Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Information Technology and Electrical Engineering
Department of Computer Science

Kasper Klæboe Berg

Supporting Collaborative Learning Groups with IT

Social Learning Technology

Master's thesis in Computer Science
Supervisor: Trond Aalberg
June 2020

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Kunnskap for en bedre verden

Sammendrag

Sosial læring er viktig. Gjennom samarbeid, kan studenter dra nytte av sosial læring i grupper. Men ikke alle studenter finner det like lettvint å komme i kontakt med medstudenter for samarbeid i grupper, når det ikke er organisert av utdanningsinstitusjonen. Dette er grunnet blant annet ensomhet og/eller mangel på venner, som er svært vanlig blant studenter i Norge.

I denne masteroppgaven har det blitt utviklet en prototype for en mobil applikasjon, kalt KollokvieSveip, for å utforske metoder og teknikker for å hjelpe studenter komme i kontakt med nye medstudenter for samarbeid i grupper, for å igjen forbedre sin læring. Gjennom enten å bli med i andres grupper, eller ved å lage en ny gruppe selv, skal studenter ha muligheten til å dra nytte av sosial læring når de selv føler for det. Ettersom denne oppgaven er konsentrert rundt studenter på NTNU, vil dens hovedfokus være studenter på NTNU, og samarbeid i form av øvingsarbeid, eksamenslesing eller annet relevant studiearbeid ved NTNU.

Oppgaven adresserer tre forskningsspørsmål, og undersøker de gjennom tre faser som inkluderer litterært arbeid og spørreundersøkelser, utvikling og testing av applikasjonen, og avslutningsvis en evaluering av forskningen.

Resultatene viser at applikasjonen kan ha et stort potensial blant studenter som starter på sitt første semester ved universitet. Studenter er mer åpen til sinns og mer på jakt etter nye vennskap i det starten av semesteret, og har derfor et større ønske for å danne nye relasjoner. Eldre studenter er mer komfortabel med å studere med deres veletablerte samarbeidsgrupper, noe som fører til en høyere terskel for å møte nye studenter.

Å ha muligheten til å dra nytte av en slik applikasjon fra tidlig i studieløpet, kan potensielt hjelpe ensomme studenter, med mangel på vennskap og medstudenter, og håndtere det nåværende problemet med ensomme studenter i Norge.

Applikasjonen er tilgjengelig på `https://kollokviesveip.surge.sh` i nettleseren, og dens MIT-lisensierte kildekode er tilgjengelig på Github[1].

[1] https://github.com/kasperkberg/kollokviesveip

Abstract

Social Learning is essential. Through collaborative learning, students can benefit from social learning in groups. However, not all students have an as easy time connecting with fellow students for such collaborations when the educational institution does not organize it. This is due to, for instance, loneliness or a lack of friends, which are common among students in Norway.

In this Masters Thesis, it has been developed a prototype for a mobile application, KollokvieSveip, to explore methods and techniques to help students connect with new, fellow students for collaborative learning to enhance their learning process. Students should be able to utilize social learning whenever they feel the need for it by either joining someone else's existing group or by creating a new group themselves. As this thesis is centered around students at NTNU, its primary focus has been students at NTNU, and collaborative learning in forms of doing assignments, preparing for finals or other cases of studying in relevance to NTNU.

This research addresses three research questions and investigates them through three phases, which include a literature review and surveys, implementation and testing, and finally, an evaluation of the entire research.

The findings showed that the application would have much positive potential for students going into their first semester at university. Students in their first semester are more open-minded and friends-searching, hence more open to forming new relations. Older students are more comfortable studying with established collaborative learning groups, providing a higher threshold for involvement with new students.

Utilizing an application like KollokvieSveip early on in the students' study program, could potentially support lonely students, with a lack of friends or fellow students, and help reduce the amount of loneliness currently existing among students in Norway.

The application is available at `https://kollokviesveip.surge.sh` in the browser and the MIT-licensed source code is available on Github[1].

Preface

This thesis was written during the spring of 2020 at the Norwegian University of Science and Technology (NTNU), Faculty of Information Technology and Electrical Engineering, Department of Computer Science. I would like to thank Trond Aalberg for great help and motivation throughout this process, and I would also like to thank:

- The 56 students who participated in the survey
- The 3 students who participated in the user testing throughout the development
- The 5 students who participated in the final user test of the application.

Trondheim, June 10, 2020
Kasper Klæboe Berg

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Abbreviations

NTNU	=	Norwegian University of Science and Technology
IDI	=	Department of Computer Science
SLT	=	Social Learning Technology
TEL	=	Technology Enhanced Learning
CLG	=	Collaborative Learning Group
NSD	=	Norwegian Centre for Research Data
HLR	=	High-Level Requirement
ICT	=	Information and Communications Technology

Chapter 1

Introduction

This introduction begins by presenting the motivation behind this thesis. Next, the goals and research questions are presented, and after that, the research methodology applied in answering the research questions. Finally, the contribution to the thesis is presented before finishing off with a brief structural overview of the remaining thesis.

1.1 Motivation

All students are unique, and with that, their preferences differ in how they choose to learn. Some students benefit from studying on their own, while others learn best from social learning. Through social learning, students learn in groups while collaborating. These groups tend to be formed with friends, where some students have lots of friends to "choose" from, while others have few. Some students do not have friends or at least no friends with which they can study together. If one is to study in groups, it will be beneficial to be working on the same topics, or at least work on the same course. This means that in the sense of study groups, not knowing any fellow students in the same course is the same as not having friends for collaborations.

When students arrange these groups, they tend to stick to them, as working with friends is what can be referred to as being in the comfort zone when it comes to learning. Students know their friends and vice versa, so the group dynamics have been set, and will most probably be staying the same throughout the group's life. While some students become part of different study groups, there are many students left, which has yet not formed any groups. Some students might prefer working alone and are purposely pursuing not working with others. However, as will be shown in this thesis, loneliness is a big problem among students, and at universities in general, it is possible to assume most would wish they had the option to be working in groups.

Therefore, this work aims to explore methods for students to connect with other students for collaborations. To test this out, an application has been created that should provide the option to collaborate whenever the students want, with as many students they want and for as long as they want.

1.2 Context

This research is done in the context of a thesis at IDI, at NTNU, during the spring semester of 2020. It builds on the author's specialization project, which presented a concept for a mobile application that aims to connect students through joining and creating collaborative learning groups. The research is supervised by Associate Professor, Trond Aalberg.

1.3 Research Questions

The following research questions have been developed for this thesis;

RQ1: *What are students attitude to collaborative learning?*

How do students view collaborative learning? Do they prefer individual learning, or to collaborate with others? Do they choose to collaborate with their friends when NTNU does not organize it? Are the collaborations planned, or spontaneous?

RQ2: *In what contexts are students searching for fellow students for collaborative learning?*

As mentioned, the project aims to explore a way for students to find other students for collaborations. But how, and in which context is this best achieved? What alternatives exist today? How can students be supported in finding groups or people for collaborations? What techniques currently exist, and what techniques are relevant to help students meet each other in learning situations?

RQ3: *Are students willing and able to go out of their comfort zone and study in groups with new/random students on a common mission to enhance their learning?*

Which social features need to be considered to help students get out of their comfort zone? Are students willing to study with new, random students? How much information do students need to know about the students they potentially can work with? Which barriers do students have to overcome to meet others?

RQ4: *What methods are applicable to support students in finding or establishing collaborative learning groups?*

Which methods can be implemented in an application to support students in connecting with other students for collaborative learning? How can students be supported in creating or joining collaborative learning groups?

These research questions will be discussed later on in the thesis. An overview of the RQs relation to the thesis can be found in figure 1.1

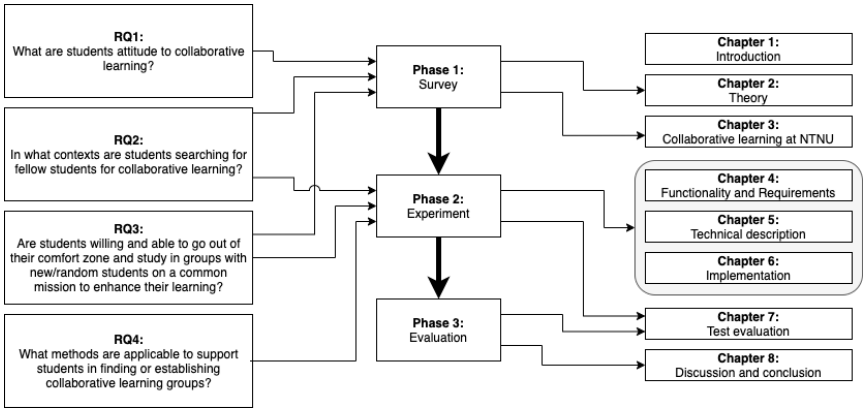


Figure 1.1: Thesis overview in relation to the research questions

1.4 Research method

This thesis consists of three phases; the survey, experiment and evaluation phase.

The Survey Phase
This phase includes a structured literature review of Social Learning Technology, and a survey was conducted on students at NTNU.

The Experiment Phase
To test the research found in the survey phase, an application has been developed, which has been implemented and tested in this phase. This test was conducted on a group of students, which results in the foundation of the result and discussion for the project.

The Evaluation Phase
This phase consists of evaluating the experiment, and binding its findings together with the theory and survey to form a final discussion and conclusion for the project.

1.5 Contribution

During this thesis, the literature review and conducting the survey has counted for a big part of the contribution. However, the main contribution of this work has been the implementation of the mobile application, KollokvieSveip, and the research of ways to best connect students.

1.6 Thesis structure

This thesis consists of 8 chapters.

- **Chapter 2** presents the theory behind Technology Enhanced Learning, Social Learning Technology, Collaborative Learning, and its existing ICT services.
- **Chapter 3** presents two surveys, and elaborates on the problem in which the project aims to tackle.
- **Chapter 4** holds the application's high-level design and its functionalities, features, and requirements.
- **Chapter 5** presents the technical aspect of the application, describing the used technologies and architecture.
- **Chapter 6** introduce the application, its implementation, and the reasoning behind the different features and functionalities.
- **Chapter 7** presents the final test of the application, and the following results and findings.
- **Chapter 8** concludes the thesis with discussion and a conclusion.
- The **Appendix** includes emails with importance to the project (Appendix A), approval letter from NSD (Appendix B), the survey's questions (Appendix C) and results (Appendix D), screenshots of the developed application (Appendix E) and finally the test process and results (Appendix F).

Chapter 2

Theory

In this chapter, the fundamental theory behind Social Learning Technology (SLT) will be presented and discussed, which includes, Technology Enhanced Learning (TEL), Information and Communication Technology (ICT), Social Learning, Collaborative Learning Groups (CLGs), and the different existing services students experience today.

2.1 Technology Enhanced Learning

Learning is defined as the process of acquiring competence and understanding, which results in a new ability to do, and/or understanding of something. TEL is a broad category, open to a range of interpretations, but can, in short, be summarized as any technology that enhances the learning process. It is used to describe all circumstances that play a significant role in making learning more effective, efficient, or enjoyable (Goodyear and Retalis, 2010). In today's society there exists a lot of technology, both hardware, and software, which has its goal towards enhancing learning in some way. With *hardware*, for instance, smart boards, computers, phones or tablets, or *software* - such as online notebooks, repositories, lectures, quizzes, or communications platforms, students today have a magnitude of tools surrounding and impacting learning in their daily life. The field of TEL is experiencing dramatic growth, causing multiple new and exciting opportunities for the consumers, as hardware is decreasing in cost and increasing in performance, and new software coming to life every day. In recent years, it is shown that TEL is transforming and enhancing education and educational institutions beyond recognition (Cullen, 2018).

With this rapid growth within the field and new opportunities coming to life, it is possible to see changes, according to NDLA (2017), especially within:

- Mobility and accessibility:
  With technology, students can learn whenever they want, where they want. Students learn at their own pace, which with technology, is no problem as it makes the learning process flexible for the students. Each student can adjust their time spent on studying to their own need.

- Crowd-sourcing:
  People joining forces online, creating or improving services, learning material or tools, where Github[1] and Wikipedia[2] are among the top tier examples of such.
- Data and privacy:
  TEL offers ever-increasing interactivity and personification. It is now possible to have targeted user-specific content and meet the end-users individual level of competence, needs, and preferences. This requires updated rules and regulations within the privacy and how the software manages personal data.
- Universal design:
  No matter the disability someone may have, one should be able to use the software. The main rule is that all ICT-services in Norway should have a universal design. This includes requirements for the use of images, sound, colors, contrasts.
- Learning analysis:
  This is defined as "registration, collection, analysis, and reporting of data about students in a context where the end goal is to understand and enhance the learning process and the social environment where the learning takes place" (NDLA, 2017).

2.1.1 ICT in education

As with TEL, ICT is a broad term, with no universal definition, because the concepts, methods, and applications involved in ICT are constantly evolving on an almost daily basis, and it is difficult to keep up (Riley, 2015) (Tas, 2011). ICT has become one of the basic building blocks of modern society. Countries now understand the importance of ICT and mastering the basic skills and concepts of it as part of the core of education.

The relationship between TEL and ICT is that TEL is concerned with how ICT might support individual learning and learn in groups. The use of ICT in education makes the teaching-learning process effective and exciting. ICT includes any communication device or application, and when such technologies are used for educational purposes, to support and improve students' learning and develop learning environments, we consider ICT to be a subfield of Educational Technology (Kumar, 2008).

ICT in education has been a high priority in Norway over many years and is associated with increased opportunities for flexibility, efficiency, and accessibility (Tømte and Olsen, 2013). With the use of ICT, education can reach out to more students and has increased flexibility for institutions, professors, teachers, and students, and the institutions are saving time and resources on administration and communication.

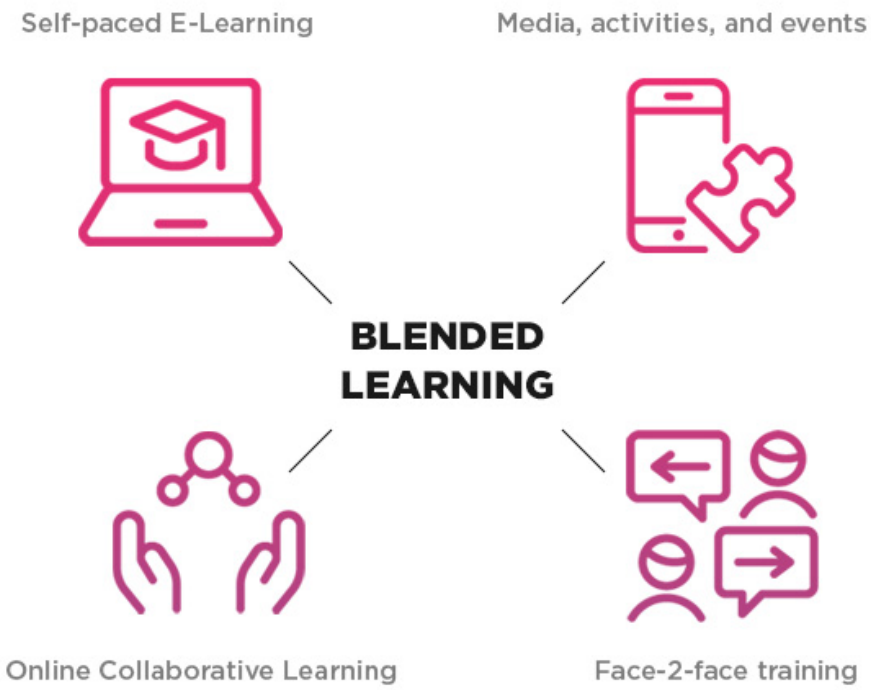
Given ICT, education can be classified into three main categories – E-Learning, Blended Learning, and Distance Learning.

E-Learning refers to computer-enhanced learning and deals with both the technologies and methodologies in learning using the network or multimedia (Kumar, 2008). Typically, e-learning takes place on the internet, where students can reach their learning materials online at any place and time. E-Learning usually occurs in the form of online courses, or online programs (Tamm, 2019).

[1] https://github.com
[2] https://wikipedia.org

Blended learning is a style of different education delivery methods in which students learn using a combination of electronic or online media as well as traditional face-to-face teaching (Staff, 2020), i.e., a combination of multiple approaches to learning. It is usually used to define a situation where different delivery methods are combined to deliver a particular course (Graham, 2011). This includes methods such as face-to-face/classroom-, self-paced- and online collaborative learning, see figure 2.1, to form multiple types of blended learning, such as flipped classroom[3], remote learning[4], station- and lab rotation[5] among many others (Staff, 2019).

Distance learning is a type of learning where the teacher and students are in different places for all or most of the time that they teach and learn (Moore and Kearsly, 2012). Commonly, students work on their own at home or the office and communicate with faculty and other students via e-mail, electronic forums, videoconferencing, chat rooms, instant messaging, and other forms of computer-based communication (Webopedia, 2008).



Source: https://tft.unctad.org/about/strategy/blended-learning/
Figure 2.1: Blended Learning

[3]https://edu.usn.no/flippe/
[4]https://trainingindustry.com/glossary/remote-learning/
[5]https://medium.com/teacher-voice/station-rotation-lab-rotation-blended-learning-models-a7813ad6fed8

2.1.2 Areas within Technology Enhanced Learning

Within TEL there are many different areas, such as:

- Systems for adaptive learning:
  The software uses algorithms to customize resources and learning activities for users based on the need of the specific user. For instance, automated tests and assignments, which observe and analyze input from users.
- Peer review systems:
  Systems, or software, where peers evaluate each other's work, to acquire increased learning, competence, and/or reflection about a subject.
- Gamification of assignments and lectures:
  The use of elements, mechanics, metaphors, and/or principles in gaming to increase the learning experience, improve motivation, and enhance engagement (Marczewski, 2013).
- Social Learning Technology:
  When using TEL in a social setting, it is considered as SLT. This includes enhanced learning through social interactions, either virtually or in reality.

As the motivation behind the thesis spans around the social aspect of learning, the area which this project will focus on is the SLT. Accordingly, it will now move on to social learning and elaborate on collaborating in groups.

2.2 Social learning

The first to define social learning was Albert Bandura[6], with his social learning theory. His initial research analyzed the grounds of human learning and the compliance of children and adults to imitate behavior perceived in others, in particular, aggression (Bandura et al., 1988). Bandura and Walters (1977) claimed "Most human behavior is learned observationally through modeling: from observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action", meaning people learn from one another through observation, imitation and modeling (Ormrod, 1990). Social learning refers to the skills that are developed within a social group. It depends on how successful the individuals of a group are at dynamic interactions. It promotes the development of practical and emotional skills among its participants, as well as self-perception and acceptance of others.

However, in Bandura (1986), he expanded the social learning theory into social cognitive theory, as his research leaned more towards human cognition in the context of social learning. The social cognitive theory focuses on how human growth and behavior are affected by social activities (Grusec, 1994). One can see other people's behavior, attitude, and the consequences of these, and then learn from such observations. People may learn without being the ones attempting and potentially fail, and instead watch others do.

The most important factors of the social cognitive theory concerning education are:

[6] https://albertbandura.com/

- *Self-efficacy* – an individual's belief in one's capability to exercise control over their own activities (Bandura and Walters, 1977),(Bandura, 1986).

- *Self-regulation* – refers to the process of learners actively taking control and responsibility for their learning (Zimmerman, 2000).

- *Observational learning* – is concerned with the acquisition of attitudes, values, and styles of thinking and behaving through observation of the examples provided by others (Bandura, 2008).

- *Reciprocal determinism* – a theory that states that a person's behavior influences and is influenced by personal factors and the social environment the person interacts with (Bandura, 1978).

Bandura's theory can be applied to education as it affects the student's and teacher's motivation and learning (Golas, 2010), (Bandura et al., 1996). Increased self-efficacy makes students and teachers aim higher when setting goals and increasing dedication to achieve the goals. In education, this refers to one's confidence to participate in settings that will help them achieve goals (Erlich and Russ-Eft, 2011).

2.3 Collaborative Learning Groups

In education, all students have their preferences on how they best learn academic content. While working for themselves at their own pace is a common way for students to learn, many students prefer studying in a group, or Collaborative Learning Group (CLG). Research by Rau and Heyl (1990) shows a significantly higher test score for students working in groups than individually. When studying in CLGs, students collaborate and socially learn with other students or peers. The social learning aspect was covered in the previous section; this section will describe the collaborative learning aspect.

As with most terms in this thesis, *collaborative learning* is hard to define, as it is a broad term with a wide variety of uses. Dillenbourg (1999) gathered 20 scholars within psychology, education and computer science, and defined collaborative learning as "a *situation* in which *two or more* people *learn* or attempt to learn something *together*", where each element of the definition can be interpreted in different ways.

Gokhale (1995) defines collaborative learning as an instruction method in which students at various performance levels work together in small groups toward a common goal.

According to McCormick (2004), two important themes emerges from the research about collaborative learning – "collaborating to learn" and "learning to collaborate". *Collaborating to learn* is when the collaboration enhances learning. In this process, the focus is on the creation of intersubjectivity[7] and its benefaction to learning. *Learning to collaborate* focus on the skills and understandings needed to ensure successful collaboration. The participants of a group need to acquire both skills in order to secure a successful collaboration.

[7] "shared understanding based on a common focus of attention and some shared presuppositions that form the ground for communication" (Rogoff, 1990, p. 71)

2.3.1 ICT in Collaborative Learning Groups

Multiple ICTs support CLGs, one of them is web-based ICT. For many students, CLGs are occurring over the internet, especially at universities and for web-based or online study programs. For the online students, it is evident to use web-based ICTs, but also lots of students at universities have their collaborations happening online. Through online CLGs, students will only benefit from some of the essential principles of Bandura (1986), as some of the principles are difficult to achieve online. CLGs, where students are physically present, will potentially benefit from all of Bandura's principles about Social Learning. This can be achieved through a Blended Learning ICT, where students are physically present, benefiting from face-2-face learning while using ICT as the communication or scheduling of a meeting.

