as higher education students. This plethora of digital technologies potentially constitutes a challenge for students and influence their everyday life.

This thesis aim is to create knowledge on how students experience digitalization of higher education studies, bringing to light some of its challenges and their perspectives on it.

To create this knowledge, I explored the students' use of technology identifying issues that can be seen analyzed within the Computer-Supported Cooperative Work (CSCW) research field, especially through the lens of the common information space.

Moreover, I contributed to the CSCW research field observing educational related activities as work. Furthermore, taking into consideration emotional aspects of cooperative work is a new take on CSCW. The field recognizes cooperative work as a social act (Schmidt and Bannon, 1992). Therefore, I argue that in this sense cooperative work has interesting emotional implications. However, emotions in the field are often overlooked.

1.1. Background

As technology's use has become an integral part of our daily life, it has also become a crucial aspect for making use of the services offered by the public sector, including education. Citizens have to deal with increasing numbers and complexity of technology, which can potentially constitute a barrier for them reaching these services. Since these services should be accessible and usable to the most significant extent amount of people, Norway, to maintain digital equality among citizens, has introduced a law (Likestillingsdepartementet, 2016) which established the requirement for these technologies to be universally designed.

Universal design originates from an architecture study of Ronald Mace (Center for Universal Design NCSU, n.d.) about designing a physical space that suits as many as possible. Its definition is "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design." (The Center for Universal Design NCSU, n.d.)

Universal design is often associated with design for people with function variabilities. However, it is more in general aimed at the inclusion of the plurality of human beings to accommodate their diversities, simplifying the life of everyone (Lid, 2014) .

Because of the high percentage of higher educated citizens (Statistics Norway, 2020), Norway has to cover and accommodate the students' many different peculiarities and needs and universal design. Therefore, universal design is used as a strategy for facilitating an inclusive learning environment, limiting the digital barriers for the students (VUU Veileder universell utforming, 2012).

This study is concerned with higher education students' experience with different technologies they use to support their studies. I will refer to these technologies as digital learning environments (DLEs) which Saplacan et al. (2020, p. 87) define as: "digital platforms, websites or specific webpages used by course instructors and students in a course for exchanging information or knowledge, relevant for their learning, respectively teaching, within the frame of the course." Furthermore, following the same approach of a recent paper on DLEs (Saplacan, 2020a), I will consider them from the perspective of cooperative and collaborative communication tools, which serve to share actively various types of information necessary to students and course instructors.

I found Computer-Supported Cooperative Work (CSCW) relevant and interesting as a theoretical framework under the circumstances of this research because, being a multidisciplinary field, it suits well the exploratory nature of this study, giving me more opportunities to assume different philosophical stances on the phenomenon. Moreover, whether CSCW has a focus on cooperative work, this is not just merely in terms of tasks to be achieved but also of the social dimension, which I find particularly relevant to discuss related educational activities.

In CSCW, cooperative work has an emphasis on the interdependency among "workers." In this study, I assume that relationships among students and course instructors are interdependent in the sense that it exists a mutual collaboration that consists of instructors providing some knowledge to students who, in turn, rely on this knowledge, produce and submit assignments.

One of the primary concerns of CSCW is articulation work, which refers to all coordinative activities needed for a cooperative work arrangement; in the words of Schmidt (2002, p. 184) the work to make cooperative work, work". Part of articulation work is the creation and maintenance of a common information space (CIS), a space which is constituted by the participants' information meanings and the tools used to share those meanings with others. A critical characteristic of the CIS is that these meanings are not merely shared but also actively interpreted and negotiated

by the participants who actively contribute to and understand the information (Schmidt and Bannon, 1992).

In this research, I will focus on the use of DLEs under the lens of the CIS. That way, I hope it is possible to shed to light over the implications of using different tools which support higher education students.

A similar approach has been adopted by Elsrud (2019), who investigated the use of the DLEs as co-related units under the lens of the ecology of artifact (Jung et al., 2008).

Computer-Supported Cooperative Learning (CSCL), a subfield of CSCW that focuses on relationship and communication between students and teacher and cooperative learning (Jeong et al., 2019), could also have been interesting for this study. However, my aim is not going deep into pedagogical implications of the use of DLEs. From my view, the common information space of CSCW can serve to shed light on interesting aspects and analyze the use of DLEs in HE.

Earlier researches on public sector services from a CSCW perspective are Verne and Bratteteig (2016), who investigated the tax office services, Saplacan et al. (2020) and Saplacan (2020b) who instead investigated different aspects of the use of DLE in HE. Moreover, how a common information space is supported has been earlier researched in hospitals (Bossen, 2002; Zhang et al., 2017), and more recently, in Higher education (Saplacan, 2020a) .

With this study, I first want to understand better some of the implications of using different DLEs in HE. Secondly, I want to raise awareness about how technology can influence students' lives and give insight into some current problematic aspects of their experiences with the DLEs.

I see this study as a relevant work for designers of technology for education, who can find useful information about students' perspectives on DLEs. Also, this study

could be valuable for teachers and other pedagogical staff who have to relate to these technologies in one way or another.

1.2. Motivation

The increasing digitalization of public education services constitutes undoubtedly a topic of global interest, as education is critical for our development as human beings.

Furthermore, the latest events related to the Covid 19 pandemic have stressed the importance of the use of technology in education, making it strictly necessary.

I have always been fascinated by how digital technology influences and changes our habits, lives, and society. Technology is not just a tool that helps achieve our everyday goals but also affects the way we do things, we think, and are. As a foreigner living in Norway, I am also curious about how these technologies are perceived and used in a country with higher expectations about the quality of digital services than my native one.

1.3. Research question

Kalleberg (1996) distinguishes between three types of research questions: descriptive, normative, and constructive. In descriptive research questions, the concern is to describe a situation as it is and why it is like that. In constructive questions, the matter is the value that the society has towards a situation. In constructive research questions, the concern is to improve the situation. I argue the two research questions of this study being descriptive as they aim to describe a situation as it is.

Students deal every day with plenty of different technology and among others the DLEs of the HEO. Using this plethora of different digital tools every day influences the student and could potentially constitute a challenge in different ways. Moreover, usually the students cannot choose which DLEs they use, as the HEO adopt them, and do not have the possibility to express their perspective on them.

To achieve that I discussed two research questions. The first aim is to explore the use in practice of the DLEs trying to highlight perspectives the challenges of the students while using them.

RQ1: How do students use digital learning environments in higher education?

Furthermore, at the beginning of this research, my attention was caught by some of the students who complained that they experience communication through DLEs when they discuss assessment missing empathy, body language, and support for their emotional status. Therefore, I got curious about the emotions and wanted to generate knowledge investigating on them in the context of assessment via DLEs with the following research question.

RQ2: What are the implications for students being assessed via digital learning environments in higher education?

1.4. Limitations of the research

This case study is about students and course instructor digital communication in a CSCW perspective. Unfortunately, due to the impossibility of involving course instructors in the time frame of the data gathering, their perspectives are not included, even if they cover an important role for that communication.

Secondly, my inexperience in research caused me doing some wrong decisions during the process. At the beginning of this work I was interested in the emotions of the students. I was not aware of the fact that to gather data on emotions is problematic as it is a delicate and very personal topic. Also, emotions are concerned with psychology which I have too little experience with. Focusing too long on the emotions, don't really finding a satisfactory way to integrate them in this research made me dissipate energy which I could have used in a more profitable way.

Furthermore, my limited experience with research methods have also constituted a limitation of the study. Effective and fruitful use of the methods requires, in fact, some practical experience. Moreover, I have chosen to conduct a diary study, that is particularly challenging to perform. The two main challenges I encountered are the difficulty to maintain high the participants motivation and the realization of an ad-hoc for the situation diary.

I argue the CSCW research field is valuable in creating an understanding of the higher education context, but the pedagogical implications are limited. However, as mentioned, this study is not intended to be an educational work, but just creating knowledge on aspects of communication online in higher education.

Lastly, I want to mention another weakness concerned with language issues. Even though I speak the Norwegian language fluently, I am not a native Norwegian speaker. However, for ethical reasons and make participants more comfortable I opted to conduct the data gathering activities in the Norwegian language. Choosing the Norwegian language may have implied a cost in terms of accuracy of language, and therefore, the data gathered.

1.5. Structure of the thesis

Chapter 2: Case

It contains the background of this project: the UD feed project, the participants' descriptions, and an overview of their activities at the higher education organization and digital learning environments.

Chapter 3: Related work

Besides the main theoretical framework, I also explored emotions in the use of technology in higher education. This additional concept supplements the main theory in the last paragraph of the discussion.

Chapter 4: Theory

It contains an introduction to the theoretical framework of this research, which is Computer-Supported Cooperative Work. Furthermore, it is described in deep articulation work and the common information space, two central theoretical constructs of the field.

Chapter 5: Methodology

It contains the description of the methodology and the methods used for this research. Also, the data gathering process and how I carried out the data gathering through these methods.

Chapter 6: Findings

It illustrates the findings that emerged from the methods used in this research: diary study, interview, and document analysis.

Chapter 7: Discussion

In this chapter, I go deeper into the findings answering the two research questions, bringing them to light from the perspective of the theory chosen (chapter 4) and related work (chapter 3).

Chapter 8: Conclusion

It contains the consideration drawn by the discussion and indications of further research to create more understanding of the phenomenon.

2. Case

In this chapter, I describe the scope of the research. This thesis is part of the UDfeed project ("UDFeed; universal design for learning and instruction," n.d.), a pedagogical work whose primary focus is on Universal Design in higher education. In order to contribute to this project, I gathered data on higher education students' use of technology during the spring and autumn semester 2019.

2.1. UDFeed Project

'UDFeed' is a project supported by the University of Oslo and the department of informatics whose main goal is to raise awareness about universal design in higher education. The project focuses on digital learning environments and Universal Design (UD) in Higher Education (HE). The diversities and uniqueness of students and the high number of participants in some courses, constitute a challenge for some HE institutions. In some courses, the number of students reaches 500, making it challenging to cover all diversities and allow students to ask all questions they have in mind and, more generally, "making their voice heard."

With this thesis, I contribute to the UDFeed project creating knowledge about how students experience the use of different digital learning platforms and their perspectives about the use of technology in education.

As part of this project, I had the opportunity to participate in different activities to increase my understanding of Universal Design. These include a meeting with the responsible for universal design of the Norwegian University of Science and

Technology (NTNU), a seminar called UnIKT where different Norwegian organizations discuss how they approach universal design, and a workshop for NordCHI'18 where I was one of the participants. Besides, I participated in two internal meetings where higher education course instructors – teachers, professors, and teaching assistants – discussed teaching issues and UD.

With the participation in these events, I gained a more in-depth insight into the research context, which helped introduce me to this study with a broader perspective.

2.2. Participants of the study

This study focuses on higher education students and their experiences with different digital learning environments. In this paragraph, I will describe their activities and responsibilities. However, other staff at the organization, such as professors and teaching assistants, have a decisive influence on the experience of digital platforms. Therefore, I will include a brief description of the course instructors' activities, even if they did not participate directly in the data gathering.

2.2.1. Higher education students

The HEO institute accepts its students with a limited number of participants each academic year, from different high schools.

The students follow different courses which length is one semester. Attending classes in several courses is mandatory, while in other courses, it is not. The classes usually consist of several main lectures taught by the professor and supplementary classes or activities taught and supported by a teaching assistant.

Apart from the activities mentioned and self-study, courses involve a variable amount of assignments that students have to submit before a deadline. An established number of assignments must be approved by the teachers to get access to the final exam of the course.

Most of the assignments involve group work. The student can cooperate online, through DLEs and in person, wherever they prefer or in some private rooms, the department provides.

2.2.2. Other actors involved: course instructors

Professors are the main supervisors of their subjects. They have the responsibility to create, coordinate, and teach their courses. They can eventually delegate some of the didactic activities to the teaching assistants.

Teaching assistants instead are usually previous student of a subject who still are students. Their primary responsibilities are to teach the supplementary lectures, correct and grade the assignments, and support students in the different subjects.

The teaching assistant works under the professor's supervision, who gives the guidelines for how to organize the subject and gives guidance and support in case of difficulty.

Some teaching assistants do not teach the supplementary classes, but they provide support to the students for assignments and evaluate them.

2.3. The digital learning environments

Each course at the institute involves a multitude of different websites and other digital platforms that students and other staff use to get and exchange the

information they need to support their activities. As mentioned, I will refer to them as digital learning environments (DLE).

In the different subjects, the combination of DLE employed varies accordingly. A professor can choose, for example, to use or not a particular DLE to support his/her course.

Alongside the "official" DLEs provided by the HEO, there are other "unofficial" DLEs that students and teachers sometimes use. We can distinguish the official DLEs by the unofficial as the former are accessible with a user name provided by the HEO; the latter are accessible via an own personal account. For this study, I include the official DLEs provided by the HEO mentioned by the informants in the data collection.

2.3.1. Official website

The HEO official website is a complex website that encompasses many functionalities and is, in reality, a multipurpose platform that is possible to be integrated with external modules to generate complex websites. The official website contains all information related to the different faculties and educational activities. The web pages and functionalities that students mentioned the most are related to the subject pages. Each course has a dedicated section on the website containing all the information about the course as the amount of workload, a detailed description of the outcomes for the course, the syllabus, and the description of the assignments.

2.3.2. Official Q&A platform

The institute provides an official question and answers platform where the students can write questions about a subject, theory, or ask for their doubts concerning the assignments. With this DLE, the students help each other answering their questions concerning different subjects and course instructors participate and help the students just when they consider it necessary. This DLE is structured as a classic forum site where content is divided into categories resembling the different subjects.

2.3.3. Official chat platform

Some course instructors adopt an official chat platform in their courses. This DLE is used b to establish communication and share different information about their courses with the students. The information carried by this DLE is mostly concerned with ongoing projects and assignments of each course.

2.3.4. Official e-mail platform

The organization provides an e-mail client with a dedicated e-mail address to students. This DLE usually mediates all e-mail communication between administration, students, and teachers.

2.3.5. Official submission platform

The HEO provides an essential DLE dedicated to assignments grading and submission. These functions overlap with the one in the official learning platform.

2.3.6. Official learning platform

The official learning platform is a complete solution for learning purposes. With this DLE, it is possible, among other things, to create subject pages, gather study materials, and contact the teachers.

2.3.7. External tools

Other personal digital tools are sometimes used in combination with the official one, for example, as some students mentioned in data gathering: Messenger, Kahoot, Mentimeter, and Google drive.

2.4. Communication at HEO

The students and course instructors exchange every day a substantial amount of information.

During the semester, students deal with much different information as schedules, timetables, programs of courses, exam requirements, syllabuses for their courses, assignments requirements, and much other information they may need.

