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Implementation of a Microsoft Teams integration into a proprietary platform using user-centered design

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EXAMENSARBETE

Designvetenskap

**Implementation of a Microsoft Teams
integration into a proprietary platform
using user-centered design**

Implementation av en Microsoft Teams
integration i en proprietär plattform med
hjälp av interaktionsdesign

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Abstract

As the COVID-19 pandemic forces people to work and study from home, a change that also might last after the pandemic, the usability and functionality available in a Learning Management Systems(LMS) become crucial for everyday life. The goal of this master thesis was to design and implement an integration between Grade's platform and Microsoft Teams in a way that allows Grade and their customers to manage, plan, and conduct online teacher-led courses in a user friendly simple manner. The process was based on literature research, user-centered design iterations and implementation.

The project resulted in a working integration which automates much of the manual work required when holding courses via Teams. The final implementation was user tested. The test results show that the implementation is good, but that the implementation has room for further work and improvements.

Sammanfattning

Eftersom att COVID-19 pandemin tvingar folk att arbeta och studera hemifrån, en förändring som kanske även kvarstår efter pandemin, blir användbarheten och funktionaliteten som är tillgänglig i ett Learning Management System(LMS) avgörande för vardagen. Målet med detta examensarbete var att designa och implementera en integration mellan Grades platform och Microsoft Teams på ett sätt som tillåter Grade och deras kunder att hantera, planera och hålla lärarledda kurser online på ett användarvänligt och simpelt sätt. Arbetsprocessen baserades på litteraturundersökning, iterativ interaktionsdesign och implementering.

Examensarbetet resulterade i en fungerande integration som automatiserar mycket av det manuella arbetet som krävs när man håller kurser via Teams. Den slutgiltiga implementationen användartestades. Testresultateten visade att implementationen var bra men att det finns utrymme för vidare utveckling och förbättringar.

Keywords: Microsoft Teams, Learning Management System, E-Learning, User-Centered Design, User Experience

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Dictionary

- **API** - Application Programming Interface.
- **Hi-Fi** - High fidelity.
- **LMS** - Learning management system.
- **Lo-Fi** - Low fidelity.
- **MS Teams** - Microsoft Teams.
- **UCD** - User-Centered Design.
- **SUS** - System usability scale
- **TAM** - Technology Acceptance Model
- **HCI** - Human-computer interaction

Chapter 1

Introduction

This chapter introduces the background of this thesis to give the reader insight into why this project was started. Some related work is presented and then the research questions and goals are stated together with the limitations. Lastly, a description of the company Grade AB where this thesis was carried out is given.

1.1 Background

In recent years the use of e-learning has become increasingly common and widespread. Although often consisting of learning on the format of recorded material being available to the user at any time. One year into the COVID-19 pandemic and close to half of the worlds students are affected by closed or partial school closures [27]. Also, The Public Health Agency of Sweden recommends that employees shall work from home and use digital alternatives instead of meetings in person [?]. Therefore companies and schools that require supervised learning had to rethink and start depending on services such as *Google Classroom*, *Microsoft Teams* or *Zoom*. A way for companies to alleviate the stress, technical mistakes, errors, and hurdles involved with these services for their customers is to implement an integration between their product and the service, with the customer's needs in mind. By involving the customers you as a designer will get a deeper knowledge and understanding as the people within the field [25]. This master's thesis was carried out in collaboration with the company Grade AB. They are a software company that offers a platform with a wide variety of tools as a learning management system (LMS). Their platform is including supervised course sessions that nowadays are held through video conferencing tools where their customers have asked specifically for a integration with Microsoft Teams. A more detailed description of Grade and their platform can be seen in section 1.4.

1.1.1 Related Work

There are not many studies regarding distance education through video calls yet, since it has not until recently become more necessary. Likewise, there is not a lot of information about integrating a collaboration tool into another platform. However, there is research about alternative tools, how to favorably use them, and specific research about Microsoft Teams. Additionally, there are general studies about the design process and e-learning which is valuable for this thesis.

Singh and Awasthi have researched the positives and negatives of different conferencing apps since it has become a daily need [22]. The platforms that they focused on were Google Meet, Zoom, Microsoft Teams, Cisco WebEx Teams, and GoToMeetings. The general conclusion is that the major difference is the security support where Zoom is ranked the lowest. Regardless, Microsoft Teams fulfills all the examined fields even if some of the features require payment.

Another free tool is Moodle which is evaluated and compared with Microsoft Teams by Krašna and Pesek [10]. They are focusing on the tools as a part of teaching-learning-studying processes since Moodle has established itself as a favorable LMS and Microsoft Teams is one application that challenges the market. The researchers were trying out the two systems in different courses and each system was superior in different purposes. Moodle was the winner in traditional educational tasks like assessments, peer to peer assessments, quizzes, etc. However, Microsoft Teams is the better alternative for communication through chats, video-conferencing, lecturing, and screen sharing. Furthermore, the study shows that there is no winner in the assignment category, use of mathematics symbols, and file distribution. Hence, Microsoft Teams cannot replace Moodle yet since the latter tool is better at assessment and has a clear structure of the course. However, Microsoft Teams is a great complement for communication and the choice of tool should be based on the specific task.

Furthermore, a study by Pal and Vanijja evaluates the usability of Microsoft Teams on both mobile and desktop devices in India during the COVID-19 pandemic [17]. The used methodology is metrics such as System Usability Scale (SUS), a human computer interaction based approach, and the Technology Acceptance Model (TAM), an information system based approach. Their findings show that the experience while using Microsoft teams is sufficient and recommendable regardless if a mobile or laptop is used. However, the study only considers Microsoft Teams and therefore might be biased towards it as there is no inherent comparison involved. The researchers end the report with emphasis on how online learning is a complex scenario having multiple factors. The result is affected by the quality of course content, quality of the video lectures, the provided support, etc. Future studies should therefore focus on the broad user experience aspect.

One more LMS is Canvas that Garcia et al. tested as a web-based tool in their e-learning program [7]. They also used the TAM strategy and made 214 students answer a questionnaire according to the model. The result showed that students find that Canvas improves their learning since it assists them with tasks. This is done by functionality that is easy to operate and easy access to their coursework. Thus, Canvas serves as a great experience for students. Moreover, the study was conducted during a pre-implementation phase and therefore recommended technical assistance and support to the students using Canvas to equip them with essential skills, confidence, and innovative new ideas through the LMS.

Another aspect that is concerned by Torun is the correlation between e-learning readiness

and academic achievement since we are about to face a new paradigm of online learning [26]. This study claims that the results of a learning process are better if the users are prepared for the e-learning system. Additionally, the study emphasizes that it is harder to motivate students when using online learning. For this thesis, Torun's study shows the importance of usability in relation to online lectures since it should not be required a lot of preparation to achieve the same result as in an onsite lecture. Usability should reduce the preparation and create a more natural flow for as many users as possible.

Moreover, Alexandrescu and Butnaru conclude what a university in Romania has done to facilitate teacher-student communication and how they handle third-party integration [1]. The problem statement focuses on two different aspects where the first one is the student's access to resources and the second one that students need to be evaluated and graded. In order to set up the e-learning system, an efficient architecture with a single sign-on was created and roles with different access were considered. The proposed solution enables online teaching and easy teacher-student communication but could be improved by auto-creating courses on the third-party services with the required permissions for each role.

Besides all the information about specific conferencing applications and e-learning, the process of integrating this with user-centered design shall be enlightened. According to Göransson et al, usability and the development process have to be two natural, nonseparable parts. [8, p. 115, 127]. To bridge the gap between Human-computer interaction (HCI) and software engineering one needs to integrate both the design and software development processes tightly together to achieve desirable results. Furthermore, as the world is currently being subject to more new software than ever, the number of design methods available for use to conceive a product is at an all-time high. A study investigating the usage of user-centered design(UCD) techniques and methods in e-learning interfaces shows that in 17 investigated works the three most common methods for gathering requirements were: a survey with 7 occurrences, interviews with 6, and observations with 3. Furthermore, the research shows that the two most common design methods are high- and low-fidelity prototyping respectively [9]. Hasani et al [9] also claim that it is important to involve both the learners and the teachers in the design process.

1.2 Research questions and Goals

The aim is to answer the following research questions:

- How can Microsoft teams be integrated into Grade's product?
- How can user-centered design be used to meet both Grade's expectations, and the expectations of their customers?
- How the quality of Grade's online teacher-led courses can be improved using user-centered design?
 - How does one achieve on-site quality learning on an e-learning platform?
 - What differs on-site learning from e-learning and what parts should be included or avoided?

By answering the research questions the following goals will be fulfilled:

- A student/coworker shall be able to self-register for a course, if said course is given remotely, then the student/coworker should with as little resistance as possible participate in the online meetings/lectures of the course.
- If the meeting/lecture was recorded, then it should be easy to find and view the recording.
- An Admin/Supervisor should have easy access to options that allow one to set a meeting/lecture as available digitally. Upon doing so, every related person(student etc) shall then receive the necessary information and links to participate.
- A preferably automatic system that keeps track of who participated in the course moment.
- A student/coworker's supervisor should be able to follow their subordinates' progress in the course.

1.2.1 Limitations

The limitations of this work are mainly constrained by the fact that it's a master's thesis. The amount of time available is limited to 20 weeks consisting of 40 work hours each. Limitations also lie in how much functionality, customizability, and accessibility Microsoft offers both in terms of their Application Programming Interface(API) for Teams and the Teams application itself. Another limitation also lies in the current circumstances regarding the COVID-19 pandemic forcing user-testing, interviews, etc to be conducted remotely. Beyond the already stated limitations, this work also depends on how interested and cooperative the customers of Grade are. If the customers themselves do not wish to participate in the design process it will be very difficult to design the system for them. Lastly, the new functionality depends on an already existing design that has to be taken into consideration.

1.3 Grade AB

Grade AB, <https://www.grade.com/>, is a company that offers and provides the platform known as *GRADE*. According to Grade the platform creates a cycle of competence, learning and engagement. The platform naturally connects the employee's career paths, performance, and development plans with flexible learning activities. The platform consists of four modules, namely *ENGAGE*, *TALENT*, *LEARNING*, and *ANALYTICS*, described in detail below.

ENGAGE is a tool to measure the engagement in the workplace, by periodically sending out surveys consisting of a handful of random questions from categories such as *health*, *ambassadorship*, *environment* etc. Through this the company can gain insight and see trends. Depending on the polarity of the trends *ENGAGE* offers improvement suggestions.

TALENT is a Talent Management System that aims to increase engagement and talent among employees. This module includes but is not limited to tools like goal-setting, competence development and performance reviews. Through tools like career path visualisations it is possible for employees to see what opportunities are available to them, and which requirements they need to fulfill to advance.

LEARNING is Grade's own LMS which aims to increase employee competence through flexible learning activities. It contains full support and functionality for online courses, administration of physical courses and blended learning. Grade also offers a cloud based toolkit called *COMPOSER* which allows customers to create interactive e-learning content.

The *ANALYTICS* module collects and visualises data from *TALENT*, *LEARNING*, and *ENGAGE*. It allows for creation of custom report templates that automatically gather data on refresh for certain parameters.

Chapter 2

Theory

This chapter presents different techniques, concepts and approaches that will be used to develop the final product.

2.1 Usability, Utility, Interaction Design and User Experience

This master thesis base relies on usability and is the main core for the entire project. Usability is a quality attribute describing the ease of use and satisfaction in terms of five components which are the following [16]:

- Learnability: Ease of first-time usage.
- Efficiency: How quick one can perform a task once the user has learned the design.
- Memorability: After returning to a design not used for a period of time, how easy it is to use once again.
- Errors: Number of errors a user makes, the severity of errors, and the ease of recovery.
- Satisfaction: The feel of satisfaction and how pleasant it is to use the design.

The definition of usability is also a part of ISO standard 9241-11:2018 [5] and described as follows "extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use".

Another quality attribute is utility that describes the functionality which provides what the needs for a user are. Together, these two terms create the definition of what a *useful* product is. Additionally, why these terms are in focus and widely talked about is because if a product is not useful it will not be used by people. Nobody wants to read a manual before using a website and if it is difficult to use people are leaving, thus usability is necessary [16].

The meaning of interaction design is the design of interactive products that helps people to communicate and interact in their daily life. The meaning of this is to create user experiences that improve and pushes the way humans are working, communicating, and interact. Thus, this principle is the base for every computer system aimed at human beings that need to be explored and developed. Interaction design is mainly about different perspectives and methods that are used to develop products with the user in mind. One central term within interaction design is the user experience that emphasizes what people are feeling about a product and their satisfaction or enjoyment when using it. The design itself provokes the aimed feeling and is creating the wanted user experience both in terms of the overall impression and the smallest details [18, p. 29-38].

2.2 The Process of Interaction Design

The iterative process is containing four main activities which are to identify requirements, create alternatives, build prototypes, and evaluate. When identifying requirements it is crucial to have a user-centered design in mind to generate data by understanding who they are and what their needs are. Once the requirements are set, the alternative solutions are developed from a conceptual model to a more concrete one. The alternatives are compared to each other and evaluate the pros and cons. When the best ideas are gathered, the next step is to prototype the ideas into an interactive product. The prototypes can be anything from a paper model to a more implemented prototype as long as the prototype gives an interpretation of the future product that could be tested and evaluated. The evaluation is an opportunity to realize what the user needs are and if they are fulfilled or not. These four activities are done iteratively to improve the prototypes and finally the end product [18, pp. 414-415]. The process is shown in figure 2.1 to give an overview of the different activities.

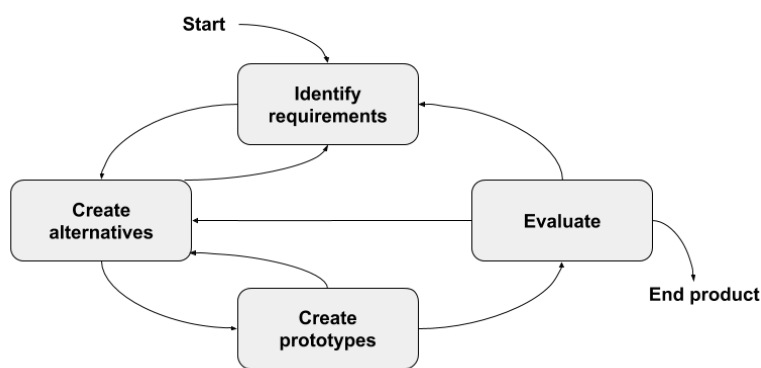


Figure 2.1: Overview of the iterative process of interaction design.

2.3 Design Principles

In Don Norman's book *The Design of Everyday Things* he defines the most important characteristics of good design as discoverability and understanding [4, p. 3]. Discoverability refers to the ability of a user to figure out what actions are possible and how to perform them. Understanding refers to the ability of a user to learn how the product is supposed to be used, and what different buttons and settings do. Norman also describes three additional terms, namely *affordances*, *signifiers*, and *feedback*. The term *affordances* describes the relationship between a user and an object, namely the ability of a user to perform a certain action with the object. An example would be chairs, as they are providing support for the user to sit down. He describes a variant of the term, *anti-affordance*, which refers to some an object does not offer, e.g. the blocking of passage of air through glass [4, p. 10]. Signifiers refer to where an action should take place. To achieve good design, it needs to consider both affordances, actions that are possible, and signifiers, where the action takes place [4, pp. 13-14]. The final term, *feedback*, refers to the communication of an action to the user. He highlights the importance of instantaneous feedback, as only the slightest delay can result in the user getting frustrated. In addition to being delay-free, the feedback also has to be informative, yet not too much. If the feedback becomes a backseat-driver, chances are it will cause more frustration and annoyance than help the user [4, pp. 23-25].

