Taking responsibility for my motivation and insecurity during my master thesis: a tool focusing on soft skill development on Blackboard

Master Thesis Human Computer Interaction

Anna Zoet

a.zoet@students.uu.nl

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First supervisor: Dr. ir. E. Herder

Second supervisor: Dr. S.A. Sosnovsky

Department of Information and Computing Sciences

Faculty of Science

Universiteit Utrecht

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Table 1. *List of Abbreviations*

Abbreviation	Description
LMS	Learning Management System
ECTS	Credits
LE	Learning Environment
LO	Learning Organisation
AR	Action Research
UCD	User-Centered Design

Abstract

This research looks into the possibility of a supportive tool on a Learning Management System to guide students through their master thesis by focusing on soft skills. This research consists of a literature research, as well as a survey and interviews with students. Various problems are encountered during the writing of a thesis, according to literature and confirmed by students themselves. These problems mainly refer to overarching subjects, such as planning, motivation and insecurity. These are closely related to soft skills, which are not only necessary to increase one's employability, but also to apply knowledge and conduct a thesis research, for example. Writing a thesis means going through one Action Research cycles, which exists of the phases: planning, acting, observing and reflecting. Developing soft skills to contribute to these phases could benefit from Self-Regulated Learning. This could be enhanced through guidance and confirmation from supervisors or peers. The results of this research comprise a suggestion for the functionalities of such a supportive tool on the Learning Management System Blackboard. These functionalities meet the needs of students to solve their issues, by enhancing affiliation, motivation and decreasing insecurity. Furthermore, the tool provides functionalities on feedback and guidelines. Reflective functionalities are not received as positively, but this is a great first step for future research.

1 Introduction

Digitization is described as a continuous convergence between real and virtual worlds that can be seen as a pillar for innovation. This innovation takes part in all sectors within the global economy. Because of this digitization, the amount of data available grows exponentially and together with the creation and improvement of technologies leads to changes within this economy [64]. Due to the arising amount of technologies that are created to aid people, it becomes more important to understand how to integrate these technologies within tools and systems and maybe more importantly how to create valuable insights in the data created by and transferred within these systems [49]. As was just mentioned, the innovation takes place in all sectors within the economy. This also accounts for education [105].

Education is advanced by an expansion in (learning) technologies, because of the increase in literacy and the arising technological possibilities [53]. These technologies are implemented in learning environments, which are defined as environments in which learning is applied [75]. But what is learning? When learners proactively try to achieve personal learning goals, one speaks of *learning* [41]. According to Hashim (2018), not only teachers, but also technology plays an important role in students' learning [53]. So-called Learning Management Systems (LMS) have been developed since the 1990s. These are enterprise-wide and internet-based systems that provide students with virtual learning environments. Subject management and tools to provide pedagogical assistance combined set the base for an LMS [27], which are used at universities too.

These internet-based systems are used to provide students with a system where course material is uploaded and contact with peers is allowed. Even though every student is able to access such an LMS, their educational journeys differ. They do have one thing in common, however, since every student has to adhere to university rules in order to graduate. One of these is writing a thesis [11]. At some universities, this is referred to as graduation project or internship. Studies show that many are unable to finish their thesis in time [11][149][123]. Multiple reasons are mentioned by The Science and Engineering Research Council of Great Britain (SERC) (1983) amongst others as to why students struggle with this issue:

- First of all, bootstrapping one's thesis is harder than one might anticipate [149];

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- Secondly, students tend to get distracted by all available information. This has to do with the exponentially growing available amount of data, as mentioned in Section 1 [149];

- Thirdly, students might encounter problems with their (planning) skills [149];

- Fourthly, perfectionism sometimes takes the best of students[149];

- Lastly, it is important the relationship between student and supervisor is pleasant. Unfortunately, this does not seem to be the case very often [12].

Students being unable to finish their research in time and a lack of confidence and motivation has to do with social and intellectual problems, namely isolation and loneliness. These can be overcome by workshops, for example followed by student and supervisor [149].

These problems have one thing in common. People possess two types of skills: hard and soft skills. Hard skills are levels of expertise and academic skills, for example, whereas soft skills are described as "self-developed, interactive, communication, human and transferable skills" [142]. Even though soft skills support the development of one's personality traits, there has been little extensive research yet [2]. But Wats and Wats (2009) state that soft skills apply for up to 85% of humans' success. Companies value well-developed soft skills, as it is believed that students' employability is high, which means they would be competent for the current job market [10][89]. Even though universities should make sure that students live up to certain levels of these soft skills upon graduation [1], in practice they do not seem to be as well developed as desired [133]. According to Tseng et al. (2019), the Information Communication Technology (ICT) discipline defines soft skills as "interaction, articulation and interpersonal skills". They should be taught through explicit learning and instructions, as well as the opportunity to observe others, practice one's skills and receive constant feedback.

1.1 Introducing the problem

A Learning Management System is useful for universities and other educational organizations. However, an interconnection of different parts of a system will only be useful to the user if the information is adapted to its specific user. Hirschfeld and Kawamura (2006) state that it is important to take individual user preferences into account [56]. To create a personal and informative Learning Management System that combines existing standards

and requirements, a user-centric approach should be applied during the design process [24]. This is often referred to as User-Centered Design (UCD) and is elaborated upon in Section 9.

The goal of such an approach is to make sure a user is engaged when using the system. This refers to creating a constant, personalised interaction between user and system. Engagement partly shows the extent to which a user has a positive experience during the interaction with a device or website. This positive experience is referred to as great usability of a system. Another way to determine how well this interaction is experienced is called User Experience (UX). This can be well evaluated through various metrics, such as user tests. This is also further elaborated upon in Section 9.

As mentioned in Section 3.1, there are various Learning Management Systems available in the Netherlands alone, as well as globally. For the scope of this research, only Learning Management Systems that are used at universities in the Netherlands are taken into account during the literature research, together with systems focusing upon the development of soft skills or support during thesis writing. There does not seem to be a universal standard available yet, even though some are based on an architecture provided by O.K.I. This is described in Section 2.4.1.

I would like to propose a research that looks into the possibilities of creating a (possibly adaptive) Learning Management System aiding students who are writing their thesis. This Learning Management System should combine findings from the literature, as well as requirements and preferences found during the survey and interviews amongst university students. I would like to look into the possibilities to support students during thesis writing by focusing upon the development of their soft skills. This research will determine whether these possibilities can be made adaptive as well.

This research will ultimately aim at answering the following research question:

RQ *How can an (adaptive) LMS focusing upon soft skills development support students who are writing their (master) thesis at the information science faculty of Utrecht University?*

To answer this, various steps should be taken to obtain the needed information. These steps can be found in Figure 5. To guide the first step,

the literature research, the following sub-questions have been created:

SRQ 1. *What problems do students encounter when writing their (master) thesis?*

SRQ 2. *How are these related to soft skills?*

SRQ 3. *What soft skills exist?*

SRQ 4. *How are soft skills currently embedded in Learning Management Systems?*

SRQ 5. *Are there currently useful adaptive features present in Learning Management Systems regarding master thesis support?*

SRQ 6. *Are there guidelines regarding the requirements of an adaptive Learning Management System?*

As mentioned in Section 1.1, a user-centric approach should be applied during the design process to ensure a better user experience. This means that the interaction, opportunities, functions and attributes that belong to the system are supposed to be designed for people who are meant to use the system [21]. Within this research, the target group will thus be the students who will be using the Learning Management System. Furthermore, the sub-questions are mainly focused upon obtaining the requirements of the functionality of the system. In other words, the prototype that will be created as fourth step will consist of screenshots that take into account the requirements that have been found in the literature and during the survey and interviews. This is why evaluating the mock-up system will eventually provide information on the functionality instead of the usability of the system.

2 Literature Review

The following Section provides information about writing a thesis, soft skills and Learning Management Systems, amongst other subjects that are relevant for this research. First, the relevant aspects of writing a thesis will be addressed. Then, an extensive review on soft skills will be given, after which Learning Management Systems are elaborated on. Lastly, important background on already existing Learning Management Systems and their

functionalities are discussed, as well as the public relevance of this research.

2.1 What comes with writing a thesis?

As mentioned in Section 1, students are meant to conduct a research and write a thesis, before being able to graduate. Writing a thesis consists of two goals: learning and assessment [34]. This entire process consists of many steps, which differ per university [131]. It is hard to manage various curricular programs centrally [123], which explains why these differ per faculty or even per (master) program. According to Tiwari (2019), writing a thesis has common requirements, such as proposing a research topic, accommodating a research problem, writing a proposal, obtaining data and conducting research. As stated by Nunan (1992): "Research is a systematic process of inquiry consisting of three components: (1) a question, problem or hypothesis, (2) data and (3) analysis and interpretation of data". In other words, every student learns how to create a research design and implement this, whilst reporting the entire research [97]. Researches also differ in the end product they deliver. The process of writing a thesis thus shows a students' knowledge, skill, attitude and value, which is important to assess before graduating [131]. At faculties of science, more specifically the department of Information and Computing Sciences, the end product is often an artefact [14], such as a prototype, algorithm or system, in example.

Even though the entire process of a thesis - from beginning to end - can differ per university or faculty, writing the thesis itself is often formatted uniformly. There exist guides for students on how to do this [72]. A student has certain own responsibilities regarding the writing of a thesis, which are listed below [14]:

- Discuss the nature of the relationship with their supervisor: what type of guidance is preferred by the student?;

- Discuss and plan the frequency of meetings with their supervisor and talk about research topics;

- Maintain progress and report (written) material to their supervisor in time for feedback;

- Decide on a final deadline together with their supervisor.

According to Berndtsson et al. (2007), writing is a big part of the process and supervisors should provide guidance during the preparation, but

also during the writing [14]. However, there are still problems encountered by students during this process that are common, such as having trouble conducting and writing a literature research [17]. Apparently, students are not necessarily aware of the importance of a literature review [120]. According to Denney and Tewksbury (2013), writing a literature review comes with various factors. Researchers are supposed to be able to recognize similar and different findings, so they are able to establish links between findings. Furthermore, they are meant to find gaps in existing studies, which they can build their research upon and compare obtained results with these and similar studies [38]. Students are often unaware of the relevance of filling gaps of previous research and trying to build upon what has been researched already. Gall et al. (2007) mention that a literature review plays a central role in the process. It is important for bounding research problems, looking for new perspectives upon the research, avoiding certain approaches, pinpoint subjects for future research together with a foundation for the current research [141].

Students can thus experience various problems during writing their thesis, for example during the literature review. However, according to Schmaltz et al. (2017), encountering such problems does not necessarily mean students lack an understanding of the purpose of a literature review, but are more likely less developed in terms of their critical thinking skill [108]. This is in line with research by Shahsavar and Kourepaz (2020) who found that students have poor performance when it comes to critical thinking. They are likely to solely report their method, design and analysis, without coming up with explanations as to why [120]. This is the reason why the development of soft skills, such as critical thinking, is so highly important [119]. In Section 1, it was described as the third problem students might encounter: underdeveloped soft skills. This research will therefore look into possible aid for students during their thesis, by focusing upon providing support for the development of soft skills.

Another interesting point concluded from the study by Shahsavar and Kourepaz (2020) is the fact that students indeed encounter issues regarding time to finish their thesis, as mentioned in Section 1. This undermines the quality of their literature review, which can be explained as an issue of planning. Besides, not every student is able to finish their thesis in time, for example due to lack of feedback. This has to do with the fourth point mentioned in the Section 1: the relationship between student and supervisor. The expectations between student and supervisor might not be aligned.

Internal and external factors influence students' master thesis process [3]. Akmal et al. (2017) mentioned these factors, namely:

1. Lack of interest in the subject;

2. Lack of motivation;

3. Difficulty finding materials;

4. Shortage of funds; financial issues;

5. Shortage of time;

6. Fear to meet with your supervisor;

7. Academic procrastination (perfectionism);

8. Disbelief in own abilities;

9. Personal circumstances or issues (friends, family et cetera);

10. Fear of what's next (what does the future hold after graduating?).

They looked into the role of achievement motivation, which can be either the hope of success or the fail of failure. Their findings were a decreased academic procrastination in case of hope of success, whereas fail of failure increased this procrastination.

In a study by Wagener (2018), students who had just completed their master thesis were sent a survey to test the dimensions that were found during his literature study. His findings showed that the quality of one's master thesis depends on technical and methodological skills, as well as on affects. Self-regulation and the relationship between student and supervisor are equally important [140]. Maybe even more importantly, he concluded from the analysis of the survey's answers that the training of students requires some change. Furthermore, coaching for supervisors is suggested to improve the relationships between students and supervisors.

Supervision itself can be researched from two perspectives, even though often only one of them is taken into account. These two perspectives are the social-emotional (relationship with supervisor) and cognitive (feedback) perspective [35]. A study by de Kleijn et al. (2014) shows that affiliation[1] is seen

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[1]The term *affiliation* is continuously used throughout this thesis, as this is in line with the study performed by de Kleijn et al. (2014).

as most important by students. Control affects student satisfaction (SS) and feedback-forward has an effect on the Perceived Supervisor Contribution to Learning (PSCL). Furthermore, it was found that feedback perceptions are most important when the relationship with the supervisor is deemed suboptimal by the student. In other words, de Kleijn et al. (2014) have found that it is important for supervisors to create a safe and helpful relationship with students and thus be highly affiliated. If it turns out that this relationship is not optimal, a student should be extra cared for by providing feedback.

Even though little research has been done upon face-to-face feedback, this type of feedback can also be used during master projects [33]. On the contrary, feedback in written form has been researched by many. The study by de Kleijn et al. (2013) indicates that students perceive feedback in terms of goal-setting and feedback-forward (*How am I going and where am I going next?*. When students perceive their feedback positively, they are likely to be satisfied with their supervision.

In a study performed by Zuber-Skerritt and Knight (1986), most problems that are experienced by students who are writing their master thesis could be prevented by guidelines and/or better supervision. The best moments to apply these solutions would be during the definition of the research problem and the writing of the first draft, as these are two critical phases during the conduction of a research [149].

According to McEvedy (1984), writing a thesis consists of four stages, namely: analysis, synthesis, evaluation and presentation. Each stage consists of different steps.

Tackling the two problem phases - the research problem definition and the writing of the first draft - could prevent the issues as described by SERC, in Section 1.

According to Zuber-Skerritt and Perry (2002), writing a master thesis means going through one Action Research cycle. Each cycle consists of a few phases, namely planning, acting, observing and reflecting [150]. Action research (AR) is described as a way to conduct research within a Learning Organisation (LO), which benefits both the organisation and the subject about which a report or thesis is written. According to Kidd and Kral (2005), AR allows access to people, context and knowledge that would otherwise not have been accessible. They describe Action Research as a tool to create new knowledge, solutions and strategies to tackle problems and rising questions that continuously emerge [67].

The aim of Action Research is to change three aspects: researchers' practices, how their understanding of those practices is and the conditions in which they apply those practices [66]. According to Kemmis (2009), Action Research can be seen as a (self-)critical process. Meant by this is that transformations of practices, understanding of practices and conditions enabling these practices are the main goal. In other words: action research aims at transforming what we do, think and say and the ways we relate to everything around us.

AR is in-depth research, which is carried out by either an individual or a group to either determine problems in processes or solve or improve them [41]. This method combines research and practice, which are not mutually exclusive [7]. According to Avison et al. (1999), a framework ensures iteratively that theory and practice are combined by change and reflection in a problematic situation. This can also be seen in Figure 2, because Action Research allows steps to evaluate. Action Research can be applied to writing a thesis as well. As Figure 2 shows, writing a thesis can be seen as an extension to AR, where fieldwork resembles a normal AR cycle. The information shown in Figure 1, can be shown more graphically as well. This is depicted in Figure 2. There are three main points that are important during Action Research [150]:

- A group of people at work,

- who are involved in the Action Research cycle (planning, acting, observing, reflecting) of their work more systematically than usual;

- A public report (a thesis, in example).

As just stated, Action Research combines research and practice. This is the case for applied action research during thesis writing as well. Four types of Action Research can be distinguished [7], namely Action Research:

- Focused upon change and reflection;

- Aimed to resolve conflicts between espoused and applied theories;

- Emphasizing participant collaboration;

- Learning for programmed instruction and experiential learning.

All these types of AR have one thing in common: they all have to do with *learning by doing.* This implies coming up with a solution to a problem, applying this solution and evaluating afterwards. If it deems the incorrect solution, another one is applied and evaluated [41]. This is a loop, which is in line with the iterative framework mentioned by Avison et al. (1999).

Usually, AR is applied in qualitative research, but recent academics have applied it in quantitative context as well. In educational context, AR aims at the understanding of problems and producing solutions to these by applying certain changes. It is sometimes referred to as 'teacher research' as well, as it turns out to have a positive effect on teachers' professional development [41]. Universities have applied Action Research to their graduate programs too, mainly to courses about methodology [96]. However, the findings of a content analysis by Durak et al. (2016) indicate that AR is applied during thesis research frequently as well, which is non-curricular. This can be explained due to taking on the role of a researcher as a student when conducting research for your master thesis [96]. Action Research can thus be seen as *researching your own learning (process).* In other words, when applying AR, e.g. during the writing of your thesis, one should carefully think about what they are doing and how/why. This is self-reflection, which is in line with the Self-Regulated Learning Theory.

2.1.1 Self-Regulated Learning

The Self-Regulated Learning Theory is a self-directive process during which learners turn their mental competencies into academic skills. It was described by Zimmerman (2001) as "learning that happens when students are meta-cognitively, motivationally, and behaviorally active during their own learning processes" [147]. Students' motivation has great impact on the process of achieving their learning goals [113]. The Self-Regulated Learning Theory in turn states that learners have self-generated thoughts, feelings and behaviors, to achieve these personal learning goals. A proactive attitude means that students monitor their own efforts and behavior by keeping their goals in mind and self-reflecting on their progress [145]. Self-reflecting is the step after self-monitoring and has to do with self-judgment. Self-reflecting and self-judgment are both related to performance outcomes [111]. Academic learning skills are multifaceted. In other words, many skills are supposed to be in line with each other to achieve certain performance outcomes.

However, being able to learn in a self-regulated manner is not an individual trait everyone possesses. Self-Regulated Learning contributes to the

enhancement of students' employability and thus the development of their (soft) skills. More than solely having knowledge of a skill, self-regulation ensures self-awareness, self-motivation and skill to apply that knowledge [145].

Self-regulation has to do with certain skills that must be applied to various tasks. These skills are stated by Zimmerman (2002):

- Goal setting;

- Adopting strategies to achieve these goals;

- Monitoring performance;

- Restructuring social context to be able to achieve goals;

- Managing time and being time efficient;

- Self-evaluating own actions;

- Finding link between applied strategies and results;

- Adapting future methods.

The Social Cognitive Theory has influenced the Self-Regulated Learning Theory and resulted in three problem-solving phases that SRL consists of, namely: the Forethought phase, Performance phase and Self-reflection phase, as depicted in Figure 3. These phases each indicate a certain monitoring or reflection state on one's performance and the steps they have undertaken or strategies they have chosen to use [138].

Self-observation, self-judgment and self-reaction are especially important during problem-solving. When students start learning, their goals are often to acquire certain (soft) skills, which they then observe, judge and react to [111].

According to Schunk and Zimmerman (1994), students' level of performance and learning is based on the presence or absence of these skills. These skills are closely related to certain soft skills, which will be explained in Section 2.3. Concluding, Self-Regulated Learning is closely related to certain aspects of Action Research and the development of soft skills, which are both relevant during the writing of one's thesis.

Core action research project

Thesis action research project

Plan and design of the thesis

Defining the research problem
Thesis design and rationale
Literature survey
Internet search
Justification and methodology

Action = field work

Identifying workgroup's thematic concern
Planning/acting/ observing/reflecting on
  professional and organisational
  practices and learning
Report verified by participants

Observation in the thesis

Description of research process and
  procedure
Analysis and evaluation of results of action
  (content *and* process) in the light of the
  literature review

Reflection in the thesis

Analysis of reflections by the practitioners
Reflections by the candidate
Conclusions from the research
Knowledge claims and limitations
Suggestions for further research

Figure 1. *Action Research during Thesis Writing [150]*

2.1.2 Different roles involved with a thesis

It has now been established that a (master) thesis is written by a student and guided and assessed by a supervisor. Besides a supervisor, there is an examiner involved in the assessment of students' theses as well. Their role is to assess the student's work by evaluating it and deciding upon a grade [14], instead of also guiding the student like a supervisor is supposed to. At Utrecht University, this role is called a *second supervisor*. One main notion is that examiners expect students to pass, according to Golding, Sharmini and Lazarovitch (2014). This is based upon the idea that students receive great guidance during the writing of their thesis [68].