2.3.2 Challenges

While the advantages of CLGs over individual learning are well-established, the CLGs are not always practical for students. The educational benefit that a learner acquires through the collaborative learning process depends largely on the interaction among the group members. This suggests that forming an effective group is critical to ensure educational benefit to the members (Inaba et al., 2000). In many cases, CLGs will encounter challenges. Järvelä et al. (2010) states that these challenges can prevail due to people having different goals and objectives, priorities, and expectations for the group work. Another reason might be a significant distinction in communication- or study practices between the group members. All students have different experiences and views on how to collaborate successfully.

2.3.3 Goals

As argued in subsection 2.3.2, having different goals and objectives for the collaboration can be devastating for the group. Having a clear and specific goal is vital to achieving a well-working collaboration and experience. All participants must acknowledge the common goal for the collaboration, and what the group wishes to learn. This goal can, for instance, be specific assignments, tasks, a number of pages, a grade, or a topic. When collaborating on assignments, a typical goal is to complete the assignment, but the goal can also be to fully understand the topic or get through a certain amount of pages related to the topic. It is frustrating to collaborate with other students if the group members are not going into it with the same ambitions for the collaboration as the others, as it tends to have some of the participants to do most of the work.

2.4 Existing services

In today's society, there is an overload of apps for all kinds of purposes. Many of which is solely focused on learning, and many of which are not. However, many of the applications not directly focused on learning are nevertheless being used for such by students. **RQ2** focuses on how students can find fellow students for collaborative learning, which will be

the main focus when researching the existing services. Therefore, to further investigate **RQ2**, this section will elaborate on some of the services which impact the daily lives of students, and if they contain features of valuable interest in this thesis' application. The applications are divided into categories as follows;

2.4.1 Discover

In this subsection, the applications which offer an opportunity to discover other people are being presented. Students are well familiar with applications that connect them, as it is a big part of their social life.

LinkedIn

LinkedIn[8] is commonly known as a business- and career application, which focuses on the interaction between employer and employee. LinkedIn does not enhance the learning process but can be used as a tool to find other students. As LinkedIn holds a high threshold for students to contact each other, it is not very effective for students to find friends on this application. Most people see LinkedIn as an application students use to find work and not student friendships. However, LinkedIn provides a helpful way to find other students, and in that way, at least provide a helping hand in seeing familiar faces on the student's program of study, which might help them get to know fellow students. On LinkedIn, it is common to send connection requests to other students one know or have seen before, without any strings attached to such connections. This means that even though students are connected through LinkedIn, they are not connected in real life.

Tinder

Tinder[9] is a social dating application where people find and interact with each other. On Tinder, the users swipe through a deck of cards, representing the different user profiles, where a left swipe means the user "dislike" that person, and right swipe means "like". Tinder is commonly used among students, as it is an easy and straightforward way to get in touch with others, both for dating and friendships. The swipe logic in Tinder is a powerful feature and a massively discussed instrument. It is a feature most people are familiar with, regardless of having ever used it. According to Tinder's former CEO, Sean Rad, the swiping provides a feeling of being responsible for a casting session, where the user is in the director's chair, deciding on what they want (Grigoriadis, 2014). It feels less superficial and provides a lower threshold to connect with others.

Studievenn

Studievenn[10] is an application developed by a Norwegian student at the University of Oslo. Its purpose is to gather students for social activities, such as playing volleyball or having a barbeque in a park. The developer of Studievenn, Erik Mathisen, says that it was important

[8] https://linkedin.com/
[9] http://tinder.com/
[10] https://apps.apple.com/us/app/id1457537556

to create an application for everyone, no matter if the student already has a great circle of friends or not, see Appendix A.3.

The main issue Studievenn is facing is overcoming the initial phase of the application, to have students use it. To drive students to make the first step is a significant issue, and something the developer spent much time to come about. He said that many fear to throw themselves out there, without being sure to receive any response from others.

2.4.2 Communication

Many applications offer instant communication between individuals and groups. These application has almost completely taken over for the SMS and email communication, and are today the most common way for students to communicate locally or across the world. This subsection describes the most commonly used applications for such.

Facebook Messenger

According to a survey held by Telia[11], the two most student-used applications are Facebook[12] and Facebook Messenger[13] (NTB, 2016). Facebook Messenger is the messaging application between Facebook users, and the most commonly used application for students to interact and talk to each other online through instant messaging. Most people have Facebook accounts, and therefore it is easy to connect and talk to each other through Messenger. When students form groups at university, it is usual to chat with the group through Facebook Messenger. That way, Facebook Messenger becomes an ICT, as it works as communication between group members, enhancing the learning process. Having the ability to chat with the group is essential for good communication flow.

WhatsApp

WhatsApp[14] is very similar to Facebook Messenger in the style of communication. It is a very frequently used instant messaging application, and people can easily talk to others by having their phone number. Hence, one is not able to search for others. In Norway, WhatsApp is not as commonly used as Facebook Messenger. According to Statista (2018), only 12% of Norwegians use WhatsApp as their go-to messaging app, in contrast to Facebook Messenger's 51%. Statista (2019) also claims that WhatsApp has 2 billion monthly active users worldwide, which means that it is a commonly used application in other countries.

Slack and Discord

Slack[15] and Discord[16] are two commonly used, and similar-looking, communication tools. They are great tools for long-term groups, teams, and workplaces, as users can organize the messages in different channels by topic. However, contrary to Facebook Messenger,

[11] https://telia.no/
[12] https://facebook.com/
[13] https://messenger.com/
[14] https://whatsapp.com/
[15] https://slack.com/
[16] https://discord.com/

one will necessarily not be finding any new people on these platforms, as it is not possible to search for random students, only other members of one's Slack- or Discord-teams.

2.4.3 Supported Learning

Besides services that offer discovery and communication among students, it is interesting to see what applications exist that support students' current learning process. There are many of these, where the applications with the most relevance to this project now will be presented.

QueueMe

QueueMe[17] is an application that was available for students in some courses at NTNU after it was developed in a software engineering course by four students. This ICT's purpose was to facilitate queuing for corrections of assignments more feasible and effortless for students and teaching assistants. The analog process of students standing in line now was made digital. However, it faced some issues with combining the old and the new way, as not everyone used the application. QueueMe is no longer in use.

Hold

Hold[18], the application which attempts to force students to focus on their work, while not being distracted by their phones. As mobile phones are the main distraction during studying, Hold rewards students with points for every 20th minute not spent on the phone. Hold is handy in both individual- and collaborative learning, as it enhances the learning process and makes it way more effective.

Doodle

Doodle[19] is a calendar tool for time management and coordination of meetings or activities. It is particularly used for groups of people trying to agree on a specified date/time for a particular activity. This activity can be meetings, sports, or travel, but for students, it is commonly used for a group to concur on a specific time for collaborative learning groups.

RomRes

RomRes[20] is a room booking system for students at NTNU. Here students can book rooms for activities such as collaborative learning groups and meetings. RomRes is frequently used among students and the only way for students to work in their Collaborative Learning Groups in private rooms at the campus.

[17] https://facebook.com/QueueMeApp
[18] https://hold.app/
[19] https://doodle.com/
[20] https://ntnu.no/romres

Mazemap

Mazemap[21] is a service for indoor maps, designed for large building complexes, such as universities, hospitals, and airports. If students need to navigate to a room at NTNU, they are using MazeMap, especially during the first semesters. MazeMap is commonly used for navigation to the room one has booked using the RomRes-booking system.

2.5 Definition

As shown, Social Learning Technology and Collaborative Learning holds for broad terms, with many use-cases. A definition of Collaborative Learning has been created in table 2.1, to simplify the use of Collaborative Learning, and limit the scope.

"*Collaborative Learning* is defined as a group of *two or more* students *studying course material* and performing *problem solving* of course assignments *together*, *face-to-face*, *synchronous*, with *joint effort* by all members of the group towards a common *academic goal*"

Table 2.1: Thesis definition of Collaborative Learning

With this definition, the scale of collaborations is limited to students in a minimum of a pair. The maximum group size is ideally limited to six, as it is harder to interact with all group members in groups larger than six. For effective group work, everyone's opinion should count. The more members in a group, the more obstacles one will encounter when experiencing a productive group dynamic. Hence, a limit of six students is pragmatic and reasonable. The definition also requires the group to meet face-to-face. This thesis aims to explore methods for students to connect for collaborative learning, as stated in the research questions. Even though working in groups over the internet can be effective, the focus will be on having students meet in person and working together. As students who feel lonely are the main target group, it is essential to have them physically meet fellow students, and not virtually.

Lastly, the definition says students are studying the course material and performing problem solving of course assignments, towards a common academic goal. There are many alternative ways for students to connect for non-academic purposes; hence, this thesis will focus solely on enhanced academic learning. This academic learning will be centered around a course all the group members are enrolled in, where the collaborative learning group will collaborate on the same topics.

[21] https://mazemap.com/

Chapter 3

Collaborative learning at NTNU

Throughout the years at university as a student, at least at NTNU, one come across multiple and quite different types of collaborations. For instance, having collaborations formed by the course staff or collaborations students initiate themselves. These CLGs will, in some courses, take on projects, mandatory assignments in others, and laboratory or field assignments in some. At the end of most courses, students use CLGs for exam-preparations. In a project, assignment, and laboratory group settings, CLGs are, to some degree, facilitated by NTNU, while during preparations for finals/exams, collaborative work is for students themselves to organize.

As the final weeks before the exams are particularly important for most students, students must utilize effective study techniques. As will be shown below, collaborative learning is an effective way of learning for many students, hence having fellow students to collaborate with is crucial to thrive as successful students and acquire excellent results on the finals.

3.1 Survey on study habits and techniques

Using CLGs is very common at NTNU. This is confirmed in a survey conducted by Centre for Excellent IT Education, Excited, at IDI in the spring semester of 2019. The survey received 527 answers from students at all programs of study at IDI. It has not yet been published, and this is the first time its results have been utilized, see Appendix A.4. In this survey, students reported that they had had good experiences from group work so far during their study, as 79% answered that they either agree or strongly agree, see figure 3.1. From the same survey, it is also shown that many students choose to work in groups, despite the fact it is not organized, see figure 3.2. Both of these findings provide valuable feedback in regards to **RQ1**, as it indicates some thought about working in groups.

Many students are quickly growing their network of fellow students, and have multiple potential friends to collaborate with in most of their courses. However, many students cannot relate to this, as loneliness is extensive among students. Research conducted by

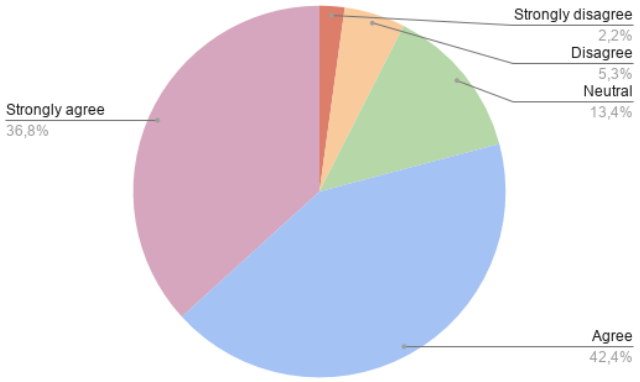


Figure 3.1: I have good experiences from group work during my study

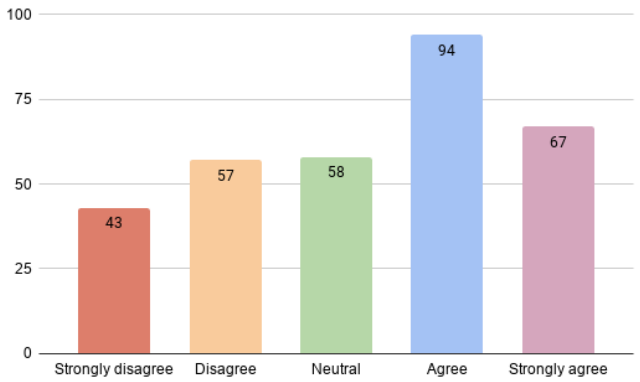


Figure 3.2: I often collaborate with others, even though it is not organized by NTNU

	Total	Male	Female	18-20	21-22	23-25	26-28	29-35	South-east	West	Central	North	Abroad
Miss someone to han around with*	23	21	24	28	22	22	24	24	23	22	23	26	26
Feels left out*	17	14	18	19	16	16	19	21	18	16	16	19	18
Feels isolated*	16	15	17	19	15	15	18	20	17	15	15	18	18
Often/very often lonely 1/3 of the questions	29	27	31	34	28	28	30	32	30	28	28	32	32
Often/very often lonely 3/3 of the questions	10	8	10	11	9	9	11	12	10	9	10	11	10

* Has answered "often" or "very often"

Figure 3.3: Loneliness in percentage

Norwegian Institute of Public Health, FHI[1] (Knapstad et al., 2018), see figure 3.3, shows that near 1/3 of the students in Norway feel lonely. Furthermore, it shows that 23% of students miss having fellow students to spend time with, 17% feels left out, and 16% feels isolated. These numbers make it easy to conclude that many students do not have fellow students or friends for collaborations. A major issue with this is that two students who are both lonely, have a harder time potentially finding each other. As mentioned in the introduction and section 2.5, this is among the most important motivations behind this thesis.

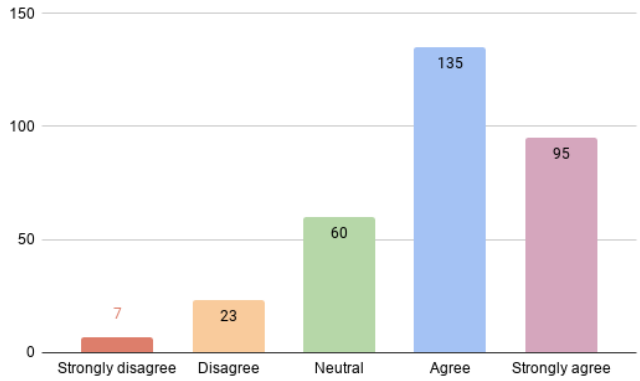


Figure 3.4: Group work is an oppurtunity to get new friends

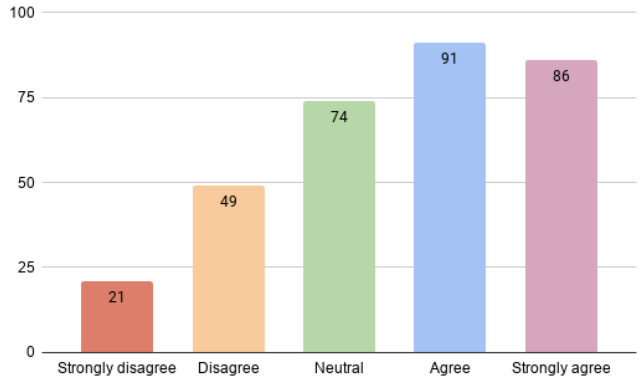


Figure 3.5: I have made good friends from working together in groups

Furthermore, it can be seen from the IDI-survey that students find group work as a good way to make new friends. 71,9% either agree or strongly agree that group work is an opportunity to make friends, see figure 3.4 and 55,1% says that they have made good

[1] https://www.fhi.no/

friends from working together in groups, see figure 3.5. As many students view CLGs as a good way to make new friends, working in groups can be seen as a good attempt to tackle the issue with loneliness. As many instances of group work are organized by NTNU, this can be seen as a way students find fellow students for collaborative learning, from **RQ2**.

In section 2.3, it was found that common challenges experienced in collaborations can prevail due to different motivations and ambitions for the group work. It was also stated that a significant importance for successful group work was to have a shared mission with the same goals and objectives. These findings are confirmed by the students in the survey, as 89% of the participants states that they think all members of the group should go into the collaboration with the same level of ambition and motivation, see figure 3.6.

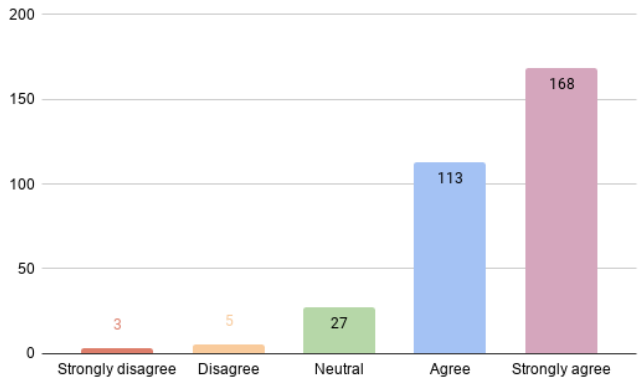


Figure 3.6: All members of the group should have the same level of motivation and ambition for the work

3.2 Survey on Collaborative Learning

To further investigate the student's relation to CLGs at NTNU, with a focus on assignments and exams, there has been conducted a survey. In this section, this survey will be presented. First, its purpose, ethics, and participants, before the questions, results, and findings.

3.2.1 Purpose

As learned in section 3.1, CLGs are commonly used at NTNU. To map the use of CLGs among students when working on assignments or exams, or reasons not to use CLGs, this survey is made. The main purpose of this survey is to highlight the need for an application or a tool where students can find fellow students to cooperate with in the courses they want to and when they see the need for it.

3.2.2 Ethics and privacy

When gathering, handling, and analyzing personal data, where one can directly or indirectly identify students based on the submitted information, it is obligatory to notify NSD[2] - Norwegian Centre for Research Data (NTNU, 2020a). In this survey, two questions ask about the personal information that indirectly can identify a person, see figure C.1, where it is being asked about the gender and year of study. The process of receiving the final approval lasted for a while and consisted of a few messages back and forth with suggested changes and additions to the information text. On February 28th, the final approval came through, see Appendix B.1. The survey were created in Nettskjema[3], which is the standard tool for creating surveys at NTNU (NTNU, 2020b) (NTNU, 2020c),

3.2.3 Participants

As the entire thesis focuses on students, the target group for this survey is students. With Nettskjema, one can assure that only students can answer, as they have to log in with Feide[4] to reply to the survey. This makes the survey more reliable and less chance for fake replies.

To best answer the survey and best find answers to the research questions from section 1.3, answers have to be gathered from experienced students, which has had the opportunity to study for assignments and exams in previous semesters. At the same time, the students should have some years left of their degrees, to best reason about the potential use of such an application. Hence second or third-year students are the main target group for this survey.

The survey was shared with the Facebook-groups of second and/or third-year students at Engineering and ICT, Computer Science, Informatics and Communication Technology at NTNU. Besides, it was shared with the students enrolled in IT2810[5] at NTNU.

3.2.4 Questions

In this section, the questions for the survey will be presented, and the reasoning behind them will be discussed. First, the introduction and the introductory questions, then moving on to the main part of the survey, before presenting the last part of the survey, which is a voluntary part, where a deeper elaboration from the participants is highly appreciated. The entire survey can be found in Appendix C in its full form.

Introduction

The introduction, see figure C.1 in the Appendix, contains the consent-form of the survey. NSD provides a template[6] for topics that are required in such a consent form. This information is critical for the survey, as it holds the rights for the participants and for the survey itself, as well as the general information about the purpose of the survey. A lengthy

[2] https://nsd.no/
[3] https://nettskjema.no
[4] https://feide.no/
[5] https://ntnu.no/studier/emner/IT2810
[6] https://nsd.no/personvernombud/hjelp/informere_om.html

introduction can, in many cases, impact the survey negatively, as it can cause participants to turn bored and not be interested in the survey, leading to either not responding or providing bad replies. Hence, it was attempted to include all required topics at the same time as keeping the introduction short and concise.

After the introduction text, the questionnaire holds two initial questions – *what gender are you?* and *what year of study are you currently at?*. *Gender* – because it can be useful in the discussion to see if there are any apparent differences between the genders. The survey held by Knapstad et al. (2018) showed that almost three times the amount of men is without any confidential friends, compared to women. Furthermore, *year of study* – because the target group of the survey is 2nd and 3rd-year students, it is potentially useful to filter on the year of study.

Main part

In the main part of the survey, see figure C.2 and C.3, the most interesting information from this survey is gathered. Matrix questions are used, as those are the most suited type of questions when one wants students to answer to many statements, as it reduces space in the survey and is less time consuming for the participants. For the two matrices, the students have to answer each statement based on a scale containing

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

where the student sees the statement best fit.

For the first matrix, see figure C.2, the students are told to be considering the statements while thinking about the courses on a general degree, and not on specific courses. Here, the purpose is to uncover to which degree the students collaborate with others, and if they prefer it. Furthermore, if the students prefer working at campus, and if they, while being at the campus, collaborate with others.

The next matrix, see figure C.3, aims to discover if students are willing to collaborate with new students for assignments or exams if facilitated. It also seeks to find if students believe collaborating with others will have a positive impact on their learning.

Voluntary part

In the next and last page of the survey, see figure C.4, the students are asked to share some thoughts if they have. It is voluntary, not forcing the students to come up with something. This is because text answers are beneficial if the students are free to think. Forced text-replies will, in many cases, be misleading, as it is better to not reply at all, than making up a biased answer because they just want to finish the survey.

Pros of collaborating with others – will hopefully lead to replies that contain reflected positive thoughts about CLGs, while *cons of collaborating with others* – will lead to the negative thoughts. These will be helpful in the discussion, as it can provide new thoughts about CLGs.

Additionally, the participants are asked about which courses they prefer collaborations. This is beneficial to use in the discussion and to see if an application should be focused on specific courses or not.

Lastly, the students are being asked if anyone wants to help out testing the application by leaving their email address. Nettskjema automatically inserts this, see figure C.5, from the login with Feide.