2.4 Conceptual Model

Before the start of designing and prototyping a product, a conceptual model is developed to understand what the initial expectations are. The model is on a high level where the concept is described in terms of metaphors and analogies to communicate what the product is supposed to do and how it should be used. These metaphors and analogies are placed in specific concepts that have different relations to each other. All this together with the connections between the concepts and the user experience that the product aims to support creates the conceptual model. Since this is used in an early stage of the design process it shall not be complex but instead help the designer to clear up one's mind [18, pp. 70-72].

2.5 Prototypes

Prototypes are more concrete than the conceptual model and are a tangible creation of artifacts which levels can vary depending on the phase of the product. The prototype takes ideas into form and is essential for testing. The fidelity of the prototype depends on where you are in the process [14, p. 138].

A low-fidelity, Lo-Fi, prototype is common in the early phases of the design process and can consist of a paper prototype, storyboards, or other simpler artifacts. These prototypes are serving as a possibility to test early ideas and concepts to get quick feedback that can be used in the next prototype [14, p. 138]. Also, another advantage is that they are cheap and easy to modify and therefore it reduces the fear of change, which is rather encouraged. One prototype method which allows the user to interact with the Lo-Fi prototype is called Wizard

of Oz. The method is often used together with a software-based prototype where a human operator is simulating the response to the user [18, pp.485-488].

Unlike a Lo-Fi prototype, the high-fidelity, Hi-Fi, prototype is closer to the final product in terms of material, look and feel. Their purpose is to give feedback in a later phase of evaluation from customers and users but also to market ideas and test technical aspects. From the feedback, it is possible to change and add components [14, p. 138; 18, p. 489].

In addition to the opportunity to test the ideas and product before it is implemented, a prototype also makes it possible to communicate effectively and efficiently. Prototypes can have the answers to which alternative design to use and develop further as well as clarify the requirements [18, p. 484].

2.6 Personas

Developing an application requires a user-centered design. One way to find out who the potential users are and what users need is to work with personas. According to Magnusson et al. [13, pp. 21-22], personas are used to identify characteristics of future users based on real people. Additionally, personas put a face to abstract information about different target groups and are used as a common starting point in the design process. One purpose of creating personas is that they shape goals for the product that can look different from person to person. Some goals are also common between the different roles which makes it easier to see prioritized requirements. Additionally, a persona does not only describe the goals but also the user's attitude, skills, tasks, and environment. This is defined to help the designer feel that the persona could be a real and potential user to have in mind while designing [18, p. 448].

2.7 Scenarios

A scenario is used to predict how a product will be used in the future, which can help the design team discussing problems. Also, scenarios formulate the context that the application will be used. Often, this is done with a certain persona in mind but at least always with a user perspective. The scenarios start with a trigger event to set the scene in order to solve the tasks and focus on what the technology enables. Hence, scenarios encourage discussion [14, p. 152]. Another perspective is that one shall not only focus on one kind of user when formulating the scenarios. Instead, the focus should be on different abilities to find different solutions that fit a bigger target group [13, pp. 23-24].

2.8 Data Gathering

This section describes the different data and methods that will be used to gather it both to understand the requirements but also the possible improvements implied by tests. Different methods are used to achieve triangulation which means that a phenomenon is examined through at least two different perspectives. There are different types of triangulation but here we will focus on method triangulation and data triangulation. Method triangulation

means that different methods are used to gather data and data triangulation in our case that data has been collected from different types of persons [18, p. 290].

2.8.1 Qualitative Data

Qualitative data is descriptive in terms of quotes from interviews, notes from an activity, images, etc. This is the type of data that often are not expressed in numerical form even if it is possible to translate it into numbers. Qualitative data can expose users' feelings of frustration that can not be measured [18, p. 349].

The data can be collected through several methods like interviews where the responses to open questions, video material, and the respondent's opinions can be relevant. Another data gathering method that can generate qualitative data is questionnaires. Just like interviews, responses to open questions in questionnaires are qualitative data. Also, responses in 'further comments' fields and respondent's opinions belong to this. Moreover, observations can record the behavior, describe an undertaken task, or make copies of informal procedures [18, p. 351]. All this data can be analyzed through categorizing, identifying critical events, difficulties, or errors, and finding patterns, or themes to get a better insight into the users [18, pp. 365-375].

2.8.2 Quantitative Data

Unlike qualitative data, quantitative data is in form of numbers or easily transformed into numbers. It can be the number of events at a duration of time or the time it takes to perform a task. The analysis of this data uses numerical methods to determine the magnitude, amount, or size of something. This can be presented through different diagrams or tables with processed data [18, pp. 349, 352-364].

However, the same methods used to gather qualitative data can be used to gather quantitative data. Interviews and questionnaires with closed questions collect quantitative data. These methods can also generate information about age, job role, years of experience, etc. Observations can measure time spent on a task, the number of people involved in an activity, etc [18, p. 351]. In other words, it is not the method that decides what type of data is gathered but how the method is used and constructed.

2.8.3 Interviews

Interviews is a part of survey research and can be described as a conversation with an aim. There are different types of interviews depending on what the purpose is. An unstructured interview, only containing open ended questions as guidelines make the interview more like a comfortable conversation for the participants. Additionally, it is possible to ask follow-up questions and dig deeper into the subject as long as the interviewer does not have an agenda for a certain approach [18, pp. 295-296].

Since an unstructured interview bears the risks of both taking longer to conduct, and to analyze, there is an alternative that is much quicker. Structured interviews contain a set of fixed, short, and precise questions that often have specified answers are quicker than the unstructured alternative and useful when the goal is clear. The structured interview also

means that the questions shall be formulated the same way and in the same order to each participant [18, p. 296].

The last option is a mix between the two other alternatives and is called semi-structured interviews where both open-ended and closed questions are allowed. The prepared questions are working as guidelines but should be replicable and supplementary questions are encouraged as long as biases are avoided. Probes are a useful method to get more information and to use prompts to help out when the participants get lost in words [18, pp. 296-297].

Interviews can be conducted in groups or with one respondent at a time. When a group is interviewed, often a focus group is used which consists of representatives from a target group. This arrangement of interviews is common in requirement activities to identify conflicts in terminology or expectations from different perspectives. Focus groups are advantageous to generate varied questions or sensitive questions that risk getting lost. Also, the method supposes that individuals develop their opinions in a social context and that a supportive environment establishes the individual opinions regardless of contradictions within the group [18, pp. 300-301].

2.8.4 Questionnaires

Questionnaires are similar to interviews since they both can consist of open or closed questions. However, questionnaires can be distributed to more people than is possible with interviews. Since there is no one to answer questions about the questionnaire it is important to be well-formulated and clear to avoid confusion or wrong answers. If possible, negations should be avoided or complemented with other positive questions to control the answer considering the risk of confusion [18, pp. 307-308].

The structure of questionnaires usually starts with some general questions that are relevant as background information. This could be the age of the respondent or something that reveals their technical experience. The key point is that the background questions are used to understand the respondent's other answers. Once the background is set, more specific questions related to the goal of the data gathering are asked. Also, the order of the questions is meaningful and can have an impact on the answers. Sometimes it is also appropriate to have different versions of the questionnaire depending on the target groups [18, p. 309].

Furthermore, there are different types of questions and answer formats that can be used. In demographic questionnaires, it can be useful with check boxes since there is a predictable answer. However, different rating scales are effective when you want to compare respondents or to make people judge distinct aspects. One common rating scale is called Likert scale which is used to measure opinions, attitudes, and beliefs. Hence, Likert scales evaluate user's satisfaction with the product. It is structured with a statement and a rating scale either with numbers, representing agreement or disagreement, or words indicating how much the respondent agrees or disagrees [18, pp. 309-312].

One questionnaire that uses the Likert scale is called System Usability Scale [19] which is a part of ISO standard 9241 [20, p. 194]. This kind of questionnaire aims to measure the satisfaction of the participants and therefore questions that can be observed should not be asked. Instead, the focus is on the participant's feelings and previous experience [20, p. 194]. However, this survey scale was developed as a quick and dirty method of 10 statements that access the usability of a product or system. SUS ranges a final score from 0 to 100 where a higher score indicates better usability. The statements alternate between positive

and negative and therefore you will need to pay attention while calculating the score [2]. To calculate the score of a SUS questionnaire with a scale of 0-4 you will need to subtract 1 from each positive worded scale position and for each negative worded take 5 subtracted with the scale position. Then you add all of these together and multiply with 2.5 to get a score between 0-100. A SUS score above 68 is above the average score [3].

Another rating scale is semantic differential which explores ratings between bipolar attitudes about a specific item. Each attitude is represented by a pair of adjective where the respondent is asked to rate on a scale which word that suits the item best. Afterward, a score is calculated for each pair of adjectives that can be compared between different target groups [18, p. 312]. This scale is used several times throughout this thesis where the words were rated on a scale from 1 to 5 and the exact adjectives used were the following Swedish words:

- Ful - Attraktiv
- Förvirrande - Tydlig
- Klumpig - Smidig
- Komplicerad - Sempel
- Inkonsekvent - Konsekvent
- Dåligt utformad - Bra utformad
- Irriterande - Tilltalande
- Onödig - Nödvändig

2.8.5 Brainstorming

Brainstorming can be described as a session of ideation where the purpose is to generate as many ideas or solutions as possible within a group. This is done by using anything from sticker notes to mocking up. Before the generation of different options, the context is set to clarify the purpose and framing. During the brainstorming session, the focus is on quantity to increase the possibility to find something new. Also, criticism is avoided to make it possible to explore odd ideas that may result in something valuable. Furthermore, it is encouraged to build on each other's ideas and use visuals to stimulate new ideas. Hence, brainstorming results in new potential ideas and sometimes discussions that develop these ideas further [13, pp. 43-44].

2.8.6 Observation

Observation of end-users is one of the basic elements of usability testing [20, p. 25]. It can be used during any stage of product development to gather data either to understand the users' context, tasks, and goals or to evaluate how well the product or prototype supports these tasks and goals [18, p. 318]. Thus, this is a research skill that requires attentive looking and systematic recording to gather data in a proper way [14, p. 120]. To gather the expected data it is a good idea to give the observers guidelines since it often is an unusual activity. Therefore

the guidelines contain notes about body language and making noise, taking notes, and what type of questions they are allowed to ask when they are invited to do so [20, p. 154].

Furthermore, there are different types of observations since you either can do it directly in the field, in controlled environments, or indirectly by tracking users' activities through diaries or other logging methods. It is unlikely that an interaction designer will get the full and true story through interviews and questionnaires and therefore observation in the field can help to understand details about behavior and usage. Observations in the field can be complicated and result in a lot of data that is not particularly relevant. However, if the observation is planned and carried out carefully with a stated goal and focus but still is open to changes that can give unexpected results, it is less of a risk to gather irrelevant data [18, p. 320].

In contrast, observations in controlled environments are more formal and focus on what the individual does and not how one interacts with other people, the technology, and the environment. The controlled environment can be any room with sufficient equipment and therefore participants do not have to travel to take part in the test. To record the data different techniques such as videos, photographs, taking notes, etc can be used. The different techniques capture different data and the relevance differs depending on the goal. To ensure that every participant is treated the same way to get more reliable results, an orientation script can be used [18, p. 329]. This is a script to introduce the participant to what they will be doing and to reinforce that it is the product that will be tested and not the participant [20, p. 155].

Lastly, after an observation of any kind is done it is a good idea to review both the participants and observers to understand why errors, difficulties, or other actions occurred. This is an opportunity to resolve any remaining questions or debrief things you could not see but that participant was thinking. Also, the observers have different points of view that could help you see things that you did not notice yourself and could be worth discussing [20, p. 229].

2.8.7 Think Aloud

Observations do not reveal what the participant is thinking while testing the product or prototype and therefore the think aloud technique is helpful. However, it can be hard to both explain what and why you are doing something while staying concentrated on the test [18, p. 330]. Instead of thinking aloud concurrently, another option is to do it retrospectively when a task is completed. This technique can be carried out in any stage of the design process to evaluate either a prototype or a product [14, p. 180]. Despite the fact that it can be hard to think aloud, a further disadvantage is that the technique risks avoiding problems that had occurred if the participants did not remind themselves about what they were doing by telling it out loud [20, p. 54].

Nonetheless, there are advantages with the technique since it helps gather data that otherwise is missed. To make the technique as convenient as possible it is appropriate to demonstrate the technique first to make the participant comfortable. Also, if the participant encounters strong resistance it should be possible to perform the test without the think aloud technique since it can harm the results. Another thing to have in mind is that you should pay extra attention when the participants become quiet since it indicates that they are concentrating on solving a problem. In a quiet moment, it may be better to wait and ask about

the incident later. Additionally, you should repeat comments and following up to let the participant know that you are listening and taking notes [20, pp. 205-206].

2.8.8 Affinity Diagrams and Dot Voting

To analyze and compile qualitative data from interviews etc in a comprehensive way the method and tool called affinity diagram can be used [18, pp. 365-366]. The first step for the members of a team is to write down ideas and thoughts on sticky notes. Secondly, each individual idea is organized into a cluster of similar ideas. Often, the clusters are seen as non-predefined hierarchies that appear from similar data [18, p. 366; 14, p. 12].

Another method is dot-voting which is described by Nielsen Norman Group [21] as "a simple decision-making and prioritizing technique in user experience". The method implies that each team member gets a number of dots that are used when voting for the option or options they considered best. Hence, the method is helping the team to get further with the solution that is commonly agreed upon.

2.8.9 Remote Usability Testing

Because of the current pandemic, remote testing is relevant for this thesis. Remote testing is requiring preparation and the first step is to choose which tool to communicate through. It shall be possible to share audio and screen to facilitate the communication. However, the exact same tool must not be used during each test session. If a participant is joining from an office computer it might require a specific tool and another participant may be accustomed to another tool. The next step is to plan the tasks and how to deliver them. You want to make sure that the participant reads the whole task and does not look ahead to later tasks. With these points in mind, there are three different strategies which are to send the participants a document with the tasks, use the chat function in your chosen tool to deliver a task at a time, or read them out loud to the participant. Once the test is prepared and the day of testing has come it is a good idea to send out reminders with instructions and information if they have to prepare anything both for observers and participants. The last step is to conduct the test session which is done by an invite and following a prepared script [15].

2.9 The General Data Protection Regulation and The Law of Accessibility

The general data protection regulation, GDPR, applies throughout EU and has the purpose to create a standardized and common level for protection of the processing of personal data [24]. To follow this regulation, several guidelines and checklists has been established and one of them is developed by Integritetsskyddsmyndigheten.

Another law that affects this thesis is the *law of accessibility* which requires that a digital public service is possible to perceive, manageable, understandable, and robust [6]. This can be achieved by following the Web Content Accessibility Guidelines (WCAG) standard [6], which Grade AB already does.

Microsoft Teams have already taken actions regarding accessibility by the feature called immersive reader. This is an option that launches a full-screen experience with possibilities to change the text format and play the document or message so you can hear a voice reading it aloud. The voice can also be set to different speeds and gender to achieve the version you like [23].

Chapter 3

Design Process

The project consisted of the following phases: Investigation, Low Fidelity, High Fidelity, and Implementation Phase which all included testing. At the start of the project, we wanted to investigate what we were supposed to do by constructing a conceptual model and get a better understanding of the users. Also, we were researching for inspiration by reading about related work, methods to use, and possibilities of different APIs’.

The information from the investigation phase was gathered and analyzed to create a Lo-Fi prototype in the next phase. The Low Fidelity phase involved prototyping, testing, and evaluation that later on was used to develop a Hi-Fi prototype in the next phase.