Errors, such as inconsistencies, grammar and reference mistakes tend to distract and annoy examiners. This can easily be remedied by a planning and executing a student's research well [47].
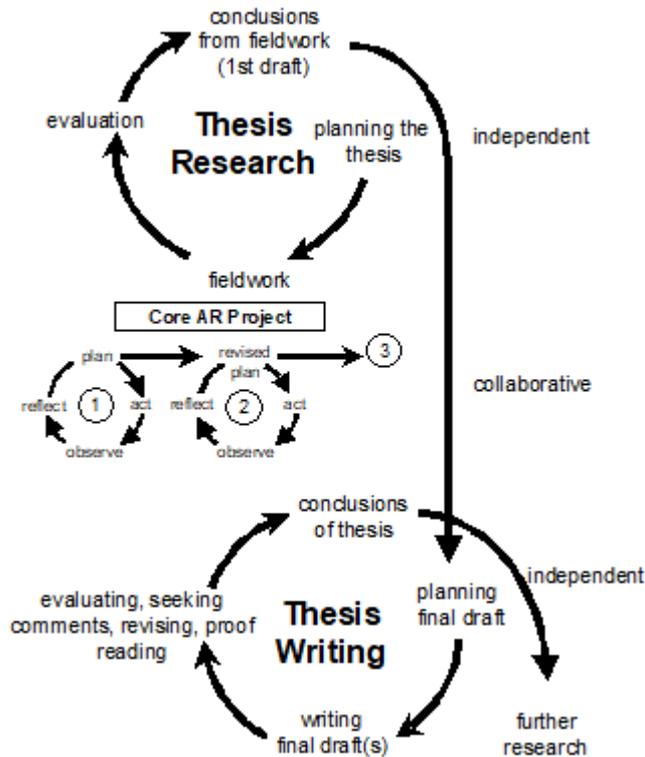
Figure 2. *The relationship between Action Research And Thesis Writing [148]*

2.1.3 Findings on theses

As was described in Section 2.1, there are many problems encountered by students during thesis writing. According to Mufanti and Susilo (2017), they often experience issues when they are supposed to come up with their own ideas and express these. This happens even though students are offered courses in academic writing and advanced grammar and learn about research methodology all through their Bachelor and Master program [87]. To counter these problems, feedback is given depending on their supervisor's preferences. How students interpret this feedback is an individual personality trait, which is an interesting point of research.

During a literature study performed by Knefelkamp and Cornfeld in 1978, it was found that five domains are important when it comes to the whole process of writing a thesis: psychosocial, cognitive-development, maturity, typology and personal environment [37]. However students' perspec-
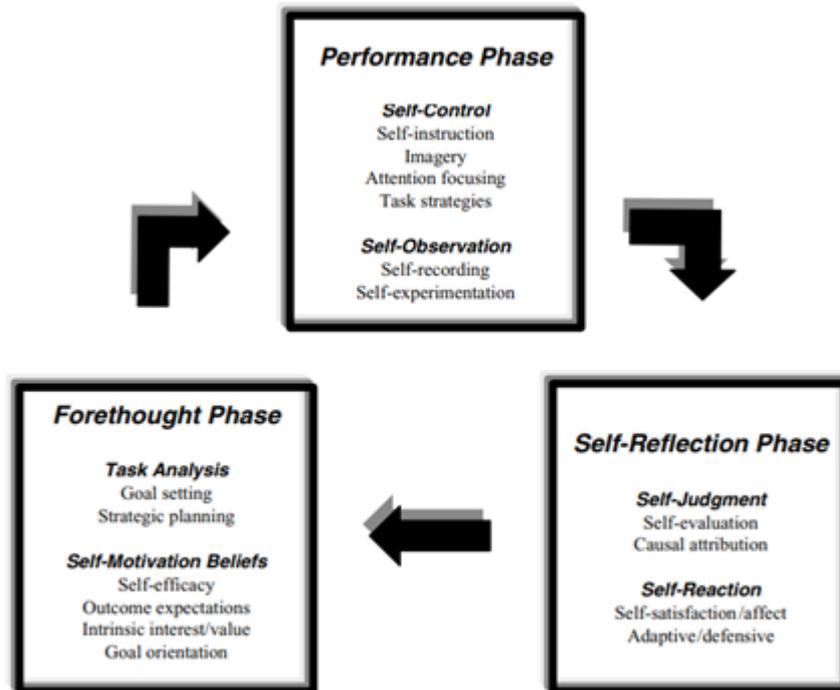
Figure 3. *Phases of Self-Regulated Learning [146]*

tives were not taken into account, which lead to unanswered questions. For example, *what do student and faculty need to contribute to ensure a successful thesis project?*, or *what constitutes a successful thesis experience?*.

According to Demb and Funk (1999), students were not necessarily aware of how extensively their drafts were critiqued during feedback sessions. This was not in line with how easily they thought they would accomplish the writing of their thesis. They mentioned this sometimes feels like a drawback to them. Experts in the field quantitatively assess their work according to certain requirements of the university or faculty [73]. However, it is hard to compare thesis projects with other students from different Master Programs of the same university, let alone between universities in the same country or even globally. It should be considered whether it would be more meaningful to look into programs within one university or even one faculty, instead of between universities [37]. Because, comparing apples to oranges leads to weak comparisons [77].

Furthermore, it is mentioned that not everyone who finishes a thesis pursues a career in research. It is therefore not remarkable that not everyone

excels in conducting their own research, or is motivated to. Even though this is what a master thesis is about, doing research turns out to be an issue to some students [17]. There have been many studies as to what assessments are made regarding master theses [47], but less on the way students perceive the holistic process of writing one. This might be explained by the fact that writing a thesis differs per university and even per faculty. Even within the Netherlands, when looking at the faculty of information sciences, there are quite some differences. On the websites of various universities, some brochures are available that provide information on the process of writing a thesis according to that university's guidelines. The following main differences were found when reading through those:

- Some universities are more strict regarding the deadlines of the thesis itself and various other (mandatory) documents;

- Every supervisory process differs. For example, there are universities that expect only a maximum number of meetings with a supervisor and allow the student to meet with a PhD student to ask more general questions;

- To be able to graduate, a student must have obtained a certain amount of credits (called ECTS at Utrecht University). The amount of credits one can deserve by passing their master thesis differs, as universities might divide a thesis over more phases, which means more documents should be submitted. Each document would then be worth credits. For example, at Utrecht University, every student has to submit a proposal and the final thesis, which are worth 15 and 30 ECTS respectively. At other universities, students might have to submit a document monthly which might be worth 7 credits, in example.

Concluding from this, it can be said that it is cumbersome to create a system that aids all students working on their master thesis nationally, let alone globally. Furthermore, the differences between universities would lead to weak comparisons, which would affect the reliability of this research. However, it is an interesting starting point to look at one faculty. Due to familiarity, it is more convenient to look into the the department of Information and Computing Sciences at Utrecht University. Since Utrecht University makes use of the Learning Management System Blackboard, this narrows down the scope of available Learning Management Systems as well, which allows a more thorough research of the functionalities and features of the one that is currently used. From there, it might be a great foundation for future research to look into the possibility of using other Learning Management Systems, as well as other thesis procedures or curricular activities.

2.1.4 Writing a thesis at Utrecht University versus Radboud University Nijmegen

But how does the process of writing a thesis work exactly at Utrecht University? In principle, Blackboard remains unused during the entire process. A student enrolls via Osiris, an information system that allows students to enroll for courses, minors and apply for cases. When a student starts working on their thesis, they are meant to apply for a *case*, which contains a summary of their proposal. Then, phase one is initiated: writing a proposal and preparing for the conduct of the planned research, worth 15 ECTS. The second phase comprises the actual writing of the thesis and conduct of research itself, which is worth 30 ECTS. In total, students are supposed to put in around seven months of work, nearly full-time (around 32-40 hours a week). Each student is allowed to choose a supervisor who has a lot of expertise within the field of research. They are then assigned an examiner as well - called a second supervisor. As described in Section 2.1, students are supposed to negotiate with their supervisor themselves how frequently they want to meet up or receive feedback. This differs from other universities, as was described in Section 2.1: doing research for one's thesis is not a uniform process. For example, at Radboud University Nijmegen, students are supposed to get in contact with a supervisor. During their Bachelor Program, they have received a tour on campus which explained what kind of research is possible, which can serve as an inspiration during the graduation phase of their Master Program. It is also possible, as is at Utrecht University, that supervisors have some research subjects available to choose from. This means students would not have to start from scratch and think of a research problems themselves. Then, students at Radboud University are also supposed to enroll via Osiris. It accounts for both universities that students are allowed to do their thesis research during an internship, but are not obligated to. The entire thesis project is worth 30 ECTS at Radboud University, which is not directly linked to strict deadlines. This accounts for meetings with supervisors as well: a student is allowed to do this in negotiation with their supervisor themselves. A supervisor, whom they are allowed to choose themselves, as well as their examiner. In principle, the thesis process can take up to one year, but students are allowed to work on their project longer, if they feel the need to. As with thesis project at Utrecht University, students are meant to work almost full-time on their thesis.

The biggest difference between these two universities is the lack of phases at Radboud University, which are a big part of the thesis process at Utrecht University. The preparation of students' theses is a big part of the

entire process at Utrecht University, which might be more divided or evenly spread over time at other universities.

2.2 Different learning types

This preparation is something the student is accountable for. However the guidance of a supervisor can make a big difference when it comes to different types of students. According to Kolb (1985), there are four learning styles: accommodator, diverger, assimilator and converger [70]. For the scope of this research, it is not necessary to elaborate on the exact meaning of each of these. It is, however, important to note that a so-called effective learner can combine all four styles to reach their learning goals in learning environments [78]. As can be seen in Figure 4, the learning types each represent a quadrant, whereas they are also reflected by four dimensions: a "feeling" learner, a "thinking" learner, a "doing" learner and a "watching" learner. Feeling is associated with the perceiving dimension and thinking is associated with abstract conceptualization. Doing is represented by the processing dimension, whereas watching is represented by reflective observation. In other words is not only every student a different type of learner, they differ in dimensions as well: one can be a "thinker and watcher" or more "thinker and do-er". Therefore, it is important to take into account that every student approaches their learning goals differently, and therefore no one-size-fits-all approach should be applied when addressing students. This means that, in the optimal situation, every student should receive individual guidance and material during their educational journey.

2.2.1 Courses and Workshops for students: learning methods

According to Hurst et al. (2013), students are meant to develop their soft skills through courses or workshops that are complementary to the offered program. Unfortunately, there are not many universities that offer those courses or workshops to provide students with the opportunity to increase their employability by developing certain skills. It seems to be assumed that students develop those through the offered courses and relationships with fellow students, even though in practice this is not entirely true. Students will only be able to develop their soft skills if universities see this development as a responsibility and start identifying this as part of a student's education [48]. However, it does not necessarily mean students take up on this when universities recognize the impact of one's personality on the development of soft skills. Training during late adolescence and beginning adulthood is essential, as this prepares people for their professional and social lives [48].

Figure 4. *Kolb's learning types [78]*

But besides the fact that not many universities actually offer such courses or workshops, it is also not taken into account that not every student learns and develops in the same way. Besides the learning types Kolb created, he also mentioned learning methods in 1984 [58]. Hands-on projects and discussions with small groups contribute to a do-er's learning progress, whilst lectures do not, in example. This confirms that a learning method is not suited for everyone [58].

To conclude, every student learns differently and could thus benefit from a personalised learning approach. This research will gain insight into the students' preferences.

So how should such a preparation of a thesis project of individual

students be addressed? As mentioned, no one-size-fits-all approach should be applied, as every student is placed differently on Kolb's quadrants, see Figure 4. Preparing a project comes with many steps: finding a supervisor, thinking of a research topic, problem and question and proposing this as a whole, as was described in Section 2.1. This comes with many skills, such as planning, which are referred to as soft skills.

2.3 What are soft skills?

2.3.1 The term "skill" explained

The term *skill* was first used in the thirteenth century and is considered as one's ability to apply knowledge correctly [132]. However, gradually, the meaning of the word skill became more vague. It is now often interchanged with terms, such as 'expertise' or 'competence'. This indicates that the word was used more frequently over the years and the term's subcategories were expanded. For example, generic skills, soft skills, interpersonal skills are now subcategories to the umbrella term 'skill'. In the literature, skill is referred to as an entity, which means a skill is an individual's property or trait [117][26].

2.3.2 Literature on Soft skills

Soft skills is one of the expanded categories of the umbrella term, as was mentioned in Section 2.3.1. Since the term has been used more widely, many terms were included in the category. For example, one of the skills within this category is called '*emotional labor*, which are skills that require complex abilities [132]. The skills that belong to the category soft skills are listed below:

- Qualities, i.e. adaptability, flexibility, responsibility, courtesy, integrity, professionalism and effectiveness and values like trustworthiness and work ethic [90];

- Attitudes, i.e. willingness to learn, learning to learn other skills, hard-working, working under pressure or uncertainty [126];

- Problem solving, decisions making, analytical thinking / thinking skills, creativity / innovation, manipulation of knowledge, critical judgment [25];

- Leadership skills and managing skills [30];

- Interpersonal skills, social skills and team skills, effective and productive interpersonal interactions [65];

- Communication skills [90];

- Emotional labor [57];

- Aesthetics and professional appearance [91];

- Cognitive ability, ability to plan and achieve goals [25].

According to Touloumakos (2020), the fact is that the term 'skill' has become rather vague. This can indeed be explained by its expansion in use and meaning. Currently, there are many overlaps and cases of ambiguity regarding the various skills that belong to the subcategory of the umbrella term. Therefore, this polysemous term is difficult to use in a unified and correct manner.

Because, not only is the term not used in a unified way, its perception differs from context to context [110]. This accounts for knowledge about skills as well. Applying certain knowledge might be unmissable in field A, whereas field B does not require those same skills. According to Schulz (2008), the importance of soft skills is dependable on the perception of an individual and the context it is applied to. There is, however, a unified opinion on which category of soft skills people find important: communication skills. This category comprises self-esteem, etiquette, presentation, body language, language proficiency and listening skills, amongst others. Language proficiency refers to the ability to speak, read and write Standard English. Schulz (2008) mentions that graduates seem to lack this type of skill. Furthermore, he describes that critical and structured thinking are lacking as well. These are strongly connected to problem solving skills.

Nowadays, it becomes even more important to master such skills, because of the exponentially growing amount of data, as mentioned in Section 1. By filtering and analysing incoming data, it would become easier to make well-informed decision when mastering such skills. In addition, mastering these types of skills allows one to come up with solutions to problems, either personally or professionally. Lastly, Schulz (2008) mentions creativity as a lacking skill. This is often perceived by people as a skill mainly used by artists and other creative professions. However, creativity refers to the "thinking out of the box" part of coming up with solutions or ideas.

According to Schulz (2008), soft skills are partly responsible for the shaping of one's personality. Students whose soft skills are well developed are more likely to learn more efficiently. In other words, learning and soft skills complement each other. Soft skills are abilities that are related to inter- and intrapersonal skills, which are influenced by one's Emotional Quotient (EQ) [104]. An EQ is mainly focused with personality traits, such as social graces, communication abilities, language skills, personal habits, cognitive or emotional empathy and leadership abilities [115]. According to Junita et al. (2018), communication skills, emotional skills, language skills, group skills, ethics and morals, courage and spiritual skills belong to this category. However, according to the HERA project, soft skills are distinguished into technical skills, meta-cognitive skills, intrapersonal skills and problem-solving skills [23]. Unfortunately, soft skills are often not the main focus of a curriculum, which results in less developed non-technical skills.

Soft skills are hard to master [150]. Even though the main aim of education is to ensure a maximized potential of students [40]. A learning process is described by Diana et al. (2022) as "a relationship between teachers and students with their environment to achieve the proclaimed educational goals". Through a learning process, education is carried out. The success of a learning process is measured in so-called *learning achievement.* This is a mixture between ability, soft skills, interests, talents, facilities, motivations, the ability of educators, attention, study habits and the learning environment [62]. One's learning achievement can be low because motivation is lacking. Motivation can be described as a force from within that enables one's willingness to perform certain activities to achieve a certain goal [19]. Furthermore, without motivation one's problem-solving skills can not be applied optimally [146]. Goal setting and planning are in turn skills that can increase the likelihood of one feeling motivated. As was described in Section 1, motivation can have a great impact on one's learning process, which accounts for writing a thesis as well.

In order to be able to develop and eventually master soft skills, students are meant to possess qualities, such as perseverance, dedication, courage and commitment [114].

2.3.3 Soft skills in literature

As becomes clear, literature provides different answers to which soft skills exist - because they can differ per context [110] - and various types are considered important for educational purposes. For example, Badcock et al. (2010) mention the soft skills critical thinking, interpersonal understandings, problem solving and written communication. The soft skills important within

education mentioned in another study by Santucci et al. (2019) are problem solving, adaptability, team working, networking, multitasking and communication skills [107]. In a study by Nikitina and Furuoka (2012) it is mentioned that the *MOHE* - Ministry of Higher Education Malaysia - has identified soft skills that students are meant to learn and develop during their academic journey. These are (a) communication skills, (b) critical thinking and problem solving skills, (c) team work skills, (d) lifelong learning and information management skills, (e) entrepeneurship skills, (f) ethics and professional moral skills and (g) leadership skills [80]. This taxonomy has been created to ensure that students' employability is enhanced [95]. Devadason et al. (2010) used the taxonomy designed by MOHE to find out whether Malaysian universities integrated these in their curricula. The findings turned out positive and students confirmed that communication skills, teamwork and cooperation and leadership were well integrated [39]. However, soft skills such as critical thinking, problem solving skills and negotiation skills were mentioned less frequently [95]. It has now become clear that there are many perspectives on soft skills and various opinions on which to implement and how exist amongst researchers and universities. In other words, there are many soft skills related to educational purposes, which extends this research. Therefore, this scope is narrowed down.

Research has been done to find out what students perceive as important soft skills. Findings by Wats and Wats (2009) show that students find communication skills the most relevant ones. Furthermore, problem solving skills, leadership skills, team work skills, IT skills and learning to learn skills were mentioned. Creativity, innovation, managing, coping with change, initiative, sensitivity towards global, societal and environmental issues and motivation are also considered relevant. Students believe soft skills lead to an increased level of confidence and understanding, which in its turn results in better performances during job interviews [142]. This is in line with the increased employability, as mentioned in Section 1.

2.3.4 Can one change their personal traits?

It has now become known that soft skills are personal traits. But can these be changed? By the use of training, it is possible to improve or adapt soft skills. It is important to understand one condition, namely that a person recognises and acknowledges if behavior is lacking and one has certain bad habits [110]. This has to do with the Self-Regulation Theory. Lack of self-regulation can lead to bad habits [139].

But why would one want to change their personal traits and thus focus more upon the development of soft skills? One reason is the current job market. Educational organisations are working towards the enhancement of the employability of graduates nowadays.

2.3.5   What are hard skills?

Not solely soft skills increase one's employability. Hard skills also contribute to how one is prepared for the job market. Hard skills are focused on analytical/technical skills, determination and vision [133]. According to Zhang (2012), education focused upon IT should ensure students are prepared for the job market by excellent communication skills with end users, the skill to solve conflicts and the skill to converge different functions to a common goal [144]. This type of skill is easily documented and formed, easily articulated and easily transferred between lecturers [6]. It is harder to describe them in detail, as they are context dependent. But according to Rainsbury et al. (2002), hard skills are used to carry out tasks in relation to technical aspects, whilst including the transfer of knowledge [104]. They are affected by one's Intelligence Quotient (IQ). According to Spencer and Spencer (1993), the minimal necessary skill set to complete basic tasks are technical skills and knowledge [104]. Currently, education on skills is dominated by hard skills, even though this leads to unevenly developed hard and soft skills [9].

2.3.6   The difference between hard and soft skills

Hard skills are taught and tested through standard tests on mastery of those skills [74]. It is quite easy to test whether one has developed hard skills, e.g. by checking one's grammar. Section 2.3.2 described language proficiency within the category communication skills. This was described as the ability to speak, read and write Standard English. One might know the correct usage (hard skills), but not know when to apply this knowledge and possibly equally important: what tone to use. This belongs to a type of soft skills [110]. As was mentioned in Section 2.3.5, hard skills dominate education on skills, whereas soft skills are actually undermined. Furthermore, soft skills are cumbersome to credit and develop less quickly and easily [9]. In addition, it is stated by many authors that these two types of skills are complementary. In other words, good behavioral - soft - skills in addition to technical - hard - skills increase one's motive, value, attitude and trait [104]. This is the reason why discussions have arisen about the implementation of both skills in educational programs. However, this extends the scope of this research.