3.2.5 Results

From the results of the introductory page of the survey, it is seen that the distribution among genders of the participants is good, near 50/50%, see table 3.1. Furthermore, the year of study, see table 3.2, where the target group, 2nd and 3rd-year students, holds for the majority of the replies at 83,9% combined, which is what the survey aimed for. As these numbers are this high, the survey will not be modified, or have the other replies removed, as those replies will not have a significant impact on the survey's results.

Gender	Amount	Percentage
Male	31	55,4%
Female	24	42,9%
Other	1	1,8%

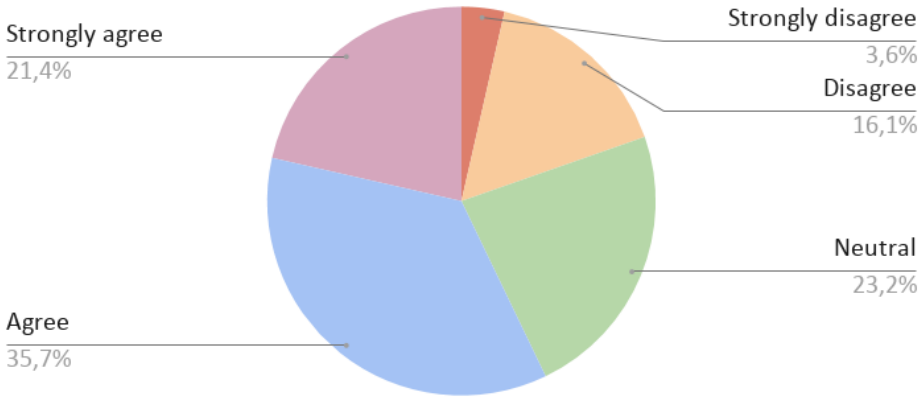
Table 3.1: Distribution of gender

In figure 3.7, there are diagrams comparing whether or not students utilize CLGs when (a) – doing assignments, or (b) – preparing for exams. They state that a significant amount, respectively, 57,1% and 44,6%, often use CLGs, which means there is a slight decrease in the use of CLG when preparing for exams. This major use of CLGs backs up; 1 – the findings from the theory stating that group work is an effective way of learning, and 2 – the findings discovered from the survey held by IDI, mentioned at the beginning of this chapter, where students said they collaborate with others, even when not facilitated.

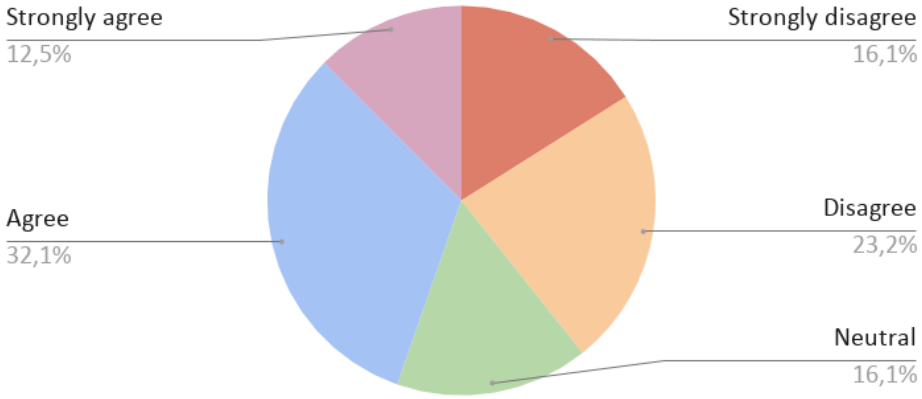
The fact that there is a slight decrease from assignments to exams has most certainly something to do with many assignments being group-based, while students are free to do what they want when preparing for an exam. However, with 44,6% of the students saying they often use CLGs when preparing for exams, it is safe to say that many students prefer this way of learning.

Year of study	Amount	Percentage
1.	3	5,4%
2.	25	44,6%
3.	22	39,3%
4.	2	3,6%
5.	4	7,1%
2. and 3.	47	83,9%

Table 3.2: Distribution of year of study



(a) I often collaborate with others when I do assignments



(b) I often collaborate with others when I prepare for exams

Figure 3.7: Comparison of collaborating with others while (a) – doing assignments, and (b) – preparing for exams

When it comes to organizing such CLGs, it is clear that, in most cases, it is planned, not something that happens randomly. Figure 3.8 shows that about 75% of the students say the collaboration is planned before the meeting. This indicates that students plan to collaborate with their friends or fellow students and do not randomly happen du be collaborating. When one does not know any fellow students, or have friends, in the same course due to for instance loneliness, as shown in figure 3.3, it will be difficult to plan any collaboration with someone.

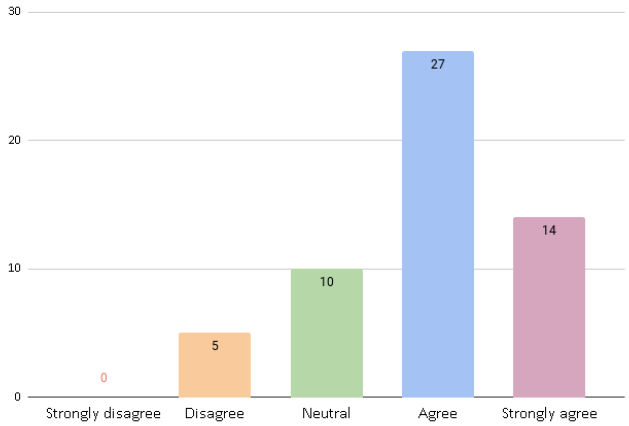


Figure 3.8: When I collborate with others, we have planned it beforehand

As included in **RQ3**, the thesis is interested in finding out whether or not students are willing to collaborate with new students. Figure 3.9 shows how students responded to collaborating with new students, if it had been facilitated for, meaning students are either placed in groups or helped to find groups. As stated, it is known that students prefer working with their friends, which makes it unsurprisingly that the majority is not interested in such. However, 25% replied that they would have liked collaborating with new students, which at least shows that there still exists quite a substantial amount of students interested.

With that in mind, it is further disclosed that 75% of students er open to collaborating with students working on the same topics as themselves, see figure 3.10, which is very interesting given **RQ3**. Only 7,1% being negative to the thought means that a major factor of collaborative learning is working on the same topics.

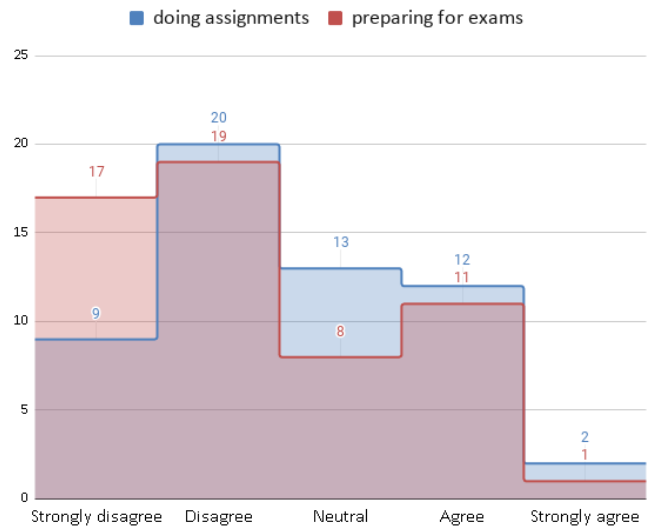


Figure 3.9: If it had been facilitated for, I would have liked to collaborated with new students while (blue) – doing assignments, and (red) – preparing for exams

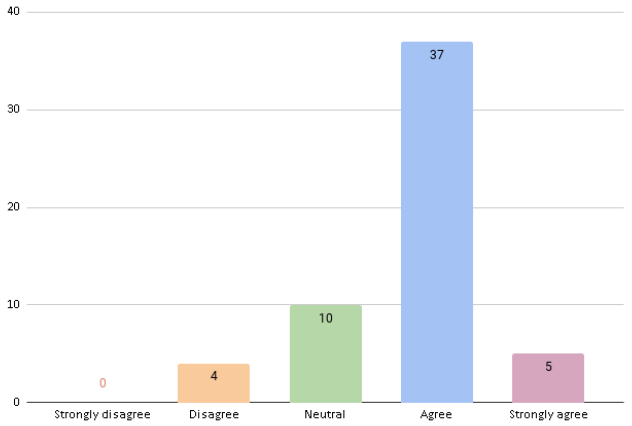


Figure 3.10: I am open to collaborate with other students who are working on the same topics as myself

While 25% of the students were open to collaborating with new students if it were to be facilitated for, a total of 55% see that kind of collaboration as beneficial for their learning, see figure 3.11. Only 4% says collaborations with new students will have a negative impact.

The reason for this difference will be more evident when looking at figure 3.12a, where it is shown that almost half of the students say they are skeptical about collaborating with students they do not know in advance. 23,2% are neutral, leaving 28,6% not being skeptical of such collaborations. This again confirms that students prefer collaborating with their friends. The problem is that students that do not know that many other students will have an even harder time getting to know others, as the other students initially are skeptical about such collaborations.

What is interesting about this is if one looks at the students who agree or strongly agree to be skeptical about collaborating with new students, and see what they think about the two previous questions. These findings are located in figure 3.12b and 3.12c. It shows that students who are skeptical about working with new students are (b) – initially open to collaborating with students working on the same topic, with 63% that agrees or strongly agrees, and (c) – that they still believe their learning will benefit from collaborating with others, with 37% agreeing, and only 7% disagreeing.

This is interesting because students seem to look at the collaboration itself as positive, but as stated earlier, students are more comfortable collaborating with their friends rather than new students.

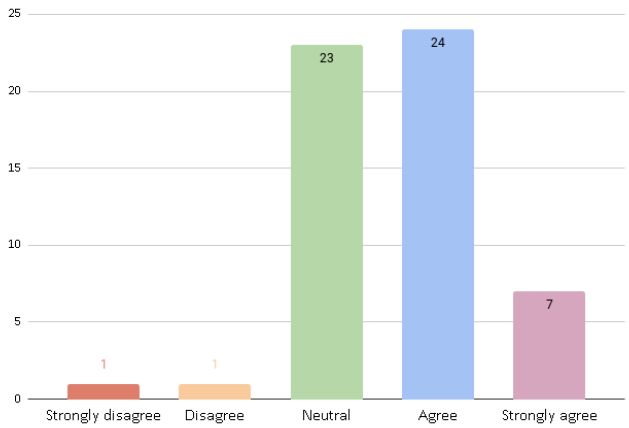
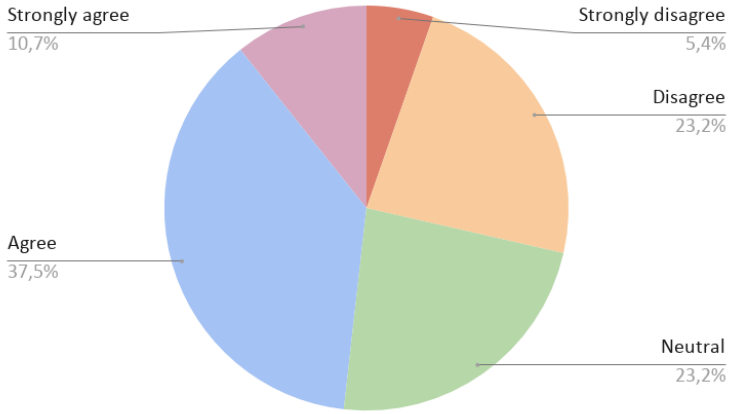
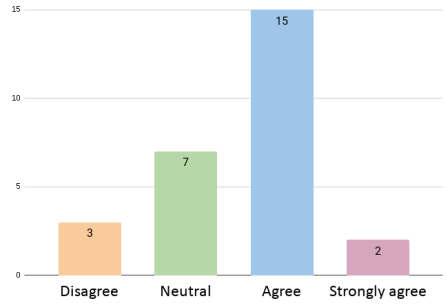


Figure 3.11: I believe my learning will benefit from collaborating with new students

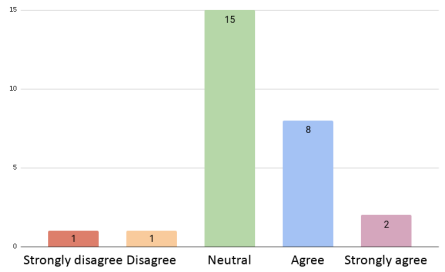
The participants were also asked about providing any pros and cons regarding CLGs, where the raw answers can be found in Appendix D.1 and D.2. To simplify and better visualize, the main topics each reply covered has been extracted and put in the diagrams in figure 3.13. How this is done is if a reply mention, for instance, “You get to discuss with others and usually see problems from a new angle. Easier and quicker to solve problems than sitting trying to read yourself”, it is placed under “Discussion”, “Perspective” and



(a) I am skeptical about collaborating with strangers

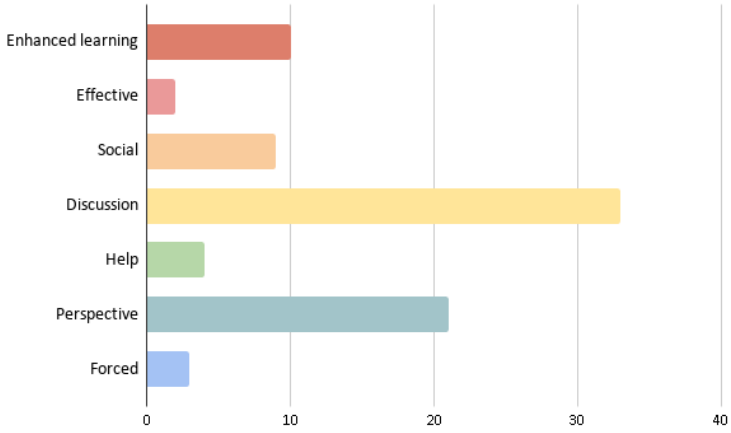


(b) I am open to collaborate with other students who are working on the same topics as myself

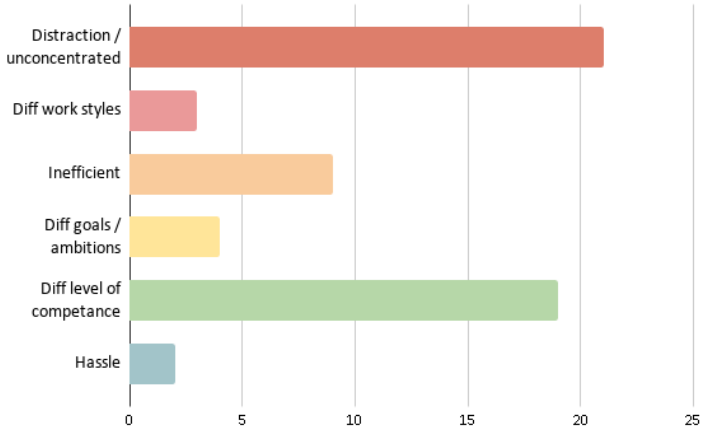


(c) I believe my learning will benefit from collaborating with new students

Figure 3.12: (a) – shows the students who are skeptical about collaborating with others. (b) and (c) – shows the students who agreed or strongly agreed from (a)



(a) Pros of CLGs



(b) Cons of CLGs

Figure 3.13: (a) – Pros and (b) – Cons of CLGs

"Effective", as those are the main topics the statement covers.

The pros, or the positive effects, of CLGs, are shown in figure 3.13a. The "Discussion" factor of a collaborative learning group is the most important one. Second, having a new "Perspective" of the topic from another person, scores quite high as well.

For the negative part of a collaborative learning group, there are also two factors which are the clear "winners"; see figure 3.13b. Being easily distracted while collaborating is the main issue being mentioned in 20+ replies. It is also shown that challenges covered in subsection 2.3.2 are being mentioned, most significant being experiencing different levels of competence for the topic, but also having different study practices and goals for the session.

3.2.6 Discussion

It was argued that CLGs are very important and that students choose to work in CLGs when learning, even when not facilitated by NTNU. This speaks well for student's views on collaborative learning, **RQ1**. One of the most important topics for this thesis, included in **RQ3**, is to assess the willingness of students to get out of their comfort zone to collaborate with new students. It was stated earlier that most students prefer working with their friends, which is where they also feel the most comfortable. When working with new students, most students will experience discomfort to some degree, since they do not know the others. However, in many instances of collaborative learning at NTNU, students are grouped with students they do not know, which in itself is a great experience, which was backed up with the 79% of students who have had good experiences from group work during their study.

Most students are more comfortable working with their friends, which is confirmed as almost 50% of them are skeptical about working with students they do not know before. This finding goes against **RQ3**, as it seems like a lack of willingness to get out of one's comfort zone to collaborate with others. However, as all students are welcome to benefit from a potential application, the main target group for this project is the students who feel lonely, which presumably will be open to collaborating with new students.

Loneliness is a major issue, and it was found that almost 1/3 of the Norwegian students feel lonely. Being lonely makes a bad foundation for finding students to collaborate with, as 1 – the other students prefer working with their friends, 2 – students, in general, are skeptical about working with new students, and 3 – the lonely students have fewer contact points with other students.

From the list of pros and cons regarding CLGs, it is also a significantly higher amount of positive replies than negative, which indicates students having a more positive than negative relation to collaborative learning, giving a useful insight of their attitude of such work, as investigated in **RQ1**. From before, it was found that being able to discuss and communicate and receiving new perspectives about a topic will lead to enhanced learning. On the downside, being easily distracted was an outstanding disadvantage, which should be focused on when conducting a collaborative learning group. As covered in subsection 2.3.3, having the same goal and ambition for a collaboration is crucial, as many students mention having different goals or ambitions as a negative impact of CLGs.

We have from the surveys that students have good experiences working in CLGs and sees them as a good way of learning as they choose to work in groups outside of NTNU facilitation, and see many pros of such work. When working in CLGs, it is clear that students prefer working with their friends, which is due to many of them being skeptical about collaborating with new people. Students see the value of new collaborations, as many of them see it as beneficial. However, the adverse effects of collaborations, such as different levels of competence, ambitions, and goals, cause the skepticism to be too significant.

Chapter 4

High-Level Design

This project aims to explore a way for students to connect with other students. This is explored by developing and testing a tool that enables students to connect by creating new, or joining existing CLGs for enhanced learning. This tool, or ICT, should be an application accessible for all students at NTNU. It should help support and provide strengthened conditions for students to connect. When students have successfully connected, they thereafter will meet physically for collaborative learning. It aims to combine an application with the traditional face-2-face learning, which is classified as blended learning, covered in subsection 2.1.1. A simplified model of how the application aims to function is displayed in figure 4.1.

4.1 Functionality

4.1.1 Existing services

As shown in section 2.4, there exist many applications that help to connect students, facilitating communication, and enhancing the learning process, with many essential features. Key features to take into account, and which is interesting for **RQ4**, is:

- Search for or find students in similar programs
- Communication with groups of students
- Create or find groups of students within their courses
- Easily agree on a time to meet
- Experience effective collaborative learning

4.1.2 Surveys

From the surveys discussed in section 3.2.6, it was argued that students see CLGs as beneficial and that they prefer collaborating with friends. Many students expressed that they were skeptical about collaborating with new students, and listed several adverse effects for such collaborations. From **RQ4**, it is interesting what methods are applicable for such an application, and to deal with these findings from the survey, exciting features are:

- Low threshold of joining and creating groups
- Filter on preferred courses or topics
- Description of the goal and ambition for the collaboration

4.1.3 Initial ideas

The application should first and foremost be a social application, tackling the issue with loneliness among students, which does not have friends or fellow students for collaborations. It should do so by providing a way to connect students and have them interact with each other by joining groups together for collaborative learning. If students want to collaborate with fellow students for an assignment, they shall be able to do so through this application. Furthermore, it should be a shallow threshold for students to create groups and to join them. This is crucial, as it was argued in the survey in section 3.2 that most students are skeptical about collaborating with others. Also, students who have a hard time finding friends at the campus might very well have a hard time connecting with others online.

To achieve a low threshold for joining groups, it is vital to provide enough information about a group and its members, while at the same time avoid violating any privacy issues. Balancing being able to display enough information about said group and members, while at the same time storing the minimal needed amount of data, is an essential principle of the application, and directly relevant to **RQ4**. It is known from the surveys that students prefer collaborating with their friends, being in their comfort zone. A key factor of investigating **RQ3** is by looking at the information provided for the students about each group and its members.

We know from the background theory about challenges and goals related to CLGs in section 2.3, and from the survey in section 3.1, that it is important for students to be on the same page when it comes to goals and ambitions for a given collaboration. Hence, the students need to be aware of what type of group work they are joining in on when using the application.

Even though the main focus of this project is on Norwegian students at NTNU with a lack of friends, or fellow students to collaborate with, it should not exclude others, such as students with lots of friends who want to collaborate with new people or exchange students. The exchange students, which in many or most cases are starting their exchange year or semester with a clean slate, usually are very open to finding new friends to collaborate with in their courses. Having the opportunity to support both English and Norwegian, can therefore, enhance inclusion for them as well.