Likewise, the High Fidelity phase involved prototyping but this time with the results from the previous phase in mind. The Hi-Fi prototype then was tested and evaluated to improve the prototype. Therefore the Hi-Fi phase was split into two phases for further improvements before developing the final product.

Lastly, the implementation phase was carried out by first planning all features and functionality to be included. After everything was accounted for, the features and functionalities were prioritized and then the existing code and Microsoft Graph API were explored and researched to come up with a solution. The solution was then implemented and potentially presented and/or discussed with our supervisor at Grade. Otherwise the process was repeated and a new feature was selected from the top of the priority list. Finally, this concluding phase ended with a final usability test of the integration.

In Figure 3.1, the different activities during each phase specified in a workflow diagram. This diagram is supposed to give an overview to help the reader understand the following sections that are containing more detailed information about the methods in each phase.

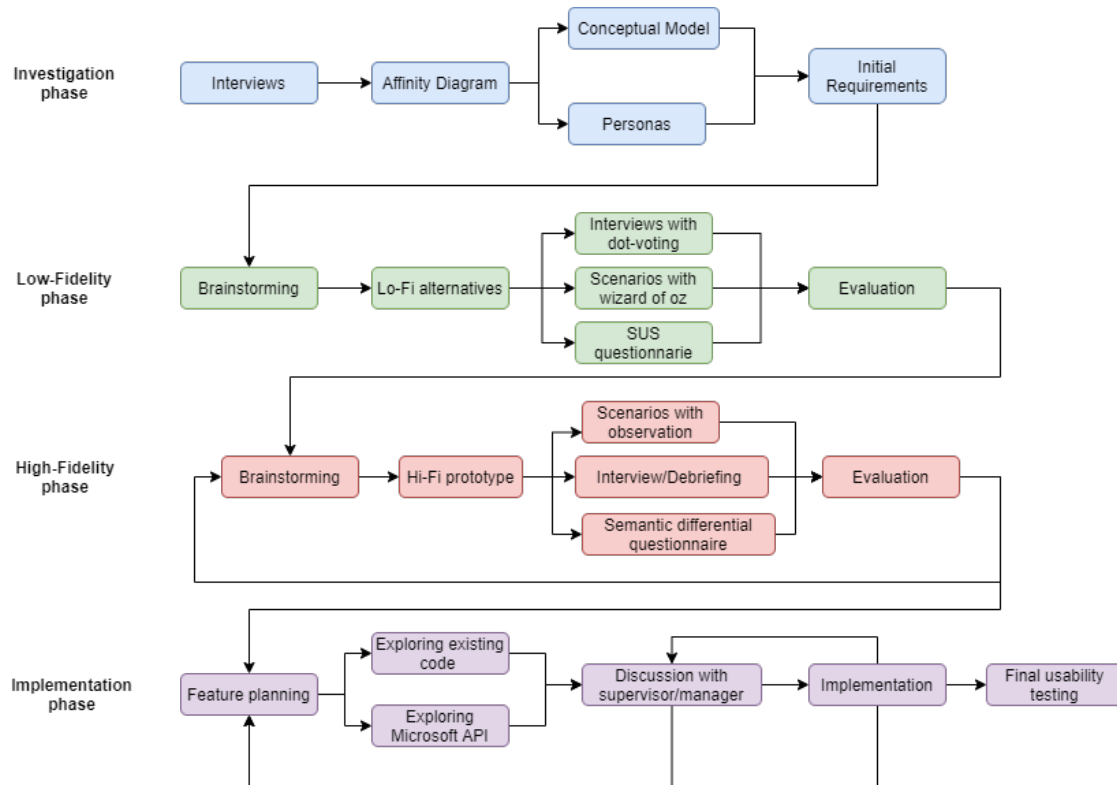


Figure 3.1: The workflow during each phase and their relation to each other.

3.1 Investigation phase

The investigation phase was initiated by performing literature studies to find sources for the intended methods, related work, and to see if similar work had been performed before. We then moved on to writing a script for the semi-structured interviews which were held with the stakeholders, both internal stakeholders at Grade AB, and external stakeholders in the form of their customers such as different regions - who also are a part of the main users of the to-be implemented system. The script contained open-ended questions about how they use the product today and predictions and wishes for future product integration with Microsoft Teams. The script also encouraged further discussions and unplanned questions. In total 6 internal interviews and 1 external interview were held where the internal was held individually and the external had two respondents representing the same customer. The interview was about 30 minutes long and there were 2 women participating and 6 men. The age of the participants was between 20-39 and the average age was 32 years.

The manuscript that was seen as a guide for the internal interviews was created with questions about the future integration of Microsoft Teams. The questions address how the product should be used, by who, and when. Open questions about wishes and expectations were also included. A corresponding interview guide was made for external interviews where the goal and purpose of the project were explained. In the external interviews, the questions that differed from the internal interviews were about how they handle distance courses today.

As the interviews were semi-structured the response from each participant varied widely.

One of the most common answers from the internal interviews was that the integrated product should not feel like a completely different application when moving from Grade's portal to Microsoft Teams. This attitude was supported by several different expressions as seamless, user friendly, and ease. The expression *user friendly* is interpreted by us as an application with a great user experience where actions lead to the expected result. Several respondents also emphasize that a product with a great user experience is mostly automated and shall contain as few clicks as possible to perform the wanted action.

Due to a lack of interest from Grade's customers, only one group interview was conducted with such users. From the interview data similar to the data from the internal interviews were gathered. The participants wished that the integrated product provided a seamless experience and that it should give a great user experience, be easy to use, and require as few clicks as possible.



Figure 3.2: The resulting affinity diagram with several ideas collected from interviews and brainstorming generating categories that present the user needs in broad terms.

From the internal interviews, an affinity diagram was created with the use of post-it notes on a whiteboard. As seen in Figure 3.2 an affinity diagram resulted in the five following categories:

- *Navigation* - In terms of calendar bookings, easy to find course sessions and hyperlinks, and get reminders.
- *Automation* - In terms of not having to create a course session both in Microsoft Teams and in Grades' platform, automatic attendance lists can save conversations in chats and save recordings of video.
- *User Experience* - In terms of a natural flow, flexibility, ease to understand and administrate, the feel of one system and not two different, and something else than hyperlinks that is hard to understand.
- *Seamless* - In terms of synchronization, that the different tools shall mirror each other, a homogeneous experience, smooth and seamless navigation between the platforms.

- *Communication* - In terms of being able to discuss, cooperate, interact between course participants, break-out rooms to discuss in smaller groups, and being able to answer and ask questions in real-time.

From the affinity diagram, an initial conceptual model was established. The foundational pillars of the virtual classroom's conceptual model can be described using the categories identified in the affinity diagram, *Navigation*, *Automation*, *User Experience*, *Seamless*, and *Communication*. It shall be an application with great user experience in terms of simplicity, a natural flow, flexibility, easy to maintain, and easy to understand. The integration should bridge the gap between the two systems in hopes of providing a seamless experience. The navigation for the end-users should not be unnecessarily complicated and the application shall provide many points of entry. With these points in mind, it is important to ensure that signifiers, affordances, and icons are used properly. To provide the services, necessary features like synchronization, attendance-check, recording, and uploading of seminars, and the sign-in process shall be automated as much as possible. It should be possible for users to communicate with ease before, during and after class sessions.

Furthermore, there are certain terms that are important for the application. A *course* can have several *course sessions* including the same material each period. Also, there are different users with different aims. An *administrator* uses the *administration website* to manage existing courses and sets up new ones. A *participant* uses the *portal* to attend courses and see achievements. Lastly, we have an *educator* that is responsible for the learning material during a course and uses the *portal*.

The new integration with Microsoft Teams will use the metaphor *classroom* since it is the location where the course session will be held. Inside the classroom, the participants and educator are able to discuss and have classes. Once a class is ongoing a meeting is held on Microsoft Teams where the educator can share its screen as a projector would inside a physical classroom or use it as a whiteboard.

The conceptual model was then used to reiterate and improve the semi-structured interview script before any external interviews were performed. From the internal interviews and our own perception three personas was created to represent the different target groups. In Figure 3.3, 3.4, and 3.5 a typical admin, educator and participant is described. The personas provide a better insight into the intended end-users and their needs. AI-generated pictures from <https://generated.photos/> was used to give the personas faces. The reason why the external interview was not a part of the affinity diagram relies upon the fact that it was not possible to have an earlier interview and therefore was scheduled later compared to the internal interviews. Likewise, it was hard to get in touch with external customers which ended up in only one interview.

An admin is a somewhat more technical skillful person who is used to both Grades' system and the company that uses Grades' platform. An educator, however, must not be as technical and can be anyone at a company with the right skills that are about to be learned during a course session. Therefore the educator is not a teacher since it does not have any education within pedagogics. Lastly, a participant is someone that needs new competence within the area that the educator has skills in. Thus, a participant can be anyone within the company that holds the competence development through a course session managed in Grades' platform.

These conclusions about the different types of users were based on the descriptions of customers from interviews with Grades' own employees. The employees at Grade have insight

into the customers since they work with support and sales. Also, after the interview with one of Grades' customers at a region seemed to agree upon this picture.

Lisa

Administrator



Background

Lisa works on the IT team of a big firm that utilizes the product in question. She has several years of experience working with the solution and is well accustomed to it. She has always had an interest in technology and thinks that most configurations & design, and intended steps are obvious.

Motivations

Lisa is one of the main administrators of the deployed system at her company. She has a broad understanding of technology in general and has little to no issues regarding usage at the moment.

Frustrations

Sometimes she thinks there are better solutions than the existing one even if she can manage it. Additionally, she finds it frustrating when she needs to perform the same task repeatedly in different areas of the product to achieve a fulfilled result.

Gender: Female

Age: 29 years old

Technical Comfort: Expert

Ideal User Experience

Lisa would like the product to be as automated as possible and the tasks that need to be done should only be done once.

Figure 3.3: Description of a persona representing an administrator.

Anders

Tool expert



Background

Anders is a handyman who has always enjoyed working with his hands. After many years as a carpenter, he was picked up by Toolers AB and educated into a tool expert for their line of new high-tech tools. In his free time, Anders enjoys playing candy crush on his mobile device competing within the family. He likes all kinds of beer but prefers the cheap kind. Anders is not afraid of taking charge, and sees the world in a logical way - he is very problem-solving in nature.

Motivations

Anders has a long experience at the company and has become an expert. He is liked by his peers and was elected by the company board to teach customers about their tools and how to use them properly. He has been hired by Hammerers, to teach them about Toolers AB new sledge tooling.

Frustrations

Although Anders is a very problem-solving in nature but also has a hard time adapting to different circumstances. When he expects the application to behave in one manner, but it does so in a different one, he gets very frustrated and angry.

Gender: Male

Age: 48 years old

Technical Comfort: Beginner

Ideal User Experience

Since Anders is a very logical person he wants the application to clearly signal what kind of actions are possible and how it will behave.

Figure 3.4: Description of a persona representing an educator.

Karin

Nurse



Background

Karin had a summer internship at a retirement home that she found meaningful and has since educated herself into a nurse. She has been working as a nurse for 10 years. In her spare time, she spends time with her family and grandchildren. When her grandchildren are there to help her out, she is uploading pictures from her mobile phone to Facebook to keep her close friends up to date.

Motivations

From time to time there are learning opportunities at her workplace.

Frustrations

Karin preferred her workplace before the time of computers. She has never appreciated them and continuously refused to learn them. She finds most applications hard to use and requires aid in most of her tasks.

Gender: Woman

Age: 63 years old

Technical Comfort: Beginner

Ideal User Experience

Intended action for Karin to take has to be extremely apparent and easily identified. The fewer clicks Karin needs to perform the better.

Figure 3.5: Description of a persona representing a participant.

3.2 Low Fidelity Phase

To set up proper Lo-Fi tests we made sure to establish a collection of scenarios for each kind of user found in the system, namely user, educator, and administrator. The scenarios' purpose was to understand the context and inspire us to what components were important in the upcoming prototype with inspiration from our conceptual model and personas created in the previous phase. The scenarios can be seen below in figure 3.6.

Scenarios

Administrator

You want to add a new course session to a supervised distance course.

Educator

You have previously been assigned as an educator to an upcoming course session on distance and therefore you would like to explore how to connect to the online-meeting and other possibilities.

You would like to begin with starting a video call and explore screen sharing.

You want to record the lecture to distribute the material afterward.

The session is over and you want to control the recorded material.

Participant

You want to attend a supervised course that nowadays is educated on distance. The meeting is about to start and you want to participate.

You have missed a course session and want to catch up through a recording from the session.

Figure 3.6: Scenarios for inspiration to the Lo-Fi prototype.

With the scenarios prepared we moved on to creating low fidelity prototype. Initially, the prototypes were created from scratch on paper but we realized after a while that it was inefficient and because inconsistencies in size and clarity would negatively affect the ability to perform remote Lo-Fi testing. Instead, we opted to take screenshots, set them to black and white, and printing them on paper. Before printing the papers, different methods and services for performing low fidelity prototyping remotely were investigated and we realized that attempting to do so on paper using a camera would prove difficult and confusing for the user. Instead, we created *Google Slides* for easier use when testing. The prototypes for the different types of users and their use cases were produced first by brainstorming for design variations and types, followed by then taking screenshots on relevant screens and adding text or buttons that convey the intended new functionality for each case. When the prototypes were created, we revised them against the previously specified scenarios and realized that the scenarios were not representative of already existing functionality and were corrected since we thought that the prototype was more representative than the scenarios that inspired us to the result. The resulting Lo-Fi prototype's vital parts are shown in figure 3.8, 3.9, and 3.7 below.


*SessionTitle	Plats	Startdatum. +	Deltagare/Antal platser
Vecka 4	Teams	2021-01-24	<div></div> 0/30
*SessionTitle	Plats	Startdatum. +	Deltagare/Antal platser
Vecka 4		2021-01-24	<div></div> 0/30
*SessionTitle	Plats	Startdatum. +	Deltagare/Antal platser
Vecka 4	Till Teams	2021-01-24	<div></div> 0/30

Figure 3.7: The alternatives for an educator to reach Microsoft Teams either through a hyperlink, icon, or button.


ad	ad	ad
Administrationsregulationer Genomgång av de nya regulationerna som befaller vår verksamhet under Februari 2021  Visa kursen	Administrationsregulationer Genomgång av de nya regulationerna som befaller vår verksamhet under Februari 2021 Visa kursen	Administrationsregulationer Genomgång av de nya regulationerna som befaller vår verksamhet under Februari 2021 <div>Teams</div> Visa kursen

Figure 3.8: The three alternatives for the course session card containing either an icon, nothing at all, or a text.

Once the prototype was created, a test was prepared to evaluate the design. To conduct the test an orientation script was written and contained an introduction, background questions, updated scenarios, and debriefing. However, if we knew that the participant already was familiar with Grade's platform the orientation script was modified and did not contain as many details. The orientation script included statements that made sure that the participant knew that we were testing the prototype and not their knowledge. Moreover, the orientation script asked the participant to think aloud and made them understand that every comment and concern was of great value.

Additionally, the test session was conducted with the Wizard of Oz technique since we controlled the different steps in the scenario. The test started with background questions about their previous experience with online education and conferencing apps. Then the test continued with a read-out-loud scenario with a goal using one specific design developed for the role represented by the participant. A variety of design prototypes were then shown to every role except administrator after participating in the test. The design variations were graded using dot-voting. Furthermore, the participants were interviewed after testing, and a questionnaire based on SUS was constructed to let the participant answer at the end of the test. There were two background questions about their age and role. The questionnaire then contained ten SUS questions that were positive and negative alternated with a rating scale

from 0 to 4 where 0 represented that the respondent strongly disagreed and 4 strongly agree. The questionnaire ended with an open-ended question if they wanted to add something about their experience.