2.4 What are Learning Management Systems?

As was explained in the Section 1, Learning Management Systems are systems that provide students with virtual learning environments. They have many functions, namely [116]:

- Sharing learning materials;

- Conducting discussions;

- Managing classes;

- Assigning homework or tasks;

- Holding exams;

- Receiving feedback;

- Arranging learning materials;

- Keeping student, teacher and system records;

- Creating reports.

LMSs are mostly used in online or blended learning environments. Online education is called *e-learning* and has its advantages, such as being able to create adaptive environments to engage every single learner. However, it has disadvantages too. Face-to-face learning allows a student to receive immediate feedback from the instructor, whereas this is not the case within an e-learning environment [5]. Even though the application of computers for educational purposes dates back to the 1950s, LMSs have only been developed since the 1990s [143]. The application of such systems is based on computer-based instruction (CBI), computer-assisted instruction (CAI) and computer-assisted learning (CAL). These are often focused upon so-called drill-and-practice programs, higher-level tutorials and individualized instruction [101]. LMSs find their history in integrated learning systems (ILS), which are hardware or software management system that uses instruction based on computers. They are often used for education on mathematics, reading or writing, but also for science [8]. In example, they are also used to aid students who need help with academic writing.

2.4.1 A standard for Learning Management Systems?

A common misunderstanding is that LMSs are not seen as frameworks. An LMS is in fact an infrastructure used to provide the user with manageable instructional content. Furthermore, it identifies and assesses users and their goals and performances. Many LMSs have been created in collaboration with the Open Knowledge Initiative (O.K.I). O.K.I was the pioneer in creating industry-wide standards [27]. It has defined an architecture for learning technology, to fit the needs of education. This architecture states how the components of an LMS communicate with each other (intra) and with other systems (inter). Furthermore, they have provided standards for the interface of an LMS, together with open source examples of its workings [84].

The O.K.I provides a framework, which allows components to interact independently with each other. However, there are requirements described that should be met by all LMSs, namely: high availability, usability, scalability, interoperability, stability and security [79].

Besides the management and pedagogical tools an LMS provides, they usually also allow asynchronous and synchronous communication. This means that teachers and students can communicate through an LMS via e-mail, chat, list servers, instant messaging and discussion forums [29]. Furthermore, teachers can develop and deliver content and provide formative and summative assessments. There is a functionality available to allow students to manage course registering, enrollment and to display timetables. Student activities and electronic office hours can be managed as well. However, the fact that these possibilities exist, does not necessarily mean that they are implemented within every Learning Management System. In other words, these functionalities are available and can are customisable per LMS.

An LMS helps the user to meet their goals and supervises their learning process, as well as that of the organization as a whole [128]. Such a Learning Management System provides the user with (course) content, but handles the course registration too and tracks and reports their performance [46]. An LMS thus provides easy access of (course) material and allows two-way communication with and between students and teachers [1]. This research focuses upon the creation of such an LMS that provides features which helps students during their thesis writing by focusing upon the development of soft skills.

2.4.2 What is an adaptive learning environment?

In Section 1, learning environments were discussed. Blended learning environments allow the usage of Learning Management Systems. But how does this differ from *adaptive* learning environments? According to Paramythis and Loidl-Reisinger (2003), a learning environment can be seen as adaptive if monitoring users' activities, interpreting these, inferring users' requirements and preferences from their activities and representing these correctly and dynamically facilitate a user's learning process is possible [100]. This is the tailoring to requirements or needs and preferences of an individual [100]. Every student is different and in need of a personalised approach when it comes to support or supervisory [40][149]. This is in line with the learning types by Kolb [70]. Besides, this would thus call for an adaptive learning environment to optimize the learning process, as was mentioned as the main goal of education according to Diana et al. (2022).

According to Radwan (2014), personalisation is one of the most desirable e-learning system characteristics. It is important to note that a distinct is made between adaptive and adaptable systems. A system is called adaptable when its parameters can be changed by the user. An adaptive system, however, adapts automatically to its users based on their so-called *user model* [103]. Adaptive systems obtain data from its users and create a user model. As just described, the system bases its adaptations - the presentation of the course material, how to navigate through this material and the annotation - on this model [20]; it works in a circle. There are a few adaptive learning frameworks available, such as *AHA!*. This open source general-purpose adaptive hypermedia system supports techniques, such as adaptive guiding, link annotation, link hiding and adaptive presentation [98]. Systems that make use of adaptive hypermedia techniques benefit since content can be kept up-to-date easily, as well as the support of discussions and interactions between students and teachers. Furthermore, it is quite simple to distribute new courses to students [55]. Since students have various interests and paces in which they learn - as learner types are an individual trait - it would be helpful to allow different versions of course material. Adaptive hypermedia techniques allow steps in this direction, as they adapt content to the needs of the student [55]. In a paper by Brusilovsky et al. (2003), it is mentioned that AHA! provided a flexible framework for adaptive hypermedia, which allows the implementation of various adaptation methods. Not only does this framework provide adaptable possibilities for user interfaces, it is AHA!'s ticket for an adaptive hypermedia environment that can be used for all kinds of applications [31]. This would allow systems to be adaptive, instead of

adaptable.

In this case, an adaptive Learning Management System would adapt the content to the user's needs, instead of changing the soft skills or learning paths to their preferences. However, adaptiveness comes with disadvantages as well. Because adaptiveness indicates that parts of the system are automatically adapted, mental workload of users is reduced, which can lead to errors. Furthermore, adaptiveness can be seen as a disadvantage when focusing upon the preferences of a user. Sometimes, having everything automated is not wished for. Due to these reasons, the need for an adaptive the Learning Management System is still unclear and will be looked into during the survey and interviews.

2.4.3 Requirements of an adaptive learning environment

In a paper by Komlenov et al. (2010), certain requirements to an adaptive LMS are stated:

- Connections between learning objects;

- The possibility to reuse some parts by connecting them vertically;

- Pre-/post-test facilities and a ability to sequence;

- Advanced branching - to meet individual learning goals/requirements.

However, at least at the time of their study, there was no LMS using all of these [71]. In other words, when findings of this research show that adaptiveness is preferred by students, these requirements should be taken into account.

3 Background

3.1 Related Work

This Section will elaborate on some of these Learning Management Systems and will explain their advantages or disadvantages, as well as some studies that have been done on them.

3.1.1 Comparison between Learning Management Systems

A study by Machado and Tao (2007) compared two Learning Management Systems, namely Blackboard and Moodle [79]. They researched the usability and effectiveness of the two systems. According to their results, if students felt comfortable using information technology in general, they were more likely to prefer using Moodle over Blackboard. This can be explained by Moodle's user interface, which turned out to be easier to understand than Blackboard's. In other words: Moodle excels in terms of user experience in comparison to Blackboard. However, results on the functionality were not definitive. Students mentioned that their prior knowledge on information technology was helpful when working with a new system, which could explain the indefinite results. Even so, Moodle seemed to be the preferred Learning Management System, which was in line with previous research [137][18].

In a paper by Croitoru and Dinu (2016), globally used Learning Management Systems were compared based on features and capabilities and on technical requirements. They found that Blackboard was in possession of the most features and missed only three of forty in total. Moodle, however, came really close and missed only four features. Blackboard excels in communication tools, administrating and creating learning material and tracking the data [29]. By the use of plug-ins and other tools that recreate the classroom environment, Blackboard enriches a student's experience [29].

3.1.2 Blackboard as a Learning Management System

Blackboard is a widely used networked learning environment (NLE) [16]. The system offers better management of learning objects, student profiles and allows creation of online portals, which are the key elements of an NLE. However, this does not necessarily mean Blackboard can be seen as an LMS, even though there are many articles available identifying Blackboard as one. Blackboard refers to its product as a Course Management System (CMS): "Blackboard's online learning application, the Blackboard Learning System, is the most widely-adopted course management system" [143].

At Utrecht University (UU), however, Blackboard is used as Learning Management System [135]. There are other universities that have implemented a different system. For example, the Universiteit van Amsterdam (UvA) makes use of Canvas [136] and the Radboud Universiteit in Nijmegen has chosen to provide students with a login for Brightspace [134]. For a broader overview, see Table 2. For the scope of this research, the used LMS

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at Utrecht University is focused upon, which means only Blackboard is taken into account.

3.1.3 Existing systems focusing upon soft skills

There also exist various systems that focus upon the development of their students' soft skills, such as Skillsoft [125]. Students are able to login into Skillsoft, use the available material and then login on Blackboard to assess what they have learned [43]. This is an example of how an LMS can be combined with a tool to help students develop their soft skills. However, there are other tools available as well. For example, Skills Builder is a framework that enables everyone to teach, learn and measure skills [22].

This framework does not solely focus upon education, but it aims at developing skills through every stage of life. Many other systems exist that focus upon the development of soft skills in organisations: courses are offered to employees to increase their soft skills, as it is mentioned that organisations benefit from this.

Co-curricular soft skill activities Furthermore, concepts that occur co-curricularly have been implemented as well. In example, at Universiti Kebangsaan Malaysia (UKM), acquiring extra curricular knowledge has been implemented co-curricularly and has been based upon eight principles [114]:

- Self-driven;

- Authenticity;

- Enjoyment;

- Total learning experience;

- Flexibility;

- Soft skills;

- Experiential learning;

- Honour.

UKM utilises a so-called *Learning Contract*. The concept Learning Contract was first developed by Knowles in 1980 and was based upon self-learning [69]. Its main goal is to compliment the already existing academic curriculum to ensure well-developed graduates, physically, emotionally, spiritually and intellectually. This is defined as "a form of learning that requires

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students to plan, implement and assess their own achievement" [83]. UKM uses a Learning Contract as an agreement between student and supervisor, where students are responsible for planning and carrying out the activities as agreed upon by their supervisor [114]. An assessment takes place when a student has fulfilled all activities as stated within the Learning Contract, after which points can be assigned when done correctly. These activities are based upon the following eight learning outcomes [114]:

- Soft skills and sense of responsibility;

- Communication skills;

- Information management and life long learning;

- Values, attitudes, ethics and professionalism;

- Critical thinking, problem solving and scientific approach;

- Leadership and teamwork;

- Management and entrepreneurial skills;

- Creative and innovative skills.

Selamat et al. (2013) state that students who have successfully achieved these eight learning outcomes, will master the skills in communication, team work, planning, organisation, analytical thinking, problem solving and leadership skills.

The consensus, implementation and assessment of the activities can take place in UKM's Soft Skills Development System (SSDS). Not only does this concept enhance the development of soft skills in students, it also increases their understanding about responsibility and self-enhancement. A disadvantage of this system is the lack of usage during students' graduation projects. To ensure no interruptions take place during the writing of their thesis, Learning Contracts are encouraged during the first two years of students' study programs [114]. However, applying soft skills during the writing of one's thesis is encouraged as well.

To conclude, there are various Learning Management Systems nationally used at different universities and each has its own (dis)advantages.

In Table 2, all Learning Management Systems per University in the Netherlands are depicted. During literature research, it was found that

Table 2. *Learning Management Systems per University*

University in the Netherlands	Used Learning Management System
Utrecht University	Blackboard
Universiteit van Amsterdam	Canvas
Vrij Universiteit Amsterdam	Canvas
Radboud University	Brightspace
Erasmus Universiteit Rotterdam	Canvas
Technische Universiteit Eindhoven	Canvas
Technische Universiteit Delft	Brightspace
Universiteit Twente	Canvas
Wageningen University and Research	Brightspace
Maastricht University	Canvas
Tilburg University	Canvas
Universiteit Leiden	Brightspace
Rijksuniversiteit Groningen	Blackboard

some universities decided to start using Canvas or Brightspace instead of Blackboard. According to an article by Instructure (2020), Canvas enhances Problem-Based Learning (PBL), which allows students to become more independent. This is the main reason why Maastricht University decided to change their LMS [130]. Furthermore, Technische Universiteit Delft decided to switch from Blackboard to Brightspace in 2017. According to the director of education of TU Delft, the way in which Blackboard was used by lecturers from all faculties differed. They were looking for a more stable base for students and teachers, which was used uniformly [82]. This shows that Blackboard is currently not suitable to be used nationally yet.

It is thus true that there is no standard Learning Management System used at universities; these differ. As was mentioned in Section 2.1, writing a thesis can not be brought down to one simple procedure, as these differ per faculty and per university too. This is why this research will narrow its scope to the Learning Management System used at Utrecht University - namely Blackboard - and focus upon the procedure of writing a thesis used at the faculty of science (Department of Information and Computing Sciences). In addition, Blackboard is recommended for higher education [29], which proves this Learning Management System is a great starting point for this research.

3.1.4 Current support in Learning Management Systems

A system that supports scientific processes in thesis writing exists, which is called *SciPro*. Although it has been developed to tackle the problems students encounter with too little instructions and infrequent feedback [50], it is globally used and has shown an improvement in both quality and quantity of theses. Not only does it provide users with features such as an idea bank,

it also evaluates the thesis process of users by looking at completion rate, the time spent with their supervisor and others [121]. However, it is not an implementation in a Learning Management System.

Advantages of current support in LMSs According to a study by Shakerian et al. (2020), implementing support in an LMS to support students who are writing their thesis was almost two times as successful as other methods. Not only does it increase the rate of theses that are completed, the study showed that the quality and quantity of research are improved through improved feedback as well [121]. They researched whether an adaptation of educational technology could be improved by implementing technical support requirements. This was indeed the case.

Hansson et al. (2012), however, were pioneers in using an ICT system to provide support during thesis writing. They showed how relevant collaboration is between thesis' components, to ensure an improvement of quality [51]. To achieve this, they stated certain requirements for the system, namely: project management, a discussion forum, exercises, resource websites, private correspondence files, a reflective journal and resource material databases. These were implemented in an LMS for doctoral dissertations and the results improved. As a conclusion from observations, interviews, focus groups and log analysis of the data, they mentioned an improvement of the quality of theses, time being saved and value being added [121]. A case study by Peiris et al. (2013) showed that ICT can function as great support for students who are writing their thesis [102].

Besides the SciPro system and the fact that thesis support in an LMS would indeed help students improve their theses, there do exist some forms of support within LMSs. As was mentioned in Section 2.4, Learning Management Systems are used for things such as support for academic writing. On Blackboard, for example, there exists a collaborated-based instruction that helps students improve their academic writing. According to Motlhaka (2020), this instruction increases student engagement, which leads to better academic writing results. He states that the findings are in line with the theory of the Zone of Promixal Development [86]. This is a theory by Vygotsky (1920s) which states that one learns better with the help of adult guidance or peer collaboration [118]. This would indeed mean that support through an LMS could lead to better results if implemented correctly.

A study by Araka et al. (2021) states that Learning Management Sys-

tems are underutilized by students. According to them, there is a lack of personalised feedback, as well as too little interaction with peers and guidance of a supervisor. Improving this could enhance Self-Regulated Learning in online learning environments [4]. This is further elaborated upon in Section 4.1. According to Sezer and Yilmaz (2018), many features are in-built in LMSs, such as forums, chats, quizzes, assignments, blogs, emails and wikis. Such features are implemented to engage the user and make sure they have an active role during learning. Many studies have shown that LMSs improve the effectiveness of instruction, student learning, interaction, student performance, motivation and communication and contribute to global use [116]. According to Berking and Gallagher (2013), LMSs allow the following functionalities in general [13]:

- Structure;

- Security;

- Registration;

- Delivery;

- Interaction;

- Assessment;

- Tracking;

- Reporting;

- Record keeping;

- Facilitating reuse;

- Personalisation;

- Integration;

- Administration.

On top of that, functions such as competency management and skills-gap analysis are implemented in more comprehensive LMSs and succession planning, certifications, virtual live classes and resource allocation, such as rooms, textbooks and instructors, too [13].

Besides, there are other features of Learning Management Systems mentioned in the literature, such as to-do lists, presentation areas, bookmarking and note taking and e-portfolios [4]. These features, mentioned by Araka et al. (2021), promote Self-Regulated Learning. They are related to the Self-Regulated Learning concepts of time management, goal-setting and self-monitoring, which are connected to soft skills as well.

Concluding from this, it can be stated that lots of functionalities are available in Learning Management Systems to enhance students' learning experiences. However, not every functionality is implemented within each LMS, which is why educational and organizational institutions are supposed to choose which suits their goals best. Furthermore, there has been research regarding adaptive features in LMSs as well, which still leaves room for interpretation within this research.

4 Public relevance

According to Schoonenboom (2014), Learning Management Systems are not always used as intended in higher education. This can cause LMS to be infrequently used, even though they are supposed to aid face-to-face learning in blended learning environments, as well as online learning environments [109]. Sclater states (2008) that the disadvantages of LMSs might be due to a lack of understanding of its functionalities in combination with the misunderstanding about how to facilitate learning [112]. He also mentions LMSs being rather inflexible systems, as not every functionality works as intended.

Interoperability is mentioned as a core element of an LMS by Sclater (2008). He explains that data is transferred between Learning Management Systems and other systems, which means that a standard would increase the probability of institutions and universities using these LMSs as intended [112]. SURF (2020), an association of Dutch educational and research institutions, mentions an article by the Volkskrant that calls educational institutions to action [32]. According to this article, these institutions should work on a secure and responsible digital, educational environment themselves [36].

To make LMSs more appealing and useful to students, the Open Universiteit has already tried to make fundamental changes to the architecture of their LMS. They allowed them to create their own forums, blogs and other tools for purposes of certain courses [112]. It is important to keep in mind that institutions should not lose control of what their students are doing [112].

In other words, it is important to create a learning environment that follows a standard and allows educational institutions to provide students with an easy-to-use and appealing LMS, but also creates a pleasant user experience for students and teachers. This way, all types of users will benefit from one Learning Management System that communicates with other systems used within one educational institution.

4.1 Changes in training of skills

According to Wagener (2018), it is necessary to implement changes regarding the training of students. He found that self-regulation and the relationship with supervisors majorly impact the process of writing a master thesis, which is in line with other research as described in Section 2.1.

Learning processes should be carried out when students are motivated [133] and self-regulated [124], using strategies to transform into skills over time. According to Tseng et al. (2019), motivation is considered a soft skill, necessary to reach optimal personal development. According to Paas et al. (1993), motivation should be considered when designing an e-learning system [99]. Motivation will improve students' performance in an LMS [88].

4.2 Soft skills that are important when writing a thesis

As was described in Section 2.1.3, students can experience problems when it comes to developing and expressing their own ideas. This has to do with creative skills, for example. When bootstrapping one's thesis, it might be the case that a student has to come up with their own research, when they do not follow up on a research topic of their supervisor. This relates to the soft skills problem solving and critical/strategic thinking. Students are supposed to see the bigger picture, but be able to narrow down their focus as well. This can be seen as a form of information management: another soft skill. According to Ivanovic et al. (2013), a downside to online learning and the use of Learning Management Systems is that students tend to teach themselves more: Self-Regulated Learning. As mentioned in Section 2.1.1, during the Performance phase of Self-Regulated Learning, self-observation takes place. This is trivial to solve simple problems, because of recall and prior attempts to apply certain solutions. During problems that are more cumbersome, however, learners tend to get overwhelmed with the amount of useful data [146], which is a problem that could be tackled by developing one's information management skill.

By letting students learn on their own, they are probably more likely to increase their hard and soft skills [60]. To guide them during this process, students are supposed to have meetings with their supervisor to discuss their plans, progress and other notions. This goes with the soft skills communication, 'people skills' and teamwork [150]. Furthermore, research has shown that students can experience problems to finish their thesis in time. Even up to 50% per year has experienced this issue at the faculty of Psychology at University X between 2011-2015, which has been anonymized [3]. This relates to the soft skill planning. On top of that, as described in Section 4.1, motivation is another soft skill. Without motivation, students would be unable to engage in the process of writing a thesis from start to finish.

These soft skills can be related to already existing functionalities in Learning Management Systems. For example, as was described in Section 2.4, LMSs possess the functionality to share learning materials and receive feedback. Receiving feedback helps to boost the soft skill critical thinking and sharing learning material and thus a form of assistance can increase motivation and enhance the skill to solve problems [42]. Furthermore, as described by Berking and Gallagher (2013), LMSs also allow personalisation, which might enhance motivation as well. As described in Section 1.1, engagement indicates a positive experience during the use of a system. This means that motivation can be enhanced by engaging the user, for example through the use of quizzes, assessments or other tools. The functionality to apply structure can help students with their planning, or information management. More complex system allow for succession planning, which might help as well.

So how can Self-Regulated Learning and soft skills be enhanced? According to Zimmerman and Campillo (2003), peers and teachers should be initially used to show how to apply self-regulatory techniques and provide students with feedback.