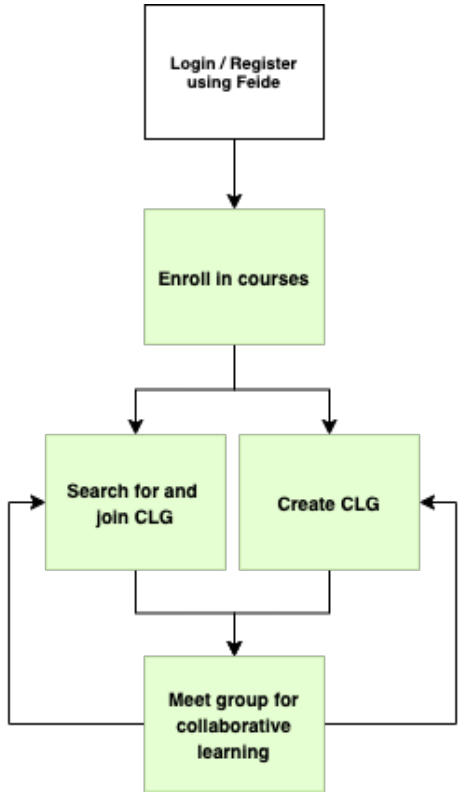


Figure 4.1: Flowchart displaying the high-level features

4.2 High-Level requirements

High-level design is an essential first step when developing new applications (Couvering, 2018b). When creating the high-level design, the "What, not how"-principle (Date, 2000) is a standard guideline to follow. This principle's purpose is to avoid getting too much into detail when developing High-Level Requirements (HLRs). When writing requirements, make them declarative, not imperative. They should describe what needs to be built, not how to build it (Couvering, 2018a).

The HLRs are rated by priority and difficulty on a scale of *Low*, *Medium* and *High*. Priority represents the importance each HLR has for the application, while difficulty is the complexity of implementing such a requirement in the application. The difficulty-ratings are guesses based on the author's experience with web app development and software engineering.

The app shall only be available for students
Priority: *High*
Difficulty: *High*

The entire project focuses on students, and students are the target group for the application. This means that the application shall solely be for students to use. The integrity of the app and its users relies on the fact that all users are students, and that all users know that other users are students. The application should be fully dedicated for students to use.

Students shall have a user profile
Priority: *High*
Difficulty: *Medium*

When using the application, there will be generated data about each student. The students need to be able to access, view, and modify this data. When it comes to user data, it is important only to store necessary information and to display enough information.

Students shall be able to join groups
Priority: *High*
Difficulty: *High*

The project aims to find ways for students to cooperate with fellow students for assignments, preparations for exams or other study-related work, and work in CLGs. This means that users shall be able to connect with others and interact with them. To do this, students shall be able to join CLGs consisting of other students.

Students shall be able to create groups in their courses
Priority: *High*
Difficulty: *High*

These mentioned CLGs are meant to be for and by students. Students shall then not only be able to join these groups but also create them. All groups shall be made by students, and for students to join.

Students shall be able to filter on their courses
Priority: *High*
Difficulty: *Medium*

The CLGs, which by now are both possible to join and create, have a shared mission, which is to enhance learning and work together for assignments or exams. When collaborating, a key factor is to collaborate on the same topic, which in this case, is the course itself. Students work together to do assignments for their courses or prepare themselves for the final exam in the course. This means that to be able to either join or create a given CLG, the student has to be enrolled in the course in which the CLG is related to. This is crucial, as students only want other students within the same course to join their group, or to be in the group they join themselves.

Students shall be able to see relevant information about the groups
Priority: *High*
Difficulty: *Medium*

Even though a group is focused on the same course as you are enrolled in, the student needs more information about the group before considering joining it. Relevant information to take into consideration is the date, time, duration, and location for the group, which other and what amount of students have joined the group. Exactly what information should be displayed has to be analyzed and discussed, and will be mentioned later on.

Students shall be able to see their upcoming groups
Priority: *Medium*
Difficulty: *Low*

Students may join multiple groups on multiple days in multiple different courses, and therefore needs to be able to keep track of the upcoming groups.

Students shall be able to communicate with their groups
Priority: *Medium*
Difficulty: *High*

The students within a group shall be able to communicate with each other. There are many reasons why there might arise a need for this, which includes help for directions to the location, messages about being late or discussing details about the work.

Students shall be able to see a guide of how to use the application.
Priority: *High*
Difficulty: *Medium*

When starting to use a new application, it can be hard to figure out how to use it. The application shall provide a user-guide in which all first-time users be presented and easily accessible thereafter.

List of HLRs			
ID	**Priority**	**Difficulty**	**Requirement**
HLR01	High	High	The app shall only be available for students
HLR02	High	High	Students shall be able to join groups
HLR03	High	High	Students shall be able to create groups in their courses
HLR04	High	Medium	Students shall have a user profile
HLR05	High	Medium	Students shall be able to filter on their courses
HLR06	High	Medium	Students shall be able to see relevant information about the groups
HLR07	High	Medium	Students shall be able to see a guide of how to use the application.
HLR08	Medium	High	Students shall be able to communicate with their groups
HLR09	Medium	Low	Students shall be able to see their upcoming groups

Table 4.1: List of HLRs

Chapter 5

Technical Description

Before going into the implementation of the application in chapter 6, the technical aspect of it will be presented. First, the chosen architecture will be elaborated on, and thereafter the technology used.

5.1 Mobile application vs. Web application

In the specialization project, there were developed a concept of the application. This was developed in React Native[1], and deployed to Expo[2]. This way, it could be tested and used on mobile devices, or through an emulator on a computer. During the project, there were quite a lot of issues with Expo, and it appeared as an inefficient way of working. Another pain point was to have other students test the application on their phone.

Ideally, an application like this should be accessible on both mobile phones and computers. On the phone, the best solution would be to have it as an application one could download from either AppStore[3] or Google Play[4]. On a computer, it is best accessed through a website by having the URL. Achieving both of these solutions would require tons of work, as one would have to develop the application for each environment.

For this project, it was decided to go for developing a Web Application only. The benefits of this include:

- Support for both mobile phones and desktops:
  A somewhat compromise to have the application accessible through a browser on mobile phones and desktops.

- Less painful development:
  Finding helpful documentation for developing a web app is far easier than for a

[1] https://reactnative.dev/
[2] https://expo.io/
[3] https://www.apple.com/no/ios/app-store/
[4] https://play.google.com/store

mobile application. At least when comparing the resources available about React Native and React[5].

- Easier testing and debugging:
  On React Native, every app reload lasted for some seconds, and the error codes were confusing. With Web App, the page reloads instantly, and understanding and locating errors are way easier.

- Seamless deployment:
  Publishing an updated application to the web is done in a matter of seconds, and the newly updated website is accessible for everyone everywhere.

- User testing:
  As anyone has access to the application in a browser in an instant, having someone test the web app is very practical. Go to the URL and test it. As easy as that. No need for the test user to download the application on some third party application.

However, this implies developing from scratch, which starts with deciding a new architecture.

5.2 Architecture

There are many aspects to take into account when deciding how to structure the architecture of such an application – having the project being easily maintained, to use modern technology, but also not to be too time-consuming, as the project only lasts for one semester.

5.2.1 Server-less

Serverless is a cloud computing execution model where the cloud provider dynamically manages the allocation and provision of servers (Bashir, 2018). This means that the developer only needs to focus on the application and not the infrastructure. Figure 5.1 demonstrates the server-less architecture for the application. For small sizes of storage, reads, and writes, one will find services that are free of charge and offers a pay-as-you-go plan for executions which exceeds a set limit. In the case of applications like this, exceeding such limit will not happen unless the application attracts hundreds of daily users. Not only can storage be handled, but also the authentication. From figure 5.1, it is seen that Google Cloud Firestore[6] is being used for storage, while Feide is being used for authentication.

5.2.2 Single-page application

For the application, the idea is to create a web-app, which can be displayed in a web browser. For such an application, it was decided to go for a single-page application, which is what most websites use today. A single-page application is a website that loads the page

[5] https://reactjs.org
[6] https://cloud.google.com/firestore

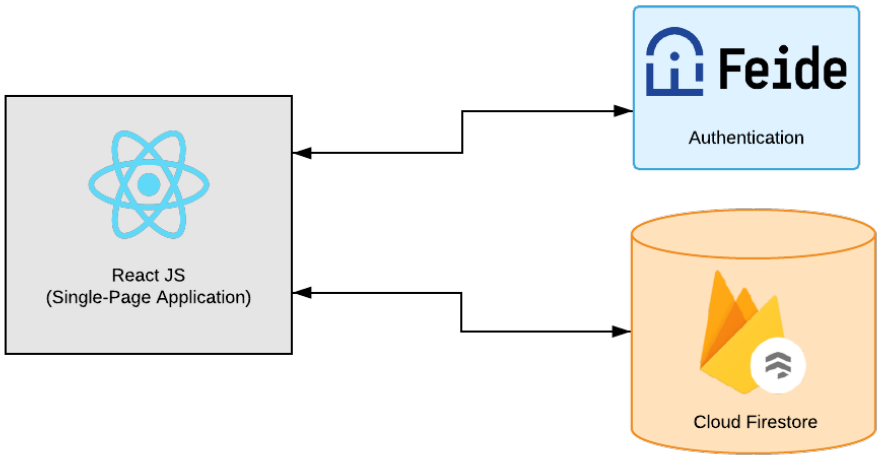


Figure 5.1: Deployment diagram displaying the server-less architecture of the application

once, and are then able to manipulate the DOM[7] elements using Javascript (Groom, 2018), (Neoteric, 2016). This is in contrast to the traditional web page architecture, which loads new .html-pages for every page link.

Going with a single-page application was an easy choice, as it is fast, simple, and easily maintainable, and the author had prior experience with React, a widely used framework for single-page applications. React will be further elaborated on in subsection 5.3.1. Figure 5.2 shows the architecture of the single-page application.

5.3 Technology

This section describes the different services used in the application. The stack consists of React, Redux[8], Feide, and Google Cloud Firestore.

5.3.1 React

React is among the top-rated JavaScript libraries (Suschevich, 2020) and is maintained by Facebook. React is widely used, hence there being tons of easily accessible tools, help, and documentation. It is open-source, continually developing, and open to the community. The specialization project was, as mentioned, developed in React Native, which is very similar to React, and the author had worked with React in previous projects. The choice was therefore natural, as the time-constraint mentioned initially in this chapter prevented spending time learning another programming language.

[7] Document Object Model
[8] https://redux.js.org/

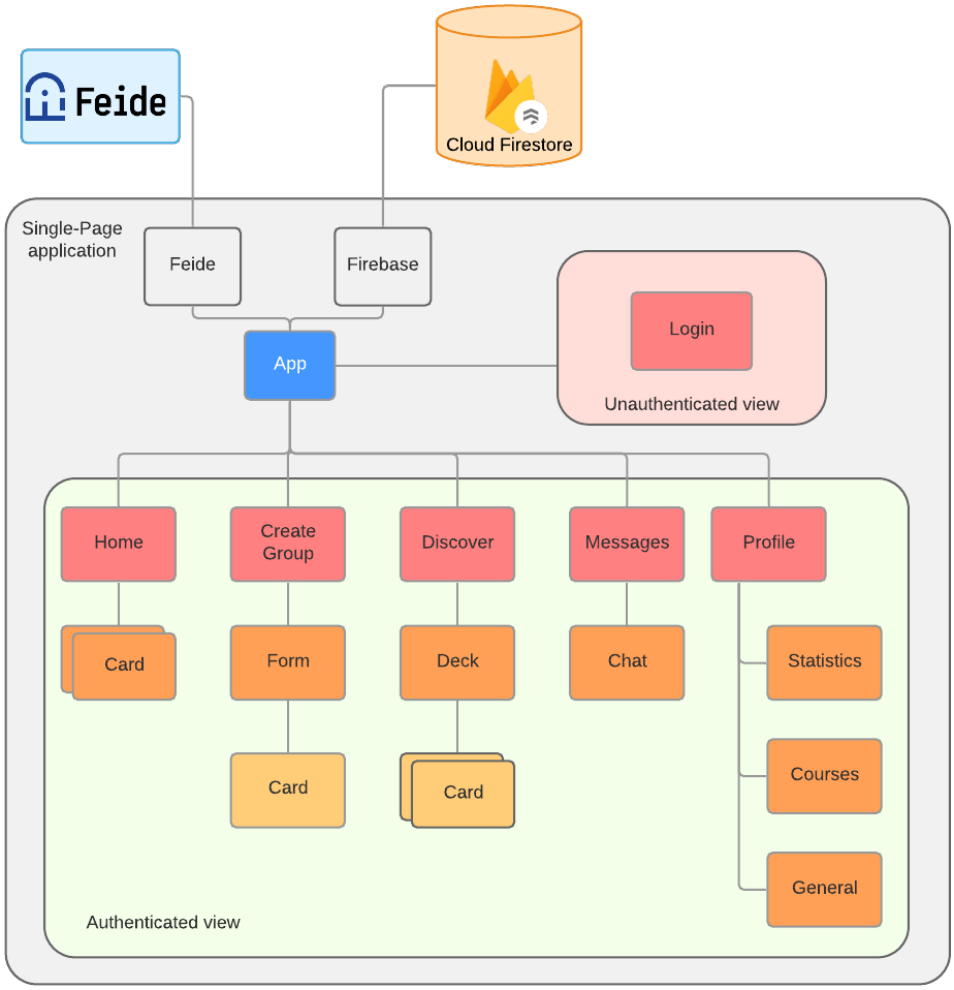


Figure 5.2: Component diagram displaying the single-page application

5.3.2 Redux

Redux is a state management library that fits well with React. It simplifies storing and managing component states in applications with many dynamic elements. The state is stored in a single object and allows every component to access the application state without dealing with child components or using callbacks (Altexsoft, 2018). The three main parts of Redux are Actions, Reducers, and Store:

- **Actions** are payloads of information that are dispatched from the application to the store.
- **Reducers** specifies how the application's state changes in response to the dispatched actions.
- The **Store** is the heart of the application and holds the application state, which is accessible from all parts of the application.

These three are all displayed in the deployment diagram in figure 5.3.

5.3.3 Feide

In order to authenticate students in this application, Feide is being used, which is a secure login system that only allows users with student accounts to be authenticated. Students log in using their NTNU username and password. Feide is the nation-wide solution for secure authentication and allows students to access many different services using their student account safely. Feide is delivered by Uninett AS[9] - The ICT infrastructure company for Norwegian research and education, and cooperates with UDIR[10] - The Norwegian Directorate for Education and Training, and Unit[11] - the Norwegian Directorate for ICT and Joint Services in Higher Education and Research, in maintaining the service.

5.3.4 Google Cloud Firestore

For storage, the selected provider is Google Cloud Firestore. It is a fast, flexible, serverless, scalable, and fully manageable NoSQL document database that simplifies storing, syncing, and querying data (Stevenson, 2020). Similar to the Google Firebase Realtime Database[12], it synchronizes the data through real-time listeners and works regardless of network latency.

A major reason behind choosing Google Cloud Firestore is that the author had previous experience using it. As with React, the time-constraint for the project made it a natural choice to use a familiar service.

[9] https://www.uninett.no/
[10] https://www.udir.no/
[11] https://unit.no/
[12] https://firebase.google.com/docs/database

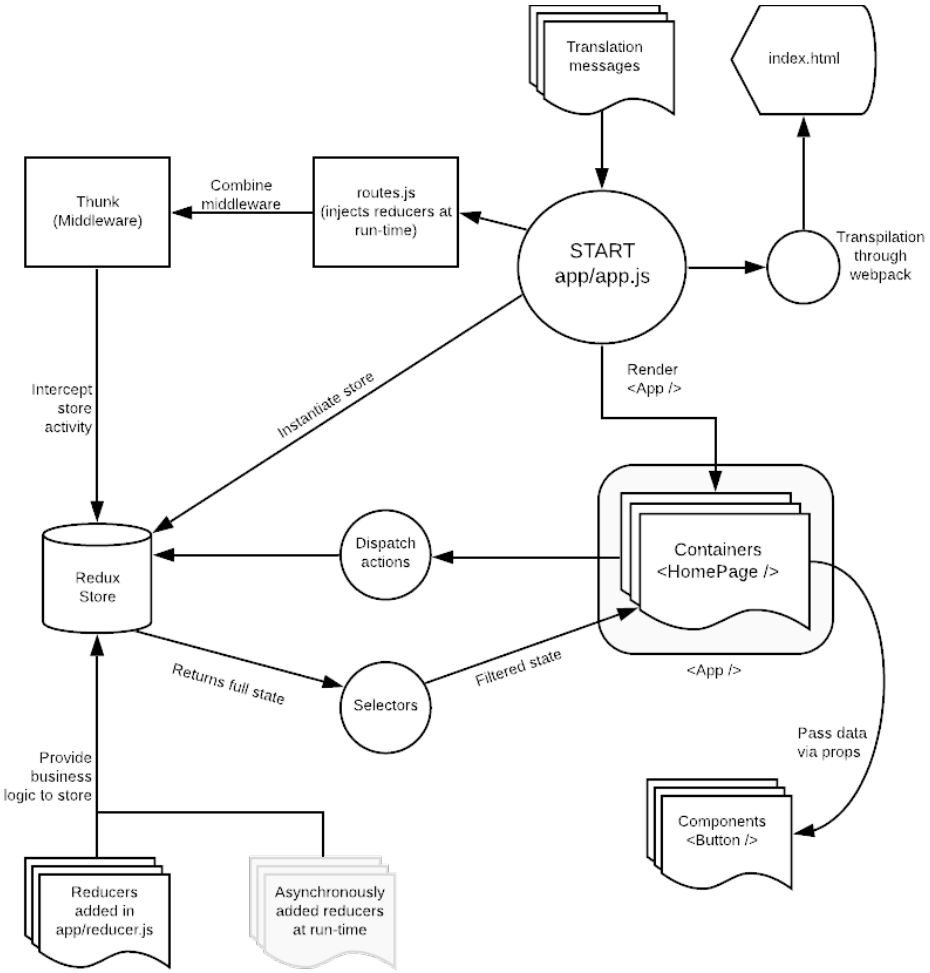


Figure 5.3: Deployment diagram showing the workflow of the application

Chapter 6

Implementation

6.1 The Application: KollokvieSveip

In this section, the implementation of KollokvieSveip is presented. There will be a walk-through of each "screen", and the features and functionalities included for each screen.

Figure 6.1 shows a site-map of the authenticated part of the application. The relation between the authenticated and unauthenticated part was displayed in the previous chapter in figure 5.2. Takeaways from the site-map include the Card-component, which is shared among multiple containers and the different levels of the application.

Furthermore, the flow of the application can be seen in figure 6.2. This displays how the navigation between the pages look like, and what actions each page incorporate.

Before diving into the application, there are a few notable remarks:

1. The information displayed on the cards is not finally decided upon. How much, and what information to view, is part of the research questions for the thesis, and will be further discussed in Section 7.5 and chapter 8.

2. Design, such as colors, the appearance of buttons, and contrasts, has not been the main focus of this project, and should thereafter not take away too much of the attention. The importance of the application is centered around the different features it has, and how each of these aims to benefit the research questions.

6.1.1 Login

The Login-page, see figure E.1 is very simple. As mentioned in remark 2, the importance is focused on the features within the application. The only thing to elaborate on for the Login-page is the Feide-login. With Feide-login, there is no need for user registration in the application, as it is all handled by Feide. When pressing "Login (Feide)", the user is

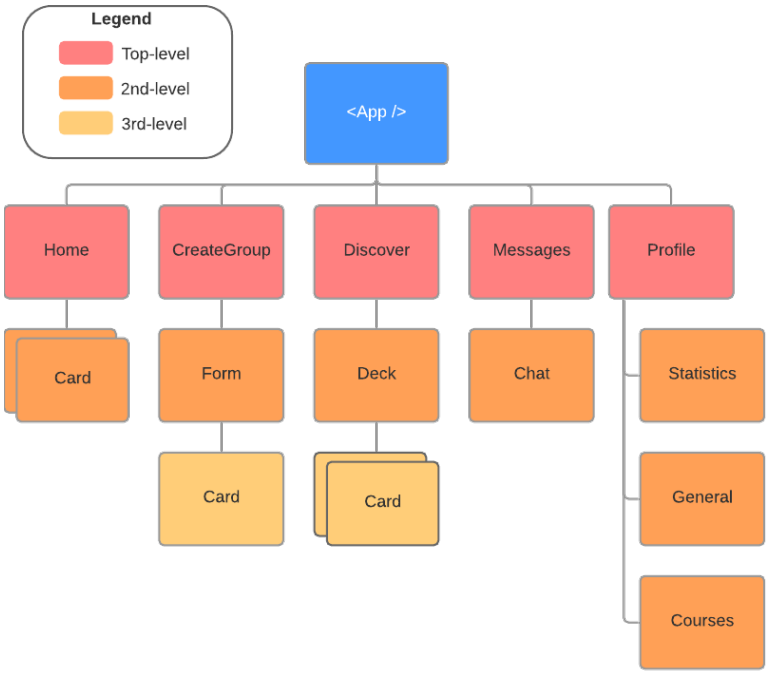


Figure 6.1: Site-map of the authenticated part of the application

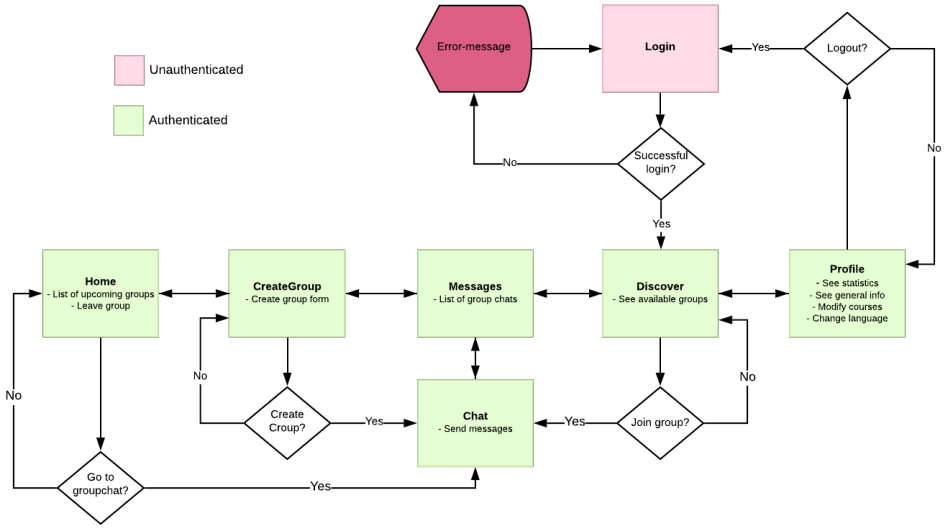


Figure 6.2: Flowchart of the application

redirected to the Feide-login page before being redirected back to the application when successfully logged in using NTNU-credentials. However, as can be seen from the Login-page, there currently is a username input-field. This is due to two reasons; 1 – when developing, it was found easier to log in just using a pre-set username, as it was way faster, and 2 – when user-testing the application, the test-users could log into a dummy-user, without having to provide any personal information. This way, it was not necessary to deal with NSD to store any personal data about the test-user. The Login-page with Feide, solves HLR01, making the application solely accessible for students.