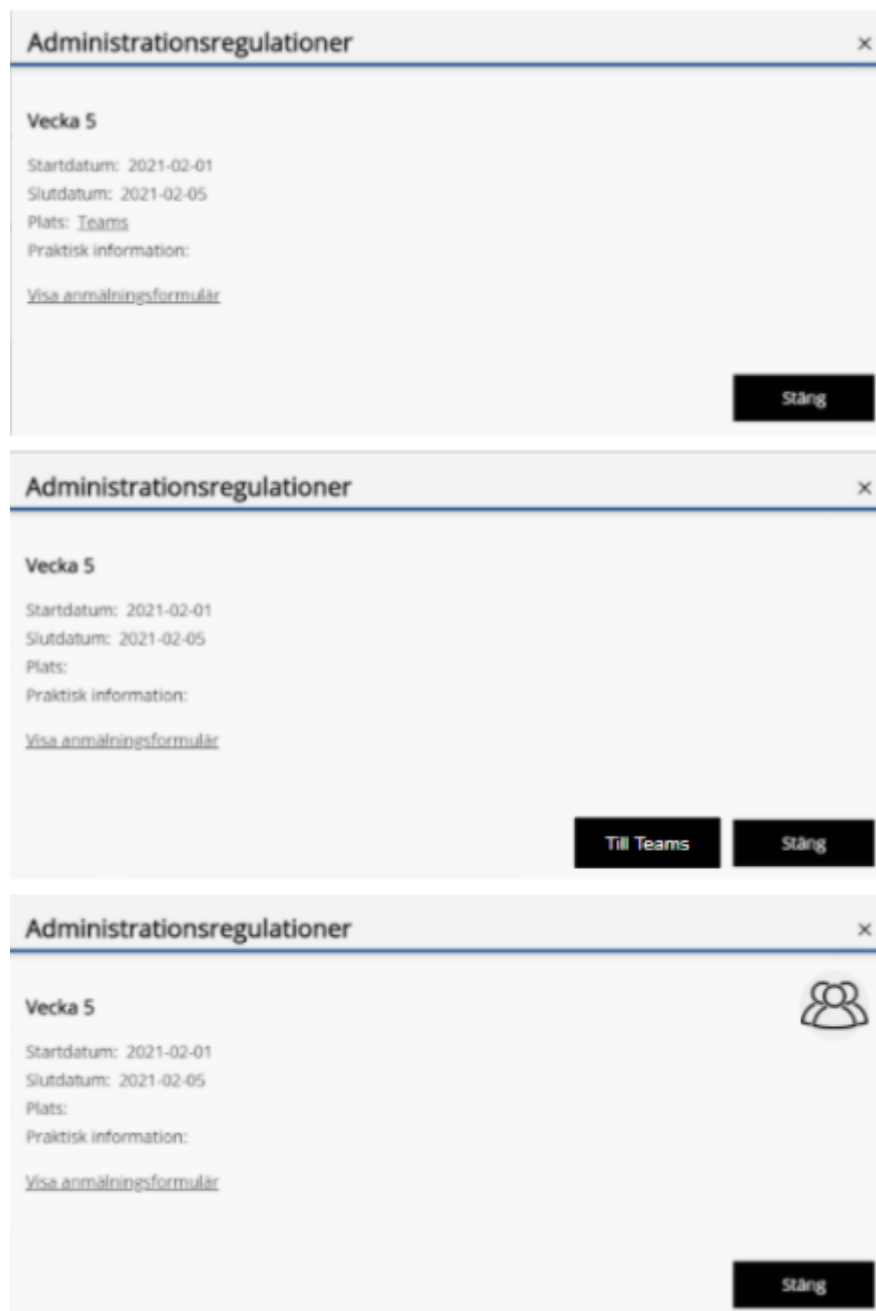


Figure 3.9: The alternatives inside course information with either a link set on the location, a button to teams, or a clickable icon.

In total 9 Lo-Fi tests were conducted where the ages ranged from 20-39 where the mean value was 30 years old. Totally, 5 men and 4 women participated in the test. Two of the test persons had not used Grades' platform before but had participated in educational lectures through other conferencing tools than Microsoft Teams before. Specifically, two administrator participants tested the administrator scenarios, two educator participants tested the

educator scenarios, and the remaining five participants tested the course participant scenarios.

The data from each test was processed by looking after patterns and common behavior, the comments from think-aloud, answers from the interview, and finally the open-ended question answers from the questionnaire. The processed data, and quantitative data from dot-voting and SUS can be seen below, and was gathered into an improvement document to aid the construction of the high fidelity prototype in the next phase.

Processed data of test results

Administrator

- It was easy to understand that the checkbox shall be used to create a Microsoft Teams course.
- The respondents' reaction indicated that they would like a confirmation when they saved the course session with Microsoft Teams.

Educator

- Allow the user to navigate through the course settings to the teams channel.

Participant

- Ensure that the *location* field is usable even though the course is teams integrated.
- If the meeting is active, display a 'meeting active, join now' option on the course card.
- The design variation using text was superior to the ones using an icon as the icon does not properly convey the intended message. One participant said that text can not be misinterpreted and another thought that the best case would be to use both an icon and text together.
- Use a tag on the course card to signify if it's a physical or remote course.
- Ensure that a distinction is made between Grade Teams and Microsoft Teams to prevent confusion.
- One participant wanted a descriptive text in the course information window that states if a course is or is not connected to teams.

Dot-Voting

The dot voting resulted in the following tables, 3.1 for educators and 3.2 for participants where the alternatives for educators is shown in Figure 3.7. The alternatives that was voted on by the participants are shown in Figure 3.8 and 3.9. Administrators did not have any alternatives and therefore there are not any results from that role.

Table 3.1: The dot voting for design variations for the educators. The alternatives is shown in figure 3.7.

Design variant	Votes (dots)
Teams button	3
Icon	0
Hyperlink	3

Table 3.2: The dot voting for design variations for the participant. The alternatives is shown in figure 3.8 and 3.9.

Design variant	Votes (dots)
Course card empty	1
"Teams" on course card	7.5
Icon on course card	1
"Teams" in course information	4.5
Icon in course information	0
Hyperlink on "location" in course information	2

System Usability Scale Questionnaire

The result from the questionnaire is presented in the following tables: Table 3.3 for administrators, Table 3.4 for educators and Table 3.5 for participants.

Table 3.3: SUS score for administrator from Lo-Fi prototype questionnaire

Test person	SUS score
Admin 1	80
Admin 2	100
Average	90

Table 3.4: SUS score for educator from Lo-Fi prototype questionnaire

Test person	SUS score
Educator 1	87.5
Educator 2	92.5
Average	90

Table 3.5: SUS score for participant from Lo-Fi prototype questionnaire

Test person	SUS score
Participant 1	82.5
Participant 2	92.5
Participant 3	77.5
Participant 4	92.5
Participant 5	97.5
Average	88.5

3.3 High Fidelity Phase 1

The previously mentioned improvement document was used to construct additions and improvements to the Lo-Fi prototypes when turning them into Hi-Fi prototypes. Once the document was put together, a brainstorming session was conducted to find solutions to the identified problems. Additionally, the results from the questionnaire and dot-voting were taken into consideration to decide which solution should be the most likable. Thus, from these three data sets, both qualitative and quantitative data were evaluated. The brainstorming session also generated discussions about signifiers and affordances to solve some of the problems that occurred during the Lo-Fi test. The Hi-Fi prototype was then developed using Adobe XD and we created a prototype that harbored all three roles.

General differences between the low fidelity prototype and the high fidelity prototype were that buttons were set to use a primary color to signify affordances. Also, we made an effort to ensure that all new buttons used text as a tool to signify precisely what the affordance offered is, i.e. button text was changed from *To Teams* to *To Microsoft Teams*. In detail the main differences implemented in each of the roles' scenarios are as follows: For the course participants, the course card now displays a tag that reads "MS Teams", to convey to the user that the course is integrated with teams. We also made sure to use one of Grade's primary colors for the "To MS Teams" button to act as a strong signifier. These changes can be seen in figures 3.10 and 3.11 below.

For the role of a educator, the flow of use which we had missed was implemented and the Hi-Fi prototype allows access to Microsoft teams through both the table on the overview, and from the page of a specific course session. In the page of the specific course session a button with the same color as used on the course information window for the participants was used, to yet again signify affordance to the users. We decided to keep the link in the table's *location* column and make sure to keep it underlined to signify that it's a clickable text. These changes can be seen in figures 3.12 and 3.13 below.

Finally, for the role of the administrator the feedback received from previous iterations was short and concise. The only difference implemented was the text *Connect to Teams* to *Connect to MS Teams* and that the course sessions in the manage course page now shows if a session is, or is not integrated towards teams, this addition can be seen below in figure 3.15



Figure 3.10: Image depicting the new tag added to course cards to signify Microsoft Teams integration

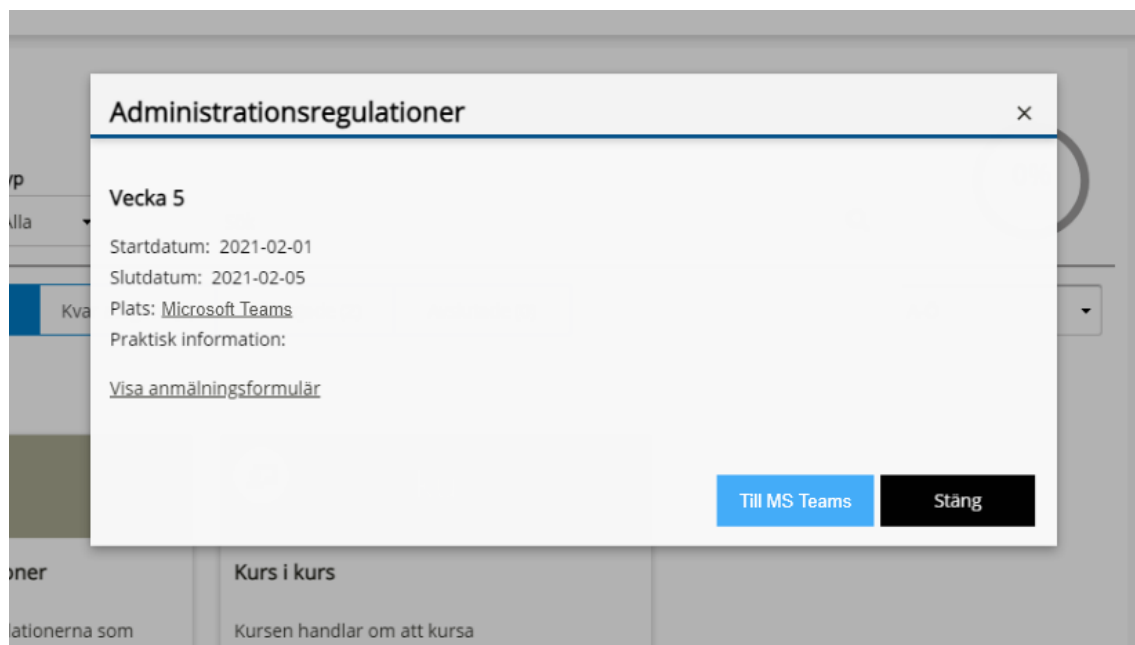
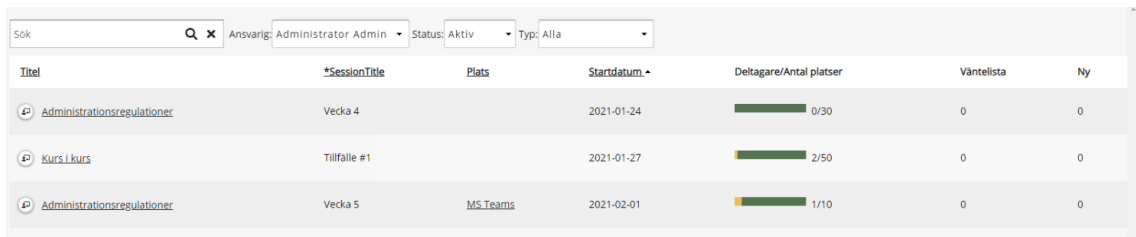
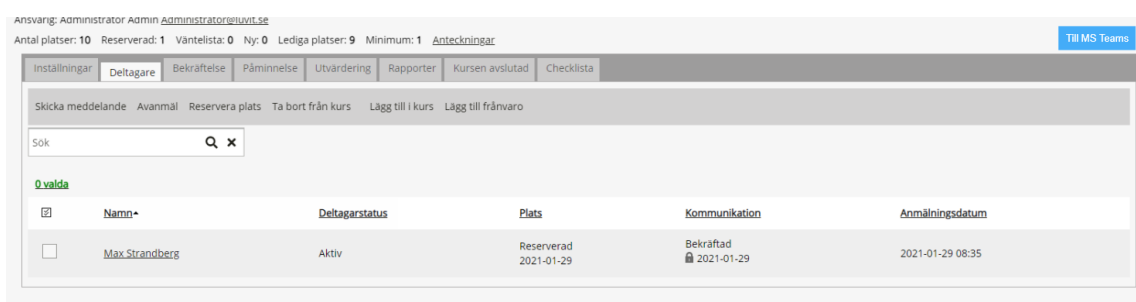


Figure 3.11: The Image depicts the new button added to the course information window with a call-to-action color to signify an affordance to the user



Titel	*SessionTitle	Plats	Startdatum	Deltagare/Antal platser	Väntelista	Ny
Administrationsregulationer	Vecka 4		2021-01-24	<div><div></div></div> 0/30	0	0
Kurs i kurs	Tillfälle #1		2021-01-27	<div><div></div></div> 2/50	0	0
Administrationsregulationer	Vecka 5	MS Teams	2021-02-01	<div><div></div></div> 1/10	0	0

Figure 3.12: Image depicting the new hyperlink in the location field added to the educator view to show that the course is being held online.