In conclusion, many soft skills can be enhanced by the already existing functionalities that Learning Management Systems have to offer. The literature research, as well as the survey and interviews can provide more insights or ideas regarding this topic, which will help answering the sub-questions that can be found in Section 1.1.
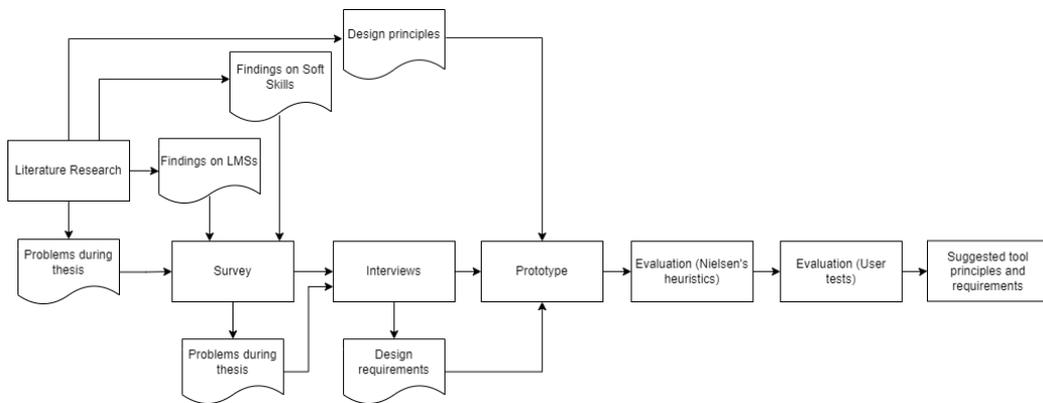
Figure 5. *Overview of the research steps*

5 Methodology and Results of the Survey

This Section elaborates upon the methodology and results of the survey. The survey design, analysis and results are described respectively. First, a general overview of the research is described.

5.1 The general research design

This research started off with a literature research. This was an extensive research, from which the findings have served as a starting point for the creation of a survey. In Figure 5, the entire design of this research is depicted. As can be seen, the literature research has been used as a base for the survey, interviews and prototype. The survey has in turn had effect on the questions that were created for the interviews, which has lead to design requirements according to participants. These have been used to create the prototype. Eventually, after evaluating the prototype, this research resulted in a suggestion for a tool, mainly stating the design principles and requirements that were found during this research.

The design of the research is further elaborated upon, starting with the survey design in Section 5.3. The results of the survey are analyzed, after which interviews are conducted. It was originally planned to conduct a focus group after the survey, discussing requirements according to the participants. Even though a focus group would provide insight due to discussions between participants, this research method is not the right fit for this research.

5.1.1 Target Group

Since LMSs are mostly used by educational institutions and this research looks into the department of Information and Computing Sciences at Utrecht University, the target group consisted of students following a Master Program at the Faculty of Science at Utrecht University. This is convenience sampling, which is a type of non-probability sampling where people are sampled simply because they are convenient resources [76].

Students who participate must follow a Master Program at the department of Information and Computing Science at UU. By the general questions that are asked first in the survey, submitted answers that do not meet this requirement can be eliminated immediately. Furthermore, the interviews were conducted with participants who meet the requirements for this target group as well.

5.1.2 Interviews versus Focus Group

According to the literature, one advantage of a focus group is the feeling of engagement with the concerns of the participant, which is important to take into account [85]. A focus group is a group discussion in a comfortable setting, chaired by a moderator, with the main aim to facilitate a conversation between the group members and to encourage interaction [122]. However, since personal issues regarding one's master thesis process and their relationship with their supervisor are discussed amongst other things, participants might feel more at ease during an individual interview than a focus group.

5.2 Research method(s)

Learning Management Systems are mainly used by students and this target group should be heard, which is why their opinion is so relevant. The survey provided mainly qualitative and a little quantitative data to provide more in-depth insight into the matter. The questions asked during the interviews were based upon the results of the survey, simply to gain deeper knowledge on the wishes of the users. These provided qualitative data as well. They are thus conducted sequentially. This is called a mixed-method approach [59].

Mixed-method approaches provide more insight that goes beyond solely using quantitative or qualitative methods [28]. During this study, both of

these methods - qualitative and quantitative - are applied in a so-called *triangulation*. This means getting the bigger picture through more perspectives [106]. Triangulation is depicted in Figure 6, which has been created for this research based on figures created by Creswell and Clark (2017). As can be seen in Figure 6, the qualitative data of the survey is dominant, as capital letters indicate priority. An advantage of this approach is the possibility of one method having an effect on the other [44].

The findings were then analyzed and interpreted. Based on the conclusions drawn from both the literature review and the survey and interviews, a prototype was created. This prototype is created in Figma [45]. After this step, the prototype was reflected on and evaluated afterwards. A design review was performed using Nielsen's ten heuristics to reflect on the usability of the tool. Based on the results of this design review, a few changes were implemented in the design of the prototype and its functionality was evaluated. It is important to gain insight into the opinion users have about the functionality of the system. The usability of the system is not the main aim of the evaluation, as the prototype of the system is a mock-up of a tool within the Learning Management System Blackboard and not a working model of what it would exactly look like. The design of the reflection and evaluation are further elaborated on in Sections 8 and 9 respectively.

5.3   The Survey Design

The survey draft was first created in Google Forms, containing questions about the master thesis process, the supervisory, feedback and others. The questions regarding the supervisory process are based on a template by SurveyMonkey [127]. The main aim of this template is to find out whether managers within an organization are working effectively. Some of the questions that were used in this template have been edited and added to the survey to find out whether supervisors are working efficiently - according to students. When finalized, the survey was created in Qualtrics. The entire survey can be found in Appendix A.1.
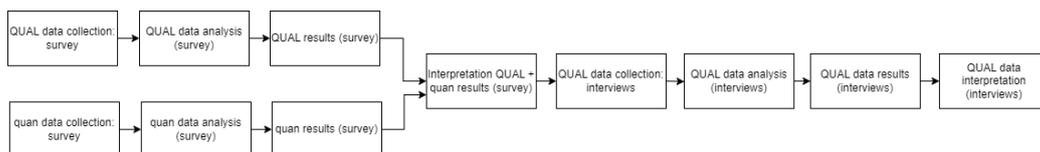

Figure 6. *Triangulation Design: overview method design, based on Creswell and Clark (2017) [28]*

The first section contained general questions about the participant's gender and Master Program. Because this research aims at obtaining data from graduates, it is important to ensure that participants are working on their thesis or have just graduated. Otherwise, their answers should be eliminated during the analysis. Therefore, questions were asked about the Master Program they are in and whether their mode is full-time or part-time.

The second section asked questions about the phase they are in, e.g. 'just started' or 'phase 1: working on my proposal'. It also contained questions about their research focus and methodology, if they had already decided on this. This gained insight into how supervisory and feedback, for example, might differ per phase or Master Program.

Section three was about the supervisory process. Not only the frequency of feedback, but also who takes initiative and what feedback is preferred were important here. Furthermore, questions were asked about possible circumstances that influence the outcome of one's thesis that participants might (have) experience(d), as were mentioned in Section 2.1 [3]. It was then questioned who students think would support them when each of these circumstances would hypothetically occur. This gained insight into what types of circumstances could possibly be prevented by expanding Learning Management System's functionalities.

Section four determined the perspectives participants have on Learning Management Systems and how they think it can provide support during their thesis writing. Questions on a Likert scale (1-5) were used to determine their satisfaction and open questions allow them to explain their opinion or ideas.

Finally, participants were asked for further suggestions or remarks and were able to leave their email addresses if they wanted to partake in the interviews that were conducted after the survey answers had been analyzed. It was once more explained that they are allowed to stop their participation even after having submitted their answer.

The survey was then sent out online, as this likely leads to more responses in a faster response time [61]. It was posted on a main Microsoft Teams page consisting of students who fit the requirements of the target group, who received an email from a member of the Utrecht University faculty containing a link to the survey as well.

5.4 Survey Analysis

As described in Section 5.2, the answers to the survey contains both qualitative and quantitative data. The qualitative data was analyzed through the use of themes by the use of a content analysis and both the quantitative and qualitative answers are described in the Section 5.5.

5.4.1 Content Analysis

A content analysis compresses text into categories based on specific rules. This means that the qualitative data that is obtained should first be transcribed before being analyzed. Before the text can be categorized, it is necessary to rule out every piece of irrelevant information. This is referred to as *data reduction* [81]. After having eliminated unnecessary text, remaining data can be divided into categories, or *themes*. This is called coding. Various types of coding exist, but emergent coding is used during this research. This is coding without any theory or model. Through this substantive type of coding, it becomes possible to analyze which concepts might relate to each other in the data that is gathered. In other words, what patterns or regularities become obvious when analyzing the data, which can be seen as thematic units [81].

5.5 Results Survey

The survey was filled in by 41 respondents according to Qualtrics. However, when analyzing the results, it turned out a few participants did not finish the survey. Even though unfinished answers can sometimes still be of value, this was not the case. Therefore, these unfinished answers were discarded. In other words, truly only 18 people finished the survey. Due to time limitations, the answers to the survey were considered sufficient and were analyzed. The analysis can be found in Appendix A.1.

The first few questions, as mentioned in Section 5.3, were more general and gave an overview of the types of master students that filled in the survey. Over half of the respondents identified as female. Furthermore, clearly the largest section of the respondents is enrolled in the master program Human Computer Interaction. Every respondent studies full-time. Most people have either recently finished writing their master thesis or are obtaining their data or writing about their results. The respondents spend between 20 - 30 hours per week on their thesis on average, alternating between 5 and 40 hours per week.

The second set of questions gave information about supervisory processes and feedback. Respondents reviewed their supervisory process with an average of 4.11 on a scale of 1-5. They filled in that they either receive weekly supervision or speak to their supervisor sometimes. Furthermore, more than half of the respondents state that both their supervisor and themselves initiate (asking for) feedback. According to them, the supervision they receive does improve their work (4.16/5) and they are generally quite satisfied with their supervisor (4.05/5). They did explain why they are (dis)satisfied with their supervisor, which is visualized in a bubble map in Figure 7.

Figure 7. *Bubble Map of the satisfaction on supervisors according to the respondents*

This bubble map depicts the reasons respondents gave for being satisfied with their supervisor (green) or dissatisfied with their supervisor (red). The size of the bubble represents how many times someone mentioned the same reason, which means *helpful feedback* or *expert in research area* were mentioned by many participants. Additionally, respondents have *frequent meetings* with their supervisor, receive *helpful input* and *compliments*. They

also mention that their supervisor *allows for creative input and ideas* from the respondents, which is received positively. However, *low effort or even no input* from the supervisor is also mentioned, as well as *too little guidance*, *no feedback on writing* and *slow response time*, which increases supervisory dissatisfaction.

Respondents state that their supervisor does help them plan their research (3/5) and helps them narrow or expand the scope of their research (3.58/5). Furthermore, 55.56% of the respondents state that they have received feedback from peers, but do actually prefer their supervisor's feedback. The reasons that are given are visualized in Figure 8. As can be seen in Figure 8, many respondents have mentioned they prefer feedback from their supervisor over peers, because supervisors have more *expertise*, give *more in-depth feedback* and will eventually be *the one grading their thesis*. However, they are *less focused upon grammar mistakes* and *give less constructive feedback than peers*.

The third and fourth sections showed promising results. As it turns out, students find that all circumstances that were mentioned in the survey could affect their thesis. The results to this question can be seen in Table 3.

Table 3. *What circumstances have an effect on students' theses?*

Circumstance	*Count*
Lack of interest in the subject	5
Lack of motivation	9
Difficulty finding materials	5
Shortage of funds: financial issues	1
Shortage of time	7
Fear to meet with your supervisor	2
Academic procrastination (perfectionism)	7
Disbelief in own abilities	12
Personal circumstances or issues (friends, family et cetera)	5
Fear of what's next (what does the future hold after graduating?)	10

They were asked as well to think about who or what could possible provide support when encountering such issues. According to participants, personal issues, such as *lack of motivation*, *fear to meet with your supervisor*, *academic procrastination (perfectionism)*, *disbelief in own abilities*, *personal circumstances or issues (friends, family et cetera)* and *fear of what's next (what does the future hold after graduating)* are more likely to be supported by peers. *Lack of interest in the subject*, *shortage of funds: financial issues* and *shortage of time* are more likely to be aided by one's supervisor or study advisor. A Learning Management System could most likely provide support,
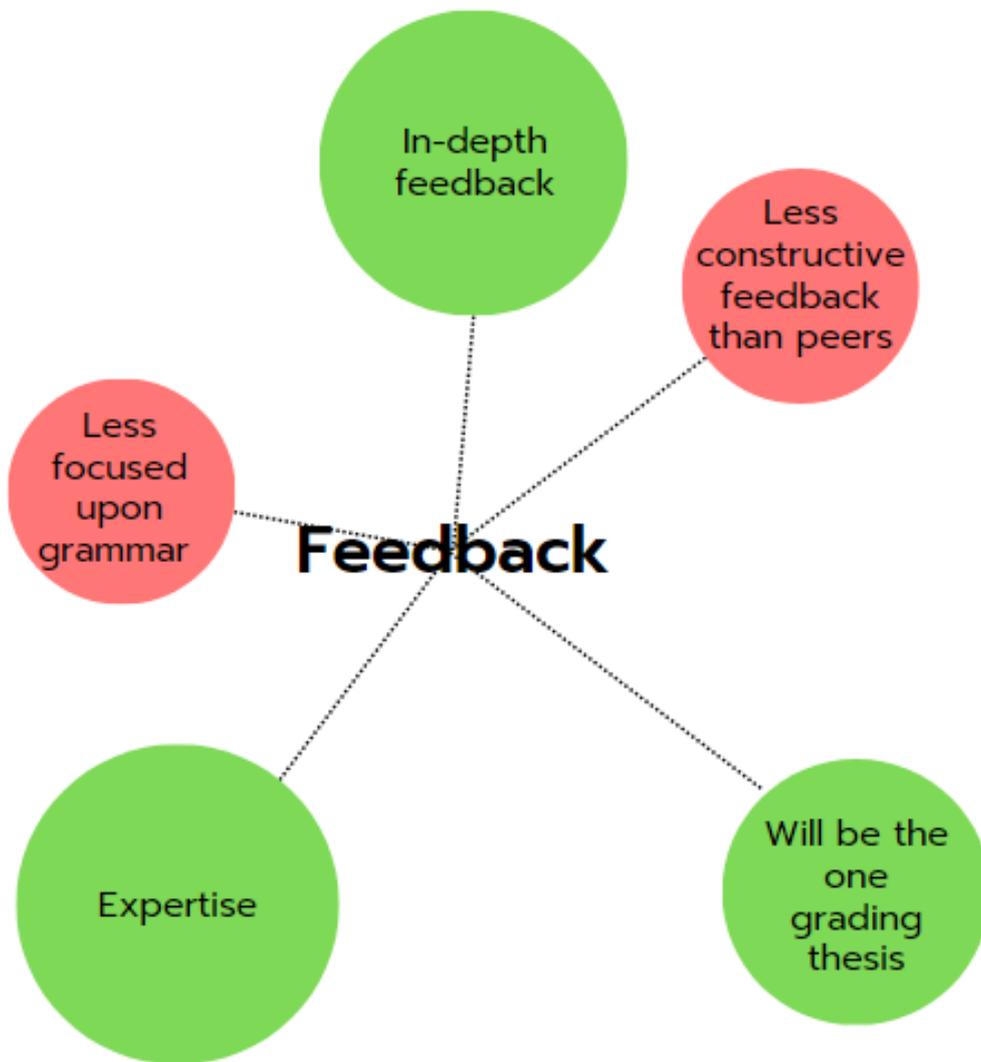
Figure 8. *Bubble Map of the satisfaction on supervisors' feedback according to the respondents*

according to the respondents, when one experiences *lack of motivation* or *difficulty finding materials*. This is in line with their own support ideas to these problems. A few ideas were mentioned by more participants, namely:

- Tips;

- Guidance;

- Resources;

- Planning tool;

- System prompts: encouraging feedback.

5.6 Interpretation Results Survey

Overall, the analysis of the answers to this survey has lead to the distinction between the following problems that were mentioned by participants:

- Planning;

- Lack of motivation;

- Insecurity.

This distinction corresponds to earlier mentioned issues that are common during the writing of a thesis, namely in the Section 1. Amongst others, issues with planning and bootstrapping one's thesis were mentioned as reasons why students struggle to finish their thesis in time. Therefore, the results from the analysis of the survey's answers are in line with the expectations.

Lack of motivation and insecurity are closely related. According to Heinström (2006), lowered motivation and insecurity lead to reduced receptivity [54]. This means less relevant information about certain tasks or subjects are acquired. Because many students experience this type of problem and they mentioned in the survey that they suppose an LMS could provide a solutions to these problems, many could possibly benefit from a tool in a Learning Management System that aids them overcome this. Therefore, the interviews will focus solely on students' motivation and insecurity regarding their master thesis.

Because the final section of the survey asked for further remarks and for participants to leave their email address if they were interested in partaking in the focus group as well, students who did this were contacted to find out whether they wanted to have an interview instead.

6 Methodology and Results of the Interviews

This Section describes the interview design, analysis and results.

6.1 Interview Design

As was described in Section 5.5, the three main issues that students encounter when writing a thesis that were found are planning, motivation and insecurity. Because motivation and insecurity are closely related and mentioned more often, the interview questions are based upon these two issues.

The interviews are recorded using the microphone app on an iPhone 14. Each participant was aware of this, because partaking in this research was only possible when the informed consent was signed. Participants were thus informed about being able to stop participating at any given time during the interview. Furthermore, if they felt uncomfortable, for example by being recorded, they were able to say so. Lastly, the form provided information about the manner in which their data was handled. This form can be found in Appendix A.2.1 as well as the questions of the interview in Appendix A.2.2.

The first two questions were a more general opening, to let the participant explain a little more about their research. Because already graduated participants were able to partake in this study as well, it was important to let them relive the time of their thesis project. Besides, this might have helped them remember their project and possible issues a little better. The other questions asked them about their motivation and insecurity during their master thesis. Furthermore, questions about preferred feedback on one side and received feedback on the other were asked. Additionally, question related to Self-Regulated Learning were asked. In Appendix A.2.2, it can be seen that a division is made between the questions at the top and the bottom. Questions at the top were asked to every single participant, whereas the questions at the bottom were only asked if necessary. These were follow-up questions, which are only asked when participants do not answer extensively to obtain more interesting data. In other words, the interview format was semi-structured, which allows for more freedom to ask questions when participants mention something interesting. The questions that are created function as a guideline more than a structured set.

The interview did not contain specific questions on adaptiveness of the

system. Mostly because this term is not generally known, but also because it is hard to imagine what such a system would look like or how it would function. This is why some questions were asked to gain information about participants' needs for such adaptiveness, such as the question *Why would you prefer a personalised manner of receiving feedback?* after having asked how participants would ideally like to receive their feedback.

6.2   Interview Analysis

Ten interviews were conducted, each taking about fifteen minutes. The recordings of the interviews were used to transcribe them. Then, the answers were analyzed through a content analysis, as described in Section 5.4.1. By coding answers that were given during the interviews, they were divided into categories. These categories have lead to the subjects of the most important aspects of the tool, which are described in Section 7.

6.3   Results Interviews

Ten interviews were held with students who belong to the target group. Because all of the participants had a Dutch nationality, it was chosen to conduct the interviews in Dutch. This allowed them to speak more freely and feel more at ease. Furthermore, since most participants follow the Human Computer Interaction master program, they were familiar and felt more at ease to share personal experiences. From these interviews, the following points deemed important.

6.3.1   Asking advice from fellow students

Many participants mentioned that they asked advice from fellow students before going to their supervisor, in case of insecurities. The insecurities that are experienced during the writing of a thesis are common:

- Many students are insecure about what is expected from them;

- Many students are insecure about the relationship with their supervisor;

- Many students are insecure about feedback they receive;

- Many students are insecure about the knowledge they have;

- Many students are insecure about how to apply said knowledge.

Especially regarding their knowledge levels and how to apply this knowledge when carrying out research, students tend to turn to their fellow students more easily than their supervisor.

6.3.2 Writing a thesis is an individual process

Many participants mentioned their thesis process is not only a project they are meant to finish on their own, but an individual (learning) process as well. This means it can be lonely at times. One participant even stated that they felt as if they were living a hermit lifestyle at times. Due to this feeling of loneliness, they were not feeling motivated. Another participant mentioned they were able to finish their master thesis partly because of their great support system: social contacts with friends, family and fellow students. A third participant declared that they felt as if their thesis became more bearable the more they got in contact with fellow students. They said fellow students are able to confirm whether you are doing well on your research and are able to provide you with a pep talk when one is needed.

6.3.3 Confirmation from fellow students

Not only did participants mention they look for confirmation from fellow students on their status: are they doing well? They also stated they are more motivated and enthusiastic to continue their research when fellow students give them compliments or constructive feedback once in a while. Furthermore, they look for confirmation on the fact their knowledge level is adequate. If their fellow students are unable to answer their questions, they feel secure enough to ask this same question to their supervisor.