6.1.2 Navigation

As displayed in the flowchart in figure 6.2, one can navigate between the top-level pages of the application. This is done through the bottom navigation bar, which can be seen on most screenshots of the application in Appendix E.

Every time the user is logging in, the first page to be displayed is the Discover-page, as that is an essential page of KollokvieSveip.

6.1.3 Discover

The Discover-page is KollokvieSveip's main attraction, as this is were some of the most important factors of the application takes place.

When a user for the first time logs in to the application, the Discover-page is quite empty, see figure E.2. At this point in time, the user has not enrolled in any courses yet, and therefore the Discover-page has nothing to show. The user is simply provided a step-by-step guide on how to enroll in courses. More on that process in subsection 6.1.7, when presenting the Profile-page.

When a user has enrolled in the desired courses, the Discover-page will look like figure E.7. The user now gets displayed a deck of cards that belongs to one of the courses the user is enrolled in. There is a drop-down menu in the top right corner to change the course in focus, see figure E.8. Each card is containing information about the groups that have been created for that course. As mentioned in remark 1, the current information is one of the key topics in the discussion of the thesis and is therefore not fully decided upon. HLR06 requires the student to be able to see relevant information about the groups, and the information currently being displayed is as follows:

- Course code:
  The code of the course the user picked from the drop-down menu.
- Type of work:
  The card's header displays what kind of work the group wishes to do. This can be either "assignment", "exam" or "other", depending on what the creator of the group wants to work on. For all types of work, especially "other", the description which will be elaborated on later, is essential.
- Date:
  Underneath the course code and type of work, the date of the group work is displayed, just above a number of days until the work.

- Location:
  The location of where the work will take place. Currently, this is manually typed in, and the creator has to either book a room through NTNU's RomRes, presented in section 2.4, or find a suited location for the group. If the creator does not know of a room, some of the other members of the group might know of one and can convey this to the group in the chat, which will be presented in subsection 6.1.6.

- Amount of students:
  The amount of students is being displayed as a fraction, where the numerator represents the amount of students currently in the group, and the denominator represents the maximum capacity.
  When pressing the "info"-button in the bottom right corner of the card, one will be prompted with a modal, as seen in figure E.11. This modal will potentially contain some further group info, where the group members are most relevant. Here the names, usernames, and program of study of the group members can be displayed.

- Time:
  The time of the group work is here presented in hours and minutes in a 12 or 24-hour clock, depending on the chosen language.

- Duration:
  The duration of the group work displayed in hours.

- Description:
  The last piece of information currently presented on the card is a short description of the work, which is presented as suggested work for the group. Here, the group creator can specify what assignment or exam will be the focus of the work. If the work type falls under the "other"-category, the creator must here explain what the work will be focused around.

Based on the information provided on the card, the user should decide whether to join the group. This can be achieved by either pressing the "X" or the "checkmark"-button on the bottom of the card, or by swiping, as seen on figure E.9 and E.10, hence the name, KollokvieSveip, which in English can be translated to "swiping between collaborative learning groups". When joining a group, the application has accomplished HLR02, with having students able to join groups.

The Swipe logic from Tinder is fascinating, as it provides a low threshold for connecting with others. As mentioned in subsection 2.4.1, it provides the feeling of sitting in the director's chair through a casting process. Other users of Tinder has also elaborated that it feels like flicking through a magazine or looking through a catalog (Bhattacharya, 2015), (Wygant, 2014). Hence, implementing a swiping process when deciding on CLGs in the application is applicable, and a highly disputed method researched for **RQ4**.

When students join a group, they put themselves out there and might place themselves outside of their comfort zone. In a situation like that, one may feel vulnerable, which can be scary. Hence, the feature of joining a group is among the most important features of the application. The process should be perceived as encouraging and motivating for the student and not intrusive. The process of joining groups will be largely discussed later.

Further, when attempting to join a group, one will be prompted a modal, opting to proceed to the group chat and start talking with the group, or continue on the Discover-page looking for more groups, see figure E.12.

When one has swiped left on a card, rejecting it, the next card of the deck will be displayed. There are now two possibilities of seeing the rejected card again. 1 – use the "go-back" button at the bottom left corner of the card, or 2 – when having finished swiping the entire deck of cards, it may be "reloaded", see figure E.27.

6.1.4 Home

After the user has joined one or more group(s) in the Discover-page, the group(s) will appear on the Home-page, see figure E.13, and achieving HLR09. Each upcoming group is represented by a half-card but can be expanded into the full card to see the relevant information for the group, see figure E.14. From here the user can see the same information as in the Discover-page, including the additional group-info, by pressing the "info"-button in the bottom left corner of the card, see figure E.15.

The Home-page's most important feature to be discussed later is the ability to leave a group. This is achieved by pressing the "X" in the bottom right corner of the card. A modal will then be prompted, see figure E.16, where the action to leave the group must be confirmed. *How easy should it be to leave a group?* and *How many times can you join and leave groups?* are questions that arise from this feature, and will be discussed later.

If the user neither has created nor joined any group in the Discovery-page, it will be displayed a message informing about this, see figure E.3. The user is here informed to either join a group or create one itself, which leads us to the next subsection.

6.1.5 CreateGroup

As with the Discover-page, CreateGroup-page will prompt the user to enroll in a course if not already done, see figure E.4. When that is done, the CreateGroup-page contains a form in which the user can create groups, see figure E.17. The user has to decide on the information to put in, before creating the group. As with leaving a group on the Home-page, the user will be prompted to confirm the creation of the group, see figure E.18.

The creation of a group is not only a highly prioritized requirement, HLR03, but also another important and highly debatable feature of the application. It should be simple, and at the same time, comforting for the user to create a group for others to join.

The information the user can insert is the same as what is displayed on the Discover-page card, which means this information will be discussed later.

6.1.6 Messages

Similar to the Home-page, the Messages-page requires users to join a group in order to display anything, see figure E.5.

The user's upcoming groups will be displayed on this page as a list of group chats, see figure E.19. The group's course code represents each group chat and date, amount of students, and the latest sent message in the group. If the group chat is empty, the latest

message will display “Start the conversation!” to encourage the participants to connect. If the user presses any of the group chats listed, it will take the user to the Chat-page.

The Chat-page is a 2nd-level page, where the group members can send messages to each other, see figure E.20, and meet HLR08 – allowing students to communicate with each other. In the Chat-page, the participants can see who initiated the group and the names of the people who have sent messages. The purpose of the chat is to discuss any topics relevant to the group work, such as location, what kind of work they are interested in doing, and communicate if some of the members are being late to the group work.

6.1.7 Profile

The last page of KollokvieSveip is the Profile-page, see figure E.22, where the user are able to administrate the user-profile, HLR04.

The Profile-page’s header displays the avatar and name of the user, in addition to two buttons with actions leading to respectively logging out or changing language. The logout will redirect the user to the Login-page, as seen from the flowchart in figure 6.2, while the language-button will prompt a modal, see figure E.25. By pressing “Norsk”, the language has changed, which can be seen in figure E.26.

The avatar holds the potential of displaying a profile picture of the user. As will be seen in the discussion for the test evaluation, some students think of displaying a profile picture as necessary. This will be further discussed in chapter 8.

Furthermore, the Profile-page has three sub-pages, “Statistics”, “General” and “Courses”, where “General” being the start-page. Here, the user can see the information that has been stored about the user, and that potentially can be displayed for other users of the application. The information being the name, username, program of study, and courses currently enrolled in.

Moving on to the “Courses”-page, the user will be able to enroll in courses by picking or searching for one in a dropdown-list, solving for HLR05. The page also displays the courses the user currently is enrolled in, and the ability to un-enroll by clicking a trash can placed to the right of the course, see figure E.24.

If the user is not enrolled in any courses, the page will look like figure E.6. This is how the page will look the first time the user enters the app and has been provided the steps on how to add courses from the Discover- or CreateGroup-page.

Lastly, the Profile-page has a “Statistics”-page, see figure E.23. This page has the potential to display all kinds of relevant statistics for the user, currently showing the number of groups the user has been part of and the total number of hours spent in collaborative learning groups.

Chapter 7

Test Evaluation

This chapter describes and analyzes the evaluation of the final test of the application. It begins by presenting the purpose, process, and participants of the evaluation, before laying out the results and discussion.

7.1 Purpose

The purpose of the test evaluation is to get feedback from students testing out the key application features, mechanics, and elements. These findings will help investigate and answer the thesis' research questions, and to form the discussion and conclusion for the project.

7.2 Process

When conducting a test evaluation, it is common to collect and analyze data through qualitative research, which focuses on obtaining data through open-ended and conversational communication (Silverman, 2016). The plan was formerly to conduct it using a focus group that could thoroughly test the application, both ideally and practically, with meeting in person for group collaboration. Due to the Covid-19 outbreak, this was not possible, and the plan had to be revised.

The new plan had to be following the guidelines with social-distancing, meaning being conducted online and remotely. Hence, the test was held over Whereby[1] and the test was conducted 1-on-1, with one testee at the time, and the process of observation. When using Whereby, it is possible to communicate while sharing the screen. The application was published to the internet using Surge[2], leading the testee to access it through a web browser, and share the experience live.

[1] https://whereby.com/
[2] https://surge.sh/

The testee was provided minimal information before the test, containing only the text described in table 7.1

"*KollokvieSveip* — Swipe through collaborative learning groups. Enroll in courses at NTNU, and create or find collaborative learning groups that match your demands and requirements"

Table 7.1: Application description for test evaluation

When testing the application, the testee was provided a handful of tasks to perform to experience all features that KollokvieSveip has to offer. The provided tasks can be found in table F.1 in Appendix F. These tasks include all aspects of the application, and the testee was told to think and reflect out loud while testing.

When the application had been tried out, and the testee had fully experienced the application, they were interviewed for a final evaluation and feedback. The questions the testees were asked, which are listed in table F.2, are meant to provide a clear answer and reflection on whether or not the application is applicable in a student environment, and for the project to answer the thesis' research questions. The interviews were transcribed and analyzed qualitatively.

7.3 Participants

In the last part of the survey described in section 3.2, the participants had the opportunity to leave their email address if they were interested in taking part in testing the application, see figure C.5. An email was issued to the students that left their email address, see Appendix A.2, asking if they still were interested and had the time to take part in the test. Five students replied, and all five have conducted the test described in the next section.

7.4 Results

The testing was evaluated through observation and an interview, which will be presented in this section, while the discussion follows in section 7.5.

7.4.1 Observations

From the observations of the user-testing, it was apparent that the students have rich knowledge of how to navigate and use such applications. Enrollment in courses worked seamlessly, and it was also clear that the students were familiar with the swipe-logic. Swiping through the deck went flawlessly, and the creation of new groups was comprehensive. All of the testees were very familiar with how a chat-application worked and had no problem interacting with group members in the chat. Swiping a deck of groups and a chat for instant communication appear to be great methods for joining CLGs, as being investigated in **RQ4**.

Most of the pain points regarding the application came from a design perspective due to design-choices, as stated in remark 2, such as a poorly chosen color for a button, as seen in figure E.12.

The observations reflected that the application succeeded in having students connecting with other students in creating and joining collaborative learning groups.

7.4.2 Interview

When the application had thoroughly been tested, the interview was next on the agenda. The full answers to all questions can be found in Appendix F.2, but the most important feedback has been extracted and is presented in the tables below.

Is KollokvieSveip an application you could see yourself use?	
Testee#	**Answer**
1.	• Absolutely. When you take courses with fewer friends enrolled, it is harder to find others to collaborate with.
2.	• Yes, in the first semester. Currently, it is so that the professor says that students can send an email if they do not have collaborative learning groups, which I do not think many are doing. This way, it is easier for students.
3.	• Yes, especially in the first year. • Later on when you get more settled, you are not looking for new people so much • This means I currently do not need to work with randoms.
4.	• Yes, good concept. • But when you make more friends, you rather work with them than new people. • However, if the quality of the collaborations with your friends decreases, it can be good collaborating with new people.
5.	• If I had courses without people I know.

Table 7.2: User-test replies to Q1

The first takeaway is that the test-users were all positive to the use of the application, or could have seen themselves use it under the right circumstances, see figure 7.2. Two of the students mentioned the possibilities of using such applications during the first semester, as that is a time where students have a fresh start, with a clean slate, without close friends. This is relevant for **RQ2**, as this is a crucial time to get in contact with other students. For

use later on in the study, some pointed out that if students come across courses where they do not have friends enrolled in the same course as themselves, it could be beneficial to use such an application. It seems to be a consensus that when students have a group of friends, they will rather be working with them than searching for other students. This confirms the findings in section 3.2. It threatens the willingness to get out of the comfort zone, which is being investigated by **RQ3**.

The interview also shows that most students experienced a high threshold for joining groups, see table 7.3. Four out of five say something along the lines of instead relying on their friends when it comes to working in groups than having to work with new people, which ones again confirms the findings from section 3.2.

Two takeaways from the answers in table 7.3 are; 1 – testee #1 points out the possibility of creating a group with a friend and letting random people join this group. When creating a group with a friend, it feels safer, as the friend is one know and are already comfortable around. Besides, 2 – testee #4 points out that the users of the application all have the same intention; *enhancing their learning while collaborating with other students*, hence being fine meeting and collaborating.

How do you experience the threshold for joining groups?	
Testee#	**Answer**
1.	• Socially, it is a high threshold. – In Norway people tend to be more shy – Stay in the comfort zone • You create groups knowing that anyone can join • Might be easier if you could create groups where you could add a friend, and have others join you.
2.	• Would be easier if I knew who the others are • If I could see the line of study, I would probably choose the ones who study the same as myself.
3.	• I would say it is a high threshold for joining groups • Feels vulnarable. Rather study with friends that you know.
4.	• Low threshold. • The other users have the same intention as yourself, so you should be fine.
5.	• High threshold. You commit yourself into meeting a group of random people.

Table 7.3: User-test replies to Q6

What much more or less information do you require about the groups?	
Testee#	**Answer**
1.	• I would like to see profile pictures. Pictures create a trust/credibility. • I think it is easier to join if I see pictures • Also more info about goal, productivity and level of ambition for the work
2.	• Full name, want to know who they are beforehand • I don't think the level of ambition is necessary as everyone is here for the same reason, learning. • However, I would like to know how much the others wants to work
3.	• What is the goal of the meeting? • How are people to work with? • Have a short biography about themselves?
4.	• Profile picture, to recognize other members to get an impression • Their study program. Know if they are in the same program as me • I would like to see the full name
5.	• At least the first name, and what they study • Maybe a short biography of each member? • Specify the collaboration's ambition and what we are working on

Table 7.4: User-test replies to Q7

The threshold for joining groups is arguably the most crucial factor when it comes to **RQ3** – collaborating with random students. The lower the threshold, the more likely students are to join a group. As argued earlier in this section, the threshold is quite high for this application, but with more information about the groups, it can likely get lower as students know more about what they get themselves into. In table 7.4, one can see the answers to how much more or less information students would like to know about a group if they are to join it. The information currently being shown is not enough for the average student to be willing to join a group. The full name, profile picture, and the program of study for each group member are the main requirements provided by the testees. According to Testee #1, it creates trust and credibility, which is essential for someone to get out of their comfort zone. Two of the testees, respectively #3 and #5, suggests something along the lines of having a short biography for each member, where the students could write about themselves. It could be useful if one is looking for a particular type of collaboration or want others to know more about them, the expectations for the group work, or any distinct communication- or study practice one prefers. A student's description or biography is one

suggestion, where another is having a more elaborate description of the group work and its goal. Even though students can type in whatever they want in the current description, this could probably be more encouraged, maybe by a required field on the card. On the contrary, testee #2 explains that the students looking for collaboration are all using the application for the same reason, hence it should not be that necessary to elaborate on, for instance, the group's ambition for the collaboration.

Furthermore, the participants were asked about any negative effects of joining groups or about the concept in general, see figure 7.5, and especially one interesting thought were brought to light. As mentioned in section 6.1.4, two questions arose; *How easy should it be to leave a group?* and *How many times can you join and leave groups?*. The testees can see the ability to easily leave a group as a negative side effect. Three out of the five testees are critical to students being able to join and then leave. Testee #1 mentions that the degree of anonymity is crucial in this sense, as the more anonymous students are, the easier it is to leave groups.

What are the negative sides of joining groups / about the concept?	
Testee#	**Answer**
1.	• How obligatory is it? • Easy to join, but also easy to leave • The level of anonymity is important. The more anonym you are, the easier it is to leave groups • The more people know about you, the harder it is to leave • Lots of people leaving groups will create a bad trend of people joining and leaving
2.	• The collaboration itself could be negative. • Also a risk to meet "strangers"
3.	• None
4.	• If students join and leave groups regularly
5.	• If I find out I can't meet and have to leave the group. Especially unfortunate if it happens close to the meeting

Table 7.5: User-test replies to Q8

7.5 Discussion

This section presents the discussion of the results from the evaluation of the testing. As there were five students from within the IT-study programs at NTNU in Trondheim who participated, the results are heavily impacted by that, and the results could likely be different from another group of testees, especially if they were outsiders that previously had not been in CLGs. The discussion will shortly highlight the usability and concept, before a more in-depth discussion about the most important features, mechanics, and elements of the application.

7.5.1 Usability

All the tasks that had to be performed by the testees went very well. All the testees appeared to be familiar with the swipe logic and liked the feel of it. The rest of the application also appeared intuitive, with the testees knowing how to navigate, use drop-down menus, and fill in forms. As mentioned in the remark 2 in section 6.1, the colors and some of the less critical parts' appearance has not been a major focus during the development, hence some of the testees provided constructive feedback regarding this.

The overall usability of the KollokvieSveip was perceived as good, as none of the testees encountered any difficulties using it.

7.5.2 Concept

The feedback regarding the application's concept was excellent, as all of the testees thought it had the potential to be a proper supplementation for students when looking for collaborations. This relates both in regards to enhancing their learning, and a way for students to find friends, no matter if they are lonely, a first-year student, or just want to expand the network of friends. By this, the application has the potential to be an answer to **RQ2**, as it can be considered a new way for students to find new, fellow students to collaborate with in these contexts.

Although some of the testees could see some potentially minor adverse effects of the application, neither of the testees thought the application could have an overall negative impact. Students either end up finding new students to collaborate with or end up in the same situation as they started in.

7.5.3 Key features

The most exciting takeaway from the testing was gathered from the first question. As stated from the replies, and as argued from the surveys, students prefer collaborating with their friends. As students go through the years of study, they increase their network of fellow students and friends, hence being less interested in collaborating with random students and use such applications. However, it was also mentioned the possibility of using such an application in the first semester, when students have a more open mind about meeting new people, as they do not necessarily know people from before. It would be exciting to assess how integrating a tool for finding collaborations in the first semester would impact, and possibly change, the students' thoughts of collaborations later on in the study.

Furthermore, as argued, the swipe logic works well, and the testees say that the functionality of joining a group is seamless and intuitive. However, the threshold is currently too high for the average student to join a group. This is mainly due to the information given on a group's card being insufficient. A major part of solving this issue is balancing gathering and displaying enough information while storing as little personal data as possible. According to the testees, when working with new people, students have to know at least some personal information about the students they are to form collaborations with. The name is the least amount of information required, but preferably a picture and a biography of the students as well. Having too much information can, in many cases, have a negative effect. When finding new students to collaborate with on a mission to enhance their learning, one should not be too worried about the appearance of the other students. The more information students have, the more likely they are to choose groups based on looks and appearance, making the application more similar to actual Tinder or any other dating application. This will especially be the case if there is presented a profile picture for each user. As shown in the Profile-page in subsection 6.1.7, there is a possibility of displaying an avatar. However, this avatar does not have to be an actual picture of the student. This avatar might be a more fictional description of the user, showing a drawn representation of the user. This way, other students will get an idea of what the others look like, without knowing in detail.

With Feide-login, all users know that the other users are students, which at least provides a certain degree of assurance for the collaboration. By also having the program of study, students can know some more information, yet not able to identify the individual. An idea could be to show the username of the other students, as that is somewhat cryptic, yet identifiable. That way, students could join a group where they see a familiar username and join based on that.

Being able to join a group where one sees a familiar student leads us to the next potential interesting feature: having the ability to create a group together with one or more students. There are many cases this could be useful, for instance, being a pair or small group of people who want to include one or two more students in the collaborative learning group, or just having the comfort of at least knowing one person when meeting new people. The latter can resemble trying a new sport, starting as a student at NTNU, or traveling to another country. Under these circumstances, having a friend to rely on and feel safe around will make getting to know others or getting out of the comfort zone easier.