Ansvarig: Administrator Admin [Administrationsregulationer](#)

Antal platser: 10 Reserverad: 1 Väntelista: 0 Ny: 0 Lediga platser: 9 Minimum: 1 [Anteckningar](#) [Till MS Teams](#)

Inställningar Deltagare Bekräftelse Påminnelse Utvärdering Rapporter Kursen avslutad Checklista

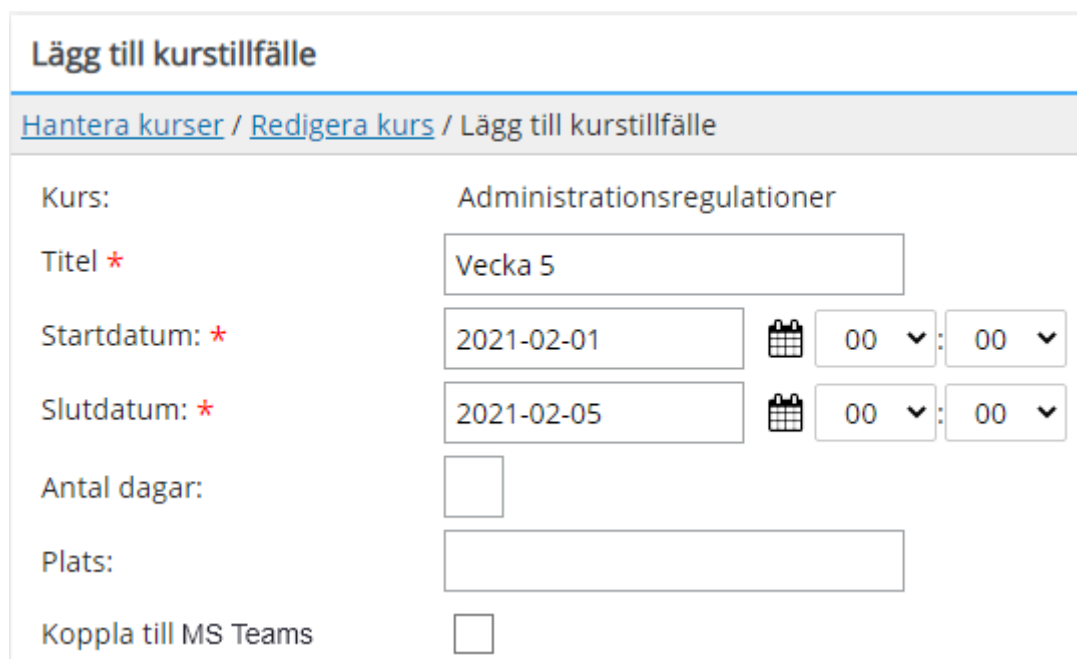
Skicka meddelande Avboka Reservera plats Ta bort från kurs Lägg till i kurs Lägg till frånvaro

Sök

0 valda

<input type="checkbox"/>	Namn	Deltagarstatus	Plats	Kommunikation	Anmälningstidpunkt
<input type="checkbox"/>	Max Strandberg	Aktiv	Reserverad 2021-01-29	Bekräftad 2021-01-29	2021-01-29 08:35

Figure 3.13: The Image depicts the new button added to the course session settings with a call-to-action color to signify an affordance to the user



Lägg till kurstillfälle

[Hantera kurser](#) / [Redigera kurs](#) / [Lägg till kurstillfälle](#)

Kurs: Administrationsregulationer

Titel *

Startdatum: *

Slutdatum: *

Antal dagar:

Plats:

Koppla till MS Teams ☐

Figure 3.14: The Image depicts the new checkbox added to connect a course session to Microsoft Teams.

Titel	Startdatum	Kursansvarig	Status	Teams
Vecka 5	2021-02-01 00:00	Administrator Admin	Aktiv	Ja
Vecka 4	2021-01-24 00:00	Administrator Admin	Aktiv	Nej

Visa 10 poster/sida

Ny Kopiera Ta bort

Figure 3.15: The Image depicts the new column(rightmost) added to the course session table to show if a session is, or is not integrated with teams.

The Hi-Fi prototype was pilot tested on one person before any multitude of tests were conducted. The pilot test resulted in valuable feedback as it introduced behavior previously not considered. The prototype was modified to allow for this new behavior, which more specifically meant being able to go back to previous steps in the prototype and undo or add certain choices.

The Adobe XD prototype was then used in conjunction with Microsoft Teams meetings to allow the test participants to explore the prototype on their own, sharing their screen to the meeting. The participants were asked to share all of their thoughts as they moved through the prototype. We noted everything of interest and after the test scenario was completed a debriefing was held where we gathered their thoughts, suggestions, and concerns. Finally, the participants were given a survey with semantic differentials and an open-ended question about additional comments to fill out. In the previous phase the SUS-questionnaire was used, but it was replaced with the semantic differential questionnaire as all participants had minor to major difficulties understanding and answering the questions.

In total 5 internal and 5 external prototype test sessions were conducted. The internal test participants were employees from Grade, who also participated in the lofi-testing, they range in the age range of 20 to 50, they all have experience both technically and in the platform itself. The external test participants were a variety of customers and outsiders, 3 of 5 participants were customers who had previously participated in the lofi-testing, and the other 2 were outsiders, one of which had previously tested the lofi-prototype. They had a wider range of ages ranging from 20 to 70, technical experience, and use of the platform. The mean value of all participants age was 41. Totally, 6 women was tested and 4 men. The complete outsiders mainly tested the participant prototype and had the opportunity to comment upon the educator's view since these two roles could be anyone. The customers, however, tested the prototype that suited their role and daily work.

The survey responses received and notes taken from these tests were used to construct a new improvement document. We decided that at least one more iteration of the Hi-Fi prototype was required to further establish and improve on all expectations of the implementation phase and final results. The processed qualitative data and quantitative data acquired from testing can be seen below.

Administrator

- Missing feedback about how the Microsoft Team and its channels are created or not.
- Remove all abbreviation.
- Some sort of help or description which describes what "Connect to Teams" infers.
- Add the checkbox before "Location" and if the checkbox is checked in, "Location" is automatically filled in with a link to Microsoft Teams, see 3.14.
- Keep the current textfield which allows the users to fill in a link to a meeting, useful when another tool than Microsoft Teams is used.

Educator

- Users struggled to recognize and identify the blue button introduced in figure 3.13.
- There are too many options in the view shown in figure 3.13 that hides the blue button.
- Place the blue button in the menu shown in figure 3.13 to achieve a consistent design that is uniformed with the existing style.
- The abbreviation MS for Microsoft can be confusing.
- This is not the only view used by educators. Some educators have limited permissions that imply other views.
- A solution for other tools than Microsoft Teams is needed.
- Obvious and easy because of the hyperlink that indicates that the text is clickable, see figure 3.12.
- 4 test participants used the link in figure 3.12 and 2 participants used the button in figure 3.13.

Participant

- 7 out of 10 of the participants tried to click on the tag shown in figure 3.10.
- 3 out of 10 theorize that one click on the tag in figure 3.10 since the clickable link "Show course" is much more discrete than the tag which draws attention to it.
- All participants finds the blue button in figure 3.11 distinct and clear.
- Stakeholders at Grade want us to avoid the abbreviation MS for Microsoft.
- The text on the blue button in figure 3.11 is ugly because the mix of upper and lower case letters.
- Maybe have a shorter text on the blue button in figure 3.11 and a hover with information on it.

- The tag in figure 3.10 is inconsistent with the existing design that describes the status and should be reconsidered.

Semantic Differential Questionnaire

Table 3.6 shows the total score for each type of role and the maximum that could have been reached. Also, the score is presented as a percentage relative the most positive word, i.e. *Total/Max*, with two significant digits. The goal is to have a percentage of 100%. Since the result was very equal between the different adjective pairs, no word is distinguished from the rest, and therefore no results about the most or least popular word are presented. One answer from an educator differed a lot from the others with generally lower scores. However, this respondent also comments on the already existing design and not the new integration at the end of the questionnaire.

Table 3.6: Score for each role in High Fidelity Phase 1.

Test person type	Total	Max	Total/Max
Administrator	139	160	87%
Educator	228	280	81%
Participant	275	320	86%

3.4 High Fidelity Phase 2

In conjunction with the interview responses and the improvement document, changes were made to the Hi-Fi prototype. To ensure a more wholesome and consistent experience for the prototype sessions *before*, *during*, and *after* scenarios were considered and added for each role. More specifically, for the participant, this means that new scenarios consisting of registration to a course session and connection to a meeting inside Microsoft Teams. Furthermore, new views for the other roles that were not considered before were added not only to give better completeness and workflow, but also to address functionality missing in the previous prototype.

Just like the previous Hi-Fi prototype, this one was developed in Adobe XD with some reused sequences and images, but mostly new ones. Since the feedback from the first iteration was consistent, not as much brainstorming was needed and the solutions were implemented straightforwardly from the improvement document. The vital parts and improvements of this Hi-Fi prototype is shown and described below.

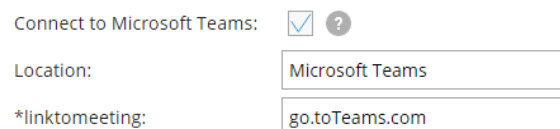
The differences between phases 1 and 2 are that several views that were not evaluated before were added. This includes the portal overview which shows all registered courses, the course catalog with all available courses, and the registration view where a participant can register for a specific course. Also, after a participant is registered they can view the course form. Additionally, an educator can have permissions as both an administrator or educator which provides two different but similar views with different permissions that generate different menu options.

The administrator view were updated with a question mark, which is shown in figure 3.16, with information about what the connection to Microsoft Teams means. Also, the field

called *Location* and **linktomeeting* were automatically filled in when checking the box. Lastly, the abbreviation *MS Teams* was removed and instead spelled out as *Microsoft Teams*

For the educator, the hyperlink to Microsoft Teams, shown in figure 3.12, changed text to *Microsoft Teams* but otherwise retained in the same way as before. Moreover, the blue button in figure 3.13 was moved to the menu and the abbreviation was removed as seen in figure 3.17. The same button and hyperlink were used in both the view for administrators and educators in the portal.

The prototype for participants changed the most due to the several new added views. A common tag was added to the catalog view, registration view, portal overview, and course card which are seen in figures 3.18, 3.19, 3.21, and 3.22. The course card contained the tag before, as seen in figure 3.10, but now the tag was moved to the top of the card. Furthermore, the course information card, seen in figure 3.23, was changed to not have a hyperlink on the location and instead **linktomeeting* was used. Also, the the abbreviation on the blue button was spelled out and the same button was reused in both the registration form, see figure 3.20, and the portal overview, see figure 3.21.



Connect to Microsoft Teams: ☒ ?

Location: Microsoft Teams

*linktomeeting: go.toTeams.com

Figure 3.16: The updated admin view with automatic filled in fields and a question mark.

The prototype was then tested on 5 internal and 4 external respondents with the different scenarios in mind. The external respondents ages reached from 20 to 52 and the internal from 30 to 50. The mean age of the test persons was approximately 37, and 3 women and 6 men tested the prototype. All except one of the external respondents were unfamiliar with the platform, and therefore they only tested the course participant and educator roles since these roles can be represented by anyone. Also, two of the external test persons had tested the prototype from Hi-Fi phase 1. All the internal respondents from Grade except one tested all three roles. The one who did not was not used to the admin view and not a relevant representative.

The test participants were sent the scenarios in a chat and asked to read them out loud before exploring the prototype. This way, the person could always check what the task was whenever they wanted. During the test, the participant was also allowed to ask questions but it was not certain that we would answer them. This depended on the type of question and if the answer would affect their performance during the scenario too much. The participants were observed and once the test session was done, a debriefing was conducted to ask about specific incidents and spontaneous impressions. Next, we showed and discussed the different solutions that the test person had not discovered. Finally, the test ended with the same questionnaire that was used in High Fidelity Phase 1.

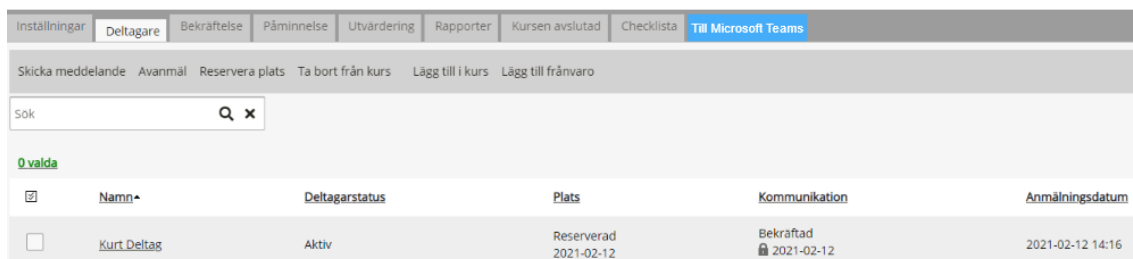


Figure 3.17: The updated educator view with the blue button moved to the menu.



*instructorledtraining

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

Läs mer

Figure 3.18: The course catalog view with a tag.



Figure 3.19: A tag and location on the registration view.

Anmälningssformulär: Kurt Deltag

Anmälan är mottagen.

Skicka meddelande	Avanmäl	Till Microsoft Teams
▼ Historik		
Status		
Bekräftelse		

Figure 3.20: A button to teams in the registration form.

Mina kurser

Pågående	HLR	Microsoft Teams	▼
Tillfälle 1			
Startdatum: 2021-02-10			
Slutdatum: 2021-02-17			
Plats: Microsoft Teams			
Visa anmälningssformulär			Till Microsoft Teams

Figure 3.21: The portal overview with a tag, location, registration form, and button.

	Microsoft Teams
HLR	
★★★★★	
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.	
Visa kursen	

Figure 3.22: The course card with the tag moved to the top.

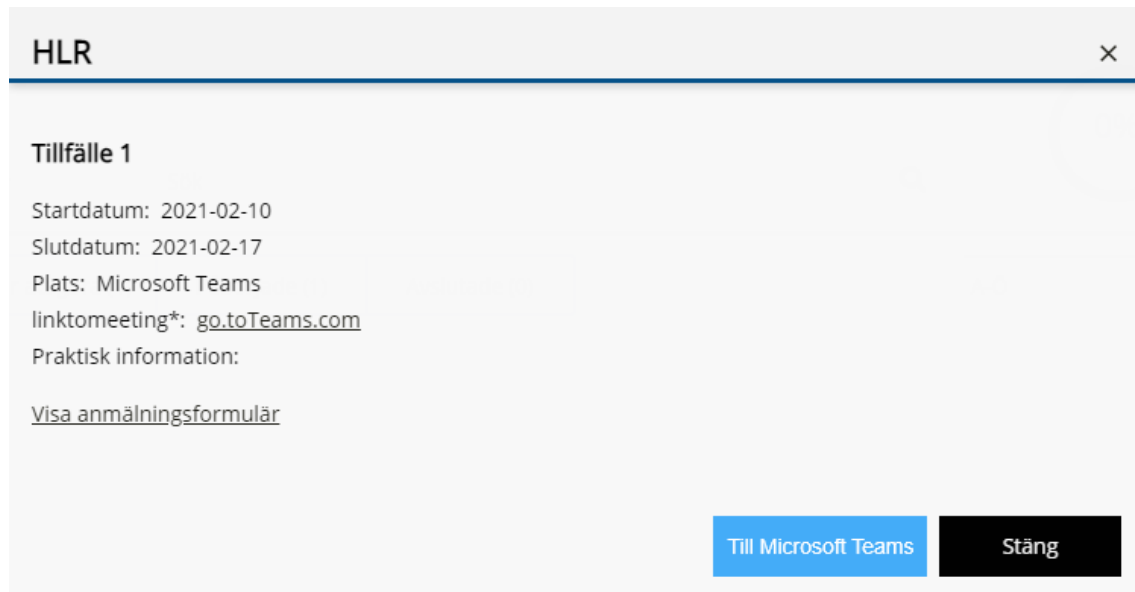


Figure 3.23: The course card information with the label called link to meeting.

The general impression of the second iteration of the high fidelity prototype was that it was an improvement on the first iteration. The participants had no issues performing the scenarios and all criticism received was minor. An improvement document was constructed from the feedback and criticism in terms of qualitative data through thinking aloud comments, observations, and debriefing. Improvement pointers from said document can be seen below. Also, the compiled quantitative data from the semantic differential is presented.

Administrator

- To make clear what is done manually and what happens automatically, the fields that are auto-filled when the box is checked should be disabled.
- Positive impressions about the question mark that was introduced in this prototype, see figure 3.16.
- Feels good that the location and link to meeting is automatically filled in, it provides a smooth and intuitive experience

Educator

- The external respondents that were not used to the platform found it difficult to understand the header in the menu called *manage registrations* where the path to handle courses as an educator is.
- 2 out of 9 think that the blue button is unclear as it looks like a tab, the rest think the button is clear.
- The hyperlink is somewhat unclear and needs a better affordance.