6.3.4 Feedback should be encouraging

If students do feel secure enough to turn to their supervisor, they usually ask for feedback on either their writing or research methods, for example. During the interviews, it became clear this feedback should be encouraging. Some people are looking for more general feedback on their work, which confirms they are doing well. Others would like some more detailed feedback. The received feedback is not always perceived as probably intended, which leads to an increased sense of insecurity. For most participants, they would ideally receive feedback from their supervisor and discuss this face-to-face. Some participants were indifferent about meetings being online or face-to-face, whereas others were explicit about their preference for face-to-face contact with their supervisor.

6.3.5 Feedback from supervisor is preferred

However, even though supervisors and students are not always in line if it comes to feedback, students do prefer receiving feedback from their supervisor more than fellow students. According to them, this has to do with the fact that their supervisor will be grading their graduation project. Furthermore, students perceive their supervisor as an authority with expertise, in contrast to their fellow students. One participant even mentioned seeing their supervisor's feedback as 'sacred'. They stated they did not take advice from anyone other than their supervisor due to this reason.

6.3.6 Structured overviews of (learning) goals increase motivation

Many participants mentioned the creation of a general planning at the beginning of their thesis. However, not every participant is able to keep up with their own planning or actually uses it as intended. There were a few participants who mentioned being really structured themselves and feeling no need to get aided during this process. On the other hand, there were participants who did feel this need and explained that a more structured overview of their planning and to-do list would motivate them. For example, one participant mentioned that this naturally cuts up the entire project into smaller pieces, which makes it seem more doable. Another participant mentioned creating structured overviews would lead to less stress and feeling more at ease when finishing another task. Another participant also mentioned that it would help when feeling insecure. According to them, looking back at a structured overview with finished tasks and achieved goals not only motivates, but also helps decreasing the feeling of insecurity.

6.3.7 Guidelines are meant to guide

Guidelines can exist in many forms. Some participants stated they feel a need for a guideline on *how to write a thesis*, while others feel more need for general explanations on research methods, such as statistical analyses. Furthermore, one participant mentioned feeling a need for guidelines or tips on *how to overcome a writers block*. Not only is there a need for general guidelines on theses, but participants also mentioned being overloaded with information. According to them, information about the writing of a thesis can be found in many places, on different websites. They stated they want this information to be kept in one place, for example by providing URLs or other resources. Furthermore, one participants mentioned that information that is searched for and used to update one's knowledge level might not always be

academically approved. A tool that provides students with information that is, would solve this.

6.3.8 Adaptiveness

According to the analysis of the interviews, students do see the possible value of an adaptive or personalised tool. However, they do note this is not the most important aspect of such a tool. Additionally, they would rather receive better, more constructive feedback and have better relationships with their supervisor, in example.

6.4 Interpretation Results Interviews

According to students, confirmation increases their motivation and makes them feel more secure about their applied knowledge. Students tend to prefer feedback from supervisors. However, the expectations of supervisors and students are not always in line, even when it comes to feedback. For example, upon receiving feedback, not every section or chapter is provided with feedback. They then tend to believe in the saying *silence is consent*, even though this might not always be the case. As mentioned in Section 6.3.6, cutting up the graduation project into smaller pieces makes it seem more doable. This relates to one of the issues provided by SERC in Section 1, namely being unable to finish one's thesis in time. From the interviews, it can also be concluded that adaptiveness is not the most important feature of the tool. Participants would prefer more personalised feedback, instead of an adaptive tool. Consequently, this is not included in the design phase.

6.5 Reliability and Generalizability

This Section elaborates upon the reliability and the construct, as well as the external validity of this research.

6.5.1 Reliability

The study could be reproduced under the same conditions. Selecting samples of similar sizes from the same population could result in similar outcomes. This is based on the fact many participants mentioned the same ideas, points of issue and remarks. When conducting the same study under the same conditions, it is likely that similar results will be found, but it could also be the case that bigger sample sizes result in more varying results

or more in-depth perspectives.

The reliability of this research can be established in terms of the consistency of the measures. Part of the results that were provided are reliable, since enough participants were included during the interviews. However, as will be elaborated on in the Section 10, the survey is not reliable. Larger sample size results in a reduced sampling error, but simultaneously decreased rate of occurrence [129]. Often, a sample size of a hundred participants is minimally suggested. If enough are included, the differences as well as similarities become clear. However, if a researcher feels as if the obtained information is enough to learn from and/or build upon, sample size is not that important. Therefore, it can be concluded the sample size of the survey was not sufficient.

6.5.2   Generalizability

As this research results in a suggested prototype for a tool that tries to prevent issues found in the literature and mentioned in the surveys and during the interviews, it was important to focus on the user and their preferences. These findings allow the research question as mentioned in the Section 1 to be answered. Besides, using triangulation improves the validity of a research. Therefore, the construct validity of this research is high.

The results are generalizable beyond our samples. All participants were students who were writing their thesis or had recently finished, all part of a master program of the Department of Information and Computing Sciences. However, the fact that only students were used who make use of the Learning Management System Blackboard may lower the external validity. They might differ in attitude towards the LMS from people within the same population who are familiar with other LMSs. This might have resulted in different outcomes regarding the survey.

7   Prototype

The interviews gave many insights that were recognized from the literature review as well. The findings from the literature were used to make connections between the categories that arose from the analysis of the interview. Some citations were chosen to second these findings.

It was stated in the literature review that problems, such as loneliness and isolation, can cause students being unable to finish their research in time

and experience a lack of confidence and motivation. This is in line with statements made during the interviews. According to the literature, supervisors are not only supposed to guide students during the writing of their thesis, but during the preparation of their research as well. This guidance can be implemented within a Learning Management System, where the relationship between student and supervisor can be enhanced through certain functionalities. This is in line with the Learning Contract as used by UKM. Students' learning achievements are their own responsibility, but they should be able to receive guidance when needed. Participants mentioned that the relationship with one's supervisor is an important factor affecting the level of one's insecurity. When this relationship is suboptimal, students seem to be less motivated to conduct their research. A suboptimal relationship with one's supervisor not only leads to students being less motivated, it influences the chances of getting a good grade as well, according to participants. Additionally, this relationship has an effect on how students perceive the feedback they receive from their supervisor. This accounts not only for the relationship with one's supervisor, but motivational words and constructive feedback as well. When received feedback is indeed constructive and received as intended, students will be more likely to know what to do next. Participants mention that writing a thesis is a very individual project, during which they can feel lonely. This relates to what was found during literature research. Self-regulation and the relationship between student and supervisor are equally important. The literature stated that affiliation is seen as most important by students, which is in line with findings from the interviews.

A Learning Management System can thus support students to enhance the relationship between student and supervisor through various functionalities, which will be described in Section 7.2. Besides, an LMS can provide students with guidelines, tips and external links that are helpful to them.

7.1 Design Considerations

The following subsections of this Section will describe the design considerations, after which the design choices will be explained as well.

7.1.1 Affiliation

The feeling of affiliation can be enhanced by the type of relationship one has with their supervisor. Participants mentioned becoming more enthusiastic to conduct their research when in regular contact with fellow students. This has to do with motivating words and advice they receive from them.

It pleases to find out that they and other students are *in this together*. It was frequently mentioned by various participants that brainstorming with fellow students decreases insecurity and can even lead to increased motivation. Receiving motivational words can reduce the feeling of stress. Furthermore, participants stated that the phrasing of these words are important: sometimes words are actually positive, but are not received as well as other wordings. This accounts for feedback as well.

7.1.2 Feedback

Feedback perceptions are most important when the relationship with the supervisor is not optimal, which was found in the existing literature. For example, criticism is often perceived negatively, even though it can be intended as encouraging. One participant mentioned they received many critical notes regarding their writing style, even though they were already aware of the fact their academic writing skills were lacking. Whenever one receives criticism on things that were already discussed or they are aware of, feedback is more likely to be received negatively. Furthermore, it demotivates whenever a student receives feedback that is not constructive, even more when this has been discussed with the supervisor already. Negative feedback can increase one's insecurity, which is why it is important to discuss this with one's supervisor. Therefore, it is important to plan a meeting with one's supervisor to discuss 'how it is going', which regards mainly the supervision. Are both parties content? In example, one of the participants mentioned that they had a meeting with their supervisor to discuss the fact that they found the feedback they received from their supervisor too harsh and asked for more constructive comments. However, the supervisor did not adapt to the student's request, which was highly demotivating. Another participant mentioned the amount of feedback and attention all students who were writing their master thesis simultaneously differed greatly, which seemed unfair. They suggested more guidelines on the types and amount of feedback, provided by the university.

7.1.3 Guidelines

Besides issues with supervision, most problems experienced by students who are writing their master thesis could be prevented by guidelines, according to the literature. During the interviews, guidelines on various subjects were suggested by many participants. For example, one participant mentioned they would like to be able to rely on documents explaining how to write a thesis. Another participant said they would have liked a document

on statistical analyses during their master thesis. The main problem that is encountered by students during a master thesis is they are unaware of what is expected from them. A guideline one *How to write a master thesis* containing what is expected from students would solve this. This could be a general guideline per University, for example. Creating a goal to work towards, like what is expected from you, leads to less insecurity. Two participants mentioned feeling unmotivated and insecure because they were lacking clear goals. Furthermore, one of them stated that what is expected from you can be multi-interpretable, which makes it even harder to understand what goals to set for themselves. This leads to an increased feeling of insecurity. But not only guidelines were mentioned, some participants talked about documents containing *tips and tricks*. According to them, these help overcome certain insecurities. For example tips such as *How to overcome a writers block* or *How to conduct research method X*, to refresh one's memory.

One participant mentioned that guidelines would not have been the right solution during the problems they encountered, but strict guidance from their supervisor would have been. According to them, being able to ask for strict supervision would ensure better knowledge of what is expected of them by their supervisor and the university. Therefore, it would be helpful to discuss upfront with one's supervisor what is actually expected, besides being able to read a general guideline on writing a thesis. Being able to do this easily within an LMS could enhance the relationship between student and supervisor. This is in line with literature, as the issues that were described by SERC in Section 1 could be prevented when the research problem definition and first phases of writing are clear.

7.1.4 Setting (learning) goals

Writing a master thesis means students go through one AR cycle, which means they plan, act, observe and reflect. Goal-setting and planning are skills that can increase motivation. A Learning Management System can aid users to meet their goals and supervise their learning process. It provides them with content and can report their performance. This is in line with what was stated during the interviews. Discussing problems with fellow students is an important learning process. Moreover, creating a planning in accordance with one's supervisor can aid students to create certain (smaller) learning goals for themselves, which they can work towards. According to some participants, this motivates greatly. This accounts for a framework of one's thesis as well. Before starting one's research, it might be helpful to write down the chapters one wants to or has to include in their thesis. Regardless of whether one does

research and writes simultaneously or sequentially, this framework can be seen as an overview of what is still left to be done. One participant mentioned writing their thesis whilst doing research and being able to generally see what they still had to do because of this. Furthermore, self-observation is trivial to solve problems, because of recall and prior attempts to apply certain solutions. This relates to what was said by one participant during the interviews. They stated that having certain learning goals to rely on might have helped getting out of a rut, when they felt stuck during their research.

7.1.5 Motivation

This self-observation is part of the Self-Regulated Learning Theory, as discussed in Section 2.1.1. Participants mentioned during the interviews they felt too insecure to actually turn the competencies they have into skills, because they were generally too afraid to actually apply them without confirmation from either their supervisor and/or fellow students. The Zone of Proximal Development also indicates that students learn best with guidance of peer collaboration. Furthermore, students' motivation has great impact on the process of achieving their learning goals. Additionally, motivation is considered a soft skill, which is necessary to reach optimal personal development. But without motivation, the success of achieving actual learning is low. Besides, without motivation, one's problem-solving skills are not applied optimally. During the interviews, many statements were made about participants' motivation. For example, three of them stated they feel highly motivated only when they are nearing the end. Their motivation increased when they were able to see more clearly what the possible conclusion or end result would look like. But to develop and master soft skills, students are meant to possess qualities, such as perseverance, dedication, courage and commitment. Furthermore, participants mentioned feeling more motivated due to setting (learning) goals for themselves. Even though motivation can come in waves, for example by feeling stuck or being in a rut, an overview of such learning goals that one has set for themselves motivates and helps feeling less insecure, according to participants. Because writing a thesis is such an individual process, some tasks can take longer than expected, which demotivates. One participant explicitly said that, even though they expected this beforehand, doing research for your thesis does not mean making progress every day, or even every week.

During the literature research, it was found that UKM utilises a so-called Learning Contract. This requires students to plan, implement and

assess their own learning achievement. As was described in Section 3.1.3, this Learning Contract is based upon learning outcomes. Furthermore, UKM utilises SSDS, a soft skills system, which allows student to take credits for their own success, which helps decreasing the feeling of insecurity. This learning contract contributes to the Self-Regulated Learning Theory, as it encourages students to achieve their own learning goals. However, because a contract is always enclosed between at least two parties, there is another party - the supervisor, in this case - who is supposed to ensure an extra check on the student's work, before being able to successfully close a contract. This is a form of confirmation on the learning achievement of students.

These considerations have lead to the design of a prototype of a tool within the Learning Management System Blackboard.

7.2 Design choices

Literature research gave insight into stated requirements for a system by pioneers in providing support during thesis writing, namely: project management, discussions forums, exercises, resource websites, private correspondence files, a reflective journal and resource material databases. The interviews only confirmed what was found in the literature, which are described as the following design choices:

7.2.1 Project management

Project management is quite a broad term. Since writing a thesis is an individual project, the 'project management' is executed by the students themselves. They are in control of their own 'projects' - personal (learning) goals - and are supposed to manage how to achieve them by self-observing, self-reflecting and being self-aware. This has to do with the Self-Regulated Learning Theory. One way to ease this process is taking into account the Learning Contract as used by UKM and described in Section 3.1.3. In order to be able to do so, they should be able to set (learning) goals for themselves and keep track of their progress.

7.2.2 Discussion forums

Discussion forums can be used to enhance (online) interaction between students. Not only can fellow students provide advice, insights, fresh perspectives or motivation, teachers are able to interact with student via forums too. This tool should thus contain a discussion forum, since almost all par-

ticipants mentioned contact with and advice from fellow students is helpful during the writing of a thesis.

7.2.3   Exercises

Another requirement for such a system is the provision of exercises. As it became clear that not every student enjoys conducting research or feels as if their knowledge level is adequate, this tool should provide students with the opportunity to find explanations or helpful videos or workshops to become less insecure about their abilities. The requirement indicates the system should have in-built exercises to increase their knowledge and skill level. However, this tool is not meant to gain knowledge of certain subjects and practice these skills, but merely to support students who are in need of help by focusing on issues that relate to their soft skills. For this reason, actual in-built exercises are not provided. Resources on how to conduct certain research methods, for example, are.

7.2.4   Resource websites and material databases

A system should provide options for people who need help, for example if they are unaware who to contact in certain situations. Students should therefore also be provided with the possibility to get in contact with study advisors, their supervisor, fellow students or other people with expertise in the field. Their contact information should be available, or it should at least be clear who to reach and more importantly: how. Besides contact information, there should be guidelines that could help students when they are feeling lost.

In other words, the 'exercises' and 'resource websites and material databases' all contribute to the same goal: helping students when they are feeling lost by providing external material or resources to help them get back on track.

7.2.5   Private correspondence files

As was stated by one participant, it might feel overwhelming to share your entire thesis or parts of it with all students who would make use of such a tool. Therefore, it should contain the option of keeping things private, or sharing documents or other files with certain people. Because participants mentioned that having a smaller group to discuss problems with and ask feedback from was experienced as very helpful, the tool should offer the opportunity to divide students in groups, where they can share personal

problems, documents or ask advice.

Besides, the system should allow students to get in contact with their supervisor if this is wished for. If not, they should not have to.

7.2.6 Reflective journal

A reflective journal is closely related to the 'project management' design. As students are meant to self-reflect and evaluate upon this, there should be an opportunity available to do so. This can be used privately by the students themselves, for example by answering questions about *how it is going*, but also in collaboration with one's supervisor. This refers to the Learning Contract as well. Even though writing a thesis is an individual project, it is important to set learning goals in accordance with one's supervisor and try to achieve these. Receiving confirmation or constructive feedback helps to self-reflect on the process, but one's work as well. Furthermore, such confirmation contributes to the Learning Contract between student and supervisor. Because as was found during the literature research, peers and teachers showing how to apply self-regulatory techniques and provide feedback helps students learn to apply this knowledge themselves. This enhances one's motivation and decreases their insecurity.

7.2.7 Already existing functionality

Learning Management Systems already contain features, such as to-do lists, presentation areas, bookmarking, note-taking and e-portfolios, which all enhance Self-Regulated Learning. These are related to time management, goal-setting and self-monitoring. Furthermore, LMSs possess functionalities, such as interaction, tracking, record keeping, personalisation and administration, which are important for this tool. The Section 7.3 elaborates upon the design of the prototype itself.

7.3 Design

This Section elaborates upon the design of the tool. This tool is called *Mastering your Thesis*. To create a clear image of the tool, the design will be described as a scenario. This will be a walkthrough through every screen.
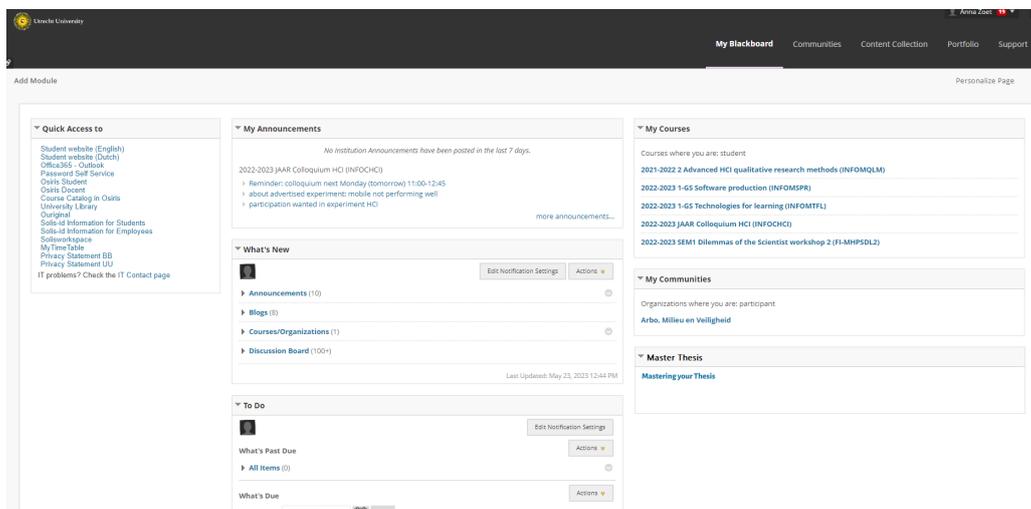
Figure 9. *Blackboard Homepage including Tool*

7.3.1 Walkthrough of the Design

When opening Blackboard, you will see the screen, as depicted in Figure 9. If you want to open the tool, because you are in need of some support during your thesis, you can click on the link to the tool at the bottom right of the screen. By clicking on [Mastering your Thesis], the screen in Figure 24 opens, when using the tool for the first time. Because it is an extension on Blackboard, the interface of the tool was designed in the same style. To simplify the visualizations of the tool, the tool shows only the body of the website, which means Blackboard's official header has been ommitted in the screenshots.

One of the advantages of this tool is being able to become part of a group, which is in line with the *administration* functionality as described in Section 7.2.7. On the starting page of the tool, you can see a textual overview of the main features of the tool, together with a link to join a group. When clicking on this link [Would you like to be grouped with fellow master thesis-writing students?], you are referred to the page depicted in Figure 25. This page provides a short explanation on the focus of such a group and allows you to become part through the button [Become part of a group]. This action only has to be performed once, unless you choose to unsubscribe from your group. This can be done at any given moment. You will then be offered the option to become part of a group again.