The feature which was highly disputed among the testees, the leave group mechanic, is also very impactable for the application. As some of the testees mention, it could lead to a trend of people joining and leaving groups, which can lead to a lot of confusion and inconsistency. Students should not be forced to stay in a group if they find out that it does not work for them, but having students join and leave groups regularly is bad for the application. The inconsistency this brings along will have a negative impact. As one of the testees points out, the level of anonymity can adjust this trend of leaving/joining groups. The more anonymous one may be, the easier it is to leave the group and vice versa. Being able to balance having the correct amount of information of each group and its members, and at the same time adjusting to how easy it is to join and leave a group, is an important factor for the application.

Chapter 8

Discussion and Conclusion

8.1 Discussion

In this section, the findings concerning the Research Questions presented in section 1.3, which formed the foundation for this research, will be discussed and elaborated.

RQ1: What are students attitude to collaborative learning?

As argued in chapter 2, CLGs are an effective way of learning, where students will benefit from observing and discuss with fellow group members. In section 3.2, it was found from both the survey conducted by IDI, and from this project, that many students work in groups outside of NTNU's facilitation, which indicated that they see it as effective, and a way to enhance their learning. It was also discovered that students see group work as a good way of gaining friendships and that 80% of the students have had good experiences from collaborative learning during their study.

Even though students view collaborative learning as a learning-enhancing way of study, and a good take on gaining new friendships, it comes with a side remark. When a student collaborates with fellow students, these fellow students are, in many cases, friends of the said student prior to the collaboration. This is shown as 75% of collaborations are planned ahead, and only 25% are open to collaborate with new, fellow students. Even though it was established that students are open to collaborating with fellow students working on the same topics and that their learning will gain from new collaborations, it was shown that most students are skeptical about getting into collaborations with new students. Hence, it is safe to say that students prefer collaborating with their friends rather than with new, random, fellow students.

To answer **RQ1**, the students' attitude to collaborative learning is that it is an effective way of learning, but under the right circumstances – with their friends when planned in advance.

> **RQ2**: In what contexts are students searching for fellow students for collaborative learning?

This thesis aimed at exploring a way for students to find other students to collaborate with, which ended up being an application named KollokvieSveip. From section 2, it was found that there currently is no way for students to find other students for collaborative learning when NTNU does not organize it. There are many ICTs which support the learning process for individual or groups of students, but when it comes to connecting with potential fellow students, there currently does not exist an alternative.

As argued, loneliness is a significant issue among students, and hence many students do not have fellow students or friends to form collaborative learning groups with. As mentioned, KollokvieSveip aimed at dealing with this, but how? The application provided a way for students to either join existing groups or create new groups for others to join. The students were presented a deck of cards in which each card represented a group. The student could either swipe right or left in an old-fashioned Tinder-style layout by reviewing the information provided on the card, depending on whether or not they wanted to join the group or discard it. If neither of the groups appeared to be interesting for the students, they are free to create a new group through a form in the application. Creating and joining groups are, in fact, two entirely different actions. The main difference is that when students join another group, they join someone else's group, while when creating a group, someone is joining theirs. When students create a group, they immediately put themselves out there, taking the first step. As Erik Mathisen, creator of Studievenn, stated in sections 2.4, that driving students to make the first step was a major issue for his application. On the contrary, when students want to join another group, they are able to be anonymous on the Discover-page until they end up joining. This means that students can "scout" for the perfect group until they finally "reveal" themselves by joining a group. KollokvieSveip succeeded in providing a seamless way for students to create or join groups with fellow students at NTNU, but it did not succeed at being useful for all students. It was argued that such an application could come in handy under the right circumstances or context. This was exemplified by referring to it as potentially being useful for students in their first semester. Open-minded students starting university, looking to creating or expanding their network, are more likely positive to collaborate with new, random students. Later on in their years of study, at least by referring to the results provided by the test group, it would need further research towards how much information is necessary to display about a group and its members, in order to be a useful application potentially. However, as the main focus on the project is centered around lonely students, some students might find the application useful as-is. To thoroughly investigate, this requires a more elaborate testing phase, lasting for a significant time, where the test-users meet for face-2-face collaborations.

To provide a specific answer to **RQ2**, students could see themselves searching for fellow students in the right context, which in this case seems to be during their first semester. However, necessarily not only for 1st-year students, but whenever students start a new semester and take courses where they might not know that many students. There does not currently exist a way for students to find other students for collaborative learning, outside of NTNU's facilitation, other than organizing with their friends. It would be interesting to see, as argued in the discussion in subsection 7.5.3, how integrating such an application early on would impact students' thoughts about collaborations later in the study.

> **RQ3**: Are students willing and able to go out of their comfort zone and study in groups with new/random students on a common mission to enhance their learning?

It was found that KollokvieSveip did not fully succeed at having students use such an application, which was mainly due to the willingness to go out of one's comfort zone. Overall, students are not willing to form groups with new people when they have friends for collaborations. There are, as discussed, multiple reasons for this, but an important factor is the comfort zone. Why should students meet a group of strangers, when they are comfortable collaborating with the people they know? As mentioned with **RQ2**, a further elaborate testing phase, which at some point will see how the more lonely students would react to such an application, would be very interesting. However, the current result is that students have a high threshold of getting out of their comfort zone, resulting in a lack of willingness to collaborate with new students.

The information provided for a group and its members is the most important factor as to why or why not one should join the group. This is what needs to be further investigated and tested. There was split feedback from the testees about precisely what needs to be displayed as information for each group, but there was consensus about requiring more information. It seemed that the information about the group's members was the most important one. Joining a group without knowing anything about the group's members other than how many of them there are, is not enough, even if all of them have the same goal of enhancing their learning about the course in question.

> **RQ4**: What methods are applicable to support students in finding or establishing collaborative learning groups?

KollokvieSveip aims to support students in connecting with fellow students for collaborative learning, through assisting them in creating and joining CLGs. The functionality itself succeeded greatly in doing so, as students found the process of using the application flawless and fun. However, as argued, the information displayed on each card about the group and its members, needs further work and testing.

Nevertheless, it is possible to establish the methods which appear to be highly applicable in such applications, from the findings in this project;

- Profile:
  The students need a profile containing relevant information. This information must include at least the full name, username, and program of study for the student, as this is the minimal amount of information students want to see about others.

- Clear group description:
  The adverse effects of CLGs are highly due to the difference in the level of competence, ambitions, and goals. To consider joining a new group of students for collaborative learning, students want to know what the group aims to achieve. Hence, having this information indicated before consider joining a group is therefore critical.

- A low threshold interaction:
  Both when joining and creating groups, it must be perceived as a low threshold

process, and not intrusive.

- Chat:
  Instant messaging between the group members to discuss and share thoughts prior to the collaboration is essential for students to feel more in control of what they get themselves into.

8.2 Conclusion

In this thesis, it is found that students see collaborative learning as a good way of learning and that most students have good experiences from collaborations at NTNU. When it comes to collaborating with new fellow students, most students see the value and benefits of such collaborations. However, many are skeptical about it due to the adverse effects of collaborations, such as different levels of competence, ambitions, and goals.

Loneliness is a significant issue among students, and it was found that almost 1/3 of the Norwegian students feel lonely. As many students see collaborations as a good way to make new friends, supporting students in connecting with others to form such collaborative learning groups could potentially address this issue.

There has therefore been explored a way for students to connect with new, fellow students for collaborative learning, through an application named KollokvieSveip. From the findings gathered in the experimental phase of the project, through a 1-on-1 test on five students, it was argued that the application could serve as a good tool to support finding new students for students in their first semester. The application needs improvement to help the average student later on in one's study, especially given the information provided for searching students. The current information displayed in the application is not enough for students to choose meeting new random students, particularly when having the option of collaborating with their friends, staying in the comfort zone.

Whether or not KollokvieSveip can prove to be a solution for dealing with the loneliness among students requires more comprehensive testing over time, making sure to reach the lonely students discretely.

8.2.1 Future work

As argued, to thoroughly investigate such an application's potential functioning as a support tool in finding collaborations for lonely students, it would require a new, more comprehensive test over time.

For the application, it would be great to integrate all relevant features of group collaboration. This means being able to book a group room through RomRes directly and be provided in-app navigation using MazeMap. During the collaboration, the group would greatly benefit from using Hold, to experience a productive and motivating collaboration, meaning integrating or encouraging the use of, Hold in the application.

8.3 Covid-19's impact on Collaborative Learning

This thesis was conducted over the spring semester that Covid-19, know as the Corona-virus, ravaged the world, and lead to a lockdown of Norway for many months. This brought along lots of repercussions, such as NTNU initiating digital, remote lectures, which will also be the case for the coming fall semester. This is directly impacting, and very relevant for the research gathered in this thesis. The initial motivating factor of providing a way for all students, but centered around lonely students, to connect with other students to form collaborative learning groups for enhanced learning is now more and more relevant for all first-year students starting at NTNU the coming fall semester. As most students usually tend to connect with fellow students in different settings during the first few weeks at their study, this now will get more difficult, as students now will not interact with other students in the same way. Having remote lectures will make it harder to know which students are enrolled in the same courses as themselves or even locate fellow students at the campus.

However, this is not only a problem that will occur in the coming semester; it is already happening. Recent research by SINTEF and UiO shows that 37% are dissatisfied with their life, due to the current circumstances (Veberg, 2020). 25% feel lonely multiple times a week, and more than 50% feel more lonely during these "Corona-times" than before. This makes it more critical than ever to provide students with a way to connect with others in the same situation.

8.4 Validity

1. When sharing the survey, the plan was initially to share it in the lectures of courses with a majority of students in the target group. Due to the outbreak of Covid-19 and the following lockdown of the NTNU campuses and the society in general, the survey had to be shared in other ways. This is why it was shared in the Facebook-groups for the students, which in many cases, is a poor platform to share surveys, as Facebook-posts are very easily overlooked and ignored.

2. The survey gathered a total of 56 replies, where 47 replies were students in the target group. Ideally, one would like to see more replies to provide a more accurate result.

3. This also holds for the testing, which ideally should be conducted on a larger focus group, over a longer time, where the students were to meet for face-2-face collaborations.

4. The survey presented in section 3.2 were initialized in the specialization project, where it was created in Select Survey[1], which was the NTNU standard for surveys at that time. However, as stated, the new standard for surveys is now Nettskjema, and the questions were therefore moved to Nettskjema accordingly. In the transition from Select Survey to Nettskjema, there occurred a mistake of losing some questions. Unfortunately, this was not discovered until the questionnaire was completed,

[1] https://survey.svt.ntnu.no/

and it was too late to perform a new survey. However, it has been concluded that it has not caused a significant impact on the findings described in section 3.2.

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Appendix

A Emails

A.1 Email sent to teachers

Hei,

I forbindelse med min masteroppgave innen læringsteknologi ønsker jeg å samle inn data på arbeidsvanene til studenter i øvings- og eksamenssammenheng. Målgruppen for undersøkelsen er 2. og 3. klassinger ved NTNU. I den forbindelse hadde jeg satt pris på om min spørreundersøkelse kunne blitt delt med studentene i faget TDT4145 Datamodellering og databasesystemer, da flesteparten av studentene i dette faget faller inn under målgruppen for undersøkelsen.

Dette enten i form av at jeg presenterer den i en forelesningspause, eller at du deler den med studentene i forelesning eller på Blackboard, alt etter hva som måtte passe best for deg.

Undersøkelsen er anonym, og bruker Feide-innlogging for å sikre at det er studenter som svarer.
Link til undersøkelsen: https://s.ntnu.no/kollo

Veileder for mastreoppgaven er Trond Aalberg.

Håper å høre fra deg!
Mvh,
Kasper Klæboe Berg
5. klasse, Datateknologi

Figure A.1: Email sent to teachers about presenting the survey in class

A.2 Email sent to focus group

Hei,

Du mottar denne mailen på bakgrunn av at du på denne [0] spørreundersøkelsen la igjen e-postadressen din.

Jeg vil først og fremst takke deg for din deltakelse, det settes stor pris på.
På spørreundersøkelsens siste spørsmål takket du ja til å potensielt kunne bli kontaktet for mulig deltakelse i en testfase av prosjektet, noe som er årsaken til at jeg nå tar kontakt. Hvis du enda kunne tenke deg å bidra, hadde jeg satt veldig stor pris på det!

Det innebærer:
- Omlag 20 minutter av tiden din på et tidspunkt som passer for deg
- At du har tilgang til PC
- Mulighet til å delta over nett på whereby.com[1]

Testingen foregår ved at du vil få ulike oppgaver du skal utføre på applikasjonen og at du svarer på noen avsluttende spørsmål.

Om dette er noe du kunne tenke deg å hjelpe til med, hadde det vært supert, men det går naturligvis helt fint om du ikke har tid eller lyst.

Håper å høre fra deg!

Mvh,
Kasper Klæboe Berg

[0] - https://nettskjema.no/a/142642
[1] - https://whereby.com/

Figure A.2: Email sent to students about participating in test phase

A.3 Email from Studievenn

Erik Mathisen fre. 24. apr., 16:03
til kasperkb

Hei Kasper,

Interessant at du tar kontakt om appen min, Studievenn. Appen ligger for øyeblikket ikke ute på App Store grunnet behov for noen endringer.

Jeg begynte arbeidet med den tidlig i fjor etter å ha sett og lest at mange studenter sliter med å ha nok folk å være med, enten det gjelder skolearbeid eller fritidsaktiviteter. Det var viktig å lage noe som skal være for alle, uavhengig om du har en stor vennekrets fra før eller ikke.

Jeg brukte en del tid på å tenke igjennom hva slags design som gir muligheten til at brukerne kan lage aktiviteter fritt, men også at det sitter langt inne hos folk å ta det første skrittet før appen forhåpentligvis får noe trafikk og blir en 'greie'. Vanskelig å formidle til brukerne, særlig de første brukerne, hva man kan legge ut av aktiviteter og hvordan det oppfattes av andre studenter. Mange frykter nok å eksponere seg selv der uten å være sikker på at man får noe tilbake.

Appen ble lansert i fjor sommer og flere universiteter viste den fram for studentene gjennom plakater, aviser, o.l . Jeg har fått en god del nedlastninger, men den største utfordringen er som med mange sosiale apper å komme forbi startfasen.

Håper det svarte på noe av det du lurte på. Send meg gjerne noen konkrete spørsmål så skal jeg prøve å svare.

Mvh
Erik Mathisen

Figure A.3: Email received from Erik Mathisen, developer of Studievenn

A.4 Email with information about the IDI-survey

Fra: Madeleine Lorås <madeleine.loras@ntnu.no>
Emne: Re: Undersøkelse om gruppearbeid
Dato: 25. mai 2020 kl. 15:11:28 CEST
Til: Trond Aalberg <trond.aalberg@ntnu.no>

Hei,

Jeg er ikke helt sikker på hvordan sånt skal referes til egentlig, når det ikke er en egen undersøkelse. Men her er litt info som kan være greit å ha med:
- undersøkelsen ble sendt ut i slutten av vårsemesteret 2019
- den ble sendt ut på epost via studieadministrasjonen
- undersøkelsen har godkjenning av NSD
- den ble sendt ut til alle studenter ved IDI (alle trinn, alle studieprogram, alle campus), totalt ca. 2500 studenter
- totalt fikk vi 527 svar
- ca. 30 % kvinner

Dette er i hvert fall det jeg pleier å ta med. Jeg har ikke per nå fått publisert noe med denne studien, men den er med i dette FIE-paperet som er på vei til publisering nå (håper vi).

Si ifra om det skulle være noe mer!

--Madeleine

Figure A.4: Email containing information about the survey held by IDI

B Research Ethics Documents and Approvals

B.1 NSD

N

NSD Personvern
28.02.2020 12:23

Det innsendte meldeskjemaet med referansekode 872513 er nå vurdert av NSD.

Følgende vurdering er gitt:

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet 28.02.2020 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

MELD VESENTLIGE ENDRINGER
Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:
nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 01.06.2020.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER
NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER
Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).

NSD vurderer at informasjonen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER
NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

Spørreskjemaleverandøren er databehandler i prosjektet. NSD legger til grunn at behandlingen oppfyller kravene til bruk av databehandler, jf. art 28 og 29.

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og eventuelt rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp underveis (hvert annet år) og ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet/pågår i tråd med den behandlingen som er dokumentert.

Lykke til med prosjektet!

Kontaktperson hos NSD: [redacted]
Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Figure B.1: Approval letter from NSD