Furthermore, students communicate directly with the teachers when they get feedback and, in general, when they need more specific and tailored information.

Students also have to communicate with other students when it comes to coordinating their group work and more in general to discuss different subject theory or challenges.

The primary reference and official source of information at university is the main website. Other DLEs integrate the information needed and for more specific and personal information, such as getting assessment feedback from a teacher.

Face-to-face arrangements, such as lectures, supplementary lectures, and meetings for group work, constitute another potential source for getting and sharing information among the actors that complement the information on the DLEs.

3. Related work

In this chapter, I introduced the related work on the concept of emotions, an adjacent concept used in my research which were useful to give a deeper understanding of my case.

3.1. Emotions

> Emotions are at the core of what we are and how we experience the world
> (Donald A. Norman, 2004).

The word emotion comes from late Latin "emovere" which consists of "ex" that means "out" and "movere" that means to move. Literally, the meaning is to "move out" or "take out." More broadly, it is a movement, a quake "inside us" or in our "soul" which, is taken out and manifests in the world.

Even if nearly a hundred definitions of emotions have been recorded and categorized (Kleinginna and Kleinginna, 1981 as cited in Rosalind W. Picard, 1997), today is still not possible to answer precisely the question "what are emotions?". Moreover, there is still not an agreement about what emotions are. However, some characteristics of emotion are recognized by the research community. I will describe some of those in this paragraph to give a theoretical background for emotions in this thesis.

Firstly, according to Paul MacLean's (1970 in Rosalind W. Picard, 1997) division of the brain in neocortex, reptilian and limbic region, the latter, is the primary seat of emotion, attention, and memory.

Secondly, several authors focus on the dichotomy of emotions. On one side, there are emotions characterized by short duration, impulsiveness, and which involve a tangible physical manifestation. On the other side, there are emotions that are characterized by long duration, cognitive elaboration and intangibility. However, this distinction is not rigid, and often an emotion does not strictly belong to one of the two categories.

Historically the focus on physiology and bodily involvement of emotion is attributed to James (1890 in Rosalind W. Picard, 1997) while the focus on emotions as cognitive manifestations to Cannon (1927 in Rosalind W. Picard, 1997).

Damasio, instead (1994 in Rosalind W. Picard, 1997) distinguishes between primary, immediate emotion and secondary cognitively elaborated emotions. An example of immediate and spontaneous emotions are the seven basic emotions that Paul Ekman (2005) identified reading facial expressions. These basic emotions are joy, sadness, contempt, fear, disgust, surprise, and anger.

Instead, examples of cognitive and longer-lasting emotions are motivation and compassion.

Lastly, it is important also to mention that all emotions can be classified as positive or negative (Calvo and Peters, 2014). These two emotions interact and influence each other in a continuous process of negotiation (Donald A. Norman, 2004).

3.1.1. Three types and three levels of cognitive processing of emotions

Later takes on the categorization of emotions in HCI are Ortony et al. (2003 in Fellous and Arbib, 2005) and Calvo and Peters (2014).

These researchers categorize emotions according to the amount of cognitive elaboration. They distinguish immediate and spontaneous emotions, processed cognitive emotions, and emotions that originate after more profound reflections.

Ortony et al. (2003 in Fellous and Arbib, 2005) name these three types of emotion as "proto affects," "primitive emotions," and "emotions" while Calvo and Peter name them "emotions," "moods" and "attitudes."

Norman (2004), focusing more on the cognitive aspect rather than the emotion itself, also proposes three levels of cognitive processing for emotions, which are the "visceral," "behavioral" and "reflective" level. The three levels, which allow to categorize emotions are summarized in the following table.

Table 1three levels of cognitive processing of emotions (The Interaction Design Foundation, 2016)

3. level **Reflective**	Cognitive, intellectual level Watches over the behavioral level & influences it No direct connections to visceral emotions
2. level **Behavioral**	The level of most human behavior. Controlled by reflection, but heavily influenced by visceral emotions we may barely aware of
1. level **Visceral**	Fast affective reactions about good & bad; Alerts behavioral & emotional reactions

3.1.2. Emotions in design of IT

Essentially, everything that designers do is to influence emotional responses (Donald A. Norman, 2004). A right balance of positive and negative emotions is what, according to Norman (2009) constitutes a good user experience. According to the author, provoking too many negative emotions leads to "tunnel vision," a phenomenon where a user feels "stuck" and unable to proceed in the interaction. On the other hand, evoking just positive emotions leads to too much creativity, which results in a status of the user where it is difficult to hold focus on a task (Donald A. Norman, 2004).

Another recommendation of Norman (2004) is to consider the three levels of processing of emotion. To satisfy the "visceral level," it is necessary to create esthetical pleasure, for the "behavioral level," to create meaningful interaction and for the "reflective level" to make the user remember the experience as valuable.

Calvo and Peters (2014), who have also discussed emotions in computing, suggest designing for human well-being, increasing the positive emotion, and reducing negative ones. To achieve a good experience, both authors recommend designing with an approximate ratio of emotions in mind: three positive emotions for each negative emotion.

3.1.3. Empathy in computer-based communication

The etymology of the word empathy is from greek "empatheia." "Empatheia" means "passion" and consists of "en" which means inside and "pathos" which is a feeling.

Generally speaking, empathy is the capability to understand other's feelings and does not yet have a unique scientific definition. However, there is a consensus on empathy being multifaceted construct

that includes emotion recognition, vicarious feeling, and perspective-taking (Singer, 2006 in Calvo and Peters, 2014).

In the social work dictionary (Barker, 2008 in Calvo and Peters, 2014), empathy is defined as "the act of perceiving, understanding, experimenting and responding to the emotional states and the ideas of another person". The definition also reveals two sides of empathy: cognitive empathy and affective empathy. The former is "the ability to recognize emotions and intentions of others", the latter "our ability to share the feelings of others and to react with an appropriate emotion to what someone else is feeling or thinking" (Calvo and Peters, 2014, p. 205).

Empathy is a fascinating aspect of human beings that is essential to healthy relationships, collaboration, well-being, and personal growth. However, it has always been a challenge for computer-based communication. A considerable amount of necessary information to empathize with other people, such as gestures, facial expressions, tone of the voice, and other non-verbal communication, is lost in computer-based communication. Attempts have been made already to fill this gap between face to face communication and computer-based communication, adding more accurate sensory channels as video audio and tactile to compensate. However, we are still far from matching these two types of communication (Calvo and Peters, 2014).

4. Theory

In this chapter, I will present the theoretical framework I chose to understand some of the implications of the student's use of the different digital learning environments adopted by the HEO.

The findings of this research will be explored through the lens of the common information space (CIS), a theoretical construct of the Computer-Supported Cooperative Work (CSCW) research field.

Beck and Stolterman (2016), analyzing previous design research papers, propose six models about how the theory can be used in research. I argue that the use of theory for this thesis belongs to the model "theory as an analytical tool." According to this model, the theory is used just as a "tool" to shed light on the findings and does not influence previous steps of the research.

Even if the theory and concepts of CSCW are usually concerned with cooperative work activities, they can give a relevant insight into the use of DLEs. Later I will also describe some of the similarities between cooperative work and student' activities.

4.1. Computer-Supported Cooperative Work

Computer-Supported Cooperative Work (CSCW) is a dynamic, multidisciplinary academic research field concerned with supporting multiple people working together using computer systems.

As a dynamic multidisciplinary field, CSCW is not prescriptive, in the sense that it is open to all research methods from different disciplines and does not prescribe any research strategy (Schmidt and Bannon, 1992).

There is still not a shared agreement about which research questions have to be addressed in CSCW (Carstensen and Schmidt, 1998) and about the core issue for the field (Schmidt and Bannon, 1992). However, Schmidt and Bannon (1989 p. 360) try to delineate some boundaries for the field with their definition:

> "CSCW should be conceived of as an endeavor to understand the nature and requirements of cooperative work with the objective of designing computer-based technologies for cooperative work arrangements."

In this view of the field, the focus on the possible research questions is then on the *understanding* and *better supporting* via computers any form of cooperative work (Schmidt and Bannon, 1992).

4.1.1. Origin of CSCW

A previous approach to group activities support with computers was called 'office automation' (OA). However, this approach run out its steam un 1984 (Grudin, 1994). The primary problem of OA was the difficulties in understanding the system requirements and focusing on technical aspects and building technologies. On the contrary, CSCW started with an effort to learn, with the help of different disciplines, how group activities unfold in practice (Grudin, 1994).

The first time that the term 'Computer-Supported Cooperative Work" was used is in 1984 by Irene Greif and Paul Caschman. The researchers, with this term, referred to how to support people in their work arrangements with computers (Irene Greif,

1988). The term was subsequently abbreviated in CSCW, acronym that has been criticized for being too long (Grudin, 1994) and needed the single terms meaning contained to be better defined (Bannon and Schmidt, 1989). In a later paper, Bannon and Schmidt (1992) gave their view on the definitions of the single terms' CS' and 'CW' of CSCW, worried about a possible dissipation of the field being too open and generic.

4.1.2. 'CS': Computer-Support

In the view of Bannon and Schmidt (1992) the computer support, instead of focusing on the technology itself, should focus on the actual needs and requirements of people engaged in cooperative work.

According to their previous definition of CSCW, the field is a design-oriented research area that aims to understand the activities to support them via computer better. The focus then is on human activity and how it is supported by artifacts to produce better-designed computer systems.

4.1.3. 'CW': Cooperative Work

There are many forms of cooperative work existing in other disciplines. Given the confusion generated by these different interpretations Schmidt and Bannon (1992) examine the concept of cooperative work that is appropriate for the current context of CSCW.

Schmidt and Bannon (1992, p. 15) claim that, in general, the term cooperative work 'should be taken as the general and neutral designation of multiple persons working together to produce a product or a service.'

The two researchers then remarked some of the crucial characteristics of cooperative work for CSCW: social and mutual-dependent. Social because the work activities are always a socially mediated process. Mutually dependent because the actors do not cooperate independently, just sharing some resources but relying on each other to get the job done. This concept of interdependency and mutual dependency is an essential aspect of cooperative work for CSCW. Furthermore, the cooperative worker's activities have to be coordinated, generating extraneous supplementary activity known in CSCW as articulation work, the core issue of the field (Schmidt and Bannon, 1992).

4.2. What is work?

The scope and focus of CSCW have been debated and challenged for many years. Especially Chabtree et al. (2005 in Schmidt, 2011) argue that limiting the scope of CSCW to 'work' would be a loss for the field and that the focus of CSCW should shift away from work to different contexts like for example homes and museums.

The researchers argue the CSCW agenda should 'move with the times' and broaden its scope and extend 'work' with leisure activities for two main reasons. The first one is that the conception of work has changed radically in the modern times. Modern times work has become more woven with leisure activities compared to the past. The second is that technology pervaded not only work settings but rather all aspects of our lives.

Schmidt (2011)does not agree with the researchers' position and, worried about the possible dissipation of the field if it would embrace such a broad scope, saw the necessity to try to define what is 'work' in CSCW.

First of all, it is not possible to define 'work' since it falls, according to Ryle (1951 in Schmidt, 2011), into the category of 'polymorph concept.' As a polymorph concept, 'work' is characterized just by its purpose and circumstance (Schmidt, 2011).

Secondly, Schmidt (2011), distinguishes between activities that can be considered work in all contexts, the primary case of work, and other activities which can be considered work only for some purposes, the secondary case of work. A primary case of work refers to activities that are considered work in all circumstances. A secondary case of work instead is a work-like activity, that resembles some of the characteristics of primary work. For example, if it serves for a practical purpose, it requires effort and concentration or presumes some mastery.

4.2.1. Division of labor and articulation work

Another study on work relevant to CSCW is Strauss (1985). The researcher conceptualizes work in terms of 'arc of work' that is the totality of work tasks that a work project involves. His main idea is that the totality of tasks in a work project has to be divided both in terms of assigning the responsibilities of each task to actors and 'decomposing' (Herbsleb et al., 2000) the task themselves.

Another important observation of Strauss (1985) is that the actor will not just work executing his/her assigned tasks, but will also work in function of the relations that those separate tasks have each other. He distinguishes a primary work, and a secondary supra-type of work, also called by the researcher' articulation work'.

4.3. Articulation Work

One of the biggest concerns of CSCW is articulation work (Schmidt and Bannon, 1992). Schmidt and Bannon (1992) consider articulation work as an integral part of cooperative work, and they identify it in a set of activities to manage the distributed nature of cooperative work.

The researchers build on the ideas of Strauss (1985) and distinguish between a primary work, which is the main task of a worker, and articulation work, which is the result of the contingencies of cooperative work settings.

Articulation work consists of 'putting together tasks, task sequences, task clusters—even aligning larger units such as lines of work and subprojects—in the service of workflow' (Strauss, 1988 p. 164). Schmidt (2002 p. 19) describes it as 'work to make work, work' or to be exact, 'articulation work is work to make cooperative work work'.

Similarly to Gerson (2008), who recognizes two types of articulation work: articulation work in the first sense and the second sense, Schmidt (2002) recognizes a first-order articulation work and a second-order articulation work.

The first refers to articulation work 'through which the cooperative work arrangement is constituted and organized: the mobilization and deployment of actors concerning activities and resources, the differentiation and configuration of skills, etc.' (Schmidt, 2002, p. 20).

The second to the secondary activity 'through which the interdependent and yet distributed activities of the cooperative work arrangement, as deployed and configured, are continually coordinated and integrated.' (Schmidt, 2002, p. 20)

In other words, the first order articulation work refers to the various organizational activities that take place before a cooperative work arrangement starts and the second

order articulation work to the coordinative activities that take place after the arrangement has started.

4.3.1. Supporting articulation work: management of workflow and common information space

According to the conceptualization of Bannon and Schmidt (1992) of CSCW, how to support articulation work is a main issue of the field. The researchers recognize two central approaches to this issue: the management of the workflow and the construction and management of a common information space.

To support the workflow is a crucial aspect for CSCW systems. As shown by Bowers and other researchers (1995), one of the main challenges in supporting the workflow is the unpredictability of how the work practice unfolds. While the computer systems generally tend to impose some rigidity on the work process, there is a need for more flexible systems that also consider the unattended contingencies that work-activities will inevitably present.

Another approach to the design of CSCW applications is constructing a common information space (CIS). Since I am using the CIS as the main framework for this thesis, I will illustrate it in more detail in the next paragraph.

4.4. Common information space

CSCW is a relatively new field, and some of its concepts have not been researched enough and are still under development. The common information space (CIS) is one of those concepts that are still in a refinement phase, and there is still not an agreement on what a CIS consists of in the research community (Bannon, 2000).

For this thesis, I will use my understanding of the concept based on some CIS aspects that have been elaborated by its main contributors.