When clicking on [Become part of a group], the page in Figure 10 opens. The menu on the right of this page allows you to navigate through the different pages of the tool and is visualized on every page. This page helps you
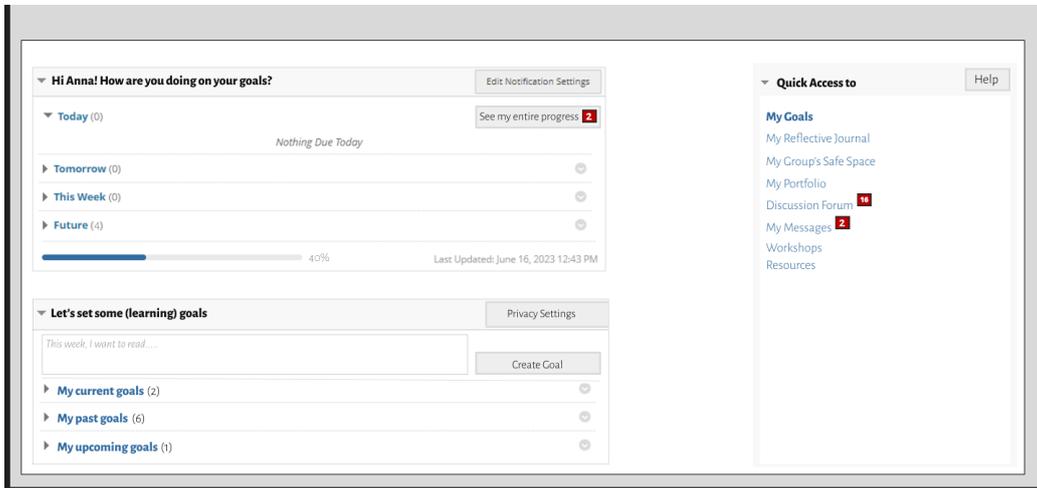
**Figure 10.** *My Goals Page of the Tool*
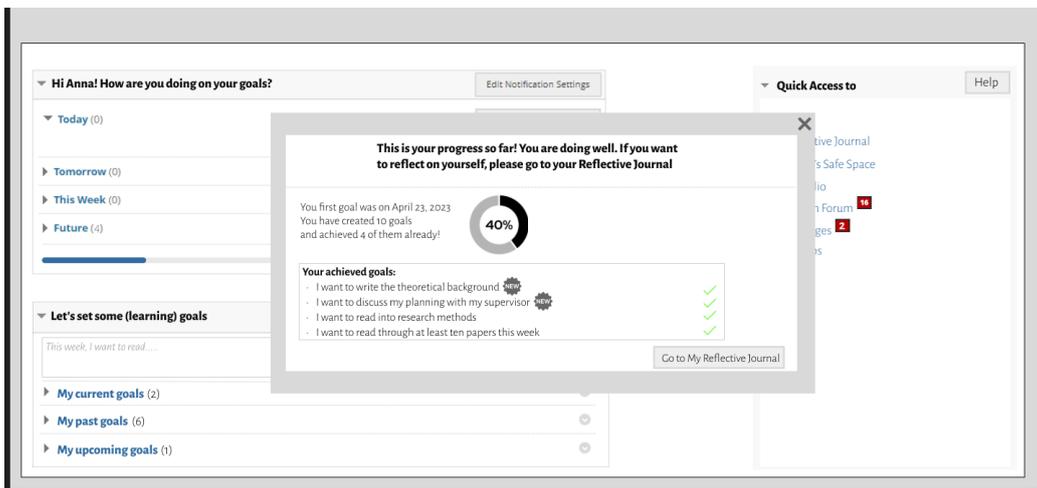
**Figure 11.** *My Goals page's Progress of the Tool*
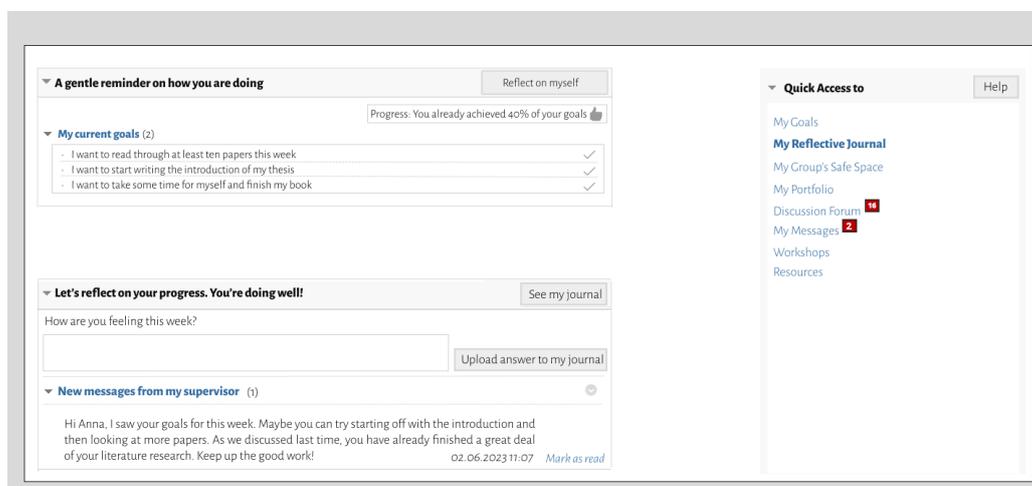
Figure 12. *My Reflective Journal page of the Tool*

create goals and see your progress. As became clear from the interviews, students are sometimes unable to see the ultimate goal of their project. By dividing their workload into smaller, more doable pieces - by setting goals - their motivation increases and their project seems to become more feasible. One of the requirements of systems providing support during thesis writing is project management. As described in Section 7.2.1, students are responsible for their own 'project management'. By managing their own progress, they can enhance their performance by achieving their own goals. Therefore, this page gives them an overview of the goals they set for themselves. Besides, you are able to create new goals at the bottom of the page.

On this page, in Figure 10, you are able to see your progress as well, by clicking on [See my entire progress]. The pop-up in Figure 11 opens, which allows you to see the overview of everything you have achieved so far. Seeing an overview motivates students, according to the interviews. Besides, it helps feeling less insecure at times, because you are reminded of what you have already done, instead of what is still yet to come. This is in line with the already existing functionality *tracking* as mentioned in Section 7.2.7. The pop-up can be closed, but you can also go through to your Reflective Journal by clicking on the button [Go to My Reflective Journal].

Your Reflective Journal helps you with self-awareness, self-observation, but mainly self-reflection. It is closely related to the Self-Regulated Learning Theory and has to do with project management and the reflective journal as described in Sections 7.2.1 and 7.2.6 respectively. To enhance Self-Regulated

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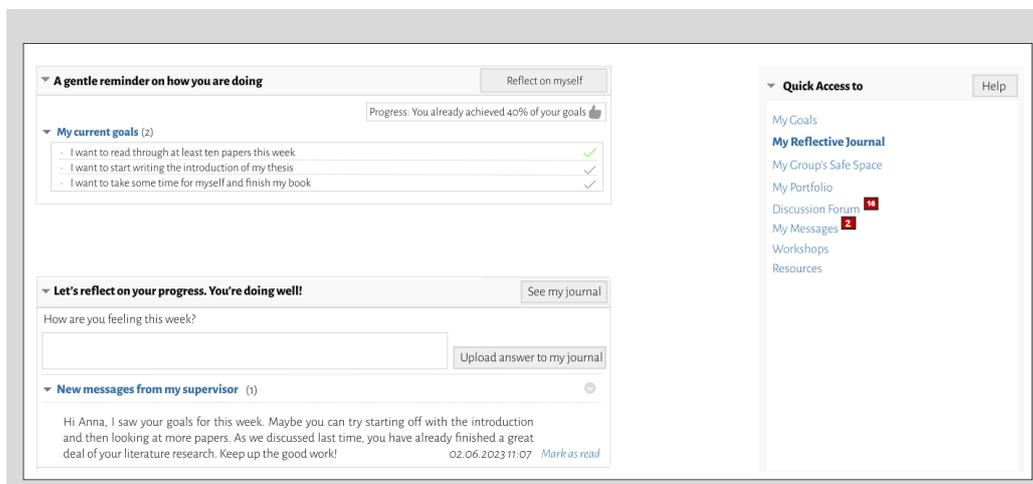
Figure 13. *My Reflective Journal page of the Tool including checkbox*

Learning, students are meant to reflect on their performances. This is implemented by setting goals and then reflecting on them. As can be seen in Figure 12, this page talks directly to you and shows you your progress. You are able to see your current goals and which of them you have achieved - see the green check box in Figure 13. At the bottom of the page, you are able to upload thoughts, feelings or other things to your Journal. By clicking on [See my journal], you can see what you have written. Figure 14 shows what this looks like. Through the button [Back to reflective journal] of via the menu, you can go back to your Reflective Journal.

As you can see, it is possible to set notification and privacy settings per page. Per types of message, you are able to change the notification settings. Furthermore, you are in control of who can see the items you upload or posts you create. If you want your group or supervisor to be able to see them and maybe help you reflect on them, this can be set in the privacy settings of a page. When allowing your supervisor to see what you have written in your journal or which goals you have set, you can ensure they are able to provide feedback or support you. For example, as shown at the bottom of Figure 12, you can see your supervisor has sent you a message providing constructive feedback on the next steps you are supposed to take. Literature showed that students learn how to apply self-regulatory techniques and provide feedback when supervisors indicate how to do this first. The fact that supervisors can be able to access student's goals or journal and help them reflect on it enhances motivation and decreases insecurity. This is in line with the Learning Contract, as achieving goals and learning is a student's responsibility, but
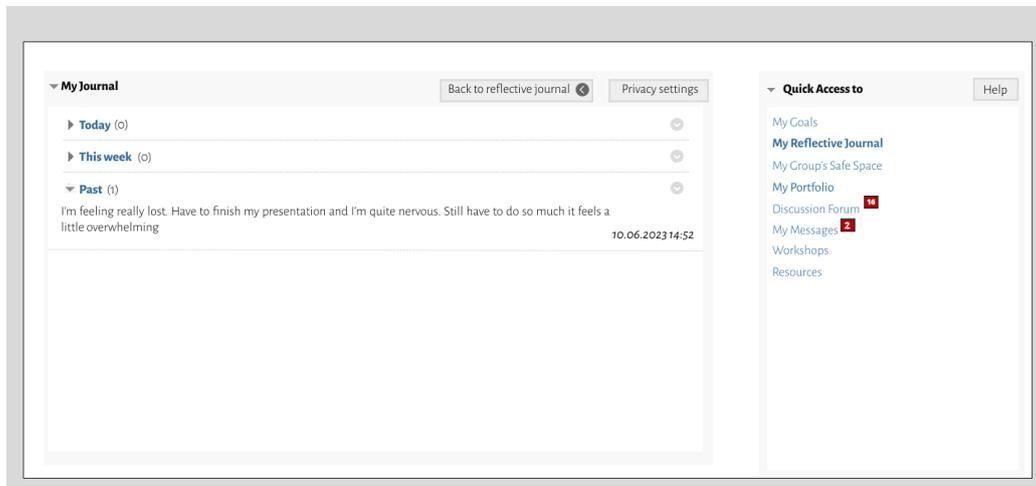
Figure 14. *My Journal page of the Tool*

can be achieved by student and supervisor working together. The message from your supervisor is merely shown here, which you can [mark as read]. All messages are listed on the page My Messages.

Furthermore, you can reflect on how you are feeling on your Reflective Journal page. At the top of the screen, you can see the button [Reflect on myself], which leads to the pop-up as shown in Figure 15. A simple question is asked, on which either [Yes], [No], [A little] and [I am not sure] can be answered. Depending on your choice, the system provides you with a pre-programmed answer that aims at motivating you, as well as reminding you to self-reflect. Sometimes it is hard to self-reflect on what you have already achieved, which is why the tool can help remind you. For example, when the answer [No] is chosen, to which the system reacts with the answer given in Figure 16. As can be seen, the tool refers you to your Group. You can reach your group by clicking on [Go to My Group's Safe Space] or via the menu.

Your Group's Safe Space is designed for your group only. When becoming part of a group, you are simply placed within a small group. According to the results from the interviews, these groups are not supposed to have too many members, because it is easier to discuss personal things with a smaller group. However, it is not necessary to know the members of your group: these can be assigned randomly. As can be seen in Figure 17, the top of the screen is solely an overview of your group. Here, you can change the name of your group by clicking on [Give your group a name] and unsubscribe from the group at any given time through [Unsubscribe from group]. The

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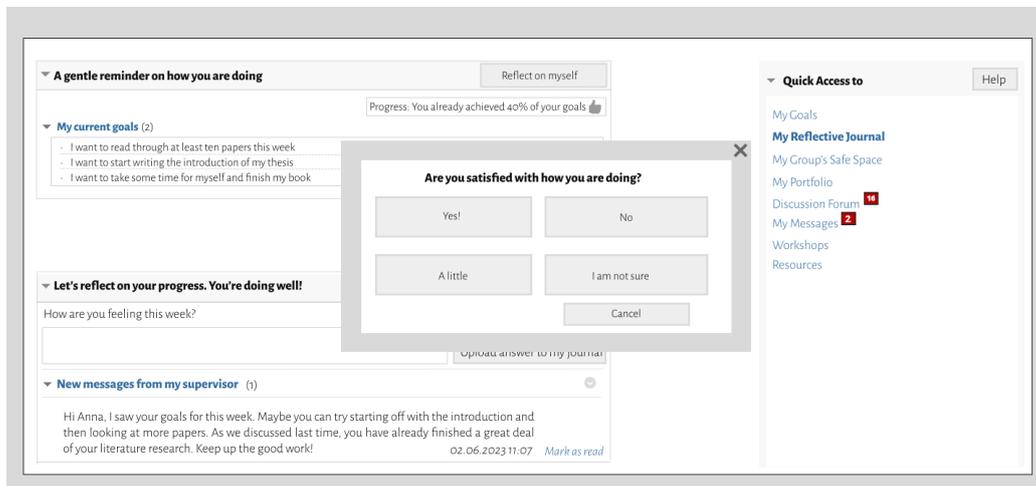
**Figure 15.** *Reflective Journal page Pop-up of the Tool*
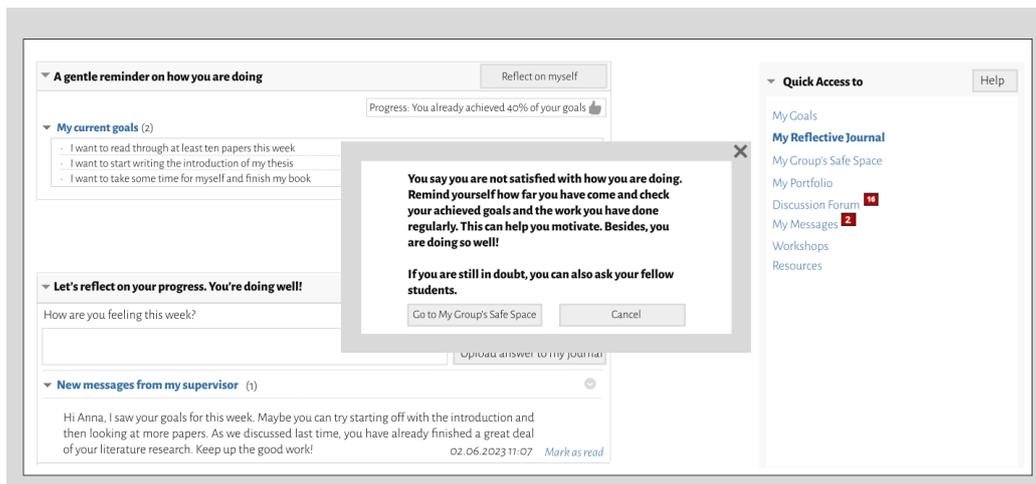
Figure 16. *Reflective Journal page Pop-up 2 of the Tool*

71
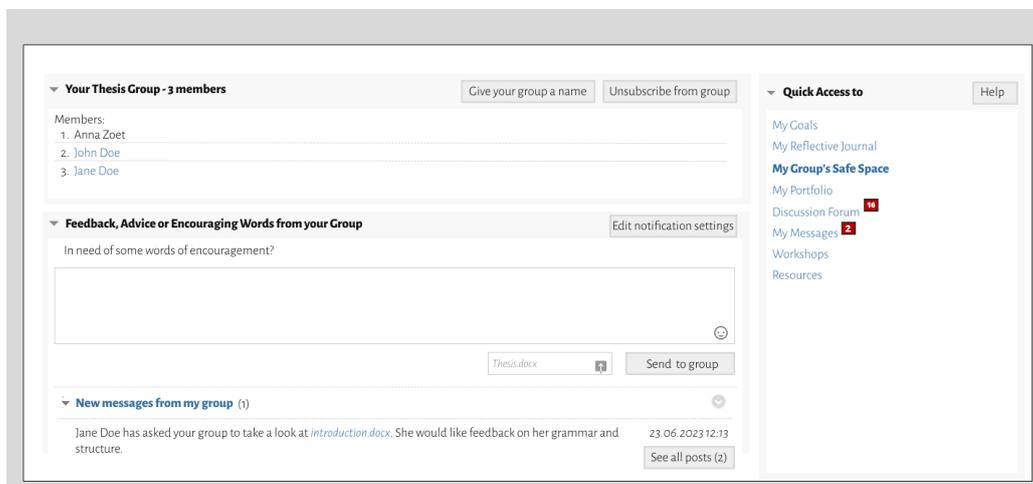
Figure 17. *Group page of the Tool*

names of your group members are shown in blue, which implies their name is clickable. By clicking on one of your group members, you can send them a personal message, as depicted in Figure 18. Furthermore, the bottom part of the Group page is more focused on the actual support. Here, you can ask for encouragement or feedback, for example. You are able to simply ask your group how they are doing, but also upload documents if you would like them to take a look at it and provide feedback. New messages from the group are shown on this page, as well as on the My Messages page. As can be seen in Figure 17, Jane Doe has asked your group to take a look at her introduction.

When navigating at My Portfolio through the menu, you can see the documents that have been shared with you as well. This page, as depicted in Figure 19, is a personal environment, which allows privacy settings too. As mentioned in Section 7.2.7, LMSs possess the functionality to keep records, as well as an e-portfolio feature. You can choose to upload documents for yourself - a cloud storage - or share them with your group or supervisor, for example. This is in line with the requirement of the tool as described in Section 7.2.5. By discussing issues or self-doubt with a group or supervisor, insecurity could be decreased, according to the results of the interviews. As *private correspondence files* is a requirement for an ICT system that provides support during thesis writing, this is combined with the wishes as found during the interviews. Uploading documents to the tool, having everything related to your thesis in one place and being able to ask for feedback on those documents, can enhance performance and thesis quality, but also decrease insecurity. It is, however, important to note again you are able to keep all
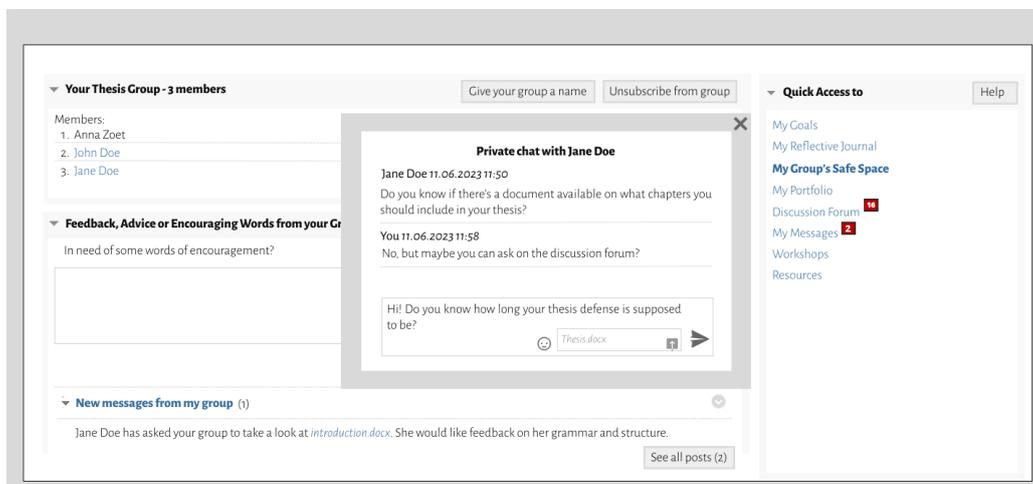
Figure 18. *Group page Chat of the Tool*

documents private, which would mean only you are able to access them.

Besides being able to share your uploaded documents with your group or supervisor, you can also ask questions to all of your fellow master thesis writing students on the Discussion Forum, as depicted in Figure 20. On this page, you can see the posts that have been created at the top of the screen. By clicking on [See all posts], you are lead to the screen in Figure 21. You can answer in general, or decide to react on a specific question. If you want to react on the question asked by Jane Doe, for example, you can reply by clicking on the arrow on the right. Through the button [Back to forum], you go back to the discussion forum in Figure 20. Here, you can quickly send a message to the entire forum as well, but you can also see all your previous posts. Being able to discuss with your group, supervisor and fellow students is in line with the functionality of Learning Management Systems *interaction* as mentioned in Section 7.2.7.