C Survey

C.1 Survey page 1

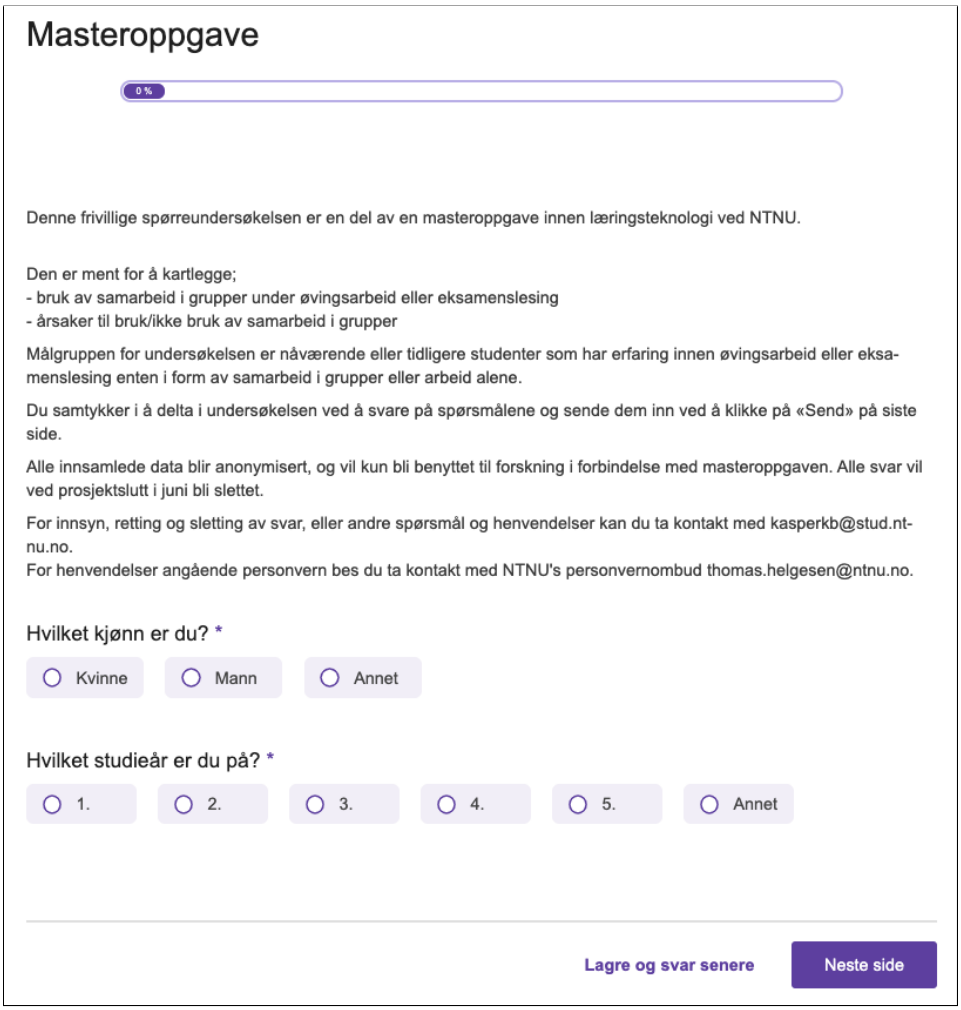

Figure C.1: First page of survey

C.2 Survey page 2 part 1

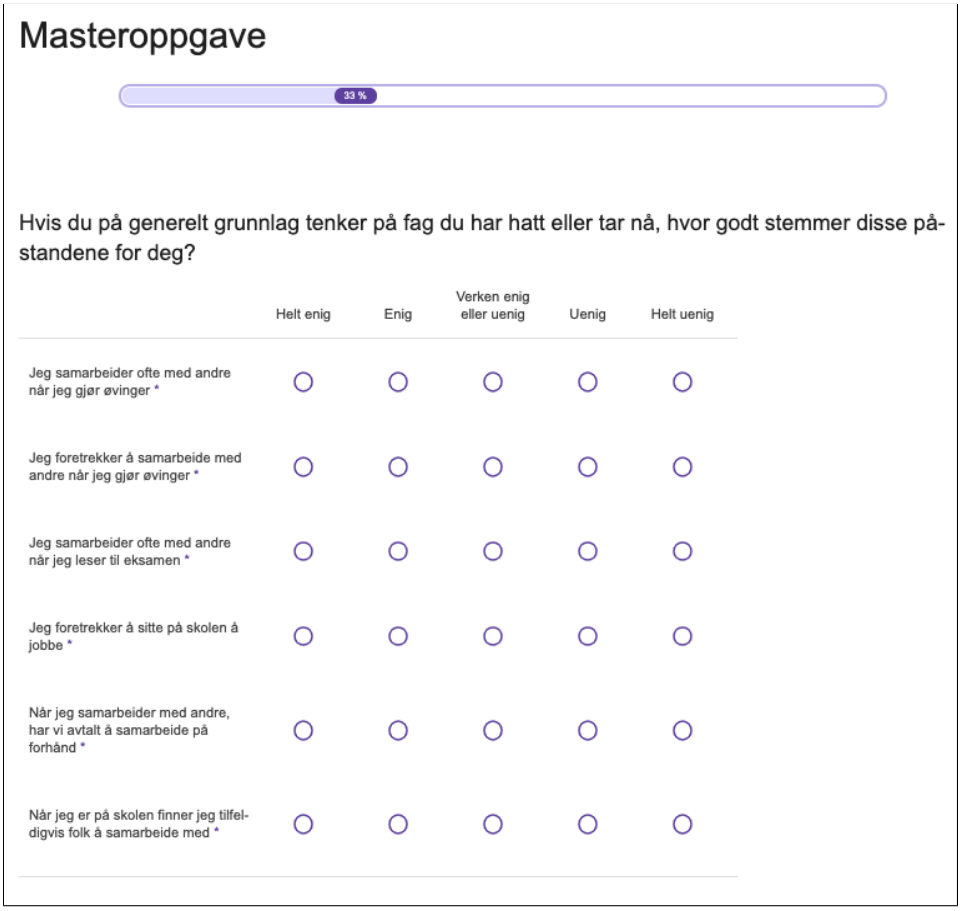

Figure C.2: Second page of survey, top part

C.3 Survey page 2 part 2

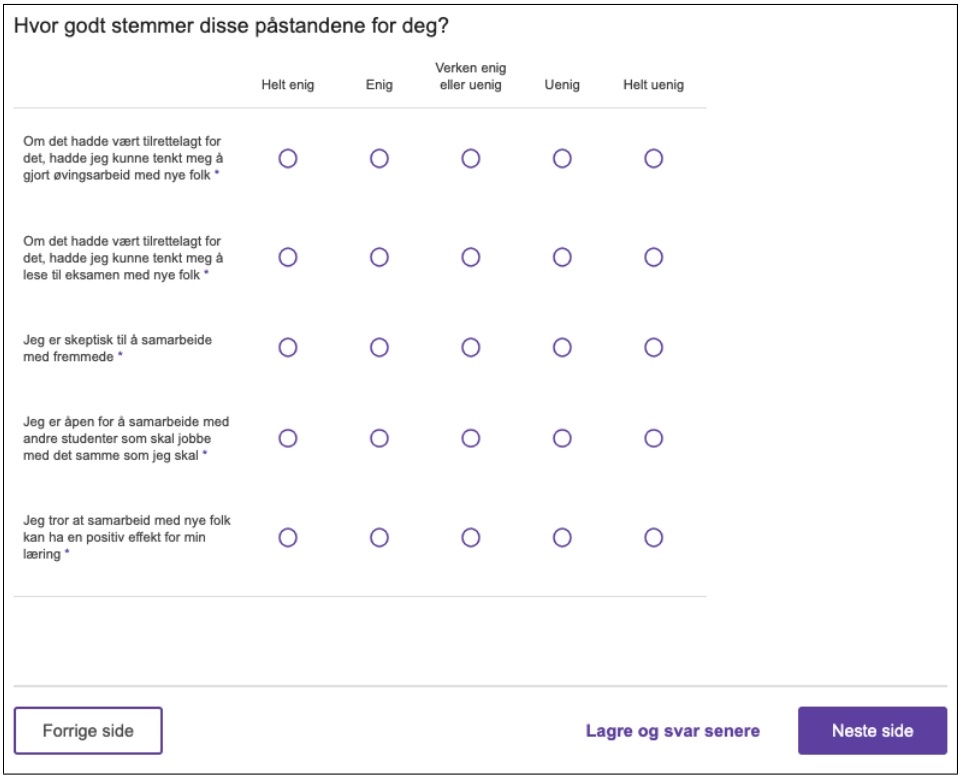

Figure C.3: Second page of survey, bottom part

C.4 Survey page 3

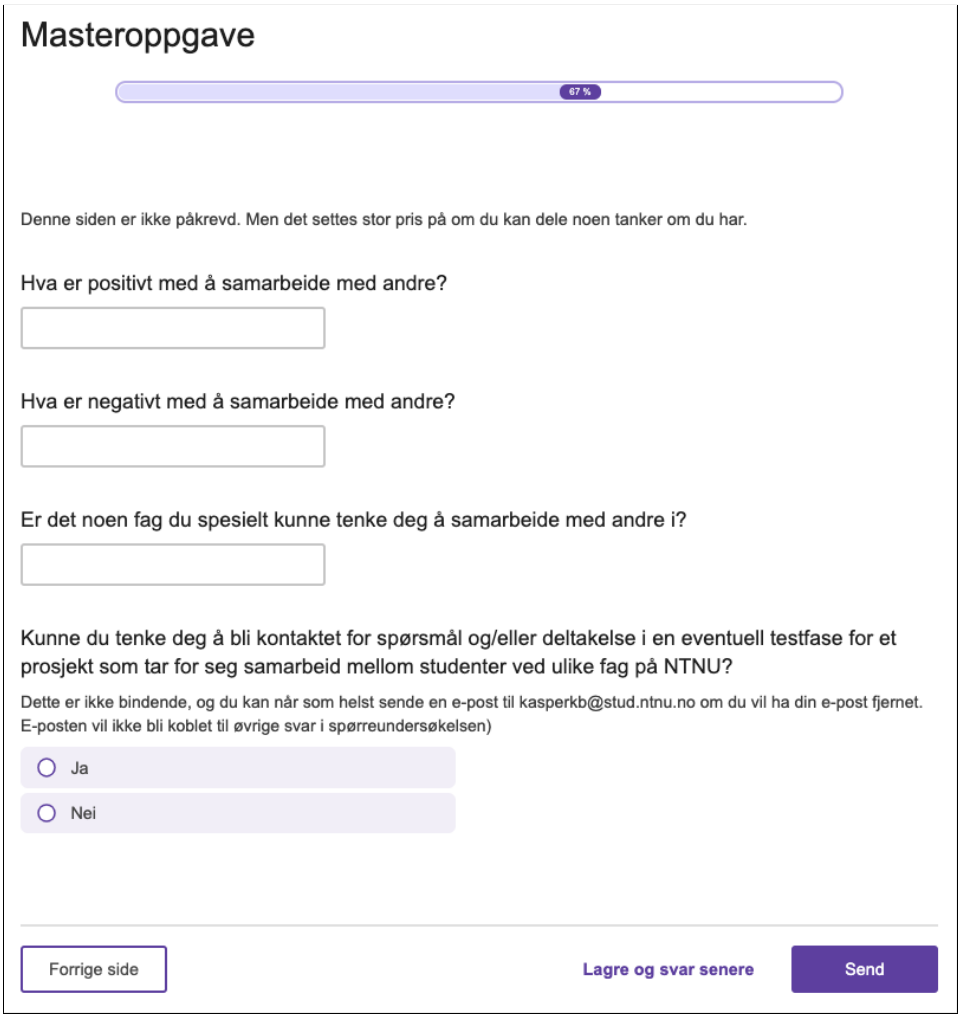

Figure C.4: Third and final page of survey

C.5 Survey email-question

Figure C.5: Question about email, third page of survey

D Results

D.1 Gender

Hvilket kjønn er du? *

Svar	Antall	Prosent
Kvinne	24	42,9 %
Mann	31	55,4 %
Annet	1	1,8 %

Figure D.1: Gender

D.2 Year of study

Hvilket studieår er du på? *

Svar	Antall	Prosent
1.	3	5,4 %
2.	25	44,6 %
3.	22	39,3 %
4.	2	3,6 %
5.	4	7,1 %
Annet	0	0 %

Figure D.2: Gender

D.3 Matrix 1

Hvis du på generelt grunnlag tenker på fag du har hatt eller tar nå, hvor godt stemmer disse påstandene for deg?

Svar fordelt på antall

	Helt enig	Enig	Verken enig eller uenig	Uenig	Helt uenig
Jeg samarbeider ofte med andre når jeg gjør øvinger *	12	20	13	9	2
Jeg foretrekker å samarbeide med andre når jeg gjør øvinger *	9	16	16	14	1
Jeg samarbeider ofte med andre når jeg leser til eksamen *	7	18	9	13	9
Jeg foretrekker å sitte på skolen å jobbe *	22	10	15	4	5
Når jeg samarbeider med andre, har vi avtalt å samarbeide på forhånd *	14	27	10	5	0
Når jeg er på skolen finner jeg tilfeldigvis folk å samarbeide med *	1	12	14	18	11

(a) Amount

Svar fordelt på prosent

	Helt enig	Enig	Verken enig eller uenig	Uenig	Helt uenig
Jeg samarbeider ofte med andre når jeg gjør øvinger *	21,4 %	35,7 %	23,2 %	16,1 %	3,6 %
Jeg foretrekker å samarbeide med andre når jeg gjør øvinger *	16,1 %	28,6 %	28,6 %	25 %	1,8 %
Jeg samarbeider ofte med andre når jeg leser til eksamen *	12,5 %	32,1 %	16,1 %	23,2 %	16,1 %
Jeg foretrekker å sitte på skolen å jobbe *	39,3 %	17,9 %	26,8 %	7,1 %	8,9 %
Når jeg samarbeider med andre, har vi avtalt å samarbeide på forhånd *	25 %	48,2 %	17,9 %	8,9 %	0 %
Når jeg er på skolen finner jeg tilfeldigvis folk å samarbeide med *	1,8 %	21,4 %	25 %	32,1 %	19,6 %

(b) Percentage

Figure D.3: Matrix 1 distributed by (a) – amount, and (b) – percentage

D.4 Matrix 2

Hvor godt stemmer disse påstandene for deg?

Svar fordelt på antall

	Helt enig	Enig	Verken enig eller uenig	Uenig	Helt uenig
Om det hadde vært tilrettelagt for det, hadde jeg kunne tenkt meg å gjort øvingsarbeid med nye folk *	2	12	13	20	9
Om det hadde vært tilrettelagt for det, hadde jeg kunne tenkt meg å lese til eksamen med nye folk *	1	11	8	19	17
Jeg er skeptisk til å samarbeide med fremmede *	6	21	13	13	3
Jeg er åpen for å samarbeide med andre studenter som skal jobbe med det samme som jeg skal *	5	37	10	4	0
Jeg tror at samarbeid med nye folk kan ha en positiv effekt for min læring *	7	24	23	1	1

(a) Amount

Svar fordelt på prosent

	Helt enig	Enig	Verken enig eller uenig	Uenig	Helt uenig
Om det hadde vært tilrettelagt for det, hadde jeg kunne tenkt meg å gjort øvingsarbeid med nye folk *	3,6 %	21,4 %	23,2 %	35,7 %	16,1 %
Om det hadde vært tilrettelagt for det, hadde jeg kunne tenkt meg å lese til eksamen med nye folk *	1,8 %	19,6 %	14,3 %	33,9 %	30,4 %
Jeg er skeptisk til å samarbeide med fremmede *	10,7 %	37,5 %	23,2 %	23,2 %	5,4 %
Jeg er åpen for å samarbeide med andre studenter som skal jobbe med det samme som jeg skal *	8,9 %	66,1 %	17,9 %	7,1 %	0 %
Jeg tror at samarbeid med nye folk kan ha en positiv effekt for min læring *	12,5 %	42,9 %	41,1 %	1,8 %	1,8 %

(b) Percentage

Figure D.4: Matrix 2 distributed by (a) – amount, and (b) – percentage

Hva er positivt med å samarbeide med andre?
– Lære mer, fortere.
– Lærer bedre, og det blir som en sosial greie.
– Man får diskutert og ser som regel problemt fra en ny side. Kan rette opp i feilantaglser man har tatt. Lettere og kjappere og – løse problemer enn å sitte å prøve å lese seg opp selv
– Kan diskutere temaer og lære hverandre ting
– Man kan spørre andre om oppgaver når man blir stuck.
– Trenger ikke å prøve så hardt. har noen å sparre med.
– Hjelp til ting man lurer på
– Andre perspektiv. De kan forklare noe man har misforstått eller ikke fått med seg og motsatt.
– Gode forklaringer fra andre, og du lærer my av å forklare selv. Får se ulike syn på samme sak.
– Flere innspill, kan lære noe nytt av hverandre
– Hvis det er noe man ikke forstår så kan andre forklare det til deg. Du blir mer tvunget til å sette deg ordentlig inn i oppgaven og prøve å forstå det.
– Lærer av hverandre. Lærerikt å evnt lære bort. Sosialt.

– Nye synspunkter på samme sak/ oppgave
– Lærer av hverandre, alle er gode på noe.
– Forskjellige meninger, diskusjoner og tankeprosesser
– Få nye perspektiv; nye løsningmetoden, andre forklaringer på teori.
– kunnskapsdeling
– Nye innblikk
– Får litt andre syn. Kan dele kunnskap
– Får svar av andre når man lurer på noe, kan lære ting bedre ved å lære bort til andre
– Forskjellige innfallsvinkler og kunnskap som kan forveksles mellom studentene.
– Nye perpektiver, lære av andre eller å forklare selv til andre
– De kan hjelpe deg med ting du ikke kan
– Lære av andre, se feil man ikke ser selv, sosialt, motiverende, man blir mer "tvunget" til å gjøre arbeidet
– Man får hørt andre perspektiver, benyttet andre sine styrker, og man er ikke nødvendigvis alene om å synes noe er vanskelig. Det er også nyttig for min læring å forklare ting til andre.
– Du kan selv lære mer ved å lære vekk det du kan, og du kan få ny innsikt og kunnskap fra andre
– Det sosiale
– Hjelp hvis man står fast, at man kan ulike ting, felles drøfting osv.
– Få andre tanker og perspektiv på ting
– flere perspektiv gjør det enklere å finne en løsning
– Man får som oftest gjort øvingene raskere. Man kan lære av hvereandre, spesielt ved å forklare hverandre ting som den andre ikke – forstår. Det er sosialt. Gøyere
– Flere perspektiver. Kan lære av hverandre. Lærer ofte mye ved å lære bort. Sosialt og hyggelig.
– Lett å stille spørsmål
– Utveksler tanker og fremgangsmåter.
– Gode diskusjoner, andre kan kanskje ting jeg ikke kan og kan lære meg
– De kan forklare ting du ikke forstår og gi deg et nytt perspektiv på ting
– Finne hull i egen kunnskap, ettersom ting blir ofte mer grundig fått imellom.
– De kan hjelpe meg med noe jeg ikke forstår
– Kan spørre de om hjelp. Når du blir spurt om hjelp, så blir du testet om du virkelig kan stoffet.
– Man slipper å bruke fryktelig lang tid hvis man er stuck
– En kan få andres synspunkt/tankegang
– Bedre forståelse ved forklaring av konsept som hjelp til andre
– Jobber i avtalt tid, får hjelp om man lurer på noe, enklere å forstå stoff sammen
– Lære av andre, lærer av å lære bort, diskutere sammen om noe er uklart eller vanskelig
– Det er gjennom samhandling med andre at du lærer deg selv å kjenne. Det å samarbeide gjør også at man er istand til å løse oppgaver som er for vanskelig å løse alene. Av og til kan flere øyer på samme oppgave gi et bedre resultat.
– Kan resonnere saman med den andre når det er noko som er vanskeleg.

– Bedre læringsutbytte uansett. Enten lærer dere 50/50 av hverandre, eller så får en person forklaring på oppgaver mens den andre får ekstra læringsutbytte av å forklare vekk.

Table D.1: Pros of collaborating with others

Hva er negativt med å samarbeide med andre?
– Distraksjon
– Kan noen ganger ta lengre tid å få ting gjort ferdig, men lønner seg som regel uansett
– Blir ofte forstyrrelser, jobber i ulikt tempo, jobber på ulik måte.
– Mye snakking om andre ting
– Mye tid kan forsvinne til abligøyer
– Kan bli ufokusert, diskutere om uviktige ting.
– Forstyrrelser
– Med for store grupper tar det lang tid og man får ikke særlig utbytte av det.
– Kan sinke deg om dere ikke er på samme nivå i ambisjoner.
– Forskjellig kunnskapsnivå fører til treg lesing
– Det kan være mindre effektivt. Når man leser til eksamen med andre kan man lure seg selv til å tro at man forstår noe man egentlig ikke forstår, fordi man får ikke jobbet med det alene slik man gjør under eksamen.
– Kan bli mye snakk og tull
– Kan være tidkrevende
– Kan bli ufokusert, og begynne å snakke om andre ting en skole
– Ikke alltid det mest effektive, nivåforskjeller kan være hindrende med mindre denne balansen er avklart i gruppa fra før
– Vanskelig å konsentrere seg og faktisk få jobbet med fagstoff.
– Ukonsentrasjon, burker tid på å ”organisere”, kan bli lurt til at du kan det
– Ikke samme tempo og forståelse.
– Kan bruke unødvendig lang tid. Folk er på forskjellig nivå
– er nivået på kunnskap for ulikt, vil de uten nok kunnskap ikke lære noe
– Får ikke gjort det i eget tempo (går for tregt eller for fort). Vanskelig å ikke skli ut (snakke om andre ting etc.).
– Ulike ambisjoner, innsatsnivå
– 1. De kan ikke noe så du må hjelpe dem med alt. 2. De gjør så mye at man ikke lærer noe
– Ikke alle bidrar like mye, lettere å konsentrere seg alene, lettere å lære seg ting alene vist man må lese etc. Samarbeid krever ofte at man har en del kunnskap fra før
– Det tar ofte mye lengre tid. Det er lett å bli distrahert fra arbeidet. Det er stressende hvis jeg er den som kan minst.
– Man bruker mye tid på ikke-faglige digresjoner
– Forskjellige arbeidsvaner
– Hvis kunnskapsnivåene er veldig ulike er det slitsomt.
– Kan være lite produktivt, mye uenigheter
– noen kan lære bort fagligfeil ting, uten å vite det selv

Min erfaring er at hvis man samarbeider på et øving som man ellers hadde klart alene så er ikke læringsgevinsten like stor som om – man hadde gjort den alene
Kan være mye bortkastet tid hvis den ene partneren har mye større kompetanse enn den andre. Fokuset er som regel ikke like høyt.
– Lett å bli forstyrret
– Får fasiten ”servert” av andre, hvis de er raskere til å komme fram til svaret.
– Noen er ikke like motivert som meg og jeg ender ofte opp med å gjøre mesteparten av arbeidet. Når det kommer til å samarbeide om å lese til eksamen stoler jeg ikke på at andre enn meg selv klarer å gi meg den læringen jeg trenger.
– Om det blir ujevnt fordelt arbeid, noen bare er med og får alle ’godene’ av et samarbeid uten å gi noe tilbake. Mindre fokusert arbeid og mer snakking
– Ting går (ofte) mye tregere
– Klarer ikke å fokusere, har sosiale traumer så mye er negativt
– Ting går som oftest saktere og er ikke alltid alle gjør fag, som kan være forstyrrende.
– Bråk og lite konsentrasjon
– Kan være ukomfortabelt hvis en ikke kjenner hverandre godt
– Forstyrrende elementer
– Kan bli ufokusert
– Blir mer prat og fjas, må bruke tid på å forklare til andre
– Dersom du havner på gruppe med slasker må du gjøre dobbelt så mye som du må gjøre på enkeltmannsoppgaver. Havner du på gruppe med kranglefanter/kverulanater bruker gruppa mer tid på å krangle enn å løse oppgaven.
– Ikkje i alle tilfeller, men i mange tilfeller er det ein fordel å møte opp fysisk på same stad til same tid. Det betyr reiseveg, å leite etter ledig arbeidareal, og å i mindre grad kunne jobbe når det sjølv passar meg.
– Hvis man føler at man holder noen tilbake eller ikke tørr å si ifra at man ikke skjønner