> "CIS was introduced as a CSCW framework for analyzing the use of shared information in cooperative work, e.g., how is information presented to actors and how the actors interpret the information." (Zhang et al., 2017)

More specifically, the focus of CIS, according to Schmidt and Bannon (1992, p. 22) is on:

> 'how people in a distributed setting can work cooperatively in a common information space - i.e., by maintaining a central archive of organizational information with some level of 'shared' agreement as to the meaning of this information (locally constructed), despite the marked differences concerning the origins and context of these information items. The space is constituted and maintained by different actors employing different conceptualizations and multiple decision-making strategies, supported by technology.'

To explain the CIS, it is useful the comparison between the notion of shared view and common information space of the Bannon and Schmidt (1992) when they start to delineate this concept. According to them, a 'shared' view is characterized by users who perceive a set of objects and share them in the sense that they can also manipulate them. There is still a set of digital objects in the CIS as in a shared database, but the difference is that the focus is not solely on the objects but also on the meanings assigned to the information carried by those objects.

In the conceptualization of Schmidt and Bannon (1992), the CIS consist of 'carriers of information' that are objects carrying the information, the information contained in those objects, and the meaning that the actors attribute to the information. Hence, it is crucial to distinguish between carriers of representation and its meaning. The researchers stress the role of the act of interpretation of those meanings by the actors and claim that as an essential aspect for the CIS.

In the CIS the meanings are constructed with the joint participation of the actors. The CIS's meanings go beyond their individual personal information space' and 'in

order for work to be accomplished, these personal or local information spaces must cohere at least temporarily' (Schmidt and Bannon, 1992, p. 28)

The researchers claim two aspects that can be critical to the construction of those meanings and hence the CIS: the cooperation at 'arm's length' and the distribution of cooperation.

The cooperation at arm's length refers to the different perspectives, backgrounds, and points of view of the actors participating in the CIS construction.

Cooperation at arm's length is an element that could prevent constructing the local and temporary cohesion of the meanings necessary to work cooperatively. Hence, the CIS should aim at the facilitation of the negotiation of the meanings among these different perspectives.

Another critical factor they mention is the distribution of the actors of a CIS.

In a later elaboration of the CIS concept, Bannon and Bødker (1997) claimed that the mechanism used to support holding in common the information varies accordingly if collaborators, the actors are co-present in time and space or are more distributed in time and space.

When the cooperative workers have more possibilities to meet face-to-face, this has a beneficial effect on the shared understanding of the meanings. Instead, in a highly distributed context, there are fewer possibilities to take advantage of enhanced face-to-face communication.

Schmidt and Bannon (1992) identify three critic aspects for the CIS support in more distributed cooperative work settings: identifying the originator of the information, identifying the context of the information, and identifying the information's politics.

According to the researchers, knowing the originator of the information is relevant because all actors have more or less different perspectives and act in a biased way. The actor's different perspective is influential on the construction of the meanings.

Hence, it is essential to understand the perspective and the point of view from which the information is generated.

When it comes to identifying the context of information, the researchers point out that the CIS actors should indicate why this information is generated, which conceptual framework has been used, or which answers stay back that information and how the workers interrelate interacting with it.

The third problem claimed by the researchers is about the political factors of the information. Inside an organization, the total amount of information cannot be considered neutral due to highly probable internal conflicts. Furthermore, some opinions may not have the same influence as others as it exists a hierarchy established by the organization's politics. 'Organizations are not perfectly collaborative systems. Rather the perspective on an organization that views them as a mixture of collaboration and conflict' (Schmidt and Bannon, 1992, p. 34)

Therefore, the visibility of the information has to be regulated as it is utopian that all information is available to the same extent to every actor participating in the CIS.

Openness & Closure

Another concept I find particularly relevant is the one from Bannon and Bødker (1997) about the openness and closure of the CIS.

In their perspective, the CIS has both the characteristics of being open and close. Even if the various actors contributing the CIS actively with their various interpretations and perspective on the other side, it is necessary to establish some boundaries for the information. The trade-off between openness and closure is another important aspect of the different CIS.

Three levels of a CIS

Zhang et al. (2017) identify three levels of information space: personal, local, and common. For instance, a personal-level information space is constituted by one person and the personal artifact he/she uses. A local-level information space involves a restricted number of people and via a local network. A common-level information space instead involves a more significant number of individuals and more complex digital artifacts to share information. In the common-level information space, more support for the negotiation of meanings is needed.

4.4.1. The seven parameters of a CIS

Bossen (2002) contributes to the framework building upon the existing conceptual elaboration and his research in a wastewater plant and an intensive care unit, proposing seven parameters that characterize the CIS. The seven parameters are: the degree of distribution, the multiplicity of webs significance, the level of required articulation work, the multiplicity and intensity of means of communication, the web of artifacts, immaterial mechanism of interaction and the need for precision and promptness. I summarized the seven parameters in the following table.

Table 2 the seven parameter of a CIS adapted from Bossen (2002)

Degree of distribution
Building on the ideas of Schmidt and Bannon (1992) and Bannon and Bødker (1997), Bossen (2002) claimed that the physical proximity of the CIS actors is crucial for the facilitation of creating shared meanings. The advantages of interacting with face-to-face interaction are significantly lost in distributed cooperative work. The absence of physical proximity implies the massive use of mediated communication, constraining the creation of the meanings.
Multiplicity of web significance
The multiplicity of webs significance refers to the different backgrounds and perspectives the actors of a CIS have. The effort necessary to accommodate the different perspectives and achieve mutual understanding is strictly correlated to the multiplicity of web significance in the CIS.
Level of articulation work
The level of articulation work is related to identifying what type and how much articulation work is necessary to the CIS.
Multiplicity and intensity of means of communication
Multiplicity and intensity of means of communication refers to the quantity and quality of communication in the CIS. Bossen (2002) argues face to face communication as the more intense mean of communication. Mediated communication can be supported in different ways to augment the intensity of communication.

The web of artifacts
A CIS can be supported by one or different artifacts that can be recognized as the web-sites, digital platforms needed to share information. These artifacts can also be seen as material mechanisms of interaction as plans, schema, and schedules. Schmidt and Simone (1996) conceptualization of those mechanisms is the 'coordination mechanism', a mechanism that aims to reduce intensive and continuous communication.
Immaterial mechanism of interaction
Alongside the web of artifacts that are the constructed material mechanisms of interaction above, these are other mechanisms that are not supported by any artifact and support the CIS. These can include the regulation and hierarchy of the organization but also knowledge, previous experience, and peculiarities of the cooperative workers.
Need for precision and promptness
The CISs of different cooperative work contexts require different degrees of precision and promptness of information. For example, critical-safety systems in hospitals or air traffic control demand total accuracy of information while other work-settings instead do not have this requirement (Bannon and Bødker, 1997).

5. Methodology

In this chapter, I describe the methodology that I choose for this thesis. I will explain the philosophical assumption which frames this study and the approach and strategy which has been chosen to conduct this research. Lastly, I describe my positioning in the research.

5.1. Interpretive research paradigm

All research, both quantitative and qualitative, is based on philosophical assumptions about the reality observed that describe how to create valid research. According to Chua (in Myers, 1997), when it comes to qualitative research, these assumptions can be framed into three philosophical paradigms: positivist, critical, and interpretive.

In positivistic research, the reality is something objective and measurable. According to this paradigm, the scientists and the tools used for the measurements do not influence the results. Therefore, the reality is entirely independent of the context. Positivist-based research is often initiated with a hypothesis that is tested to be confirmed or rejected.

According to this paradigm, the reality is a repeatable, objective event.

In critical research, instead, the reality is socially and historically constituted, and the focus of this research approach is on the various conflicts of the society. (Chua, 1986 in Myers, 1997).

In interpretative research, the reality is not objective, and it exists as a socially mediated construct. The access to reality in this perspective is 'only through social

constructions as language, consciousness, and shared meanings' (Myers, 1997). According to the interpretative paradigm, the reality is constituted by unique and not repeatable events that the researcher interprets.

This thesis has been conducted within the interpretive paradigm. It is based on my interpretation of the data, which is a personal interpretation of events of the informants. I am aware that my previous personal experiences and the methods I chose for gathering and analyzing data influence the outcomes of this study.

Interpretative research has become more popular for studying technology within the last decades (Walsham, 2006). Walsham (2006) claims that the grown importance of social issues related to technology made information systems researchers focus more on human interpretation and meanings. As technology is now ubiquitous and became more of a social fact, the need to understand its implications and its context of use has increased.

For Walsham (1993 in Myers, 1997), doing interpretive research in Information System is 'aimed at producing an understanding of the context of the information system and the process by which the information system influences and is influenced by the context'.

When we conduct interpretive research, we must consider the 'richness' of reality constituted by all its various nuances and the different views and perspectives of both the researchers and the actors. Interpretive research is based on the assumption that reality is mediated and "what we call our data are our own construction of other people's constructions of what they and their compatriots are up to" (Geertz, 1973 p.9 in Walsham, 1995).

The aim of this research is to understand, through my interpretations, the meanings of the students and the implications of using digital systems at a Higher education organization in different situations. Therefore, from my view, this paradigm is suitable for this research.

5.2. Qualitative research

Qualitative research was historically developed to enable researchers to study social and cultural phenomena and help them understanding people and the social and cultural contexts. (Myers, 2018).

This type of inquiry is characterized by intersubjectivity because it generates knowledge examining what meaning events and experiences have for those who experience them, and how these can be interpreted or understood by others. (Myers, 1997)

As well as interpretive research, also qualitative methods have become increasingly popular to understand use of technology among people better as nowadays, technology has a critical impact on society.

Researchers, as Preece et al. (2015) and Myers (1997) claimed the importance of using qualitative research to understand the use of technology better, bounding it to its real context.

Myers (1997) mentions four different strategies to conduct qualitative research: case-study, ethnography, action research, and grounded theory.

Conducting an ethnographical study could be a possibility. However, for this study, it would not be realistic since this research strategy involves spending an extended amount of time with the participant. Given the limited time frame for data gathering and limited access to the participants, I discarded the idea of this type of inquiry. Since I did not want to generate a new theory on the use of technology in HE, I also rejected using the grounded theory approach. I did not consider the action research approach suitable since it usually involves close observation of introducing a new digital system in a context, and even though new systems are suddenly introduced, I was more interested in the experience with simultaneous use of different systems.

But, since I wanted to investigate a contemporary phenomenon in its context with an exploratory approach, trying to bring to light some aspects that could be overlooked, I decided to adopt the case-study approach.

5.3. Case study

> "A case study is an in-depth study of a specific instance (or a small number of instances) within a specific life context (Lazar, 2010, p. 144)".

> "case-study research aim is to highlight issues, multiple aspects, and conflicts of a case. (Stake, 2005)

Stake (2005) and Walsham (1995) also find useful the concept of 'thick' description to explain what a case study research is. The two researchers mean that a single case study must be understood in its richness and its nuances within its context, complex situated issues, and problematic relationships. In the researchers view, the case and its context are two sides of the same coin, which is not possible to understand apart.

Stake (2005) claims that a case, to be epistemologically useful, should be considered a 'bounded system.' On one side, it is an extensive, costly, and 'thick' description. On the other side, it is necessary to create some boundaries to clarify what makes that case unique, specific, and distinct from another.

When a case study research is conducted, Stouffer (1941 in Stake, 2005) suggests that the researcher should be interested in both more ordinary and particular aspects of the case. However, it is the "uncommon," which often delivers the most salient aspects of it.

Case study research has often been criticized by the research community having a limited value compared to other research. Some of the problematic aspects mentioned (Flyvbjerg, 2006) are that it does not lead to generalization, it just suits exploratory research and involves too much openness to the interpretation of

researchers. Flyvberg (2006) examines and responds to some of these critics, underlining the importance of situated and interpreted studies instead. In his paper, he claims the reality, especially social reality as always characterized by some degree of intersubjectivity of interpretations. Moreover, he dispels the myth of the positivistic research dogma in which reality is objective and repeatable.

Stake (2005) distinguishes three main types of case study: intrinsic, instrumental, and multiple. These three types stand out according to which is the primary interest of the study. If all the interest is purely in the understanding of the specific case, the type of case study is an intrinsic one. If the interest is, instead, to provide an insight into another issue or to redraw a generalization, then the case study will be an instrumental one. The researcher in this type of case study still has an in-depth focus on the case itself, but at the same time, his/her research aim is to help pursue another external interest. The multiple case study is instead, when several different cases are studied to investigate and describe another phenomenon. In this type of case study, the interest in the case study's specific issue is even less than in the intrinsic type because here, the different case studies are meant to serve a distinct concern.

However, the borders between these three types are not delineated. A case study may present at the same time characteristics of more of the types type. Stake (2005) suggests this distinction more as an opportunity for reflecting on the case rather than a rigid classification.

I argue this research to belong to both intrinsic and instrumental type of case study. On one side, it is intrinsic because I choose the case upon my interests in education and technology.

On the other, considering that this thesis contributes to the UDFeed project, it can also be seen as an instrumental type. This study's objective is to understand some of the issues related to the broader phenomenon of feedback and high education, which is the core concern of the UDFeed project.

5.4. Positionality of the researcher

When qualitative research is performed, the researcher and participants necessarily introduce some form of bias because of their different perspectives, background, and interpretations of reality (Crang and Cook, 2007).

In this paragraph, I describe reflections on my positionality in the research and some possible biases that this thesis is subject to.

> "Since the reality is mediated by the informant interpretations and not less the researcher interpretations it is necessary that the latter "…need to reflect on their own philosophical stance, which should be stated explicitly when writing up their work." (Walsham, 1995 p.5)

One aspect of the position of the researcher is his/her involvement in the research. I see relevant for this thesis to point out other aspects of my positionality: being a foreigner studying abroad and my previous studies.

5.4.1. Involvement of the researcher

As mentioned before, qualitative research is characterized by bias that is introduced because of its intersubjective nature. Crang and Cook (2007) argue that, especially in social research, there is always a certain level of involvement of the researcher.

According to Walsham (2006), the research's involvement is a useful concept that can help to reflect on the bias the research is exposed to.

Walsham distinguishes three categories of involvement: the outside observer, the involved researcher, and the neutral observer. These three categories differ in the relationship between the context and the participants of the phenomena studied.

The researcher also remembers that this categorization is dynamic and is most likely subject to changes during the research process.

The outside observer is the most detached type researcher who probably experienced more friction in accessing the data than others. His/her detachment from the context constitutes a barrier, limiting the access to observations and interviews with participants. This detachment makes it more challenging to obtain the data needed and may negatively influence the quality of the data.

However, this type of researcher with his/her 'detached' and 'fresh' point of view may notice things that the other types of researchers will not, making possible to reveal different valuable insights.