- It would have been nice to have a shortcut in the portal overview, maybe as a new panel or notification when the meeting is about to start.
- Make sure the location field in course settings is a hyperlink.
- Logical design provides a smooth and clear experience, with no confusion

Participant

- The *Microsoft Teams* tag in the course catalogue view, see figure 3.18, is a bit too dominant and ends up fighting with the course title for attention.
- Consider integrating the *Microsoft Teams* tag into the existing status display methods/fields to avoid implementing a third one.
- Further pathways from the portal to Microsoft Teams have to be considered, e.g. the *anmälningar* view.
- The scenario offers an experience and flow that is smooth, non-confusing, simple, and easy.

Semantic Differential Questionnaire

Just as in High Fidelity Phase 1, the total score for each role, the possible maximum, and the percentage indicating the positive worded adjectives value with two significant digits are shown in figure 3.7. A 100% would indicate that everyone gave the highest score, i.e. scored the positive worded adjective the highest.

Table 3.7: Score for each role in High Fidelity Phase 2.

Test person type	Total	Max	Total/Max
Administrator	186	200	93%
Educator	321	360	89%
Participant	318	360	88%

3.5 Implementation Phase

The implementation phase started with a discussion of which features were required to achieve the functionality and design derived from the prototype and its evaluation. After which all features were given a level of criticality, and then prioritized accordingly. Once we got an idea of what we had to do we began to acquaint ourselves with the existing code and Microsoft Teams API.

As the architecture and implementation of our features and functionality depended on the already existing code no discussion regarding therefore it was not discussed before starting up the project. Instead we had to learn how to navigate through the code and understand the structure and thoughts since before.


The design decisions that were made during this phase were not tested before implementation since they regarded small changes. Instead, the changes were discussed with our manager and supervisor at Grade to get input on the design decisions and features. Throughout the whole implementation phase development was done in a variant of agile development, in one-, or sometimes two-week sprints. Each sprint started and ended with a meeting with the manager and supervisor at Grade. During said meetings, the work done during the sprint was presented, features prioritized, etc.

During development we encountered a limitation placed on our solution by Microsoft themselves. Specifically a Microsoft Team is limited to 30 private channels. Which would prove problematic if a customer of Grade operated in such a manner that they reached this limit in a short period. As the deletion of Microsoft Team channels require the channel to be archived for 30 days then it is automatically deleted. Any manual force-delete is not possible and therefore continuing forward with channels as the data structure for a course session is infeasible. To proceed we had to decide if we are to keep using channels in favor of time limitations, or if we should opt to use Teams to represent course sessions instead. The positives and negatives for both types were documented and a meeting with our supervisor at Grade was held to decide on the matter. After discussing both variants a final decision was made and it was to move forward using Teams as the main representation of a course session. The existing support for usage of channels was removed and replaced with support for usage of teams instead. Due to this change, the naming of teams also changed to the format 'Course name - Course session name'.

Another update from the Hi-Fi phase 2 is in the admin view where the link to meeting field is disabled if the course session is connected to teams. Additionally, the location field is automatically set to Microsoft Teams if the field is not filled in by something. During the implementation phase, the question mark in the admin view that explained the connection to Microsoft Teams also changed in design to match the already existing design of question marks in other places. See these three changes in figure 3.24.

Once the course session is saved the admin also gets feedback in the form of a text that says that the team is created. This is an extension of the existing feedback that says that a course session is created, see figure 3.25. Similar messages are used when disconnecting from Microsoft Teams. If the course session is saved without a course coordinator the team cannot be created since the team needs a person with admin permissions. Therefore an error message in a red box with a triangle icon with an exclamation mark inside of it is generated in this scenario that tells the admin to add a course coordinator, see figure 3.26. Similar error messages are shown with different instructions depending on the problem. To indicate that the field is mandatory a red star is used when the connection to Microsoft Teams is checked. Once a course session that is connected to Microsoft Teams is saved, one can see if the session is connected in the table of all course sessions, see figure 3.27.

The last update in the admin view regards the possibility to delete a connection to Microsoft Teams. This can either be done by editing a course session and unchecking the connection to teams, thereby deleting the team, or by deleting a course session. Before any of these options, a pop-up window is showing a warning text that the user is about to delete the team in Microsoft Teams, see figure 3.28.

Koppla till Microsoft Teams:  ☒

Plats:

Möteslänk:

Figure 3.24: A part of the admin view showing the check box that connects to Microsoft Teams, a question mark for further explanations, and a disabled field that should not be used if there is a connection to Microsoft Teams.


 Informationen sparades och kurstillfället kopplades till Microsoft Teams

Figure 3.25: The feedback after saving a course session connected to Microsoft Teams.

 Kursansvarig måste sättas när ett kurstillfälle kopplas till Microsoft Teams

Figure 3.26: The feedback after saving a course session connected to Microsoft Teams without a course coordinator.

Titel	Startdatum	Kursansvarig	Status	Plats	Microsoft Teams
 Exempelkurs 2	2021-05-06 00:00	MaxTest MaxTestsson	Aktiv	Microsoft Teams	✓
 Before saving	2021-05-05 00:00	MaxTest MaxTestsson	Aktiv		
 Exempelkurs	2021-05-05 00:00	MaxTest MaxTestsson	Aktiv	Microsoft Teams	✓

Figure 3.27: The overview of all course sessions showing if a session is connected to Microsoft Teams.

Från localhost:

Om du väljer att fortsätta kommer teamet i Microsoft Teams att tas bort permanent och du kommer inte kunna återställa denna ändring.

Figure 3.28: The warning before deleting a team in Microsoft Teams through Grades' platform.

In the educator view, small changes were done to match the existing design and open up for development prospects. This was done by removing the button from the tab panel to being an actual tab with a button inside of it. This change led to the next one which is a help box containing information about how to start a meeting inside the team, see figure 3.29.

Other issues regarding loading times and performance arose when implementing the hyperlink to the Microsoft Team in the table of activities for teachers/educators, see figure 3.12. A decision was made to put the functionality on hold in favor of other features, and to return to it if time allowed it later. This also applies to the information window in a course card, see figure 3.23, and the portal overview, see figure 3.21. Instead of the hyperlink the location of a course session where used which were set to Microsoft Teams if the admin had not changed it to something else. However, the hyperlink was kept inside a course session in the educator view beside the location if there were any location besides Microsoft Teams, see figure 3.29.

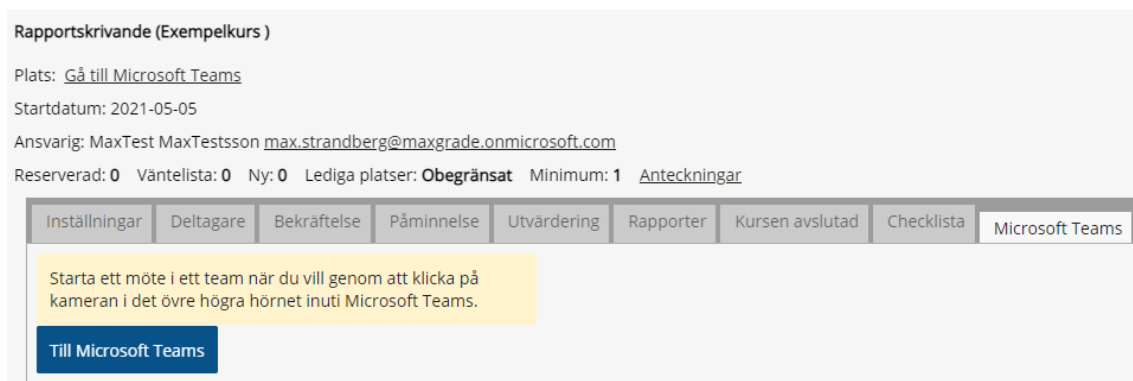


Figure 3.29: The educator view of a course session with a hyperlink at the location and the tab containing a button to teams with instructions of how to start a meeting.

The participant views main focus in this phase were the tag indicating a connection to Microsoft Teams and button to Microsoft Teams. The tag differ from Hi-Fi phase 2 to match the existing design that already contained tags and therefore the shape and placement were changed. However, the placement in the course catalogue were changed since a course is not connected to Microsoft Teams but a course session is. Moreover, the color of the tag were changed to one of the colors in Microsoft Teams color palette. The updated tags can be seen in figure 3.30, 3.31 and 3.32.



Figure 3.30: The portal overview showing course sessions a participant is confirmed on. The tag is indicating that a course session is connected to Microsoft Teams.

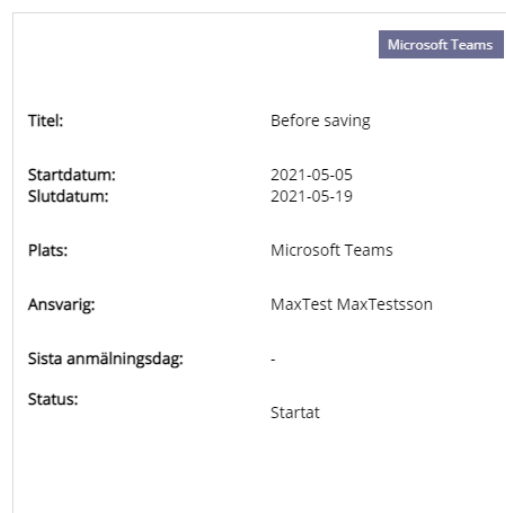


Figure 3.31: Inside the course catalog where a participant can register for a course session. The tag is indicating that the session is connected to Microsoft Teams.

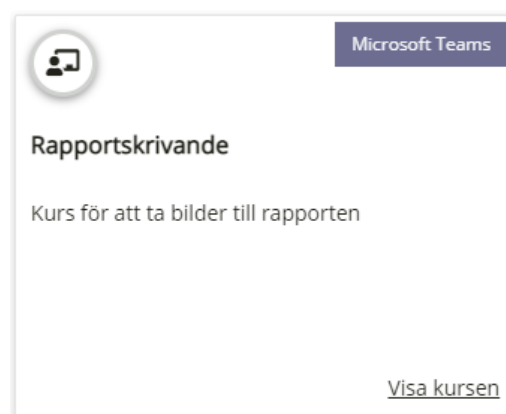


Figure 3.32: A course card representing a course session connected to Microsoft Teams. Once the course session is done, the tag is changed to a red color with the text "Avslutad".

To make the flow and experience for the participants a bit more intuitive a link to the Microsoft Team was incorporated into a calendar-booking which is sent out to all participants when they are enrolled onto a course.

Furthermore, the button that takes a participant to the team inside Microsoft Teams was replaced in this phase due to misunderstanding. Our first thought was that a course card representing a course session only contains one course session inside of it. However, it became clear that one course card contains all course sessions a participant is confirmed on. This means that there are several course cards containing the same information since there is one course card for each course session but every card contains all sessions. This may sound wrong but since it was outside our scope, we could not change it. Anyhow, this resulted in the replacement of the button seen in figure 3.33.

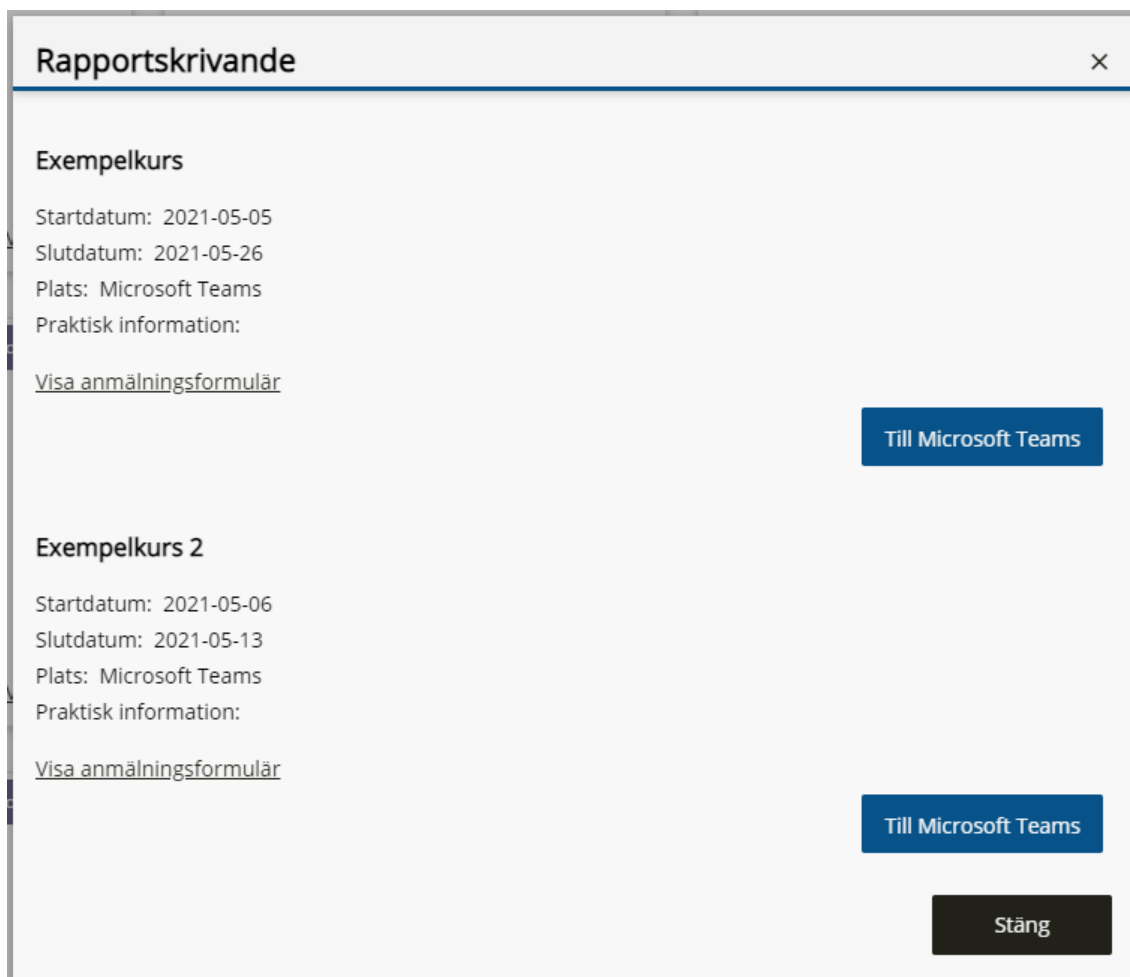


Figure 3.33: The information inside a course card containing all confirmed course sessions.

Lastly, the color of all buttons were changed to the platform's call-to-action color to ensure consistency in the platform's design and appearance.

3.5.1 Final Testing

Finally, as a part of the implementation phase, the resulting product was user-tested and evaluated. Due to lack of interest from Grade's customers who use Microsoft Teams, we were unable to book any user-testing with relevant customers and therefore had to rely on employees at Grade, friends, and family.

The tests were prepared with an orientation script which included an introduction that described the product in rough terms. It also made sure to notify the participant that it was the product that was being tested and not them or their skills, and asked the test participants to think aloud. Then three background question was asked which was the following:

- Have you used Grade's product before?
- Have you used Microsoft Teams before?
- Are you comfortable using new techniques?

After these questions, the test was about to start with two different strategies depending on if the test was performed in person or on distance. If the test was performed in person a computer with the right setup was prepared and a scenario was written on paper was given to the test person. The test person then read the scenario out loud and then did the task. Once the scenario was done, a new scenario was given and the same procedure was performed. This was done for all the roles: Administrator, educator, and participant. However, if the test were done on distance, we used Microsoft Teams to share our screen in a video call and letting the test person control the mouse through their computer. The scenarios were the exact same but this time send through the chat inside the video call. This setup did require the test person to use Microsoft Teams inside the web browser during the test and not the application since it was occupied by our video call. After the test, a short interview was held and the test person was asked to answer a questionnaire with semantic differentials. This was the exact same questionnaire used in Hi-Fi phase 2.