This interaction is applied on the My Messages page of the tool as well. This page is shown in Figure 22. All messages that are sent to you are shown here. You can see which messages are new and through the button [See all messages], you can search through all messages that have been sent to you. At the bottom of the page, you can send a message to someone. By searching for their name, you can type in a message and send this to them. When they reply, their message will be listed underneath the new ones, as well as in the list of all messages.
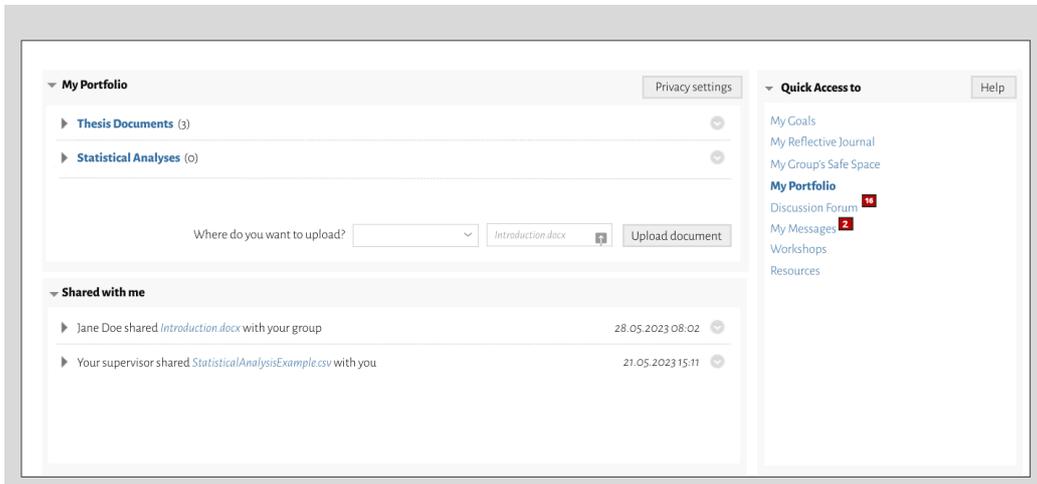
Figure 19. *Portfolio page of the Tool*
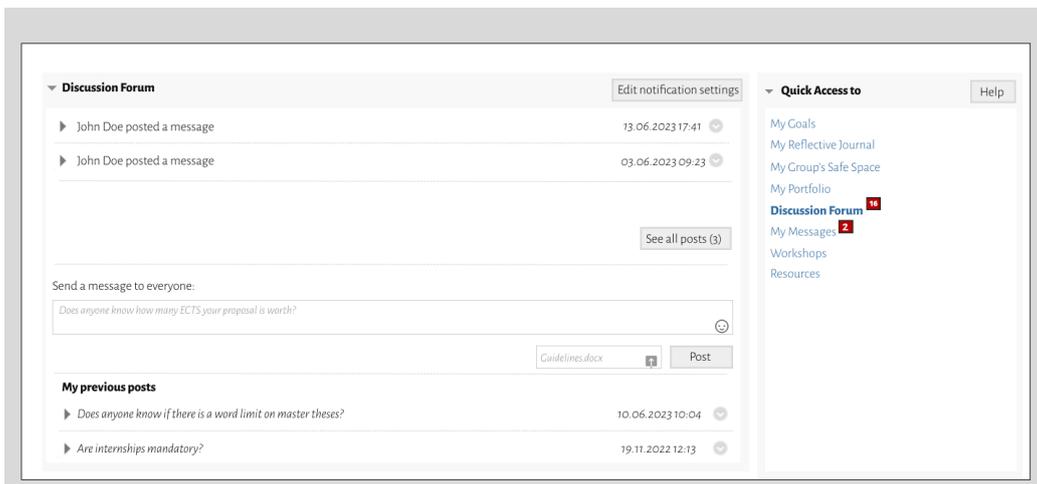
**Figure 20.** *Discussion Forum of the Tool*
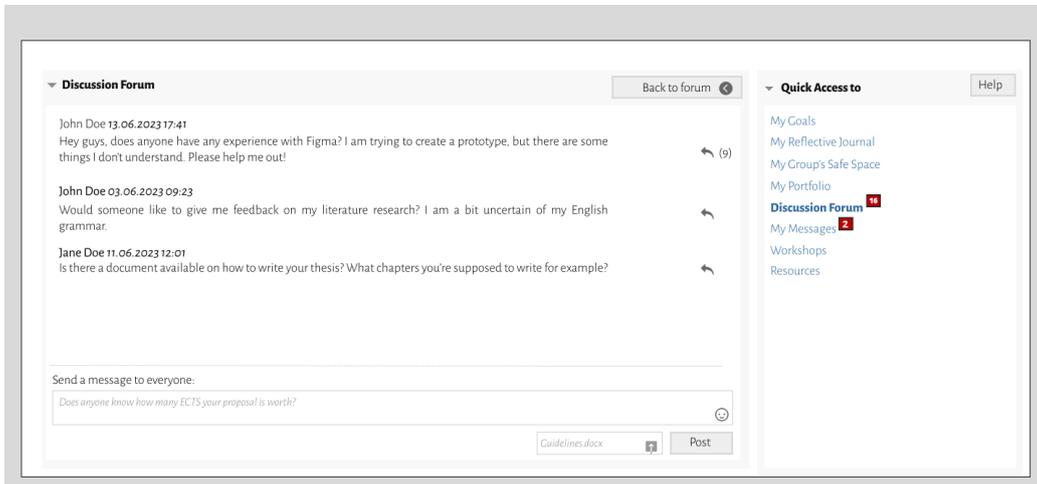
**Figure 21.** *Discussion Forum of the Tool - All Posts*
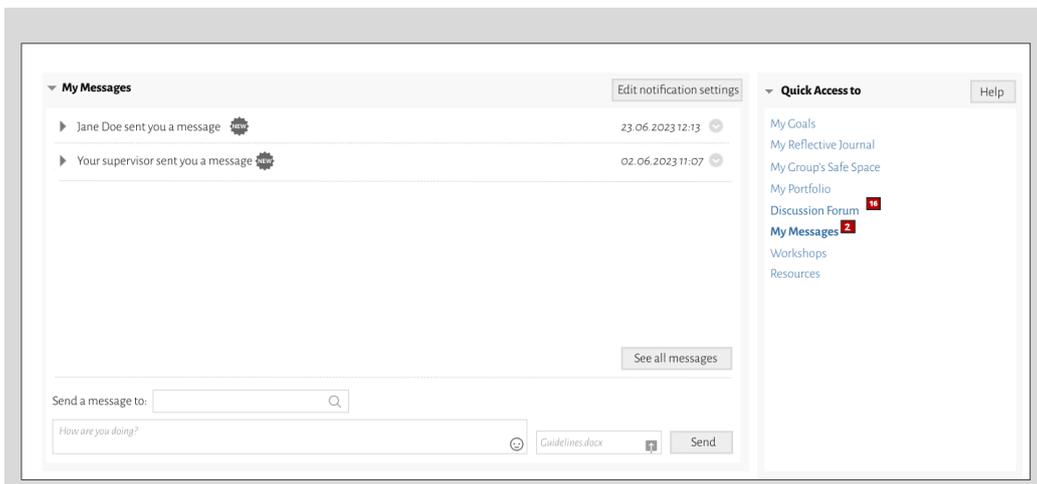
Figure 22. *Messages page of the Tool*

The last two pages of the tool are closely related. As was mentioned in Section 7.2.4, one of the design choices was to integrate *resource websites and material databases*. Participants mentioned during the interviews that they are sometimes feeling lost due to lacking guidelines. These can be provided through external websites or material databases. Therefore, the tool provides you with a page on Resources as well as a page on Workshops. In Figure 39, you can see various posts on different external links. For example, if you are looking for a workshop on Academic Writing, you can find an external link which leads you to the page on which you can enroll in this workshop. You are also able to search for specific workshops at the top of the screen. This is in line with the *exercises* as mentioned in Section 7.2.3. Even though these exercises are not in-built, the tool supports students by providing links to workshops or exercises that might help them.

The Resources page is closely related to this, as the interface is similar. Figure 40 shows you guidelines, tips and contact information. On this page, you could find guidelines on *How to write a thesis*, for example, as this was frequently mentioned during the interviews.

On every page of the tool, you can find the button [Help] at the top of the menu. Frequently Asked Questions (FAQs) can be found here, as well as a short explanation of the tool.

8 Reflection on the Usability of the Tool

According to Nielsen (1994), user interfaces that are inspected by evaluators through a set of methods is referred to as *usability inspection*. By the use of these methods, problems with the usability of the interface are found, which are then marked with a severity. Based upon the severity of these problems, they are tackled by coming up with possible solutions and applying these. Then, it is important to reflect again: it is an iterative process [93].

Usability inspection consists of various methods, such as a *heuristic evaluation*. This method makes use of usability principles, which are referred to as heuristics, to check for problems with a user interface [63]. These principles are no strict guidelines, but can be seen more as rules of thumb [92]. Another method is called a *design review*, which refers to an expert checking the system for usability issues. However, in practice this line can be blurry. In other words, sometimes it is referred to as an *expert review*, to indicate a more general heuristic evaluation [52].

As described in Section 1.1, a UCD allows an increase of usability. Its main focus is user satisfaction, which is also the goal of this reflection. Even though the main goal of this research is not to evaluate on the usability of the system, it is a helpful start for possible future research. Therefore, Nielsen's heuristics are used to obtain data about the usability design of the prototype. Nielsen's heuristics are ten principles to (Human Computer) interaction.

8.1 Nielsen's ten heuristics

The ten heuristics of Nielsen are [94]:

1. Visibility of system status;

2. Match between system and real world;

3. User control and freedom;

4. Consistency and standards;

5. Error prevention;

6. Recognition rather than recall;

7. Flexibility and efficiency of use;

8. Aesthetic and minimalist design;

9. Help users recognize, diagnose and recover from errors;

10. Help and documentation.

A design review was performed using Nielsen's heuristics. The results can be found in Section 8.2.

8.2 Reflection results

This Section elaborates upon the results of the heuristic evaluation of the tool *Mastering your Thesis*. The ten heuristics by Nielsen are described in separate subsections.

8.2.1 Visibility of system status

This heuristic is important, because it informs users about the system's status. For example, if the system is loading a page, it should be clear to the user. Because this tool is a low-fidelity prototype, the user is not informed about what the system is up to, because the tool is not functional yet. Additionally, when uploading documents, the system should inform the user about its status, which is not visible in the low-fidelity prototype. The system does inform the user about which page they are on, as shown in bold in the menu on the right side of the screen. The system also visualized how many new messages are available for the user.

8.2.2 Match between system and real world

A system should be clear to the user: the language that is used, icons and symbols and buttons should feel familiar. The tool makes use of Blackboard's existing interface, which means students are already familiar with the system. However, even though as explained in Section 3.1.1, Blackboard's interface is not preferred when compared to other Learning Management Systems. This means improvements could still be made and further research and evaluation of the system's match with the real world should be conducted. The tool does make use of symbols that are known, like the search icon on the Workshops page, depicted in Figure 39.

8.2.3 User control and freedom

Users make mistakes. They should be able to undo as well as redo them. There should be an 'emergency' available to them. The emergency in this case is implemented within Blackboard's header. Furthermore, users can switch from pages through the menu on the right. Besides, users are able to go 'back' through a simple button. Furthermore, students are able to set their own privacy and notification settings per kind of notification. They are also able to unsubscribe from their groups at any given moment, which gives them a lot of control.

8.2.4 Consistency and standards

Consistency throughout a system is an important principle, as users should not have to assume what different wordings or buttons mean. Because this tool makes use of Blackboard's existing interface, students are already familiar with its interface and do not have to make any assumptions.

8.2.5 Error prevention

Even though users make mistakes, it is even more important to help them prevent these from occurring instead of informing them about their errors. This is done within this tool by making sure the system uses buttons that are familiar to the user, for example. To be able to conclude whether the error prevention heuristic is applicable to this tool, user tests should be conducted. This will be discussed in Section 12.

8.2.6 Recognition rather than recall

Generally, users do not rely on recalling everything they do. In other words, the system should inform them by visualizing objects, actions and options. For example, the tool reminds users of their own current goals on the reflective journal page. This prevents them from having to go back to their goals, before reflecting on their own progress.

8.2.7 Flexibility and efficiency of use

This heuristic refers to accelerating the interaction between user and system. This tool does not comply with this principle yet. For example, the act of messaging one's group or supervisor could be eased by providing a button on the bottom right of the screen that leads directly to a pop-up of one's messages.

8.2.8 Aesthetic and minimalist design

Design should be minimalist to prevent information overload. Besides, every extra, unnecessary information item leads to a decreased visibility of the important items. Blackboard's interface is preferred less than Moodle's, because it turned out it was harder to understand. This, however, does not necessarily imply that Blackboard's interface design is not minimalist. Because Blackboard's interface design was used in the tool as well, more research should be done to determine whether the design is understandable, aesthetic and minimalist. Contributing to the minimalist design, the system shows collapsed messages or documents, if the user has not opened them themselves. This helps prevent information overload.

8.2.9 Help users recognize, diagnose and recover from errors

If users make mistakes, they should be clearly informed about the problem and possibly even be provided with a solution. This low-fidelity proto-

type is not functioning and therefore does not show any error messages yet. This should be researched using a high-fidelity prototype to find out whether users understand what problem occurred and more importantly what to do to overcome this.

8.2.10 Help and documentation

The system should be understandable without any guidance, in principle. However, if users do have any questions about the system, they should be able to find documentation about this. This can be found through [Help] in the menu on every page.

8.3 Findings of Reflection

In conclusion, the reflection on the tool is not extensive. Still, this was not the aim of this research. The tool has some interface designs that meet the requirements of Nielsen's heuristics, but is still in need of more usability research. Based upon the requirements that were not met yet, a few changes have been implemented in the design of the interface of the prototype. Then, an evaluation of the functionality of the tool was performed. This is described in Section 9.

9 Evaluation

This Section describes the evaluation with users that has been done. Five people have partaken in the user tests that were conducted. The findings are elaborated in this Section.

9.1 Evaluation Design

The evaluation of the system is done moderated and in-person. User testing is a way to evaluate the system by obtaining large amounts of qualitative data from participants. Participants are questioned about certain tasks and functionalities. Together with the evaluator, they go through these functionalities and reflect on this. The participants are chosen through convenience sampling, as only participants who are familiar with writing a thesis can partake in the study.

The participants must be graduates who are familiar with possible issues of writing a thesis, for example because they have written or are cur-

rently writing their master thesis. It is not necessarily important they possess knowledge of supportive tools or certain functionalities, as this evaluation only determines whether the functionality is perceived as helpful.

Even though other evaluation methods, such as interface debugging, calls for more than five participants, the magic number for user tests is three to four [15]. According to Bevan et al. (2003), the requirement is to plan for five user tests, which allows room for error, like participants who do not show. Therefore, five people were asked to partake in the evaluation.

Before initiating the evaluation, they were given an informed consent. This can be found in Appendix A.4.1. Only after signing this form, they could participate in the evaluation.

They were asked to scale functionalities of the tool, on a Likert scale of 1 (low) - 5 (high) after performing tasks. The five participants were asked fourteen questions during the evaluation, which can be found in Appendix A.4.2.

9.2 Results Evaluation

Five participants have partaken in the evaluation of the tool. They each scaled the effect of the functionality on the design considerations as found by analyzing the transcriptions of the interviews. The Sections 9.2.1 until 9.2.5 are used to each describe the evaluation of one of the design considerations, namely affiliation, feedback, guidelines, setting (learning) goals and motivation.

9.2.1 Affiliation Functionality

Participants reacted positively to the questions about the functionality that could influence affiliation. According to them, these functionalities scored between the 3 and 5 points overall on a scale of 1-5, with some exceptions. One participant mentioned they would probably not feel more connected to fellow students because of the My Messages page. However, another participant scaled this question on a 4 out of 5, because it is easy to contact fellow students when you do not have their contact information to ask a quick question. Mainly the My Group's Safe Space is received really well, with an average of 4.20 on the functionality affiliation. Participants state that this group page helps overcome loneliness and can increase contact between fellow students. As was found during the interviews, students

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experience comfort when they know fellow students are in the same situation. This Group page can enhance that feeling of comfort and thus affiliation.

Furthermore, participants mainly feel that the My Messages page enhances the feeling of affiliation more towards fellow students than their supervisor. One participant rates this page higher (4/5) regarding their supervisor than their fellow students (1/5), because they would rather get in contact with fellow students through other social media platforms, like Whatsapp or Microsoft Teams. The idea of getting in contact with them is helpful and could enhance affiliation, though, according to them. Messaging your supervisor feels less intrusive than calling or emailing them. This enhances the affiliation with one's supervisor too.

The Discussion Forum is either well received or not. Three of the five participants rate the Discussion Forum a 3/5 regarding affiliation, whereas two participants scaled the page on 5/5. The main reason for these high rates is being able to gain many perspectives on questions you ask. It is also mentioned twice that reading questions from others you might have had yourself can be helpful. But in practice, experience has learned participants that discussions forums might not always be used as frequently as intended.

My Portfolio page is perceived useful too. Being able to upload all documents related to your thesis in one place sounds appealing, according to participants. They do mention they would probably not provide access to their supervisor, except for one participant who feels like this contributes to the affiliation.

9.2.2 Feedback Functionality

Mainly the Group page is perceived as very helpful when it comes to feedback. Because becoming part of a group is not mandatory, it is likely that students who are internally motivated decide to join such a group. Therefore, participants mention it feels less intrusive to ask for feedback or advice, because group members will probably do the same. Again, participants mention it is comforting to know fellow students are in the same situation, which makes it easier to ask for help or feedback. Participants rate the influence of the Group page on feedback a 3.8.

It is briefly mentioned that the Discussion Forum would be less helpful regarding feedback than the Group page. Sharing documents or problems with a bigger group of people is experienced as harder and feels less safe.

The effect of the Reflective Journal on feedback is widely distributed. One participant rates this a 1/5, because they do not believe this would be helpful in their case. They describe they generally do not experience much insecurity and this type of feedback would therefore not support them. On the other hand, two participants rate this effect an 5/5, due to feedback from their supervisor on their goals would ensure them spending more time deciding on their goals and therefore feel less insecure when their work is confirmed.

9.2.3 Guidelines Functionality

The functionality of guidelines and other provided information is rated quite similarly by all participants. Most of them are enthusiastic about the Resources page and mention it being helpful to have all useful information centralised in one place. One participant mentioned they find it important to know which guidelines are used by their University, which is not always clear when finding sources on the Internet. If guidelines are provided by a tool which is used by the University, students are ensured of the academic quality or the resources.

The Workshops page, on the other hand, is not received as well. Participants mention they would probably not use these kinds of workshops. Mainly because this costs much time, as well as energy. One participant does mention it might be interesting when other students could review these workshops. They even state this might lead to more enrollments, because students can then see whether these workshops have actually been helpful to fellow students in the past.

9.2.4 Goals Functionality

The effect of the Goals page on insecurity receives a rating of 3.2/5. Participants mention the button [See my entire progress] can help remind them to focus on the bigger picture instead of only on what is still left to do. It is, on the other hand, mentioned that the pre-programmed answers can be experienced more negatively than motivational words from one's supervisor would be, for example. Therefore, this participant rates this button on the Goals page a 2/5.

Furthermore, they would not give access to their supervisor, as it would only seem like an obligation to them to set goals and keep track of their

progress, instead of them learning from this process. However, one participant would give their supervisor access, as they mention it is then easier to have meetings with them, because the supervisor is then more up-to-date with what one is doing, have done and will be doing in the near future.

9.2.5   Motivation Functionality

The Journal page is not received well, namely 2/5. Four participants mention it being a waste of time to write down how they are feeling, only to be able to self-reflect on this. However, one participant mentions that it could be motivating to read back on what they have been doing and how they were feeling in the past few weeks. They do mention, on the other hand, that it can be demotivating whenever everything written in the journal is negative. For this same reason, all participants mention they would not give access to anyone, because uploading to their journal is a personal process. In other words, this personal self-reflection could either motivate or demotivate when used right, according to one participant.

Three participants mention the Reflective Journal page could be helpful for people, depending on how they approach their individual thesis project. For example, one participant does like to self-reflect on their past goals and achievements, whereas two participants really do not. They rate this functionality a 1/5 and 2/5 respectively, because reflecting on their goals seems like a waste of time to them. They do mention they can imagine it being helpful to people who do like to self-reflect or need help to become internally motivated, but this is dependable on the type of person who uses this functionality.

Again, the Group page scores high on this functionality. Participants rate this 4.1/5, as they repeat that it is comforting to know fellow students feel the same. To be able to talk to them in private - as is possible through the My Messages page - and ask for advice enhances the feeling of *togetherness*. Furthermore, on participant mentions it is easier to ask for feedback or advice in small groups and experience has learned them that people who are internally motivated to help students within this small group are more likely to provide constructive feedback. Due to the fact that subscribing to such a group is voluntary, the probability of students providing adequate level increases.