The involved researcher instead is in close contact with the context, and the participants hence have facilitated in-depth access to people, issues, and data. This type of involvement opens more possibilities for both observation and active participation in the context of interest. Usually, it implies more possibilities to access the data and may positively influence the quality of data.

Although, as also Walsham (2006) pointed out, one of the disadvantages of the involved researcher is that he/she may tend to lose the 'fresh look' on the situation in contrast to the outside researcher. Being fully immersed in the context of interest may interfere with getting essential insights useful for the research.

The neutral observer is a mix of an outside observer and an involved researcher. It shares, in fact, some of the characteristics of both involvement styles mentioned above. Walsham claims that neutral observers are seen from the participants as "people in the field situation do not perceive the researcher as being aligned with a particular individual or group within the organization" (2006 p.321)

Regardless of the type of involvement, the researcher has never to be too passive regarding the context (Walsham, 2006) to facilitate the construction of domain knowledge. Too much distance with informants would have, in most cases, a negative impact because they may feel less comfortable to express themselves freely.

While conducting the research, I was fully immersed in the same context of the participants, and I was myself a user of the digital learning environments. I could probably not benefit from the "fresh look", which researchers not so familiar with a context have and which is sometimes essential to notice things that may be overlooked by informants more known with the context. I was aware of the possible bias during data collection. I tried to act as I knew as little as possible about the context favoring the participant to tell their experiences freely.

However, being a student made more straightforward access to the HEO's physical context and made it relatively easy to recruit and get data from the informants.

Foreign student

Another aspect to consider concerning my positioning in the research is that I am a foreign student studying in Norway. Although I can speak Norwegian fluently, I have a noticeable foreign accent, which may have influenced my interaction with the informants. Not being mother tongue in Norwegian could have potentially limited the empathy and social relationships with other students, which are necessary to make them more comfortable during the interviews.

Moreover, as Crang and Cook also point out (2007), researching in a foreign language leads to a potential translation problem, which can potentially cause misunderstanding of the data. I may not be aware of all 'jargon' as well, which the informants regularly use. For example, I found out that the confidential slang 'bro' in English is 'cousin' in Norwegian, and I am aware I may have missed other more local and specific use of the language.

Academical background

My previous studies in communication in a humanistic faculty could have influenced the focus of this research. Rather than focus on the technological aspects, I probably tend to look towards communication and how the use of technology influences it.

In this chapter I describe the methodology that I choose for this thesis. I will explain the philosophical assumption which frames this study and the approach and strategy which has been chosen to conduct this research. Lastly, I describe my positioning in the research.

6. Methods

In this chapter, I first describe the qualitative research methods I used for this research and why I chose them. Secondly, I describe how I performed the data gathering and used the methods described. Lastly, I describe how I analyzed the data.

6.1. Qualitative research methods

At the core of qualitative research, there is some information about the context of interest that researchers have to gather through different methods.

The information gathered with qualitative research methods is qualitative data, which is usually in the form of a text that is interpreted by the researcher.

Qualitative data sources include observation and participant observation, interviews and questionnaires, documents and texts, and the researcher's impressions and reactions (Myers, 1997).

Qualitative data is systematically exposed to interpretation bias (Lazar, 2010). Whereas some researchers have seen this as a 'problematic' aspect, Crang and Cook (2007) disagree with this view, claiming that being subjected to bias and different interpretation, hence being characterized by intersubjectivity, it is not a negative aspect but the true nature of qualitative data.

Using different methods may influence the data collected in a more or less predictable way. How we adopt and choose of research methods is crucial to the point that Lazar (2010, p. 12) views a whole research project as "a series of steps and decisions related to data collection." Different methods come with advantages and

disadvantages, making a method more suitable for a specific situation than another. Methods have, therefore, to be chosen carefully and documented well.

6.2. Triangulation

It is often used more than one data gathering method in a single research project. This use of a mix of different techniques to collect the data is known as 'triangulation.'

There are several different reasons why researchers triangulate data. For example, it may increase confidence in the validity and help deal with concerns about the quality of data (Lazar, 2010) or it may serve, especially in case study research, to identify different aspects and therefore the diversity of a phenomenon (Stake, 2005)

All research methods have strengths and weaknesses, and by using two or three different methods, we can often get a much better understanding of phenomena than we would with only one research method (Lazar, 2010).

6.3. Data gathering methods

In this paragraph, I give an overview of the two data gathering methods I used for this study: diary study and interview.

6.3.1. Diary study

The diary study is a self-reporting data gathering method that means that the participant provides data independently during their normal daily activities. Diary

studies are usually employed in social researches. However, technology researchers have adopted this method since the use of technology nowadays has become more of a social fact. Among others, Adler et al. (1998) who wanted to understand the implications of reading through a digital device and Sohn et al. (2008), who investigated how the users look for information through mobile technology.

Even though in several diary studies, participants are asked to write down data in a booklet or a diary, it is also true that it is possible to generate data through different media as the smartphone (Sohn et al., 2008) or other supports as the computer. 'Cultural probe' (Gaver et al., 1999) is another example of a self-reporting data method. It represents similarities with diary studies, but with this method, participants are asked to take photos, draw, film, and record audio with different supports, the 'probes'. Thus, diaries can be designed in different ways according to the context to accomplish the researcher's objective better and get the data needed.

Diary studies require participant self-discipline, motivation, and effort. Therefore, it is necessary to consider the "user overload" (Lazar, 2010), which means that the task asked our participants should not be too demanding.

Carter and Mankoff (2005 in Lazar, 2010), to reflect on the design of the diary, distinguish two main types of a diary: elicitation and feedback. An elicitation type of diary requires the participant to write down descriptions of their experiences when they occur during the day. Instead, the feedback diary requires the participant to notify briefly when some established occurrence happens in order to remember and discuss it in a follow-up interview.

This method has two main shortcomings: the participant's loss of motivation and the potentially low quality of data (Lazar, 2010).

Therefore, it is crucial, even more than other methods, to establish a good social relationship with the participants (Crang and Cook, 2007) to maintain a certain

degree of motivation so that participants remember to fill the diary with data (Adler et al., 1998).

Lazar (2010) considers diaries suitable for exploratory research, and Alaszewsky (2006 in Lazar, 2010) generally recommends this method for gathering data on information that changes over time, such feelings and moods.

Since the exploratory character of this inquiry and since I wanted to investigate the students' emotions further while they use the digital platforms of the HEO, I saw this method relevant for this study.

I considered the idea of using a feedback diary-type to maintain lower the amount of effort from participants. However, I decided to gather data with an elicitation type diary since I was aware that reaching out to the informants later could have been a challenge.

Moreover, due to time constraints for the data gathering and because it was the first time I used the method, I decided to keep things simple and gather data with a simple booklet that I will describe later.

6.3.2.Interview

An interview consists of a conversation and interaction between a researcher and an individual relevant to the research. Kahn & Cannell (1957 in Preece et al., 2015) define it as "a conversation with a purpose."

Interview is probably the most used method in qualitative research. The main reason is that all research methods include some form of interviewing (Crang and Cook, 2007). Furthermore, it can be generally considered as an efficient method since it is often possible to generate a large amount of data in a relatively short time with it (Crang and Cook, 2007).

It is possible to distinguish three types of interviews: structured, unstructured, and semi-structured. A structured interview has a strictly defined list of questions to be answered. Moreover, its questions are close-ended, which means they tend to be narrow and elicit specific answers from the interviewee. On the contrary, unstructured interviews involve more open-ended questions favoring a more spontaneous flow of the conversation (Preece et al., 2015).

Even if setting up an interview could seem a straightforward process, it is also true that this method has some aspects worth considering. Firstly, it is necessary to craft our questions according to the research questions and the objective of the research phase. Secondly, we must be aware of the fact that we may influence the answers of the interviewee. Thus, we have to be careful with how we pose questions and always respect and treat our informants well (Crang and Cook, 2007).

Lastly, Crang and Cook (2007) advise not to underestimate practical aspects of interviews and recommend being organized, respecting the schedules, and keeping care of the accessories you need to store the data.

6.4. Data analysis methods

Once that the period for data collection is over, data has to be analyzed. Regardless of the research methods chosen, the first step is to transfer the data to an electronic format. Afterward, it is necessary to choose from a suitable data analysis method and perform data analysis.

6.4.1. Document analysis

Document analysis is a qualitative data gathering analysis where documents are reviewed and evaluated. According to Bowen (2009), it is possible to use document analysis in multiple situations and stages of the research. The researcher points out five specific functions of documentary material: provide background information and historical insight, suggest some questions that need to be asked and situations that need to be observed, provide supplementary research data, provide a means of tracking change and development, and as a way to verify findings.

Often referred to in sociology as a secondary source of data (Myers, 1997), documents can be various, for example, newspapers, letters, maps, and charts.

Atkinson and Coffey (1997 in Bowen, 2009) define documents as 'social facts' that are produced, shared, and used in socially organized ways.

With document analysis, we try to understand and categorize the content of a document through multiple readings and reflections, writing notes, and summarize the content.

6.4.2. Systematic text condensation

Based on her research experience, Malterud (2012) proposes a structured process to analyze data in the form of text. To describe this process, she uses the laundry metaphor. She compares data analysis to sort clothes in the laundry. For example, clothes can be sorted after, color, type, or in many other ways.

Her process to systematically analyze text consists of multiple readings, looking for themes and label text. Afterward, the text has to be split and organized according to the themes and the identified labels.

This data analysis process was suitable for this research as it is very structured. As Malterud (2012) mentions, it is particularly valuable for novice researchers who do not have much experience with analysis. However, a disadvantage with this method is that this method's rigidity does not leave so much space for creativity, which can be an important aspect of research (Malterud, 2012).

To perform data analysis of the diary study and the interview I created a series of steps (attachment C), inspired by the model of Malterud (2012), which I follow to perform the analysis for my research.

6.5. Data gathering process

In this section, I describe how I performed the data gathering and how I used the research methods chosen.

The document analysis the very first insight into the research. Since the students mentioned that their emotional and mental states are important, I conducted a diary study, which is particularly suitable for observing emotions and exploring issues concerned with emotions. At the same time, I conducted two interviews, and later, I conducted several shorter interviews to get more information about students' use of the DLEs at the HEO.

Table 3 overview of the data gathering activities

Gathering method	Participants	Period	Data generated	Analysis method
Document analysis	10 students	Spring semester 2018	14 pages text	Taking notes + table

Diary study	8 students	Spring semester 2019	3 pages of transcription generated from 8 diaries (14 diaries delivered to students, 8 diaries returned)	Systematic text condensation
Interview	2 students	Spring semester 2019	13 pages of transcription generated from 2 int. x 45 min.	Systematic text condensation
Short interview	8 students	Autumn semester 2019	8 pages of transcription generated from 8 int. x 10 min.	Systematic text condensation

6.5.1. Documents

The documents consisted of written answers of an assignment that bachelor students of informatics fulfilled during one of their courses.

The questions asked were different, but the general topic was the experience of giving and getting different types of feedback in different situations through digital systems and universal design.

These documents were useful for getting the first insight into the domain and inspiring the next step of the research.

6.5.2. Diary study

The Diary study method was valuable for this research for three reasons: the first reason is that, as mentioned before, a diary is particularly suitable for gathering data about temporary and evolving phenomena as emotions of the students, phenomena I found interesting to explore further. Secondly, DLEs are used potentially all time of the day. Often for a brief time, making it challenging to observe how they are used in a real context. Therefore, I argue the Diary study being a reasonable trade-off to gather data give in this situation.

Participant recruitment

At the HEO, I was introduced to some of the teacher assistants who made it possible to contact their students.

The teaching assistants gave me the chance to present my research project to recruit some of their students for the diary study. It seems that students were hesitant and shy towards the project, and it was challenging to involve them in the study.

Maybe my non-perfect Norwegian accent played a role, influencing the choice of their participation negatively.

Look and feel

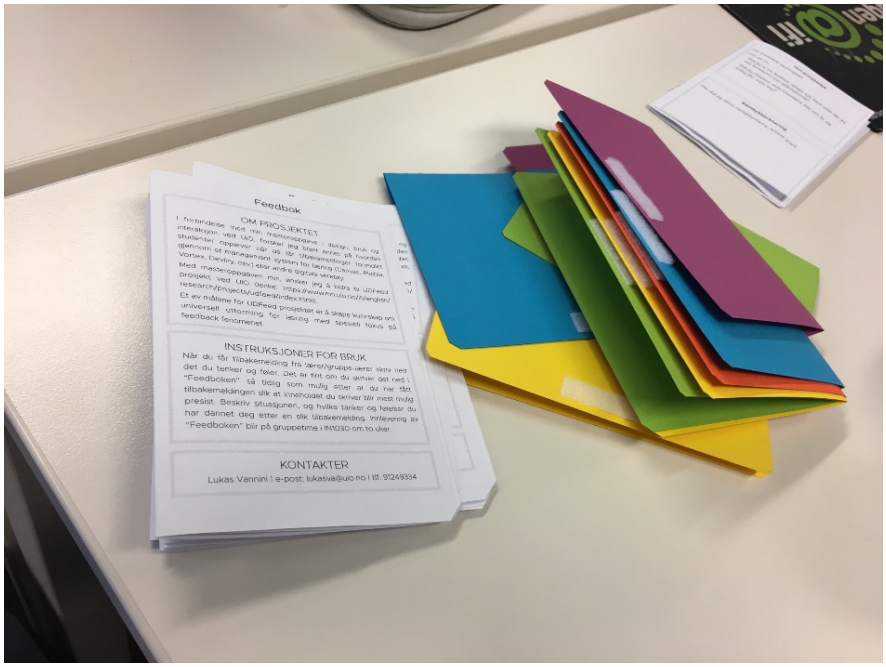

Figure 1 Diary study design of booklet

Figure 2 Diary study design of booklet b

The diary I designed was a simple booklet I assembled with paper, cardboard, and a Velcro-system I found in an office store. I designed a template for the internal pages via a program on my computer. On the first page of the diary, it is possible to find a project's presentation and my contacts, on the last page, the informed consent (attachment B) for data processing and privacy. In the other pages, there is a frame where participants could write about their own experiences with DLEs. The diary is quite small so that it could have been carried easily around by the students. It is not too small neither because, in that way, participants could have missed it. The format for the pages is 15cm x 10.5 cm, a fourth of a regular A4 sheet of paper, which allowed me to reduce waste from the cuttings. The cover is realized with colored cardboard, to give little esthetic touch and solidity to the booklet. Also, the booklet comes with a pencil firmly attached to it with Velcro, to facilitate data entry.

Figure 3 Diary study design of internal page

Structure and content

The students can fill seven pages describing their experience with DLEs briefly and on the last page with suggestions for improving the use of the method.

Generally, for a diary study, the recommended timeframe is between two and four weeks to fill in the diary. Given the situation and for practical reasons, the diary study lasts three weeks.