Table D.2: Cons of collaborating with others

E Application

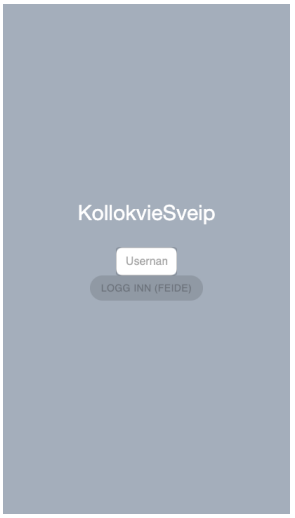

Figure E.1: Login page

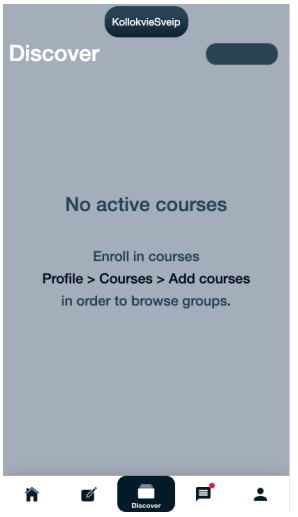

Figure E.2: Initial Discover page, before having enrolled in any courses

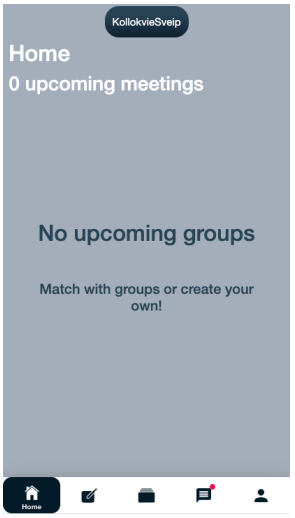

Figure E.3: Home page prior to having joined any group

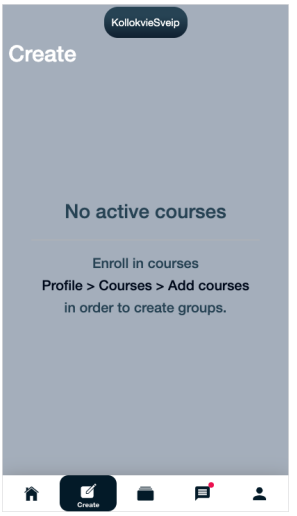

Figure E.4: CreateGroup page before you are enrolled in a course

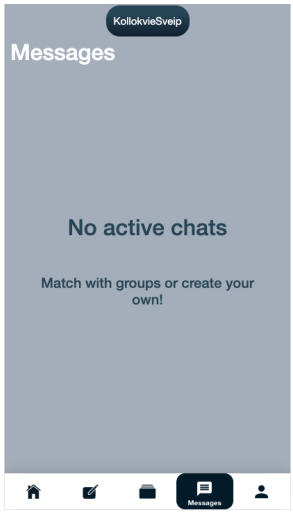

Figure E.5: Messages page before any groups has been joined

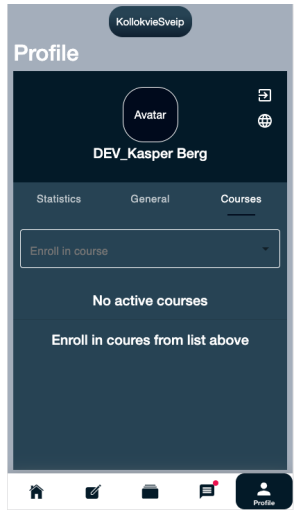

Figure E.6: Profile courses-page showing no enrolled-in courses

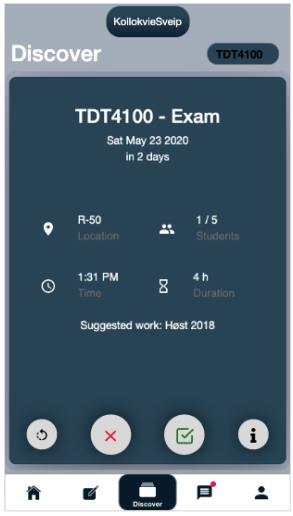

Figure E.7: Discover page

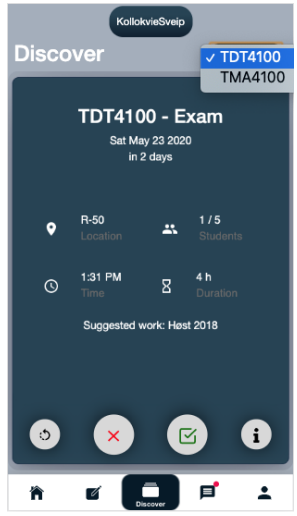

Figure E.8: Filter on courses

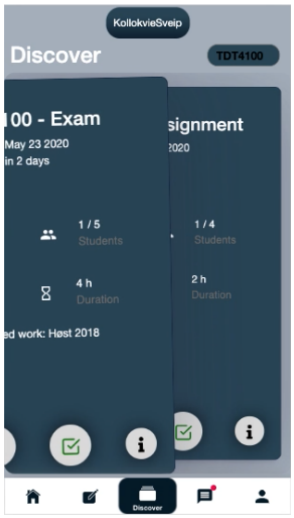

Figure E.9: Left swipe on Discover-page

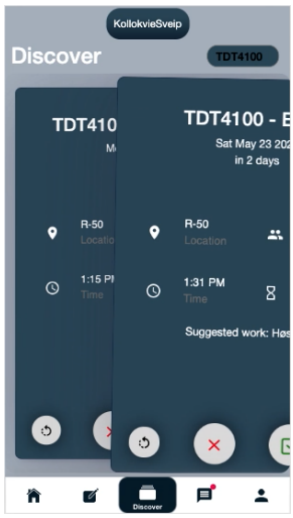

Figure E.10: Right swipe on Discover page

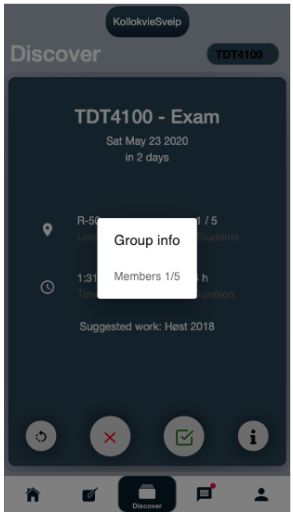

Figure E.11: Group info-modal

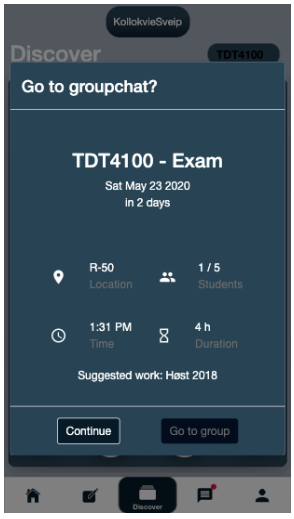

Figure E.12: Join group confirmation-modal

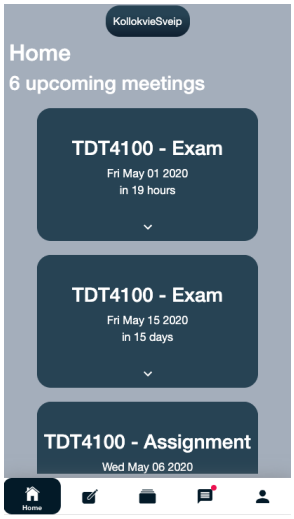

Figure E.13: Home page

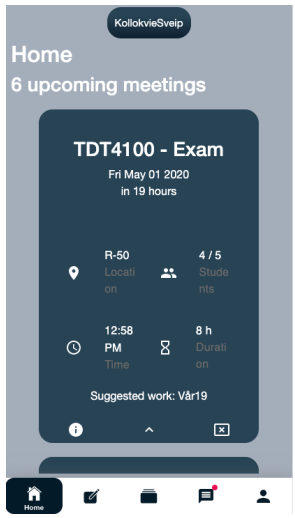

Figure E.14: Expand group

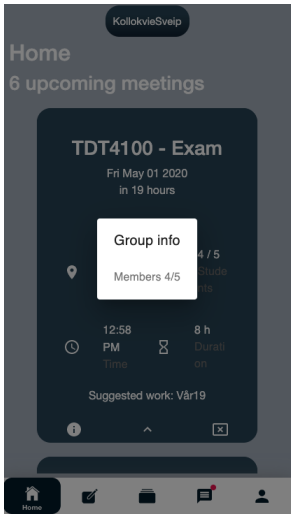

Figure E.15: Info-modal

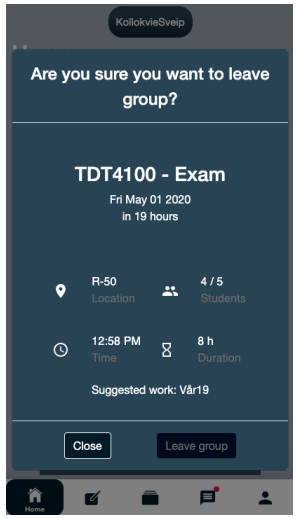

Figure E.16: Leave group-modal

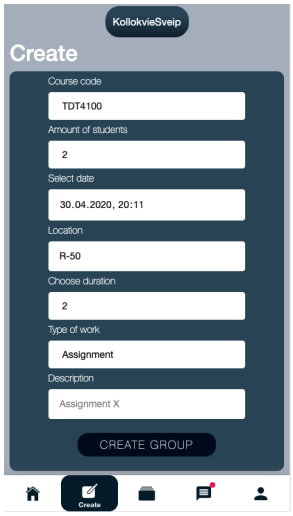

Figure E.17: Create page

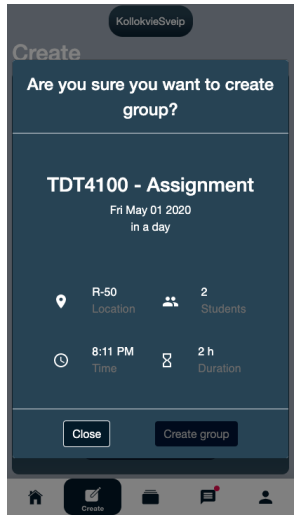

Figure E.18: Create group-modal

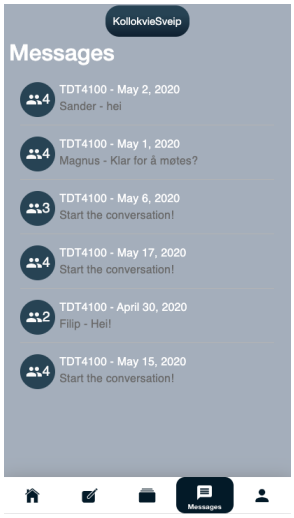

Figure E.19: Messages page

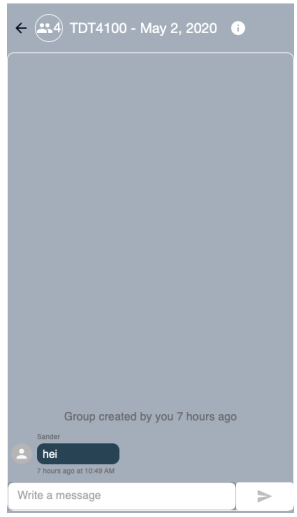

Figure E.20: Chat page

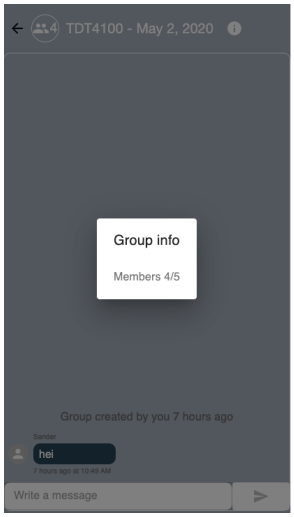

Figure E.21: Info-modal in chat

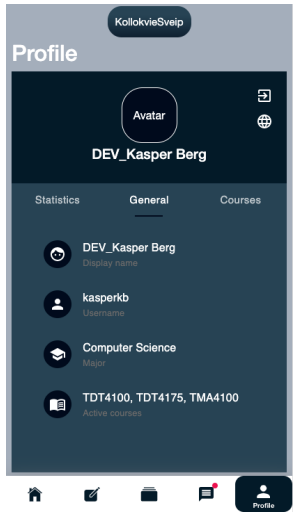

Figure E.22: Profile page

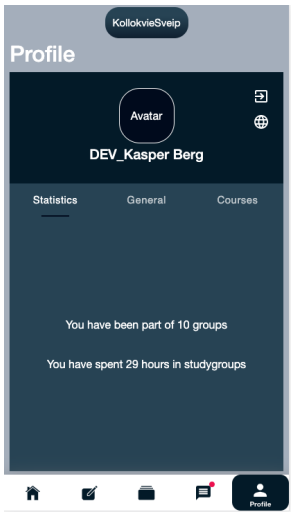

Figure E.23: Profile statistics

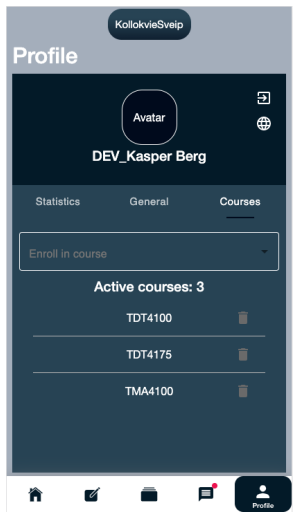

Figure E.24: Profile courses

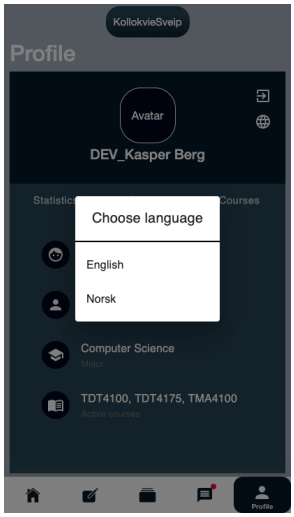

Figure E.25: Language-modal

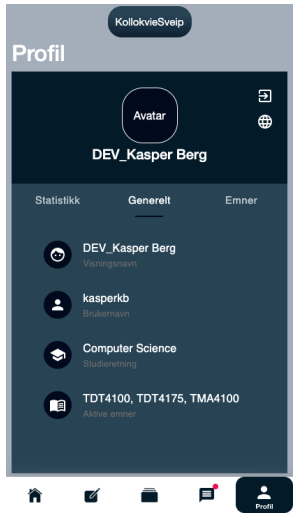

Figure E.26: Showing language changed

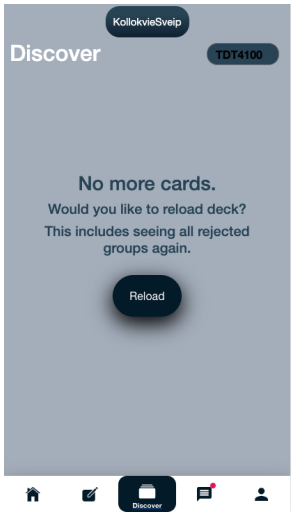

Figure E.27: Reload groups in discover

F Test evaluation

F.1 Process of final test

User-test tasks
• Logg inn • Utforsk applikasjonen, navigere rundt • Meld deg opp i noen fag • Sveip deg gjennom noen grupper, og meld deg opp i noen • Sjekk kommende grupper på hjemskjermen • Opprett en ny gruppe • Send en melding til en gruppe • Bytt språk i applikasjonen • Se statistikk

Table F.1: User-test tasks

User-test questions
1. Er KollokvieSveip noe du kunne benyttet? 2. Noen spesielle fag som er mer relevant? 3. Hvor eksponert føler du deg når du benytter appen? 4. Er det eksponert nok, eller mer/mindre? 5. Hvor enkelt vil du si at det er å bli med i grupper? 6. Er det for lav/høy terskel for å bli med i grupper? 7. Hvor mye mer/mindre informasjon vil du ha om gruppene og medlemmene? 8. Hva er potensielle negative sider du kan komme på ved å bli med i gruppe? 9. Positive? 10. Vil du si at du går ut av komfortsonen din ved å bli med i en gruppe? 11. Noe annet du vil tilføye?

Table F.2: User-test questions

F.2 Results from final test

User-test #1	
Kjønn: Mann – **År**: 3. – **Studieretning**: Datateknologi	
Q#	**Answer**
1.	• Absolutt. Nå har jeg en del venner jeg har fag til felles med, men etterhvert som det blir vanskeligere å finne folk/færre venner som har samme fag.
2.	• Valgfag, eller fag med færre bekjentskap som tar fagene jeg tar. • Fint for førsteårsfag. Hvor studenter ikke kjenner andre folk. Finner venner.
3.	• Ganske lite. Veldig lite informasjon som hentes.
4.	• Profilen, kunne vært frivillig å legge inn informasjon om deg: – motivasjon, – hvordan du foretrekker å jobbe, – informasjon som er relevant for å vite om du er interessant å jobbe med.
5.	• Virket veldig intuitivt. • Nyttig å filtrere på fag. – filtrere på annet og – Motivasjon, innsatsnivå
6.	• Lett å bli med i grupper • Sosialt sett er det høyere terskel. – Typisk norsk å være sjenert, holde seg i komfortsonen. • Lager grupper med visshet om at hvem som helst kan bli med • Kunne vært fint å ha mulighet til å lage private grupper. Ha med venner elns, eller en blanding av å kunne legge til venner i gruppen, men ha åpent for 2 til.
7.	• Kunne godt tenkt å sett profilbilde. Bilde av seg selv, skaper tillit/troverdighet. • Lettere å bli med om man ser bilder. • Mer info om hva innsatsnivå, produktivitetsnivå, målet for gruppen.

8.	• Hvor forpliktende er det? • Er lett å bli med og lett å forlate. • Har mye å si hvor anonym du er. Veldig anonym gjør det lett å forlate grupper • Mye info, vanskeligere å forlate gruppe. • Kan bli dårlig trend, om alle forlater og blir med hele veien.
9.	• Belønning for å bli med i grupper? • Poeng for mye arbeid.
10.	• Ja
11.	• Sveipingen må forklares første gangen • Men liker tinder-metaforen. Blir uformelt. Morsomt. • Sveipemekanismen er veldig bra, gir god feedback på handlingen • Filtrere på mer

Table F.3: User-test #1

User-test #2	
Kjønn: Dame – **År**: 2. – **Studieretning**: Informatikk	
Q#	**Answer**
1.	• Ja, i første semester. Nå er det slik at foreleser sier man kan sende mail hvis man ikke har kollokviegrupper, noe jeg tror få personer gjør. Mer lettvint med en slik løsning.
2.	• I fag som er mer praksis, hvor jeg trenger med hjelp av andre som gjør de sammen oppgavene. • Java, ITGK, programmeringsfag. Mattefag.
3.	• Føler meg eksponert, men det er andre og. • Men man vet at alle er studenter innen de samme fagene.

4.	• Veldig lett. • mange kjenner igjen tinder-sveipingen, og det er rimelig ålreit å bli med i gruppen,
5.	• Kunne vært mer.
6.	• Lettere om jeg hadde visst hvem noen er. • Ville kanskje valgt folk innen samme studieretning.
7.	• Fullt navn, vil vite hvem folk er. • Trenger ikke vite ambisjonsnivå, ettersom man bare skal jobbe sammen for læring, og ikke karakter på et prosjekt. • Men kan være greit å vite hvor mye folk er keen på å jobbe, hva de legger i arbeidet.
8.	• Selve gruppearbeidet kan være negativt. Dårlig samarbeid • Men det er en risiko ved å møte nye fremmede
9.	• Kan finne bekjente i grupper, og bli med. • Kan velge litt grupper selv, istedenfor å bare bli med random i grupper gjennom foreleser. • Folk som bruker appen er gjerne folk som vil det samme som deg.
10.	• Tilhører en gruppe jeg allerede er komfortabel med. • Har hatt dårlig opplevelser med fremmede i gruppearbeid før, så tror ikke jeg ville brukt den nå. • Er jeg alene i fag, kanskje!
11.	• Kunne opprette en gruppe med andre, for å finne èn ekstra.

Table F.4: User-test #2

User-test #3	
Kjønn: Mann – **År**: 2. – **Studieretning**: Datateknologi	
Q#	**Answer**
1.	• Ja, ihvertfall i første klasse • Når man har blitt etablert, finner man ikke like mange randoms • har ikke så stort behov for å jobbe med andre.
2.	• Økonomifag, kunne forklare/diskutere med hverandre • Fag med gruppeprosjektet
3.	• Føler meg ikke eksponert i det hele tatt
4.	• Kunne nok vært mer eksponert ja. • Har ikke noe problem med å oppgi mer info enn det som er nå.
5.	• Veldig enkelt å trykke/sveipe
6.	• Høy terskel for å ta en beslutning på en gruppe • Føler deg sårbar. Jobber heller med venner du er komfortabel med.
7.	• Hva er målet med møtet? • Trenger ikke bilde • Hvordan er folk å jobbe med? • Ha en kort bio om seg selv
8.	• Ingen
9.	• Få nye venner kanskje
10.	• Kommer an på hvordan jeg bruker den • Øve til eksamen med andre, ut av komfortsonen • Gjøre litt diverse arbeid, ikke ute av komfortsonen

11.	• Hvis du har en venn, men har lyst å jobbe med 2 ekstra. • Kunne legge til en bruker manuelt i gruppen • "Jeg jobber med denne øvingen nå, bli med" - Lavterskel å bli med • Jeg er åpen for å jobbe med folk, men dårlig på å planlegge frem i tid

Table F.5: User-test #3

User-test #4	
Kjønn: Dame – **År**: 2. – **Studieretning**: Informatikk	
Q#	**Answer**
1.	• Ja, konseptet er fint. • Men når man har venner, henviser man seg heller til de. • Hvis arbeidet med venner blir dårlig kan det være greit med nye.
2.	• Fag med øvingsarbeid • Mattefag, programmering
3.	• Ikke noe eksponert egentlig. Bruker apper deg jeg viser mye mer enn det der.
4.	• Kanskje legge til bilde? kan være valgfritt. • Hadde villet vist bilde av meg, og håpet at andre gjorde det samme
5.	• Veldig lett.
6.	• Liten terskel. • Andre som bruker appen har samme formål, så bør være greit.
7.	• Kankje profilbilde, for å kunne gjenkjenne folk på gruppen? Få et inntrykk av de? • Studieretning? kunne se om det er noen som studerer det samme som deg. • Greit med fullt navn

8.	• Negativt for grupper om folk kommer og går.
9.	• Veldig bra konsept, lavterskel måte å jobbe med andre.
10.	• Nei, ikke for meg, man tror det kan være det for mange andre. • Du vet at alle som bruekr appen er her med samme formål, så bør være greit.
11.	• Opprette gruppe sammen med andre • Filtrere på mer, eksempelvis hvilken dag.

Table F.6: User-test #4

User-test #5	
Kjønn: Mann – **År**: 3. – **Studieretning**: Informatikk	
Q#	**Answer**
1.	• Om jeg hadde hatt fag uten andre bekjente
2.	• Fag som man typisk samarbeider i. Praktiske fag • Mattefag, programmering
3.	• Ikke veldig eksponert slik det er nå.
4.	• Kan fint være med eksponert. • Alle som benytter appen er ute etter det samme.
5.	• Sveipingen gjør det veldig lett. Funksjonalitetsmessig veldig enkelt
6.	• Vil si det er høy terskel egentlig. Man binder seg på en måte til å møte en gruppe med nye folk.

7.	• Kan ihvertfall vite fornavn på personene, og hva de studerer • Kanskje en kort beskrivelse av folk? At man skriver noen setninger om seg selv? • En tydeligere beskrivelse av arbeidet. Mer spesifikt hva man vil jobbe med
8.	• At jeg ikke kan møte de likevel. Må melde seg av. Dumt om det skjer rett før et møte
9.	• Potensielt sett får nye venner hvis man arbeider bra sammen. • Lære mer om stoffet. Få et annet syn på fag/problemstillinger
10.	• Ja. Jeg jobber nok heller med venner om jeg har muligheten
11.	• Må kunne filtrere på mer greier. • på tidspunkt, arbeidslengde, antall personer osv. • hadde kunnet vært nice å hatt en slik applikasjon i starten av studiet • Da kjenner man ingen, og er allerede ute av komfortsonen. Har ingenting å tape på å prøve å bli kjent med folk gjennom en slik app.

Table F.7: User-test #5

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