Before any of the tests were performed, we went through all scenarios and possible failures to discover obvious errors. Also, a pilot test was done to discover if the scenarios were unclear or difficult to understand. The tests were performed on 9 persons in total but we had more plans that got canceled due to symptoms of COVID-19. All of the test persons tested the administrator role, educator, and participant since we did not have any real customers to test on. If the test person was unfamiliar with the role they were testing, they were guided throughout the scenario where the instructions did not affect the test results. 5 of the test were done in person and 4 on distance. The test person ages ranged from 23 to 48 with a mean value of 34 years. 4 women was tested and 5 men. 4 of the test persons works with Grade daily, 2 of them do not use Grade but has tested the earlier prototypes, and 3 test persons had never used Grade before.

Lastly, both the qualitative and quantitative data were compiled through an evaluation document and calculations in Google Sheets. The tests yielded both positive and negative feedback. A majority of all negative feedback came from external participants, which regarded the UI design as a whole, the use of signifiers, shapes, and colors. A more detailed breakdown of the qualitative feedback from observations, think-aloud statements, debriefing, and the open-text question in the questionnaire categorized by role can be seen below. Moreover, the compiled data from the semantic differential questionnaire is presented and lastly some final changes.

Administrator

Generally speaking, the testing of the administrator went well. We did however decide to give external participants quite a bit of help as we knew the existing design would confuse them and they would get stuck in the scenarios. Although almost none of the participants utilized the help-text throughout the scenario, during the debriefing we asked them to read it and state their opinion on it. Most, if not all participants considered the help-text for the "Connect to Microsoft Teams"-checkbox to be a bit too much text and would like to see it made more concise. A majority of the participants considered the solution to have a somewhat steep learning curve during the first few times you use the integration but stated that they think they would be able to use it proficiently after a few tries. Some wished there would be more feedback when connecting a course session to Microsoft Teams. Additionally, some comments said that it is clear that the system is old and complex like other administrative tools usually are.

Educator

As with the administrator-tests, the educator-tests went well. None of the participants deem the integration unclear or confusing. Internal participants state the integration is in line with existing design and does not cause any issues in the current workflow. Most participants did however consider the help-text in the Microsoft Teams tab to be somewhat unclear and hard to read. Some participant wished the help-text also contained an image which the text would refer to. Moreover, the test participants that had tried out earlier prototypes also missed the hyperlink to Microsoft Teams in the overview menu shown in figure 3.12.

Participant

All participants appreciated the variability in offered ways to navigate to Microsoft Teams. They also appreciated the email sent out on registration containing the ics-file which could be easily added to their calendar and later used to navigate to the team. They did however wish for there to be a link in the mail being sent out, and not just in the ics-file. Some participants complained that the tag on the course cards wasn't clickable.

Semantic Differential Questionnaire

The results from the semantic differential questionnaire is presented in table 3.8. The max score of each role is 360 points and the table also presents the how close the result is to the highest score in percentage calculated with two significant digits.

Table 3.8: Score for each role in Implementation phase.

Test person type	Total	Total/Max
Administrator	292	81%
Educator	292	81%
Participant	287	80%

Generally, independent of role, the highest-rated adjectives were "Consistent" and "Necessary", and "Confusing". For the administrator role, the top rating adjectives were "Necessary" and "Complicated". For the educator, "Consistent" and "Confusing" were the top adjectives, and lastly, the participant rated "Necessary" and "Confusing" the highest. However, the words "Confusing" and "Complicated" were mostly given by test participants who had never used Grades' platform before or only tested the prototype once before. Generally, the score did not differ significantly, and most of the answers weighted towards the positive adjective.

Final Changes

The implementation phase ended with small updates according to the results, mostly focusing on help-texts in the administrator and educator view. The rest of the suggestions from the evaluation was considered as future work.

Since the final evaluation had some easily fixed suggestions of changes regarding the help-texts in both the administrator and educator view these changes were done directly after the tests were accomplished. The updated texts is seen in figure 3.34 and 3.35.



Figure 3.34: The text inside the question mark in the administrator view that explains the connection between a course session and Microsoft Teams.



Figure 3.35: The help-text inside the educator view explaining how to start a meeting inside Microsoft Teams.

Chapter 4

Discussion

This chapter contains discussions regarding the final result of the whole project and the design process used to acquire the result. Firstly, the design decisions throughout the thesis are discussed to understand why they were made. Secondly, the scope is discussed to give a perspective on how that limited our solutions. Other shortcomings are also discussed and the test execution as well. Then the test results are discussed to get an insight into what they could imply. Lastly, further work is presented to indicate a deficiency in this thesis and what the future shall hold.

4.1 Design Decisions

Through the prototyping and evaluations, several design decisions were made to satisfy as many users as possible. However, all the decisions were limited by the already existing product. The new design could not differ too much in style and the users did have habitual behaviors from before. Therefore our task became to reveal those patterns to add the new functionality at the same location as the user thought it would be. Also, colors and shapes were at first affected by the existing design since it had to be consistent and in line with the color palette used by Grade AB. However, in the implementation phase we decided to use one of Microsoft Teams colors at the tag indicating that a course session is connected to teams. The users thoughts on the color did not generally affect their opinion.

The admin view did not generate a lot of discussions, but the test participants' behavior revealed that they missed some kind of feedback even if they could not pinpoint it themselves. Therefore a question mark was added which became noticed and appreciated in the next prototype test. Also, the automatically filled-in fields when checking the connection box were decided to be disabled after feedback from the last evaluation before implementation. This is also a kind of feedback to the user that notices that the location and meeting link is automatically generated. Moreover, a response message was shown when saving a course session and this message was further developed to contain information about the deleted or

created team. Also, before removing a team through Grades' platform, a pop-up window was shown to ensure that the admin was aware of what he was doing. This meant that the admin had to make an active and conscious decision. The new functionality in the admin view was otherwise designed properly relative to the existing design. During the final testing some participants wished there was more feedback regarding the course session successfully being connected to Microsoft Teams. Our manager at Grade suggested that one way of solving this could be to implement a button which would navigate the administrator to the team, similar to how educators buttons work. This solution suggestion was however disregarded due to time constraints. The current feedback is in the shape of status text, which states the result of the action, such as if information was saved properly or if an error occurred. Most external participants noticed this, but internal participants disregarded the status text, most likely due to trained behaviour.

Nonetheless, the educator view started more discussions both regarding the location with a hyperlink to Microsoft Teams in the educator table and the blue button inside the settings. At first, the hyperlink had the same design as the blue button since we thought that it would be consistent to use the same button everywhere. However, the button did not fit the existing design and was replaced by a hyperlink that conformed with the signifier used to indicate the settings. Unfortunately, this solution did not draw as much attention and was often missed since it blends into the table. Yet, this is not the only functionality and it should not take over everything. Therefore, two different design principles [18, pp. 50-56] were affected since we lowered the visibility but improved the consistency. This is a common problem when applying design principles in practice that Preece et al. address as a way to trade-off [18, p. 55]. Additionally, once the user did know about the shortcut, they found it convenient. However, the hyperlink was replaced by text in the implementation phase due to time-consuming processes. This could have been solved, but the feature was saved to the future since it was not as important as other functionality. Yet, the hyperlink was kept inside a course session at the location where it was less time-consuming code.

The blue button inside the settings in the educator view was easy to use once they found it in the Lo-Fi prototype. This was the reason why we moved the button to the tab menu. The new placement increased how easy and fast the users found their way to Microsoft Teams. One theory about why the button was hard to find in the first design is that the human eye often is attracted to the left corner of a screen and we had placed it to the right[12]. Also, the portal already has the most information to the left and therefore the user starts to look there. If the user has experience with the platform too, it starts with going through the tab menu where the information they occasionally use is. All this together could explain why the new solution with a button in the tab menu worked out better. Additionally, the button in the tab menu was changed to a tab in the implementation phase after discussions with our manager at Grade. The main reason was that there might be functionality in the future regarding Microsoft Teams that require more space than just one button. Moreover, the button in a tab menu did not match the current design which was not appreciated by the manager. However, our Hi-Fi tests showed that the users understood the button and found it easy to use. If it were not for future development the button should have been kept to avoid extra clicks to achieve the exact same goal. Furthermore, the new tab solution opened up for more space and therefore a help box was added with information about how to start a meeting once one is inside Microsoft Teams. This kind of help box was used in several places inside the portal and would therefore match the current design. The help box only contained a simple text since it

was not tested on users and we would not like to spend too much time on it before feedback from users. The tests showed that the users disliked the formulation of the instructions and there for it was changed.

The help texts found in the educator and admin view were both determined to be confusing and too long. Most test participants either had a hard time reading and understanding them, or closed the help window due to it being too much text. We considered the option of adding imagery or formatting in the shape of bullet lists to clarify and make it easier to take in the information. The existing structure for help text does however not support either of the options. Which forced us to rewrite it into a more concise and compact text containing only the essential information.

The last role and views regard the participant where the focus was on a tag and button on all relevant places. One design decision was to round the edges of the tag to signify that it is not clickable as no other clickable object is rounded in the platform. However, the shape of the tag changed in the implementation phase to match the existing design that also contained other tags since before. Unfortunately, the shape from the existing design contained squared edges which signified that the tag was clickable which it was not. Despite this, the squared edges were kept to avoid confusion and deviations in the interface. However, Preece et al. [18, p. 55] confirms that it is sometimes better to deviate from the existing design and use an inconsistent interface. This may be the case in our design where the results showed that the first design served its aim better. Another aspect that Preece et al. describes is that the introduced design should be located in the right context [18, p. 56]. Since we started our design process by understanding the current workflow and following up our design decisions with user feedback, all of our design decisions are based on the context users are accustomed to. Moreover, to avoid confusion the tag was moved from clickable objects. This mostly regards the course card where the tag at first was placed nearby a hyperlink and then moved to the top of the card after an evaluation. In addition, the tag in the course catalog where moved inside courses since it is a course session that is connected to Microsoft Teams and not a whole course.

Another discussion was if we should use an icon, text, or both as a tag. Most test participants liked the text more since it could not go wrong when it is in cleartext. However, some mentioned that we should use a double signifier with both an icon and text. We thought that it was a good idea but it requires a proper icon without any risk of confusion. Firstly, the Microsoft Teams icon was used but then removed due to copyright licenses. Secondly, we tried to develop our own icon but since it had to be small, due to limited space, the result was not pleasant. Lastly, we decided to skip the icon since the text was the most popular option and we did not like the icon as it took up too much space on a small area that already contained a lot of information.

Besides these design decisions, the structure inside Microsoft Teams changed during the implementation phase. At first, a course corresponded to a team inside Microsoft Teams and a course session a channel in the team. However, there is a limit of 30 channels in a team which was hard to get around. Therefore, the structure changed to using teams as course sessions where the team name followed this format: "Course name - Course session name". The first alternative where channels were used was better for the educator role since it gave an overview of the courses. However, if Microsoft Teams gets too complex due to many course sessions, one could use Grades' portal to get to the right course session in Microsoft Teams. This is not an optimal solution but it works. After all, the solution also opens up

the opportunity to have discussions in smaller groups within the Team i.e the course session. This also corresponds to how Microsoft thinks Teams shall be used which we had not taken into consideration from the beginning.

The incorporation of calendar bookings being sent out to participants on enrolment was originally intended to be performed using the Graph API supplied by Microsoft. This did however not work as intended and for the most part was unreliable and hard to work with. Resulting in us having to use Grade's own mail-server to send ics-files to all participants instead. Although this solution allows the users to create structure and removes manual work by supplying the participants with an ics-file that they can simply import into their calendar instead of making their own. It is still more manual work than if the Graph API worked as intended, as the API would automatically put the event into the participants' calendars.

During the final testing of the administrator and educator role, the external participants stated that they had some difficulties during the scenarios but that they think they'd have no issues whatsoever after a few tries. This signifies that the learnability aspect is a bit low. However the memorability aspect seems to be relatively high. On the subject of increasing the amount of feedback in the administrator view, a test participant suggested that a pop-up that tells you what will happen when you proceed after setting the course session to connect to teams. We believe this is not the solution, as it bears the risk of becoming a so called backseat-driver, introduced in the design principles section. As the pop-up has to be explicitly closed by user action, it would cause frustration and annoyance on the user, ruining the experience.

4.2 Scope

Grade's platform is a large product with a lot of functionality and complexity. When designing the different prototypes, we were inherently hindered by the existing design, complexity, and functionality as described in the above section. As the admin users are technically experienced and have a high level of habitual usage of the system, we decided that the prototypes should offer the new functionality with design in line with the current product. For the other users, *course participants* and *course teachers*, the prototypes were more detailed and the goal was to produce a design that satisfies as many as possible.

Issues arose however during the test sessions where participants would give feedback regarding design decisions we could not affect. As an example, many of the external participants gave comments regarding the design of Microsoft teams, they also gave comments regarding the navigation of the platform. These comments were primarily given during the low fidelity prototype, which made us exclude the Microsoft Teams in the first high fidelity prototype. This did however lead to minor inconsistencies which negatively impacted the perception and mental model of the new functionality. As we decided to perform an additional high fidelity prototype iteration we decided to reintroduce Microsoft Teams to the second and final iteration of the high fidelity prototype. Once again, this gave comments on Microsoft Teams rather than the integration but this time we were prepared and could handle it better by diversion.

Some features suggested by the test participants such as an icon showing if a course session meeting is currently active were at the time disregarded until further notice due to the time constraints mentioned in the limitations section. Also, some of these suggestions and feedback were not possible to achieve due to limitations in Microsoft's API.

4.3 Design Process

Throughout the project, there have been several shortcomings of varying severity. Firstly, we did not fully understand the existing product when we did our Lo-Fi prototype. This was revealed during the tests since the users tried to navigate through the platform differently than we had thought. The results from this were used in the next prototype and new views were included. This was a continued issue throughout the whole design process since we also discovered new parts of Grades' platform all the way into the implementation phase. According to this, our strategy became to design with what we at the moment knew about the existing product in mind and discover the product at the same time. This led to changes in the implementation phase that could have been avoided if we would have discovered the platform more deeply in the beginning. However, that strategy would have been more time-consuming and could not guarantee that we still would have understood everything the right way. Our strategy instead led to more prototypes and iterations that we discovered the product through. This is also supported by the fact that usability testing never is a waste of time since it both gains design insight but also brings proof to the team, as Loranger states [11]. This even complies with UX professionals that have knowledge since before and can spot bad design. By creating more iterations we thereby got a better insight into the platform but also could motivate our design decisions. Moreover, iterations through user-centered design ensure an early focus on users and that users feedback is followed up during each iteration [18, p. 410].

As we feared in the limitations, the interest and how engaged customers were in the design process was far from optimal. We never had a chance to involve more than one customer who used Microsoft Teams in their daily work and instead had to rely mostly on customers who had no experience on teams. It is hard, if not impossible to say how the actual implementation and result had differed from what we achieved if customers were more willing to partake in interviews and prototype testing. There is a high possibility that certain frustrations have gone under the radar as they were never brought to light, which leaves the integration open for potential future work and improvements.

Another potential shortcoming is that we missed something during our brainstorming sessions that may have limited the solution proposals. We had a pretty clear picture of what the possibilities of added functionality in the product were and that attitude can have excluded alternative solutions. One way to avoid this could have been to invite the users to a brainstorming session after the semi-structural interviews. However, it was hard to get users to participate and it was quicker to brainstorm by ourselves but with inspiration from the earlier interviews. Also, we discovered several solutions, and the ones we went on with worked according to the test results.