In these three weeks, participants were asked to write down notes and thoughts about how they feel when communicating online and offline with course instructors. I encouraged the students to write when occurrences manifest if possible, and write that information freely, without overthinking. The aim was not to charge students

with too much work to do and try to get more authentic and spontaneous data as possible.

Even if most communication is mediated through digital systems, I asked the participant to write their face-to-face communication experience in their diaries to have the possibility for later comparison.

During these three weeks, I also visited each group of students who participated in the study to ask if something was unclear and just to show my presence trying to motivate the students.

After the three weeks, I got back seven diaries of the 14 delivered, with 19 data entries. No students, unfortunately, offered their availability for a follow-up interview

6.5.3.Interview

To get a better and broader understanding of the learning environment at HEO, alongside the diary study, I conducted two semi-structured interviews with two students in informatics.

Choice of the method

I decided to perform two interviews because I was aware that the diary study could not have produced a large amount of data. Though, in order to get more information about the context and collect a more substantial amount of data in a relatively short time, I chose this method.

Participants

The participants of the interview where two students recruited at HEO.

Structure and content

I prepared a list of semi-structured questions (attachment D) about the general experience of the different DLEs adopted and if and how emotions could be influencing their use.

One interview was conducted inside a private room at the HEO, the other in the cantina area.

The duration of each interview was 40 minutes. I recorded the audio and transcribed the interviews. Also, I offered participants coffee and cake to make them more comfortable.

6.5.4. Short interviews

To gather more data on the DLEs, I performed eight short interviews with participants I recruited on the spot in the common area of the HEO. The duration of each interview was about 10 minutes.

Since in the two previous interviews, the participants were hesitant to talk when they were asked about their emotions, and hence I could not gather any more data on this aspect, I decided to focus solely on the DLEs in these interviews.

Choice of the method

At this point in the research, I needed more data to get more information on the DLEs student's experiences. Since it was not possible to find other students available

to a scheduled interview, I recruited eight participants on the spot in some of the common areas of the HEO.

Participants

The eight students recruited on the spot seemed to be positive and helpful with the interviews and much less hesitant than the one in the diary study previously performed.

Structure and content

To respect the participants, I decided to limit the duration of these interviews to about 10 min. The questions of this short interview aimed to gather information about issues the participants encounter while using the DLEs. The questions prepared were a mix of structured and semi-structured questions that are possible to look at in the guide (attachment E). The informants had the opportunity to type their answers into the iPad or through audio recording. I solicited oral responses for a more open discussion since, that way, it was possible to get more data. However, given the possibility of writing down the answer, I could still get some data from the participant who felt uncomfortable having an interview.

Also, I offered all participants a coffee and some chocolate during the interviews to keep them more comfortable favoring a more relaxed atmosphere.

6.6. Data analysis activities

In this paragraph, I will go through the data analysis execution for this research, where I describe how I used the methods introduced before.

6.6.1. Document analysis

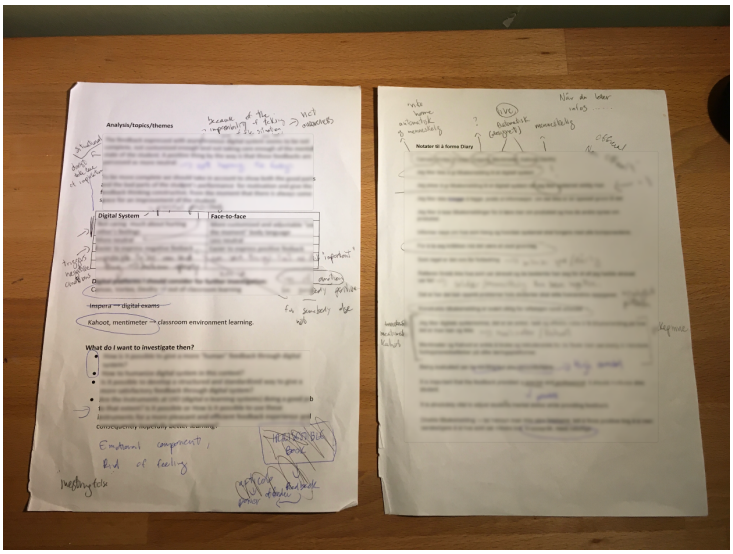

Figure 4 Document analysis process

The document analysis helped to create the first insight into the research's domain and to look for issues that could have been interesting to explore.

In this embryonic phase, the objective was also to get inspiration from the data. At first, I read the documents multiple times to grasp the general content of the documents. After these readings, I generated and noted down things that caught my attention.

Several participants claimed that students' emotional states were not taken into account when they communicate with the course instructors.

This degraded communication frustrates students who feel not understood and included. I found this issue interesting, though I generated a summary of the documents and a table where I grouped the aspects of communication through DLEs, which is problematic in students' opinions. Lastly, I wrote down some ideas and initial drafts for the questions for later interviews.

6.6.2. Diary study and interview

To analyze the data of the diary study and the two interviews, I followed these steps (attachment C) inspired by the systematic text condensation (STC) of Malterud (2012). I performed the analysis three times for each data gathering method. At the end of the third iteration, I identified three categories and seven subcategories from the diary. Also, I identified four categories and ten subcategories for the interview transcriptions.

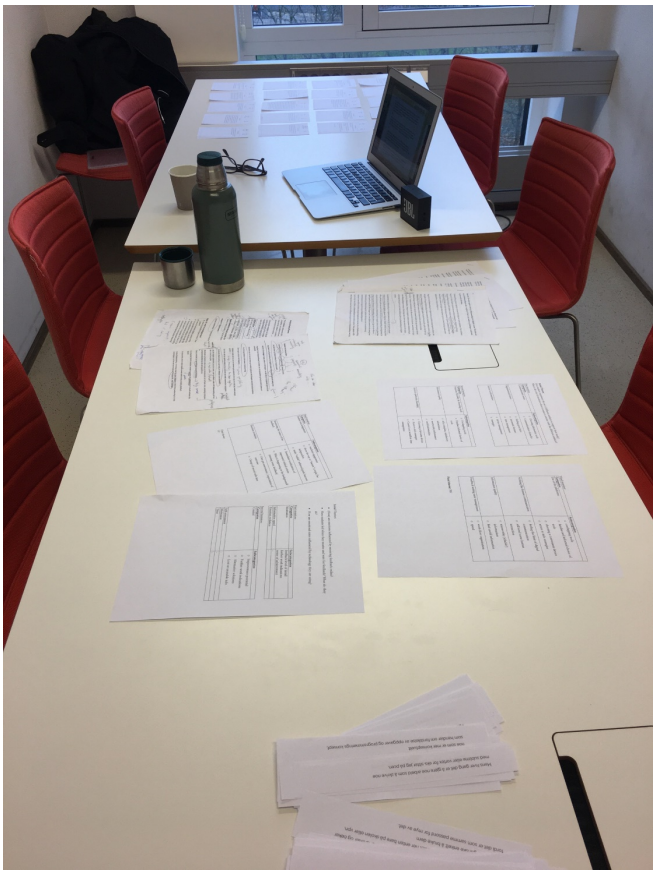

Figure 5 Data analysis

6.6.3. Short interviews

For the analysis, I also followed the same script inspired by the STC for the data analysis (attachment C). This time, since I achieved more confidence with this method, the coding process was slightly faster and more effective. I stored and organized all codes, categories, and quotations in a spreadsheet file, which also helped to keep the information tidy and have an overview of all data.

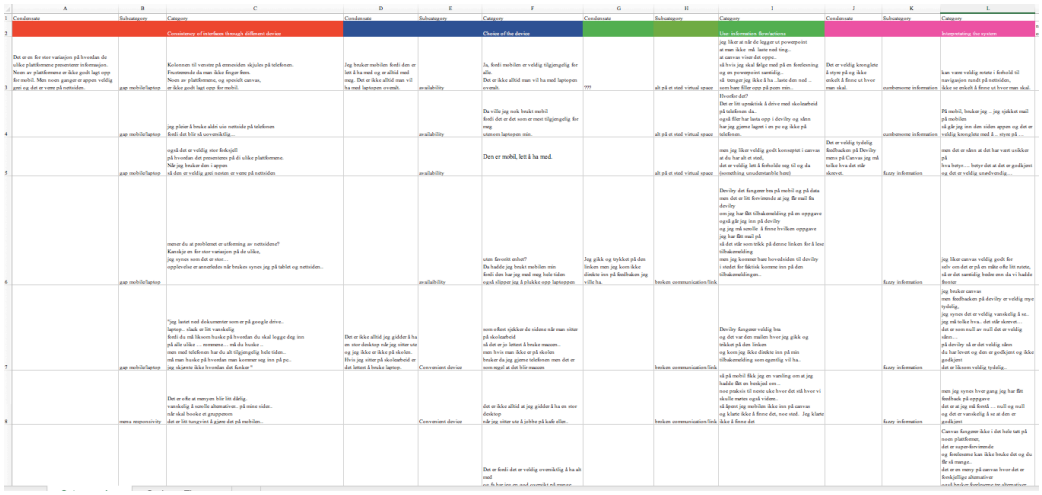

Figure 6 Data analysis categories

Lastly, I printed all thems codes categories and quotes. I cut the paper in stripes, which contained all single elements of the data analysis. I grouped the data into five categories. I found this step useful to create more confidence in the data, have an overview of all the data, and facilitate the writing of the findings, which I describe in the next chapter.

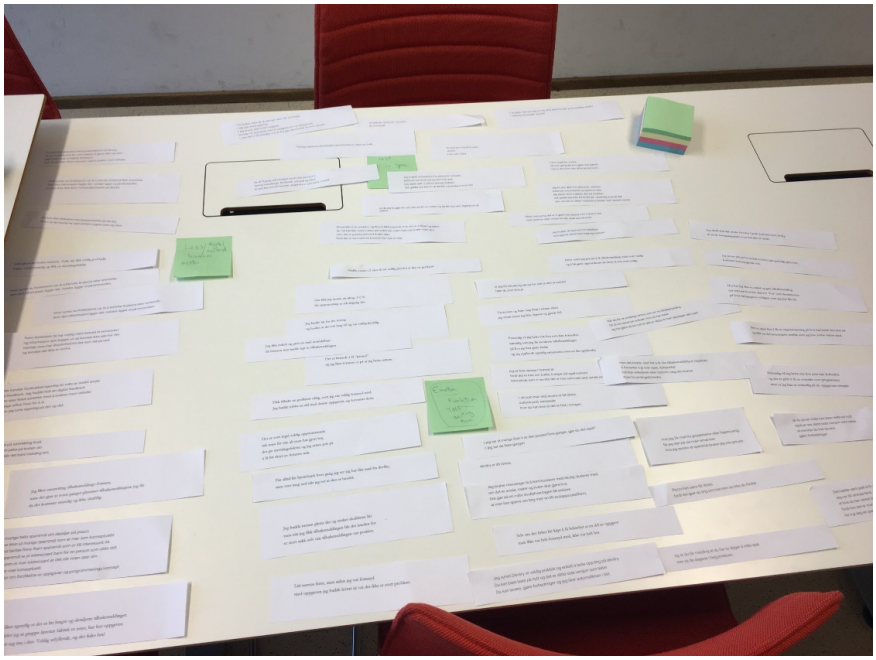

Figure 7 Data analysis b

6.7. Ethics and personal data

In this paragraph, I describe reflections over ethical aspects of this research, how I processed the data, and some possible bias from the users.

6.7.1. Informants

First of all, all informants, before they participated in the data gathering activities, signed informed consent (attachment A, B), which contained the aim of the project, informing them that they could stop their participation in any moment and how the data gathered is processed. Also, I have anonymized all data gathered to respect their privacy.

Secondly, I maintained a positive mindset during the interviews to maintain high motivation and engagement of participants. I have always been polite with participants and offered them coffee and something to eat to make them as comfortable as possible.

I decided to maintain the second round of interview short because I recruited the participant 'on the spot' at the HEO.

During the interviews, I paid attention to whether the informants were tired or just not in a good mood for participating so that I could suddenly shorten or quit the interview.

6.7.2. Personal data

Data gathered is personal data, and no sensitive data is involved. The audio recordings and transcriptions of the interviews and diary study were stored on my iPad and then transferred on my laptop and encrypted with professional encryption

software. Once the data was encrypted, it was transferred to external storage. The file audio and transcriptions were temporarily decrypted when I need to access the data. The audio was transcribed on my computer, with specialized transcription software provided to researchers and students by the HEO. The software consists of an audio player with dedicated functions to help with the transcription process. All transcriptions were printed in one copy and stored in a folder.

I was the only responsible who had direct contact with the data.

I took some photos of the transcribed data to include them in this thesis, which I made unrecognizable via software through a blur filter.

7. Findings

In this chapter, I will illustrate the data gathering findings, which include document analysis, a diary study, two interviews, and eight short interviews. Data describes the implications of the daily use of digital learning environments (DLE) adopted by the higher education organization (HEO).

I divided the findings into three sections. In the first section, I illustrate some aspects of the students' experience while using the DLEs. In the second, I describe the students' meanings about communicating with course instructors via DLE and their emotions.

7.1. The digital learning environments

The participants in this research are students at the HEO who use different DLEs as part of their studies.

The DLEs of the HEO, which were mentioned in the data-gathering activities are the official website, the official email platform, the official submission platform, the official learning platform, the official questions & answers platform, and the official chat platform.

A slightly different combination of DLEs is used in the different courses at the HEO. For example, the official chat platform and the official learning platform are not adopted in some courses.

Different courses employ slightly different combinations of DLEs, and also, the students can complement the DLEs provided by the HEO with other private DLEs.

The students of the HEO students access the DLEs from a different location at any time of the day: "… I use them everywhere: on the bus, at school, anywhere…" Moreover, the participants most often access DLEs separately for a short time. For example, check the subject page, if a teacher has answered to their email or check if the result for an assignment is available.

Some of the students mentioned that fewer DLEs would make it easier to maintain an overview of the information needed for the different subjects: "Fewer had made it clearer and less confusing as all subjects have different ways of using them."

Furthermore, some students mentioned that when the official learning platform is adopted it "…but I like the concept of [official learning platform] very much to have it all in one place, it is effortless to relate to…" However, other participants claimed they do not have any issue with using multiple DLEs.

Sometimes other non-official DLEs are used in addition to the official DLEs. For instance, a student mentioned that he/she uses often Facebook Messenger to communicate 'in am more relaxed way' with other students: "In a way, it makes studying life a little easier that one can ask for things with a slightly relaxed platform."

There is a unique user name and password to access all the official DLEs. Unique credentials simplify the access to the DLEs: "I think it is quite simple because there is the same password for many platforms."

However, one participant complained that, even though there is one password for all, it is still necessary to log in for each DLEs used: "...when you log into a platform, you don't necessarily log into another as well… so it's like you maybe log in four times. I think it is very irritating…"

In general, students use the DLEs with both their laptops and with their smartphones. However, many participants claimed that they are not satisfied accessing the DLEs with their smartphones.

Some of the students mentioned that they sometimes try to check information or answer an email from a teacher with their mobile, but then they feel the need to switch to their laptops. The problem mentioned is mostly because of a poorly designed interface, which makes the participants frustrated: "…I think it would have been wise with an app or another type of layout.", "…Some of the platforms, and especially [official learning platform], are not well designed for mobile…"

Several students claimed that it is often a problem with the different menus that are not appropriately designed for a smaller screen.: "…I think because most are optimized for PC, where you get a better overview… often the menu becomes bad on mobile..."

In general, the students have worse experience and have more difficulties when they use the DLEs on their smartphones.

Some of the DLEs are not well designed for mobile. However, the mobile version is sometimes very decent as the official chat platform, but it is worse on its website.

Some students claimed that the official website pages are confusing because of the overwhelming amount of information presented at the same time.

Moreover, the overwhelming amount of information is particularly problematic when accessing the pages with their smartphone: "the website is a little bad on mobile, I think finding links is very easy on the laptop, while so uniform on mobile and it doesn't look easy to get there.", "It seems that the menu is not adapted for mobile, and it is a confusing and terrible experience."

Also, several students claimed that the official email platform has an interface that presents too much information at the same time. Also, the chaotic interface is even

more problematic to understand on a smaller screen device: "There is a lot on the PC, and it's twisted on the phone."

7.1.1. Finding and understanding information

In general, the participants often claimed that the information on the DLEs is, in many cases, difficult to understand and to find.

Even though he/she likes the official learning platform in general, one participant finds information in this DLEs not tidy and confusing: "I like [official learning platform] very well even though it is a bit messy."

Several students mentioned that the information is presented in too many different ways by the teachers. Especially the official learning platform that, with its flexibility, gives the possibility to structure content very differently. Therefore, participants appear confused and find it difficult to understand and find the information according to the data: "All subjects use [official learning platform] differently, and all professors post things differently. So, it becomes difficult to navigate through.", "All teachers can design content as they prefer, and it becomes difficult to control.", "the professors post things differently, so it is difficult to know how to find things"

Moreover, some of the participants mentioned that the course instructors might not use the DLEs properly. Therefore they find the content not clear and confusing: "..not very clear, but this is because the lecturers have not to figure out how to use them", "... it's super confusing, and the teachers are not able to use it.".

Furthermore, one participant is confused and unsure which DLEs the course instructor is using for his course content: "Some lecturers have a very close relationship with the subject page and information that is posted, while others may not have it. Maybe someone has dispatched from what is on the web and maybe it is not that good... you think how much the lecturers were clever to refer to [official

Q&A platform] or topic page. If the information is there and notes are posted on the subject page, for example…" The student fears that a teacher may not predictably use the DLEs, causing him/her to worry about whether he/she can reach all the information needed for a course.

To support cooperation among students and course instructors, the HEO employs in some of the subjects an official questions & answers platform.

A student mentioned that the official Q&A platform is useful because it can be a valuable resource when looking for information about various subjects: "Nice to retrieve the information you need. Maybe someone else has already asked it."

However, another student instead feels ashamed when he/she publishes a question on the official Q&A platform. Show to other people that he/she did not understand something is stressful. "[official Q&A platform] can be a little stressful because there you ask things about something that you don't understand."

Whereas some of the students enjoy and find useful information on the official Q&A platform, a student argues that it is sometimes frustrating to find relevant information on this platform: "There are many stupid questions about details, and not many questions which are more like conceptual… You have to look for questions that are a bit interesting. Many questions are interesting only to a person who asked it. They are specific about something you find for yourself. However, it is more interesting when someone asks about something more conceptual about understanding assignments and programming concepts."

The different points of view and interests make it difficult to share a common ground where the students can exchange more conceptual information that could be useful for a more significant number of students.

7.1.2. . DLEs for assessment

Two DLEs are employed by the HEO to assess students during the semester. The official submission platform and the official learning environment. Whereas the first one is committed to assessment, the second is instead a multi-features learning platform.

In general, the participants appreciate the official submission platform. They claim that the DLE is straightforward to use, has a consistent presentation of information and useful automatic features: "It's very nice that you find consistent information on [official submission platform].", "I find it very convenient and easy to upload stuff on [official submission platform]… if you.. it's straightforward that you can just reload in a way also the always latest version counts…"

Moreover, one student mentioned that when she/he gets assessment feedback via the official submission platform, this is very clear and straightforward to read and understand. On the contrary, on the official learning platform, it takes and effort to interpret and understand the feedback message: "It is clear the feedback on [official submission platform] while on [official learning platform] I always have to interpret what it says."

7.2. Digital mediated assessment and emotions

In this paragraph, I describe the implications of getting assessment via digital systems and the students' emotions that emerged from the data.

I the first section I describe the perspectives and meanings of the students on digital mediated assessment. In the second, the emotions of the students towards assessment.

7.2.1. Face to face vs. digital mediated assessment

In general, the students claimed that getting feedback via DLE is a less satisfying experience than getting a feedback face to face. In contrast, few of them also underlined some advantages of this form of being assessed.

The absence of body language and the loss of emotions create obstacles in creating a constructive two-way discussion. Furthermore, the difficulty in creating empathy is crucial for the students and in many cases, frustrates them because they feel misunderstood and not included in the communication.

Body language

The general student's perspective of face-to-face communication is that physical presence and body language make assessment a more valuable resource for their development in the studies than the communication mediated via a digital platform.

Body language and things that are "non-said" are claimed essential by several students: "One of the most central parts of communication between two people is often the 'unspoken,' which disappears to a considerable extent in digital feedback."

Another participant tells that body language makes the assessment a more rewarding experience because it is easier to engage a proper communication with the course instructor: "The benefits of direct feedback are that communication is two-way direct. You have eye contact and facial expressions that make it possible to pick up things that may not be expressed in words. Also, direct feedback to me is what feels most natural, and in return, the most rewarding."

The majority of the participant of this study, when they get assessed via a digital platform, perceive that the communication with the teachers is somewhat degraded. Instead, in face-to-face assessment, they argue that communication is more constructive, reflective, and, therefore, a better learning experience: "Face-to-face feedback is vital. Constructive feedback is essential for reflecting on the work that has been done and for the road ahead. I experience this as a positive part of any work. I consider such feedback as valuable and take many lessons from it."

Moreover, a student claimed that in digital mediated assessment, even if it is convenient for some aspects, crucial information is lost: "I like these digital systems very much. It is a simple, fast, and effective way to get feedback on what you can and can't do. Then you can take in the information given and work on the problem areas. At the same time, one loses the complementary feedback that one would, for example, receive from a student group teacher or teacher assistant. This is also useful criticism of work, I get a more thorough explanation of what I have done right and wrong, and what I should be working on more."

Engaging a constructive discussion

Another issue that the participant mentioned is that when they are assessed, they find it challenging to engage a constructive, two-way discussion with the teachers. Instead, some of them realize that they are often involved in more one-way directed communication.

In general, the students tell that they prefer to engage in face-to-face discussions with the teachers to learn more and have a more valuable learning experience. "There is less 'space' for 'chatting' than there is during direct feedback." Moreover, another student claimed that conversation with teachers tends to be one way directed with digital platforms and he/she does not feel included in the assessment process when the conversation "What makes me feel included in such feedback is dialogue. If there is no dialogue and the conversation is one-way, then I would probably feel excluded."

On the other hand, in face-to-face communication, as another student mentioned, it is easier to feel involved in the assessment process. "Another benefit of providing direct feedback may be that there is a dialogue between us so that the recipient receives feedback for more detailed feedback and feels more involved in it."

The majority of students appreciate face to face communication for assessment better. However, one student mentioned that he/she would probably prefer a mix of both digital mediated and face-to-face feedback. "I might have preferred a mix of both… that you had digital feedback that said passed or failed and also talk with the supervisor.

Also, a student mentioned that in a face to face assessment, he/she does not have enough time to formulate a reply to the course instructors. In contrast, in a discussion supported via DLE, he/she has more time to reflect and reply properly: "However, the difficulty with this type of feedback is that unlike digital feedback, one does not get as good at processing the feedback before giving a possible response."

Empathy

Another aspect of mediated communication mentioned in the data is related to empathy. In general, students claimed that receiving assessment using digital platforms involves a lack of empathy, leading to misunderstandings and feelings of exclusion. Several students mentioned that it is essential to consider the individual characteristics and the feelings of students. Most of the students consider in fact that the teachers must have some awareness about the status and conditions of the students to give good feedback: "Before interacting with the person, it is advisable to consider the feelings of the person, how the person will receive the feedback and the consequences of the interaction."

Moreover, a student pointed out that when feedback is given face-to-face, it is more natural to empathize: "When giving feedback directly to another person, one sees the

reactions the receiver has to feedback, taking into account that one does not want to hurt the other person's feelings more than if one does not see the other person."

Besides, a participant claimed that in case of sensitive mental states or mental illnesses, to take into consideration the feelings of the student who receives feedback is vital. "The non-sensitive character of the content of the feedback is important for the students' mental states. As the variety of mental illnesses is considered a disability, it is vital to adjust student's mental states while providing feedback. It should be both accessible and understandable and non-provocative of unpleasant feelings in case of sensitive mental states".

Some participants claimed that lack of empathy when using digital platforms make students feel misunderstood by the course instructors.

For instance, a student feels uncomfortable because the teacher did not put enough effort into an assessment online. According to the participant, the teacher rejected an assignment without trying hard enough to understand the student himself/herself: "In the negative feedback, it said that I had done everything wrong because I had used a procedure my 'brother' did not understand. However, instead of writing this, he wrote that it was wrong. The method I had used was based on my understanding of the task, and I did my very best to share that understanding in the comments. On the other hand, the teacher did not understand what was written, and instead of trying to understand, he decided that everything I had done was wrong. " Furthermore, another student claimed that the teacher should understand the characteristics of the student. According to the student, whereas the teacher does not know the student at all, he/she will not be able to generate a valuable critic of the assignment: "Getting feedback, both good and constructive, is a good thing. However, to accept this criticism or praise, there must be some basis, I think. For example, I can say that Harald cannot draw, but if I have never seen Harald draw, this criticism does not add much value."

As another participant claims, in face-to-face communication, the possibility of misunderstanding is reduced because the student has the chance to answer and reply immediately: "One advantage of giving feedback face-to-face is that the person receiving the feedback has the opportunity to answer for themselves and clear up any misunderstandings." However, face-to-face feedback is also subject to misunderstanding.

In contrast, for one participant, who admits that is shy, a mediated by technology feedback is better: "Personally, using a digital system works best because when you talk to someone face-to-face, there is always a bit of emotion. Not everyone is good in-person interactions, everyone is different, and some people like me are shyer in person."

Objectivity

Another difference between assessment via digital platform and face to face mentioned by the students is that when the assessment is online, the mediated feedback is perceived by the students as more precise, thoughtful and objective.

On the contrary, the face-to-face assessment implies bias at the expense of the objectivity of the feedback.

A participant claimed that feedback mediated by DLEs is the best option because the teachers have more time to formulate and think about their assessment messages: "To me, passing feedback through a digital system to another person while in a learning situation is the best method to do so. When you write something, you are thinking more about what you say. In this way, you can make the feedback clear and not confuse the person getting the feedback."

On the contrary, feedback given face to face is less objective: "Feedback you give directly to another person means to me that you talk face to face about something and highlight positive and negative aspects of the feedback given in a more 'cautious' way."

Also, one of the participants claimed that it is harder to give a negative critic to another student face-to-face: "One draws more positive aspects of what is being evaluated and tries to be as constructive as possible. When giving direct feedback, it is very easy to find positive things to say. However, it can be harder to say what was less good, and one can be a bit dishonest not to be uncomfortable, which can be negative for the person receiving the feedback.",

7.2.2. Emotions

This paragraph illustrates the findings from the diary study. The data revealed an insight into students' emotional states when they get feedback from the course instructor both face to face and via DLEs.

In general, when the participants receive a feedback, they feel a mix of positive and negative emotions. As a student mention in fact: "being evaluated can be exciting but also uncomfortable."

Negative and positive emotions follow one another during the assessment process.

Several participants mentioned they are nervous at the moment they receive feedback while they feel more positive afterward: "Was nervous and felt stupid at first since I knew, in reality, a lot about what I didn't understand and did wrong.", "We went through the code together. I Was nervous at first since I knew a lot was wrong. I felt a bit dumb since there was plenty I didn't understand I did wrong. I felt I got excellent help", "I always get little heart palpitations every time I see I've received mail from [official submission platform], but I calm down when I see it's passed."

Also, another student is worried and therefore experience negative emotions before submitting the assignment, while afterward he/she feels relieved. "A little nervous at

first, but since I was satisfied with the assignment, I had delivered, it was not a big problem."

Feedback

The quality of the feedback message plays a significant role in the student's emotions according to data.

Several participants filled the diary with the characteristics of the feedback message, which trigger positive emotions. In general, the students are satisfied when the feedback is long, constructive, and contains comments on both good and bad parts of the student performance.

Several students mentioned that they feel more positive when receiving a longer and detailed feedback text: "Have received quite detailed feedback, which feels good. It seems the teaching assistants are accurate.", "I like a lot that there is a bit longer feedback, then I feel that the course instructor has read the assignment and got into it.", "... it also seems very nice how the teaching assistant thoroughly explains what I did wrong so that I can look properly through the assignment afterward.", "Very exhaustive, and it was good!".

Extensive, long feedback is perceived as positive because it contains more information useful for the students. Some of them also mentioned that receiving more extensive feedback makes them aware that course instructors are putting some effort into understanding them, which also triggers positive emotions in the students.

When the feedback consists of a short message is, in general, less appreciated by students, "Here, I have received simple and straightforward feedback where the course instructor has just written 'good' as a comment on every part of the assignment that I have been completed. This was fine so far, but I might wish the

cousin* had come up with other methods that might be better, or somehow deepened the feedback."

Another characteristic of feedback that triggers positive emotions mentioned by several students is that has to be constructive.

For a student, feedback should always include some form of suggestion for improvement. In his/her opinion, no result is entirely perfect, and it is still usually possible to learn more from a single assignment: "...I was happy with the result, but in the end, there is a lot that could be improved, and it is not so that a "passed" result is perfect. There is usually room for improvement." Furthermore, other students claimed that receiving feedback is a more pleasuring experience when they receive criticism or indications about what it can be done better: "The positive feedback feels good itself, and at the same time, I get specific information on what I can do better.", "I got some constructive criticism that I can work in the future with, and I experienced the situation as a nice experience."