Moreover, to carry out the Hi-Fi prototypes the tool Adobe XD was used. Our expectation was that we could work in parallel with this tool but the version control could not handle it. The changes were overwriting each other and therefore only one of us could change the prototype at a time which slowed down the process. This could be avoided by splitting the prototype into three different prototypes for each role. Unfortunately, we did not think about that and went on with one prototype handling all three roles. Anyhow, this solution made it easier to conduct the tests since we only had to send one prototype to the test participant.

At first, we also thought that it would be possible to use Microsoft Teams icons and logos in the platform. After a lot of research, it felt uncertain if our license allowed free usage and

therefore the decision ended up avoiding legal issues by not using their icons or logos.

4.4 Test Procedure

When discussing the validity of our results from the testing sessions, it is important to note that several test participants participated in multiple stages of the design process, which could affect their feedback both positively and negatively. As the participants no longer see the design for the first time, their behavior changes slightly because of their knowledge of the scenario and intended use. The feedback then becomes skewed in favor of their personal preferences.

Additionally, this may have caused the fact that the score from the semantic differential increased from Hi-Fi phase 1 to 2. If the test persons had not seen the first prototype the result may have been the same. Either way, the result shows that the persons liked the updated version more in comparison to the first one. As well, the SUS score from the Lo-Fi prototype was high despite that it was the first time the test persons used the design. This may have been caused by the small changes, like a button or checkbox, relative to the whole platform. Also, the users gave the impression of low expectations since they are used to a complicated system and sometimes even used guidelines to handle it. Yet, the test persons seemed satisfied with the solutions even if the result is caused by a bad experience or that they actually liked the design. Another result from the Lo-Fi prototype that may have been biased is the dot-voting. This result is based on low volumes of respondents and therefore can not represent the full truth. However, the result gave indications of different opinions and encouraged discussions about alternative solutions.

The ongoing pandemic also caused hindrance as it severely limited our abilities to perform testing and creating different kinds of prototypes. As many of the tests had to be done online, we could not perform any testing or prototyping on paper. Also, the number of test participants was limited since some of the persons did see the online format as a difficulty. However, if we were to perform the test onsite in a normal situation, the time to get to the location would have been another obstacle.

All these statements are pinpointing a pervasive problem throughout the test processes, *low volumes of test participants*. Another problem is the type of test participant since the internal ones risk being biased in comparison to the external ones. Also, there were two types of external test persons which were customers and persons who had never used the system before. The customers had a tendency to evaluate the whole platform instead of the new functionality and focused on their internal solutions that were not relevant for us. Nonetheless, sometimes this information could be valuable since it revealed their wishes for a better platform and what that meant for them.

The external test persons that had not used the platform before were, however, confused by the already existing design that was out of our scope. After explaining the circumstances they understood the problem and focused on the new functionality with the help of the test leader. Even if the new functionality was hard to find since they never had used the platform, they were pleased once they were on the right page in the platform.

The fact that the existing customers and new potential customers had two different experiences had us make decisions regarding which user we shall take the most into account. We could not disappoint the existing customers but the new ones could not find the solution

since it was hidden in a menu with an inconsistent header that did not indicate the activities behind it. However, we could not change the whole platform since it was outside our scope and therefore we focused on using the existing design that the current customers are used to.

Further problems regard how the tests were conducted throughout the different phases. In the first tests, the test leader instead of the test person read the scenarios out loud and the scenario was neither sent in the chat to the test person. This made the test person unsure of what the task was and if they remembered it right. This also made us unsure of if the test persons asked us for help since they did not understand the design or if they asked since they had forgotten what they should do. Therefore, we changed strategy and started to send the scenarios in the chat and asked them to read them out themselves. This way, they could also go back to the scenario to remind themselves of what they were supposed to do.

Another problem with the scenarios was that the formulation gave certain expectations. For example, some thought that they would go directly into a meeting and not to the channel in Microsoft Teams that contained a meeting. Therefore we had a lot of discussions regarding the naming of buttons. Some thought that the label "To meeting" was appropriate at first since they had not understood where the final destination was. Then some thought that "To Microsoft Teams" were enough whereas some thought "To course page" was the better alternative. We chose to use "To Microsoft Teams" since this was the most precise description that also was accepted by the users.

This was not the only misconception and several other problems with the tests and scenarios did occur. At first, we included scenarios after the new functionality which means scenarios inside Microsoft Teams. This gave a lot of comments on the application that we could not affect and therefore we did exclude this part in the next coming test. However, this made the test participants confused since it was hard to understand the flow and the goal of the scenario. Therefore, the last compromise was made where we included views in the prototype before and after the new functionality. These were views like the start page of the portal and attending a meeting in Microsoft Teams. This construction generated a lot of comments that were irrelevant for us and the new functionality but the comments that did affect the new design were more valuable than before since the test participants understand the purpose of the scenarios.

Even after these changes, some test participants did not understand which parts of the prototype were tested and therefore answered the questionnaires based on the perception that the whole portal was tested. This could be seen in the open question at the end of the questionnaire where the respondent could leave any remaining comments. These comments made it clear that the answers regarded more than the new functionality.

Another trouble during the test and questionnaire was that the terminology differed between us, together with the internal staff, and the customers since some customers thought they were administrators even though they are educators. This is not strange since they in a way administrates the courses. However, this meant that we needed to pay attention to their real role to give the right scenarios and made them understand which role they represented in the questionnaire. Likewise, the interface on the portal is flexible, and therefore the one they are adapted to differed from the prototype. This made us aware of which interfaces that could be more important than we had thought at the start. Also, this had us guide some test participants throughout the test to show all different paths to achieve the goal. This can have affected the result but we tried to not interact too much and not at all at the beginning of a scenario.

Moreover, some of the tests were executed on distance and therefore remote testing was used. Because of this some information may have been excluded since it was harder to notice facial expressions and body language. Therefore, the observations in these tests focused on actions, statements, and other oral sounds.

Lastly, there is always a dilemma of when to stop testing and how many iterations are needed. Further tests may have given more information but the question is if it would have given any more valuable information. Perhaps a third phase for the Hi-Fi prototype had made us more confident about design decisions made during the implementation phase. However, our perception was that another phase would have tested details where the results would have varied on an individual level. Therefore, a third iteration would not have given any new groundbreaking information.

4.5 Test Results

The general negative feedback received from external participants in the implementation phase regarding UI/UX design is aimed at the existing product and design, which our integration had to be compliant with. Hence the modernity of our implementation is limited by the existing design. Surprisingly the external participants yielded a result lower than the internal participants. We suspect the external test persons had a harder time overlooking the general design of the existing product which caused them to judge things outside of our scope.

Although the participants stated that the administrator role had a steep learning curve, they felt they would learn it and be able to use it proficiently after a few tries. There's a very high chance that this statement is in fact aiming at the already existing design and data structures, in other words, it is out of our control and irrelevant for the final product.

The first Lo-Fi prototype did however generate a high SUS score that indicated that the design was more than good enough. This can depend on that the new functionality is not a major change and a lot of the work is done behind the scenes to achieve as many automatic functions as possible. Additionally, the scores were given on prototypes and not the final product and the test persons may have considered it in their answers. Also, the test arrangement may have affected the score since the last test was more comprehensive and gave a better context both before and after the new integration.

Furthermore, throughout the tests, the administrator role rated the highest in all semantic differential questionnaires regardless of the score proceed from a Hi-Fi prototype or the implemented version. In contrast, the participant role rated the lowest in Hi-Fi phase 2 and the implementation phase. Despite this, the administrator's view was considered the hardest to use due to an old and complex system. However, it could be that the integration with Microsoft Teams in the administrator view only contained a check box which was considered easy to use and understand. Moreover, the integration in the administrator view did only affect one part of the system, unlike the participant view where there were several solutions to the same thing. Therefore the participant view may have been perceived as more complex even if all the different solutions would not be used at the same time in the real scenario.

Another theory is that the administrator view already had a complex design since before and thus, the new functionality did not felt like a difference from the surrounding interface. Once again, this contrasts more in the participant view where the interface is simple but has

several ways to achieve the same goal.

The total score of the semantic differential questionnaires also decreased in percentage points between Hi-Fi phase 2 and the implementation phase. As earlier discussed, we had to adapt the existing design that we had not considered as much in the prototypes. Thus, our original design from the last prototype would have been better but differed too much from the platforms existing design. One concrete example of a downgraded design is the tags where our tags in Hi-Fi phase 2 did not signify clickability as much as the tags in the implementation phase that match the current design. However, another reason for the lower scores could be that the workflow became clearer with the real implementation and that it did not match the test persons conceptual model.

Moreover, the qualitative data did somewhat differ from the quantitative data. The qualitative data through observations indicates that the test person used the integration with ease and their comments did match what we saw. However, the quantitative data through the semantic differential exposed that the test person found it somewhat complex and confusing to use. This may depend on that the questionnaires were done anonymously but the qualitative data was not. Another reason could be that their actions do not match their thought when they have more time to think about the solution and reflect more. Nonetheless, the result was not too low and the comparisons are made between high and higher scores which indicates that the features are more or less satisfying.

4.6 Research Questions

All the goals for this master thesis were achieved except two. An automatic system that keeps track of who participated in the course moment i.e the course session was not achieved since it was not a prioritized feature. Therefore an automatic attendance list is saved as future work. Also, the goal that a student or coworkers' supervisor should be able to follow their subordinates' progress in the course was left out. The reason is that the goal was based on misconceptions about how a course works. A course consists of several course sessions that have the exact same content but at different times and therefore there is not any progress. Instead, there one could only be approved or not by attending a meeting and therefore this goal is achieved by an attendance list in the future. All the other goals were achieved by answering the following research questions as seen below:

How can Microsoft Teams be integrated into Grade's product?

Microsoft teams was integrated into Grade's product using Microsoft's Graph API. The integration itself automates and removes double work when dealing with teacher-led courses. Specifically when a course session is set up on Grade's platform a Microsoft team can automatically be created. When course participants later enroll onto the session they're automatically added to the team and are also sent calendar bookings. This establishes a virtual classroom allowing for discussion among students and teachers outside of video calls. The integration also offers seamless navigation from the product to the Microsoft Team.

How can user-centered design be used to meet both Grade's expectations, and the expectations of their customers?

By iteratively investigating, designing and testing prototypes it is possible to involve both Grade and their customers. The investigation collects involved parts thoughts, desires and requirements. Designing takes said collected data and transforms it into a design draft which is later tested. The test collects feedback on the solution drafts and potentially collects more data. By performing these iterations several cycles chances are most opinions and desires from both the customers and Grade themselves are taken into consideration.

How the quality of Grade's online teacher-led courses can be improved using user-centered design?

The user-centered design aims to create a satisfying user experience and at the time Grade cannot deliver this to their customers regarding online teacher-led courses. Instead, distance courses are manually managed with third-party tools. To improve online teacher-led courses, user-centered design can be used to identify how the customers work today and their wishes for improvement which identifies requirements that shall be followed up during the entire design process. More details about the exact needs can be read about in the next sub-question.

- How does one achieve on-site quality learning on an e-learning platform?

By the interviews, early on in the design process, it became clear that there was a need for a lot of automatic features instead of the manual work that was done today. Therefore, one factor of quality is automatic work which means that there less of an obstacle to create an online course session or to join the session.

One automatic feature in this integration between Microsoft Teams and Grades' platform is that a student or coworker is able to self-register for a course that is given remotely without any extra work i.e the participant is automatically added to the team in Microsoft Teams once it is confirmed on the course session. Once one is registered for a course session, it is possible to participate in the online meeting, chats, or other lecture materials through Microsoft Teams. To find the right team, the participant can through several places in Grades' portal find a button that redirects them to the team inside Microsoft Teams. The result in the semantic differential questionnaire and comments from the tests and interviews from the implementation phase indicate that our implementation of this is satisfying but still could be improved.

Another goal was that if the meeting or lecture was recorded, then it should easy to find and view the recording. This is achieved since a recorded meeting is automatically saved within the team that the meeting was held. It is easy to find since a participant or educator can visit the team through the portal whenever they want as long as the course session is connected to Microsoft Teams. However, this could be improved by future work where video files and other material could be uploaded to Grades' portal.

To be able to register on a course session and thereby get access to Microsoft Teams, a course session need to be created and connected to Microsoft Teams. An admin is having this option when creating a course session just as they did before. According to the evaluation from the implementation phase and the final tests, it was an easy action to perform.

These automatic features together with design that helps the user to navigate to Microsoft

Teams connected course sessions other categories generated from the affinity diagram made in the investigation phase are achieved. These categories also define the qualities to have in mind when designing an integration between a learning platform and a conferencing tool. The qualities are the following: Navigation, automation, user experience, seamless, and communication.

- What differs on-site learning from e-learning and what parts should be included or avoided?

This research question was not answered by this thesis but instead, it was examined how e-learning was used today and how users wished it would work. Today, a lot of manual work is done to set up a team, add participants to a team, and other administrative work. With our integration with Microsoft Teams, this will be avoided since a lot of this is done automatically through Grades' platform. This solution also avoids double work since one does not need to create both a course session inside Grade and Microsoft Teams but instead, both are created through Grades' platform. To answer exactly what differ on-site learning from e-learning, further research is needed.

4.7 Further Work

There are several improvement points to the future both generally and specified for Grade. Generally, an integration between any platform and Microsoft Teams shall simulate an on-site learning session as much as possible. What this means has not been deeply studied in this thesis but instead how online learning sessions are handled today. Also, this thesis only examined the most basic features such as creating a team, joining the right members with the right permissions, deleting a team, and adding the planned session to the calendar. In the future, more features like attendance lists, recorded meetings, and other documentation from Microsoft Teams could be handled and integrated into the platform.

For Grade, this most certainly means that the tab in the educator view would be updated with file management. This affects the attendance list that could be manually uploaded to Grade and then be used to automatically check the attendance and therefore if a participant is passing a course session or not. Also, the recordings that today are saved inside Microsoft Teams and therefore deleted if someone deletes the team would have a solution that lets the educator manually upload the content to Grade.

Other future work that is specified for Grade is to update the current design in the whole platform to signify the correct affordance. At the moment, tags are signifying through their shape that they are clickable which they are not. Also, there are several course cards containing all course sessions a participant is confirmed on and therefore all course cards are duplicates of each other. This would have changed our design when integrating teams and maybe the design would have been closer to our prototypes and not changed during the implementation phase. Additional design improvements could also be done in accordance with the last evaluation from the implementation phase.

A longer test of how the integration affected the users' daily work would have shown if the integration facilitated their work or not. The examination would also discover if there were any features missing or frustrations regarding the design that could be improved. Therefore it is for the future to tell what the actual effect of the implementation is.

Lastly, due to the shortcoming of not being able to involve the most relevant customers,

any future work aiming to improve the design should ensure that such customers are properly involved.

Chapter 5

Conclusions

To conclude we have realized the issues and obstacles which arise when trying to design something new in an already existing environment. It is hard to satisfy existing customers while also creating value for potential new ones and requires a lot of compromise between consistency and affordances, signifiers, feedback etc. In our case, we were encouraged by Grade AB to follow the current design to please the existing customers.

We have also learnt the difficulties of coordinating people. All test participants had their schedules mostly filled and squeezing all of them into the current phase was difficult at times. We couldn't book ahead of time either as there was no way of telling if the current phase would be test-ready at that time.

Furthermore we have experienced the issues of depending on a third party service, in this case Microsoft Graph API to perform certain actions in the Microsoft domain. It has demonstrated how the design drafted in the earlier stages are sometimes thwarted and have to be immediately discarded or reworked during implementation.

Finally, we have learnt that users rarely know exactly what they want, and rather they describe a concept which we then drafted into a design and they later gave their opinions on. We consider this co-operation between designer and user the essence of user-centered design.

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