When the course instructors underline both positive and negative aspects of the student's performance in its feedback, students generally feel positive and motivated: "Then it was normal to pick up not on everything wrong but also point out good things. In my case, this provided motivation, and I think there is something to consider when giving feedback to others through digital media", "...It is usually very encouraging when you get to know everything you have done well. It gives a sense of achievement."

Two students mentioned that they feel less worried when the waiting time of feedback is the shortest possible: "I appreciate getting feedback as quickly as possible and being aware of this as soon as possible.". Quicker feedback makes it easier to

organize studies: "If you have failed and need to do everything again, it is important to discover it quickly.".

8. Discussion

This research has explored the use of technology of students in higher education through document analysis, a diary study, and several interviews, creating an understanding of some of the perspectives of the students concerned with these technologies.

In general, students' use of the digital learning environment is sometimes confusing, and the information shared is often cluttered. Students are confused about where to get information and often find it challenging to interpret the information online due to the multiple ways the DLE present it. Furthermore, the students feel that assessment through DLE makes their learning experience weaker due to the difficulty of engaging in constructive communication.

In this chapter, I will discuss my main findings within a CSCW perspective, especially with the CIS theoretical construct.

I have structured the chapter following my two research questions. I will first use the seven CIS parameters to describe and analyze the students' use of technology. After that, I discuss students' assessment via DLEs, especially relating to other relevant previous research on CIS and emotions.

8.1. How do students use digital learning environments in higher education?

In the last decades, digitalization has come across and pervaded almost all aspects of our lives. Students' everyday life and learning is no exception as today use of technology have become implicit to most of these activities.

From a CSCW perspective, the activities performed by course instructors and students can be seen as their "work" which is mutually dependent. Students rely on course instructors work in order the proceed with their studies while the course instructors to "get their job done" have to some extent rely on the issues and outcomes of the students.

The "work" of students and course instructors also resemble the work in the community of practices, which are "learning and working environment(s) in which most people work has important implications for the kinds of shared spaces that we might wish to develop for particular purposes." (Lave & Wenger, 1991 in Bannon and Bødker, 1997, p. 84)

An essential part of their work consists of exchanging information and communicating with each other with the help of the DLEs. These interactions, content creations, and their representations on DLEs constitute the higher education organization's common information space.

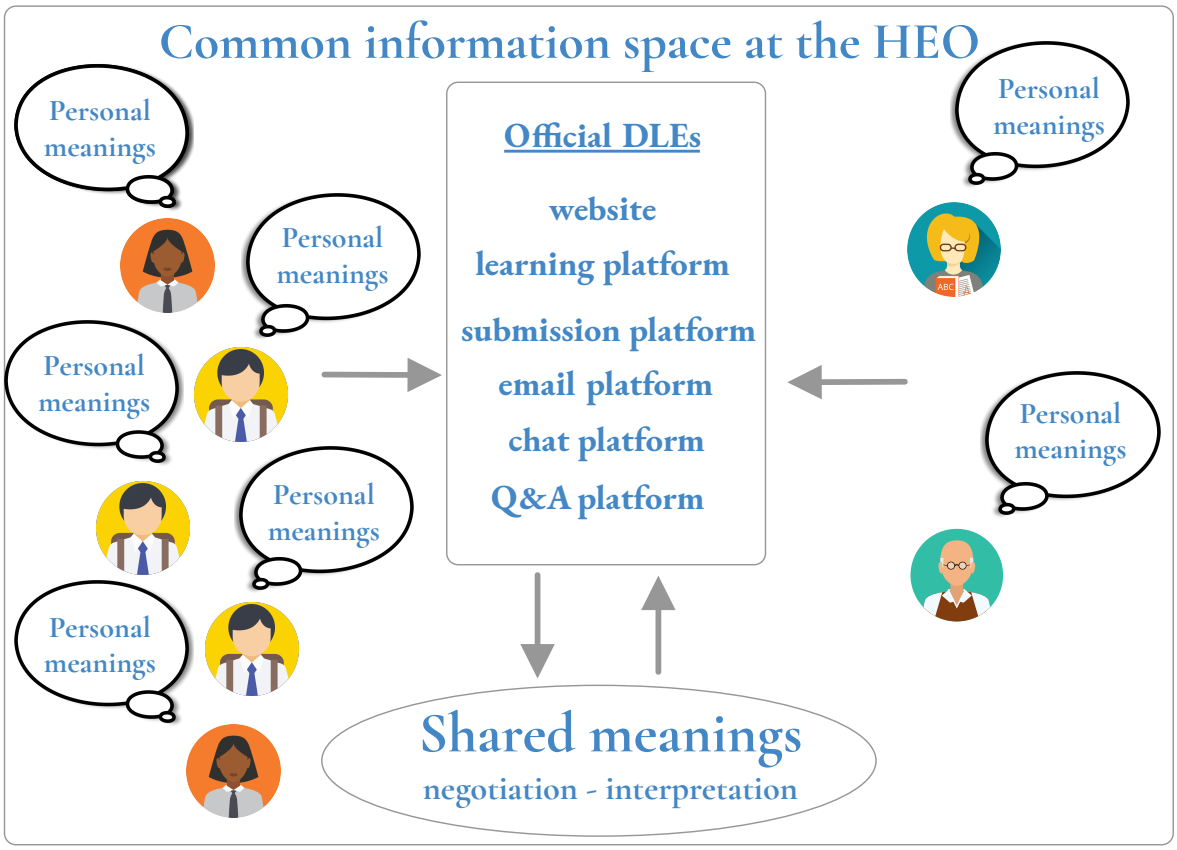

Figure 8 Common information space of the HEO

The CIS is constituted by the students and course instructors who actively share information through a negotiation and interpretation process of the shared meanings they access through the DLEs. Moreover, another element of the CIS is the personal meaning of each participant that it is just in the participant head (Schmidt & Bannon, 1992).

Bossen provides seven parameters that characterize CIS, which I argue an excellent tool to discuss my findings and answer to my first research question.

Bossen (2002), while researching on how artifacts in hospitals support communication, identified seven parameters which are useful to characterize common information spaces. These parameters are the degree of distribution, the multiplicity of web significance, the level of articulation work, the multiplicity and

intensity of the means of communication, the web of artifacts, immaterial mechanism of interaction, and the need for precision and promptness. Following, I will discuss shed to light my main findings concerning these parameters.

Students access the common information space with their laptops and smartphones in different places within the higher organization building, such as when they are at the library or during classes and outside of the building, for example: at home, in coffee shops, or on public transportation. With the nowadays ubiquitous use of smartphones and mobile networks, DLEs are in practice accessible from everywhere and from the data do not emerge the use of other non-digital artifacts that support the common information space.

This tendency to use technology in mobility rather than on a more located or stationary device and the use of multiple devices is a known phenomenon, studied respectively by Bellotti and Bly (1996) and Dearman and Pierce (2008).

In general, students have several face-to-face meetings with other students and course instructors. However, data shows that sometimes students and some of the course instructors do never meet in person, probably because, in some courses, the large number of students requires extra course assistants with whom the students have limited direct contact. I argue that the degree of distribution of the CIS can be considered locally distributed as the access to DLEs, though characterized by mobility, revolves mostly in the nearby building of the education organization.

The multiplicity of the webs significance, the second parameter, is given by the number of characteristics, perspectives, and specializations of the participants, which the CIS accommodates. Concerning the CIS for this study, we consider that students and course instructors with different backgrounds, degrees of literacy, and skills in using the DLEs contribute to this multiplicity.

Some of the participants complained that course instructors do not use the DLEs properly, making it difficult for them to find information and interpret the material published on the DLEs and improve their skills with DLEs.

I argue that this happens because most DLEs are flexible tools that can be used and interpreted in different ways. Since the higher education organization does not recommend or support any standard way to operate with DLEs, this may result in an inconsistent presentation of information among different courses, which can frustrate students who have to understand different ways to structure information.

In this thesis, the interaction between course instructors and students is seen as cooperation through sharing information and communicating through different technologies, which are the DLEs. This cooperation involves a certain level of articulation work, which is the third parameter. The articulation work in CSCW is the "supra type" of work (Strauss, 1988) which cooperative work involves. I argue that secondary order articulation work emerged from data, whereas participants did not mention primary order articulation work.

Participants have already been students and have probably used some DLEs previously. Hence, they have already enough skills to use them independently and though no relevant preparatory activities, such as training and courses, are needed.

However, since some of the participants complained that the course instructors are not able to use the DLEs properly, it should be examined more in depth if some primary articulation work is necessary in form of training with DLEs for the course instructors.

Furthermore, other research on DLEs (Saplacan, 2020b) indicates that international student, unlike local students, does not possess the same skills with DLEs. The participants of that research claimed that in their countries, the DLEs adopted are different or employed differently so that they would prefer to have some form of training for being more confident with them.

The secondary order articulation work, which emerged from the findings instead, is concerned with two main issues: one is related to information which often is difficult to understand, the other about the lack of empathy which communication through DLEs in some circumstances implies. I will discuss the former in this paragraph and the latter the next paragraph which is dedicated to emotional aspects of the use of the DLEs.

As mentioned, on one side, the participants do not express difficulty with using the DLEs. On the other, they claimed that the information they get through DLE is often challenging to understand. Students are frustrated because of the continuous effort they do in interpreting the multiple ways content is presented, wishing it more comprehensible and available more straight away. The data indicate that one of the reasons for this issue is the many possibilities the course instructors have to create their content.

Several students claimed that all the course instructors use DLEs differently and for each different course

Another reason mentioned often is also poorly designed interfaces of the DLEs especially when it comes to the mobile version. Several students claimed a lack of consistency in the use and presentation of information on the platforms when used through different devices with different screen sizes as laptops and smartphones.

Hence, these different ways the information is presented constitutes an extra effort that could influence the students' workflow. I argue this extra effort to be secondary order articulation work.

One participant instead expresses his/her concern about whether the information he/she is looking for is correct, updated, and where, or rather in which DLE, the course instructor has published it. He/ she is conscious of the fact that maybe the course instructor prioritizes one DLE and therefore keeps information updated just on that DLE. This wondering and looking across the different DLEs for the correct

information constitutes extra articulation work. Similarly, in other research on DLE in higher education, it has been observed that sharing information across multiple DLEs causes a fragmented information awareness problem, which augments the students' workload and, therefore, articulation work.

Defragmented information awareness is considered "a sense of the presence of the information of users in the context" (Saplacan et al., 2020). If this sense is too much or too little, then more articulation work is needed for the student.

In my view, these two issues can be addressed with a more structured and standardized use of the DLEs organizing both a consistent presentation of the information and which DLEs are used for specific content. These organizational activities can be seen as primary articulation work performed to tame the secondary articulation work improving workflow of the students.

As Oskarsen (2018) argues in her study about robots in hospitals, secondary articulation work can often be reduced with adjustments to primary articulation work, optimizing the workload.

Another possibility to address the issue caused by the content being presented in too many different ways is to consider the openness of the CIS (Bannon and Bødker, 1997). A slightly more open CIS could allow students to reorganize and rearrange the content as they prefer.

The fourth parameter is concerned with the intensity of the means of communication. In the view of Bossen (2002), the most intense mean of communication is face to face communication, which involves all body language and other contextual elements, for example, visual, audio, and gestural details. The type of communication that is carried through DLEs textual, often in the form of short messages of text. It could be argued that with the spread use of smartphones and laptop computer and their potential the DLEs could take advance of the possibility

of more fruitful, multimodal communication, supporting other communication channels as audio and video.

Several students claimed that communication with course instructors when they are assessed for an assignment via DLEs lacks essential elements such as body language and other contextual clues to establish better communication and empathy. Students would prefer, in this context, the "richer" face to face communication rather than "poorer" digital communication. The data indicate that in this context, communication via DLEs leads to a more frustrating experience, less inclusive, and the learning potential that students perceive is weakened. Contrarily, students claimed that through assessment face to face, they have more possibilities to express themselves and hence learn better, giving them a more fulfilling and satisfactory learning experience.

The CIS of the higher education organization encompasses different artifacts in this thesis, the DLEs. The main official DLEs are a learning platform, an email platform, a chat platform, a Q&A platform, a submission platform, and the main website. These DLEs, despite they are distinct systems are accessible with a unique user name and password. Also, students use different non-official artifacts for communication, which concur with the CIS.

Course instructors chose different combination of DLEs for their courses. Furthermore, they employ DLEs differently since they have a certain degree of freedom to generate the content because there is no standard or established way to use DLEs in the HEO.

Most of the DLEs are multipurpose systems which offer different features. For this reason, some functionalities of the different DLEs can overlap. For example, assessment feedback can be used either by the official learning platform, which has included the functionality for assessment or the official submission platform.

The immaterial mechanisms of interaction, which is the sixth parameter (Bossen, 2002), are the activities which concur to the CIS but do not involve DLEs. These interactions can include face to face meetings, habits of the participants, and implicit rules of the organization.

Since HE students have been previously a student in high schools and therefore a continuation of high school education Students who attend higher education courses has previously been students in high school. Therefore, I argue that some of their expectations influence them. They expect to attend lectures, to do, and get support for assignments and have exams at the end of the semester. Furthermore, it is nowadays implicit that in order to be a student, you will employ some DLEs.

Even though some of the support to students is given by course instructors face to face during lectures. I also argue that these interactions and interactions through DLEs are woven.

The need for precision and promptness is the seventh parameter concerned with how much accuracy and precision is needed in the CIS.

An example of CIS where total precision is needed is safety-critical operation (Bossen, 2002) as in-flight air control or power station control (Bannon and Bødker, 1997). Even though Higher education is not a critical safety environment, I argue that if we are concerned with the quality of education, some precision and promptness should be considered.

From data emerged that students often find information on DLEs unclear, difficult to interpret, and understand. As mentioned before, course instructors have individual freedom in presenting content and the effort to understand different content presentations, leading to frustration for the students.

Moreover, from data emerge, participants wish more accurate feedback from course instructors when they are assessed through DLEs and indicate the time necessary to receive that feedback to organize their later study session better.

8.2. What are the implications of being assessed via digital learning environments?

When I first read the documents for the data gathering, one thing caught my attention. Several students were not satisfied of the quality of the communication online with the course instructors when they are assessed via DLEs. The students claimed to consider their emotional states essential when they are assessed and that using DLEs this issue is overlooked. In the students view the lack of empathy and support of emotion is an obstacle for achieving a meaningful learning experience.

Therefore, I got interested in the emotional aspects of the use of the DLEs. From the data emerged that students do not find satisfactory the support of their emotional status when they use the DLEs for their assessment.

These emotional aspects that emerged from do not characterize the entire all the CIS but rather a sub information space within the CIS. Therefore, I will describe a possible subdivision of the CIS to look closer at this sub-information space. Further, discussing the findings though the concept of openness and closure (Bannon and Bødker, 1997) of the CIS and the related work on emotions and articulation work.

My findings indicate two main concerns of the students: the difficulty of engaging a satisfactory, fruitful discussion and lack of body language and lack of empathy and support for emotions. I will discuss the former through openness and closure of a CIS concept from Bannon and Bødker (1997) the latter through articulation work and emotions.

8.2.1. The sub information space for assessment

Even though Bossen (2002) consider one CIS for a context of use, for example, a hospital, Zhang et. Al (2017) claimed it is more realistic to think common information spaces are constituted by multiple sub common information spaces interacting and influencing each other.

I argue that within the common space of the HEO it can be distinguished sub-common information spaces in different ways.

From my point of view, I distinguish four different common information spaces according to the specific type of information the DLEs support. From the data emerged in fact, four primary need for communication and information which are: looking for information about courses, communication with course instructor about the evaluation of assignments, communication-related to a course which takes place during the semester and cooperative learning.

These four CISs are supported by a combination of DLEs I illustrate in the following table.

Table 3 sub information spaces of the HEO

CIS	**DLEs**
Information on subjects and assignments details	Official website Official learning platform
Ongoing communication for courses	Official email platform Official website Official learning platform Official chat platform Non-official platforms

Help for assignments	Official questions and answers platform
Assessment of assignments	Official learning platform Official submission platform

In addition to the multiplicity, Zhang et al. contribute to the CIS concept with the levels of a CIS. The researchers argue that a CIS has three-level related to how information is shared, which are personal, local common. However, as Vassilakopoulo et al. (2019) claimed in their research on CIS in hospitals, the distinction between these levels is in the context observed not neat and sometimes is more appropriate to define a CIS as a hybrid one.

Concerning the CISs of the HE organization that is the context for this study, I agree with the view of Saplacan (2020a) who researching DLEs use in HE, claimed that CIS in such context can be considered hybrid level (Saplacan et al., 2020).

Considering the four CIS for this research, I argue that they are a mix of local and common. The DLEs consent to establish both private communication and group communication as well as private communication that can eventually be shared with others.

Openness & closure

Bannon and Bødker (1997) underline the CIS dialectic nature and one of its crucial aspects: its openness and closure.

For the researchers a CIS is both open and close. On one side it is possible to interact with a certain degree of openness the CIS participating to the constructions of the shared meanings. On the other, it must be defined a degree of closure, that is a limit to this participation.

From the data emerge that students feel not able to engage a constructive discussion with the course instructors through DLEs for assessment, and therefore feel not well understood. Moreover, they claimed that they could achieve a better learning experience and learn more through discussion. Instead, not being able to discuss appropriately make the learning experience less valuable, and nonetheless, they feel excluded from learning. I argue students claiming not being able to engage a constructive and fulfilling discussion on the CIS is a problem concerned with openness and closure.

Openness and closure in the assessment are problematic because, on one side, the course assistants have to be unmistakable while evaluating students. On the other, the students want the possibility to express their thoughts at best and have the possibility to clarify their doubts and learn more.

This concern is mostly a pedagogical concern which I cannot address in this study. However, I argue that it is important to consider the degree of openness and closure of CIS could at least facilitate students feel included. As other research has shown, it is possible to make students feel included through the openness of a CIS

Articulation work: supporting emotions

From the data emerge, the negotiation of the shared meaning in the CIS for assessment is particularly vulnerable to students' emotional states.

In the Schmidt and Bannon foundational paper on CSCW, the CIS involves some active interpretation and negotiation work done by its users. The effort to coordinate this active interpretation in the CIS is seen as articulation work.

From the data emerged some of the emotional aspects and implications of the student which I categorize, according to the three level of cognitive processing of the emotions of Norman (2004).

Table 4 Students' emotions on the three levels of cognitive processing of the emotions (Norman, 2004)

3. level **Reflective**	Document analysis. Negative emotional states caused by feeling excluded and misunderstood
2. level **Behavioral**	Document analysis, interview, diary study Negative emotional states caused by not being able to empathize, express themselves in a satisfactory way, difficult to engage in a constructive two-way discussion.
1. level **Visceral**	Diary. Alternating positive and negative emotions caused by waiting for or looking at a feedback from the course instructors.

I argue the main hindrance to the interpretation of information that emerged from data when it comes to assessment via DLEs is the lack of empathy, which causes misunderstandings and negative emotions for the students at the behavioral level.

Several participants mentioned that when they are assessed via digital tools, they are often unsatisfied because they find communication for assessing missing body language and other critical contextual elements of face-to-face communication.

Moreover, these elements are essential factors that influence the perceived value for students learning and make them feel more included in the higher education learning environment. On the contrary, students feel excluded and misunderstood because of the difficulty of creating enough empathy online.

Building empathy is a well-known Achille's heel of digital communication (Calvo and Peters, 2014). Moreover, I argue that when we are evaluated, this already delicate emotional context eventually accentuates the issue.

Lack of empathy frustrates the students, causing them negative emotions, which interferes with the interpretation of meanings and negatively affects the premises for a positive learning experience. Several authors support the idea that positive emotions constitute a prerequisite that facilitates learning (Calvo and Peters, 2014; Norman, 2004).

Similarly, in research (Beyene et al., 2009) on distributed work, it supports the idea that the lack of empathy between co-workers caused by digital communication negatively influences their work flow.

I argue that supporting the students' emotions to create more empathy in communication through DLEs can be seen as articulation work to facilitate the interpretation of meanings and negotiation, reducing misunderstandings and negative emotions. Furthermore, create awareness about respect and understanding of each other's emotions, mental states, and feelings facilitate inclusion and nonetheless, support better learning.

Facilitating this articulation work can be a way to approach an improved design for a more fulfilling and inclusive learning experience.

9. Conclusion

This study aims to shed light on the implications and perspectives of students' use of digital learning environments in higher education. The data gathering for this study has been performed at a higher education organization in Norway. The participants of this study are students at the HEO who have been involved through a diary study, ten semi-structured interviews, and a document analysis. The understanding of the phenomena of interest has been explored through two research questions. The first aim is to explore the use of the different DLE unfolds in practice. The second investigates aspects of digitally mediated communication between students of course instructors of the HEO.

I try to answer these two research questions with the help of the main findings discussed through the lens of the common information space, a theoretical construct of the Computer-Supported Cooperative Work research field.

9.1. How do students use digital learning environments in higher education?

At first sight, students are comfortable using the different DLEs of the HEO. There is no evidence of significant problems while using them. Students have previous experience with similar systems, and also, being official digital systems adopted by the HEO, these DLEs are universally designed. A universally designed DLE should be accessible and understandable by the most considerable extent of users as possible.

However, several students are confused over how information is presented through the DLEs, claiming they have to do often an extra effort to interpret the content.

The main reason that emerged from data is the freedom that course instructors have generating the content trough the DLEs.

I argue this continuous interpretation of information is articulation work (Schmidt, Strauss), which could be supported or reduced by a more standardized use of the DLEs from the course instructors, or, eventually, through a DLE that accommodates the different perspectives of students and course instructors.

9.2. What are the implications for students being assessed via digital learning environments in higher education?

Several students from document analysis comparing face to face with digital mediated assessment and communication, argue that face-to the first one offers more learning value, facilitating discussion and inclusion. On the contrary, in digital mediated assessment, the difficulty in creating empathy and missing body language leads to misunderstanding and frustration of the students who cannot engage in a constructive discussion and feel excluded.

I argue the current approach to assessment through one-way directed text messages with little or no way to replicate should be revised, facilitating a more dialectical approach and openness (Bannon and Bødker, 1997) of the common information space (Schmidt and Bannon, 1992).

Furthermore, I argue that empathy and emotional states in learning activities should be supported more by DLEs to make students of the HEO included offering a more fulfilling learning experience.

The potential of the nowadays means of communication available could inspire different ways of digital interaction, involving more visual and multimodal communication, which may better suit this context of higher education.

9.3. Further research

There are several interesting topics that could be studied on the basis of this research.

First, this master thesis created knowledge about the perspectives of the students on use of DLEs in HE. However, I see the need to research the course instructors' perspectives on the use of DLEs, to create a broader understanding of the context.

Secondly, I see interesting the possibility of to involve both students and course instructors in a participatory design process where is discussed how the information should be presented in this context and how DLEs should be used as well as the frustrations of being assessed online, creating knowledge on possible alternative form of feedback design.

Furthermore, it would be interesting, according to the findings of this work, to explore different way to communicate through the DLEs including more a multimodal approach such including video, audio, visual or alternative way to design the communication to support a more empathetic communication.

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11. Appendix

11.1. Attachment A - Informed consent

Samtykkeerklæring om deltakelse i mastergradsprosjekt

Jeg, Lukas Vannini, er en masterstudent ved Institutt for Informatikk, Universitetet i Oslo. Veileder er Jo Herstad.
Epost masterstudent: lukasva@ifi.uio.no

Bakgrunn og formål

Jeg holder på med en mastergrad i Informatikk: design, bruk, interaksjon ved UiO. Masteroppgaven min handler om digitale verktøy bruk. Jeg er interessert i å forstå hvordan forskjellige digitale systemer som brukes på Universitetet i Oslo oppleves på forskjellige digitale enheter i ulike situasjoner.

Hva innebærer deltakelse i studien?

Jeg ønsker at du fyller en form samt å snakke med deg om din erfaring som student og din bruk av de digitale verktøyene som støtter deg i løpet av studiene. Jeg kommer til å ta lydopptak eller/og notater av det du forteller.

Hva skjer med informasjonen om deg?

Alle personopplysninger vil bli behandlet konfidensielt. Opplysningene vil kun være tilgjengelig for meg og veilederen om det er nødvendig. Du vil ikke på noen måte kunne gjenkjennes i materiale som publiseres fra studien.

Frivillig deltakelse

Det er frivillig å delta i studien og du kan når som helst trekke ditt samtykke uten å oppgi noen grunn. Dersom du trekker deg vil alle opplysninger om deg bli slettet.

Samtykke til deltakelse i studien

Jeg samtykker til deltakelse i studien. Sted, dato: Oslo, _____

Signatur, _____

Tusen takk for din deltakelse. Ved spørsmål angående prosjektet, vennligst kontakt hovedansvarlige.

11.2. Attachment B - Diary template and informed consent

Feedback Diary

KOMMENTARER

KONTAKTER

Hvis du lurer på noe eller for mer informasjon om prosjektet kan du kontakte meg her:

- e-post: lukasva@uio.no
- SMS tlf: 91249334

Tusen hjertelig takk for at du bidrar med prosjektet!

OM PROSJEKTET

I forbindelse med min master oppgave i design, bruk og interaksjon ved UiO er jeg interessert i hvilken følelser skaper de forskjellige feedback fra lærere/gruppe-lærere når de er formidlet via en læring management system (Canvas, Piazza, Vortex, Devilry, osv.) eller andre digitale plattformer.

Skriv gjerne eksempler, situasjoner og prøv å beskrive følelsene som feedback vekker.

Gjennom disse type undersøkelsene håper jeg å få bedre innsikt i deres opplevelser med forskjellige digitale verktøy som brukes på UiO.

SAMTYKKEERKLÆRING

Det bekreftes at me innsamlet data vil bli behandlet anonymt og vil ikke bli gitt videre til en tredjepart.

Jeg samtykker med dette at:

- dine besvarelser kan medvirke til dette forskningsprosjektet
- jeg kan bli kontaktet for videre forskning senere i prosjektet via post:

Signatur:

Dato | Tid

Sted | Plattform.

OM FEEDBACK

Dato | Tid

Sted | Plattform.

OM FEEDBACK

11.3. Attachment C - Systematic text condensation

Systematic text condensation (STC)

- Read all the transcription in a «relaxed» then write down a couple of themes that could describe the transcript
- Clean the text from un-useful content (not too much!) and organize the tex in short parts of phrases on the right
- Divide in possible "meaning units"
- Try to label and write some short notes related to meaning units
- Try to summarize the labels and notes in a couple of codes (2,3,4,5,6)
- Label now the transcript according to those final codes, look at initial themes and eventually change them (this is a process: labels, themes and codes should be changed as new knowledge is acquired)
- Organize the transcript based on codes. Divide text in paragraphs with code as title.
- Clean redundancy of text
- Divide in subgoups (2,3,4)
- Re-write connecting the text in its subgroup (still first person writing)
- Check if categories codes and themes are still appropriate
- Condensation "re-write" in third person in more analytical way
- Check again if categories codes and themes are still appropriate
- ----------
- Findings: condensation + new matured codes and ….

11.4. Interview guides

11.4.1.Attachment D - Interview

Intervju digitale artefakter og følelser

Oppvarming:

1. Hvilke digitale verktøy bruker du og hvorfor? Hva er grunn for at du bruker dem?
2. Når, hvor og hvordan bruker du dem? Hva synes du om dem? Er de vanskelige å lære og bruke?
3. Foretrekker du ansikt til ansikt feedback eller digital feedback? Hva tenker du om det?

Fordypning:

1. Fortell meg om en episode du fikk feedback, for eks du kan fortelle om en episode hvor feedback var ansikt til ansikt og en digital
2. Hva synes du om hvordan en tilbakemelding skal gis, utforme? Hva som er viktig og føler bra for deg?
3. Følte du alltid at feedback var nyttig og brukelig? Fortell meg en episode om hvordan du brukte en tilbakemelding og en episode hvor tilbakemeldingen var unyttig.
4. Hvilke svake sider har de forskjellige verktøy etter din mening?
5. Kan du beskrive «the road of a feedback»? For eksample når du får en innlevering hva er det du gjør? For eks: Du sender en epost til grupplærer, du sjekker Piazza, devilry? Hvilke følelser de forskjellige hendelsene vekker?

Avslutning:

6. Har du hatt perioder du ventet? Hvordan var det å vente, hva har du gjort?
7. Hva tenker du hadde vært beste måte å få feedback? Tekst? Lyd ? Bruk også litt fantasi, prøv å tenk utopisk

11.4.2. Attachment E - Short Interview guide

Hvilke 'Digital learning environments' bruker du oftest?

Hvorfor disse?

Er det noe du liker spesielt godt med DLEs?

Er det noe du liker spesielt dårlig med DLEs

Møter du noen utfordringer når du bruker the DLEs?

Tror du at andre studenter har samme utfordringer?

Finner du alltid informasjon du trenger eller er det vanskelig å skaffe seg det?

Hvorfor det?

Kunne det ha vært bedre med færre DLEs eller med flere?

Hvorfor det?

Kan du beskrive siste besøk på en av DLEs ? Hva gjørde du?

Var du fornøyd med det siste besøket?

Hvorfor det?