9.3 Conclusions Evaluation

The evaluation has provided insight into the effect of the functionalities of the tool on the design considerations found through the literature, survey and interviews. This has lead to conclusions about which functionalities do and which do not support students during the writing of their thesis.

First of all, the Group page is a helpful, supportive functionality when it comes to feedback, motivation and mainly affiliation. Participants can imagine the Reflective Journal being helpful as well, but mention this is dependent on the type of person who uses the tool. People who are internally motivated do not feel the need to self-reflect as much as students who are not. Besides, being able to see your progress feels a little surreal, as this confirmation is given by a tool instead of a real person.

Getting in contact with fellow students is more helpful via the Group page or private chats - My Messages - than the Discussion Forum. It is hard to share personal problems or ask questions to a bigger group of people who you might not know. Furthermore, participants mention that being able to get in contact with your supervisor via My Messages could be useful, but it is also possible to simply send them a message via Microsoft Teams. This accounts for fellow students as well, according to one participant.

Guidelines are perceived as really useful, mainly because the documents are provided in one place and ensure academic quality. This accounts for My Portfolio as well, as it is useful to be able to upload all documents related to your thesis in one place. Providing workshops is not perceived as useful. According to participants, this usefulness could be increased if students were able to review workshops on this page, as well.

10 Discussion and Limitations

This research was limited by a few factors. Firstly, the amount of respondents on the survey were less than expected. Forty-one participants answered the survey, but only eighteen actually finished answering. Due to time restrictions, it was chosen to continue using and analyzing the survey data available. This reduces the reliability of this research. After the survey, a focus group was going to be conducted. However, after having analyzed the results of the survey, it turned out many students experience insecurity during their thesis. Because of some answers that were given to questions in

the survey and findings from the literature research it seemed more suitable to conduct individual interviews than one focus group. This switch of research methods was quite last minute, but fortunately ten participants were eager to partake in this study.

Many problems are encountered during the writing of a thesis, according to literature. These problems have been used in the survey to determine which issues were experienced most by students. By analyzing the results, it became clear that most issues regarded planning, motivation and insecurity. Focusing upon motivation and insecurity, questions were asked during the interviews to determine what needs students felt to overcome these issues. There is also much literature to be found on Learning Management Systems and their functionality. The needs of students were combined with findings in the literature on functionality, which lead to the design considerations of the tool *Mastering your Thesis*. By evaluating the effect of these functionalities on the design considerations, it became clear which design functions do and do not help students who are experiencing issues during their thesis regarding motivation and insecurity.

Concluding from the evaluation, students would feel more affiliation with fellow students by becoming part of a group. This group should be a safe space, consisting of a few fellow students, where they can share feedback, advice or encouraging words. Not only affiliation is enhanced, asking for feedback would also feel less intrusive and could be done more frequently. Knowing fellow students are in the same situation as you are is comforting and can increase motivation. By receiving confirmation from fellow students, for example through encouraging feedback, students might feel less insecure.

Furthermore, being able to send messages to fellow students, supervisors or others - study advisors, for example - enhances affiliation as well. This does not necessarily account for the Discussion Forum. Because all students who use this tool have access to this discussion forum, it feels more general. It might not be used as intensively as the Group pages or My Messages, for example. Furthermore, students feel more hesitant to ask question to bigger groups of people.

The Portfolio can enhance affiliation as well, as documents can be shared with students' supervisors, for example. Besides, it is helpful to be able to keep all documents related to one's thesis in one centralised place. The fact that these documents can be accessed by one's supervisor - if the

student has provided access - is why affiliation is increased. However, providing access to one's goals or reflective journal is not wished for by students. This is a personal process, in which feedback from their supervisor would not motivate. Even though goals are a great way to self-reflect on what you already have done instead of what you still have to do, this is an individual reflection. Additionally, the Reflective Journal is not perceived as helpful if people generally do not self-reflect. Even though its value is realized, it can be concluded from the evaluation the reflective functionality is not for everyone.

This accounts for the Workshops page as well. If students were able to see reviews of other students who have followed these workshops in the past, it might be helpful. For now, it is not perceived as supportive. On the contrary, the Resources page deemed really helpful. Students' need for guidelines and a clear image of what is expected from them is met by this page.

The aim was to define a suggestion of a supportive tool on the Learning Management System Blackboard that aids students who are writing their master thesis by focusing on soft skill development. This tool can enhance motivation, decrease insecurity and help students with asking for and giving feedback through the creation of small groups. A Group's Safe Space allows students to interact with fellow students and overcome insecurities. Furthermore, this tool should guide students by providing general documents - guidelines - on how to approach certain tasks, such as the structure of their thesis or how to conduct research methods.

Besides, the feeling of affiliation is greatly enhanced through this tool. Students feel more in contact with their fellow students, mainly through these small groups. Being able to chat privately with students helps as well. The relationship between student and supervisor can also be improved, because it can be experienced as less intrusive to ask for help through this tool.

This tool, however, does not do necessarily well on the reflective functionalities. Having a structured overview of the goals is helpful for students, as this decreases the feeling of stress and might help see the bigger picture of what they have already achieved versus what they still need to do. But not every students prefers to self-reflect, which is a great part of the functionality of this tool.

11   Conclusion

This research started with the main question stated in Section 1.1. To be able to answer this question, a few subquestions were stated. Through extensive literature research, a few conclusions were drawn.

There is not one definition of soft skills, which means that many types exist. This means that no definite answer can be given to the question *which soft skills exist?*. However, many literary papers elaborate on the same types of soft skills, which can be associated with problems that students encounter during the writing of their thesis. The writing of one's thesis turned out to differ per faculty per university, according to literature. However, one common aspect is the fact that writing a thesis means going through one Action Research Cycle, which consists of planning, acting, observing and reflecting. Much of the literature states common issues: problems with bootstrapping one's thesis, information overload, problems with planning, perfectionism and a suboptimal relationship between student and supervisor. Furthermore, issues such as lack of motivation, disbelief in own abilities and fear of what's next were found in the literature. The soft skills in relation to students and education can be related to these problems. Together with Self-Regulated Learning, the enhancement of soft skills could lead to better outcomes for students who are writing their master thesis, through peers, teachers or technological advancements. Literature confirmed that Learning Management Systems already have functionalities that could enhance (the development of) soft skills, such as interaction, tracking, record keeping, personalisation and administration. Such functionalities could also teach students how to apply self-regulatory techniques and self-reflect. Confirmed by literature, it can be concluded that ICT could function as great support for thesis writing.

Because this research looked into the possible adaptiveness of a supportive system, this was taken into account during the literature review. Adaptive features do exist and LMSs can benefit from them. However, they are currently not often present in Learning Management Systems, let alone that all requirements are used. Learning Management Systems are underutilized, due to students experiencing too little personalised feedback, guidance of their supervisor and interaction with peers. Furthermore, their functionalities are hardly ever understood or used as intended. Even though many built-in features of Learning Management Systems could make up for the issues students experience. This is not the case yet.

The analysis of the responses to the survey gave insight in three types of problems that were mainly encountered by students, namely: planning, motivation and insecurity. These are either soft skills themselves, or closely related to one. During the interviews, questions were asked focusing upon motivation and insecurity. The answers participants provided gave insights into the needs they feel to overcome issues related to these subjects. According to the results of the interviews, the main needs comprised affiliation, feedback, goals, guidelines and motivation. Furthermore, the need for adaptiveness was looked into. However, students clearly stated this would be interesting to look at in the future, but most certainly should not prioritised.

In conclusion, the interviews have resulted in the main problems that students encounter during their thesis. The solution is a tool that is designed to support students who are experiencing problems regarding motivation or insecurity to enhance the development of their soft skills related to this issues during the writing of their master thesis. It is important that students are able to self-reflect, self-motivate and are self-aware. This enhances motivation, which leads to better performance regarding learning achievements, contributes to the development of soft skills and thus enhances the process of thesis writing. According to the results of the evaluation of the tool, it turns out that mainly affiliation and motivation are greatly enhanced through the provision of small groups where fellow students are able to interact. Furthermore, providing resources on guidelines and tips decreases insecurity and meets the needs of the student.

In contrast, the reflective functionality, as supported by the reflective aspects of the Self-Regulated Learning Theory and the Action Research cycle do not meet the students' needs. Students do not only think self-reflection can be a waste of time, but they also feel as if self-reflection does not necessarily help them. This accounts for the provided workshops as well; students do not necessarily see the value of this functionality.

Besides, adaptive functionality is wished for, but does not have any priority. Even though literature states the system could benefit from adaptiveness, this research has not looked further into this.

Additionally, the usability of the tool has been briefly reflected on using Nielsen's ten heuristics. Afterwards, a few changes were made to the prototype and an evaluation on the functionality was conducted. As this is only a mock-up of the tool, the functionality of the tool has not yet been

tested by users through actual task-based performances. Hence the reason why the proposed tool is not a final product and future research should be conducted.

12 Future Work

This proposal is a first step towards a functioning tool. There is still much work to be done regarding the design and development of the tool, but this research has formed a clear, fundamental proposal for a tool that guides students who feel insecure and/or unmotivated whilst writing their thesis. This is a first step to overcome problems related to motivation and insecurity that are encountered during the writing of a thesis and will possibly help many students in the future.

To ensure a working functionality that meets every requirements of its users, more evaluations on the functionality of the tool should be done. Especially since the evaluation of this proposed tool did not result in all student requirements being met. Evaluation is a iterative process, as was described in Section 9. Therefore, evaluations should take place from beginning to end. User tests and focus group considering alternative options should be conducted, which is an interesting point for future work.

As was stated in Section 8.2.5 on the tested usability of the tool, some heuristics were cumbersome to evaluate, due to the limited evaluations. Therefore, more evaluations should be conducted with the tool, such as task-based user tests and focus groups. Additionally, the tool should be evaluated on the requirements of an LMS as provided by the O.K.I., namely: high availability, usability, scalability, interoperability, stability and security.

If the tool has been evaluated thoroughly and changes in the design are implemented, it might be interesting to look into the possibility of using other Learning Management Systems. Besides, it became clear writing a thesis differs per faculty per university. The scope of this research was narrowed down by focusing solely on Blackboard at the Department of Information and Computing Sciences at the Faculty of Science at Utrecht University. However, future research should look into other faculties and universities.

Moreover, not only other universities should be taken into account, more data on issues experienced by students should be obtained. This might result in new insights regarding problems they encounter and could lead to

new design considerations.

Furthermore, the idea of an adaptive tool was not discarded by participants yet. It was duly noted adaptiveness did not have any priority within this research, but it would be valuable to look into its possibilities. Such a tool could benefit from adaptive techniques, especially the support of discussions or interaction between students and teachers. It is interesting to conduct further research in the adaptiveness of Learning Management Systems, so every type of student is able to use this. Besides, this tool might be applicable for other types of assignments or graduation projects in other fields of research.

If this tool can enhance the development of other types of soft skills to tackle issues that are experienced by people, taking into account other fields besides education, it could improve many individual processes. This is worth looking into as well.

Concluding, the foundation for tool created to help students overcome insecurity and increase their motivation has been set, but there is still future work to find more useful functionality and its suitable interface. However, this is a first step towards a more secure and motivated future for every individual master-thesis-writing journey.

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A Appendix

A.1 Survey

Hi (graduated) Master student!

Thank you for participating in my research. I write my Master thesis on the support that a Learning Management System could provide during the writing of a Master thesis, focusing upon a student's soft skills. Filling in this survey will take about 15 minutes. Your answers will be handled carefully and anonymously. Participation is voluntarily, which means you can stop at any given time if you want to.

I will make sure the answers are deleted when I have finished my Master thesis.

If you have any questions or comments, do not hesistate to contact me: a.zoet@students.uu.nl.

→

What is your gender?

- ○ Male
- ○ Female
- ○ Other
- ○ I prefer not to say

What Master Program are you enrolled in?

- ○ Applied Data Science
- ○ Artificial Intelligence
- ○ Business Informatics
- ○ Computing Science
- ○ Game and Media Technology
- ○ Human Computer Interaction
- ○ Science Education and Communication

What is the mode of your study?

- ○ Full-time
- ○ Part-time

What phase of your Master thesis are you currently in?

○ I am about to start

○ I just started: still trying to think of a research problem / topic

○ Phase 1 - working on my proposal

○ Phase 1 - started on my literature research

○ Phase 2 - obtaining data or carrying out studies

○ Phase 2 - analyzing my results

○ Phase 2 - mostly writing

○ I do not know

○ I have recently finished

What is your research question or research focus?

If you already know, can you briefly describe your research method(s)?

How much time do you spend on your thesis per week? (in hours)

Please use the slider to rate the following statement on a scale of 1-5.

Extremely bad	Somewhat bad	Neither good nor bad	Somewhat good	Extremely good
0	1	2	3	4	5

The supervisory I receive(d) is...

○————————————————————————————————

How often do/did you receive feedback from your supervisor?

○ Never

○ Hardly ever

○ Sometimes

○ Weekly

○ I have not had a meeting with my supervisor yet

Who takes initiative when it comes to feedback?

○ Me

○ My supervisor

○ We both take initiative

Please use the slider to rate the following statements on a scale of 1-5.

Strongly disagree 0	Somewhat disagree 1	Neither agree nor disagree 2	Somewhat agree 4	Strongly agree 5

The guidance I receive(d) improves/improved my work

○───────────────────────────────

I am satisfied with my supervisor

○───────────────────────────────

Can you explain why you are (dis)satisfied with your supervisor?

Please use the slider to rate the following statements on a scale of 1-5..

Never 0	Sometimes 1	About half the time 2 3	Most of the time 4	Always 5

My supervisor helps me to plan my research

○───────────────────────────────

My supervisor helps me to narrow/expand the scope of my research

○───────────────────────────────

Do/did your receive feedback from peers (fellow students/friends/family)?

- ⦿ Yes
- ◯ No

Do/did you prefer feedback from your peers or supervisor?

- ◯ My peers
- ◯ My supervisor
- ◯ Does/did not really matter

And why?

[   ]

These two last questions are hidden until the participant answers 'yes' to *Do/did you receive feedback from peers (fellow students/friends/family)?*

What kind of circumstances have effect on your thesis process? Please select all that apply.

- [ ] Lack of interest in the subject
- [ ] Lack of motivation
- [ ] Difficulty finding materials
- [ ] Shortage of funds; financial issues
- [ ] Shortage of time
- [ ] Fear to meet with your supervisor
- [ ] Academic procrastination (perfectionism)
- [ ] Disbelief in own abilities
- [ ] Personal circumstances or issues (friends, family et cetera)
- [ ] Fear of what's next (what does the future hold after graduating?)

Who or what do you think would support you in case of these circumstances?

	Who or what provides support?						
	Your supervisor	Your study advisor	A Learning Management System	My peers (friends, family et cetera)	No support	I do not know	Does not apply
Lack of interest in the subject	☐	☐	☐	☐	☐	☐	☐
Lack of motivation	☐	☐	☐	☐	☐	☐	☐
Difficulty finding materials	☐	☐	☐	☐	☐	☐	☐
Shortage of funds; financial issues	☐	☐	☐	☐	☐	☐	☐
Shortage of time	☐	☐	☐	☐	☐	☐	☐
Fear to meet with your supervisor	☐	☐	☐	☐	☐	☐	☐
Academic procrastination (perfectionism)	☐	☐	☐	☐	☐	☐	☐
Disbelief in own abilities	☐	☐	☐	☐	☐	☐	☐
Personal circumstances or issues (friends, family et cetera)	☐	☐	☐	☐	☐	☐	☐
Fear of what's next (what does the future hold after graduating?)	☐	☐	☐	☐	☐	☐	☐

I am researching whether Blackboard could provide a functionality especially made for Master students who are writing their thesis. This part of Blackboard would support them by focusing upon the development of their soft skills (e.g. planning). The following questions help me see the bigger picture of the needs of thesis writing students.

The following questions are about support on Blackboard during your thesis. This can be all kinds of support, such as help with planning, information management, academic writing, asking for/receiving feedback, interacting with peers/your supervisor.

How often would you say you use Blackboard?

- ○ Never
- ○ 1-5 times per week
- ○ 5-10 times per week
- ○ More than 10 times per week

Why do you use Blackboard? Please select all that apply.

- ☐ To communicate with my teacher / supervisor / peers, e.g. via discussion forums
- ☐ To access course material
- ☐ To submit assignments
- ☐ To view my grades
- ☐ Other

Please use the slider to rate the following statement on a scale of 1-5.

| Definitely not | Probably not | Might or might not | Probably yes | Definitely yes |
| 0 | 1 | 2 | 3 | 4 | 5 |

I would like to be able to use support on Blackboard during my thesis

If any, what kind(s) of support would you like when you experience *a lack of interest in your research subject*?

[ ]

If any, what kind(s) of support would you like when you experience *a lack of motivation* during your master thesis?

[ ]

If any, what kind(s) of support would you like when you experience *a difficulty findings materials* for your master thesis?

[ ]

If any, what kind(s) of support would you like when you experience *a shortage of funds / financial issues* during your master thesis?

[ ]

If any, what kind(s) of support would you like when you experience *a shortage of time* during your master thesis?

[ ]

If any, what kind(s) of support would you like when you experience *a fear to meet with your supervisor* during your master thesis?

If any, what kind(s) of support would you like when you experience *academic procrastination (perfectionism)* during your master thesis?

If any, what kind(s) of support would you like when you experience *a disbelief in your own abilities* during your master thesis?

If any, what kind(s) of support would you like when you experience *personal circumstances or issues* during your master thesis?

If any, what kind(s) of support would you like when you experience *a fear or what's next* during your master thesis?

Please use the slider to rate the following statement on a scale of 1-5.

| Definitely not
0 | Probably not
1 | Might or might not
2 | Probably yes
4 | Definitely yes
5 |

I would like to be able to check my own progress on Blackboard during my thesis

Please use the slider to rate the following statement on a scale of 1-5.

| Definitely not
0 | Probably not
1 | Might or might not
2 | Probably yes
4 | Definitely yes
5 |

Information that comes in handy when writing a thesis is currently missing from Blackboard (e.g. manuals about how to recruit participants or how to conduct a literature research.)

Do you have any further suggestions or remarks?

I will be conducting a focus group after the answers to this survey have been analysed. If you would like to partake in this study, please leave your email address:

I would once more like to address that you can quit your participation at any given point in time. Even after having submitted your answer.

A.2 Interviews

A.2.1 Informed Consent Interviews

Date: 24 May 2023

Research Participant Information Sheet

Study into a supportive tool on the development of soft skills during one's master thesis

UTRECHT UNIVERSITY

What is the purpose of this study?

This study will look into the possibility of a tool on a Learning Management System to aid students who are working on their master thesis by focusing upon their soft skills.

What will I do if I choose to be in this study?

I would like you to participate in an interview that will take about 15 minutes. Please answer truthfully.

What are the possible risks or discomforts?

My study contains no possible risks, but feeling discomfort is the last thing I want my participants to experience. If so, please feel free to tell me.

Will information about me or my participation be kept confidential?

Yes. I will record the interview, so I can make transcripts of them afterwards. However, I will make sure that all the information will be anonymised. Furthermore, all collected data will be deleted permanently after my research has been finished.

What are my rights if I take part in this study?

You have the right to prohibit me from recording the interview if you feel like your privacy would be neglected. If you feel this is the case, your participation will not be possible anymore. However, do note that everything I record will thus be anonymised and everything you share is safe with me.

Who can I contact if I have questions about the study?

If you have any further questions, please feel free to ask me in person or by email. My email address is a.toet@students.uu.nl

PLEASE SIGN HERE

A.2.2 Interview questions

- Are you currently working on your thesis?
- Could you try to explain to me what you are working on? And how it is going?
- Do you feel motivated during your research? Why do you think that is?
- What kind of insecurities do you encounter during your thesis?
- And what do you like to do at these moments? Who do you like to go to for support, for example?
- How do you think you could be support when you are feeling insecure about your thesis?
- Do you think it would help to have access to a tool which helps you to create (personal) learning goals and keep track of your progress?
- What do you do now to keep track of your own progress?

- How could feedback guidance ,manuals) or comunica on with peers contribute to overcome your insecuri.es?
- .f you were to receive feedback, how would you ideally like to see this?
- rom whom do you prefer to recei.e feed.ack? Think of your supervisor, fellow students, family friends et cetera Can you explain to me why?
- .magine that blacktoard would provide students with the possibility to ask for help. through feedback or some ...otivational words, for e.ample How and when would you make use of this? And when?
- How would mo..ational words contri.ute to your master thesis?
- What kind of mo...a..onal words would you like to hear?
- How do you impro.e skills you need during your research?
- .f .manuals would be accessicle, which sub,ects would you be interested in to i.nprove skills for your research?
- Would you like to receive personal support? Can you explain why?

A.3 Prototype

A.3.1 Suggested prototype interface
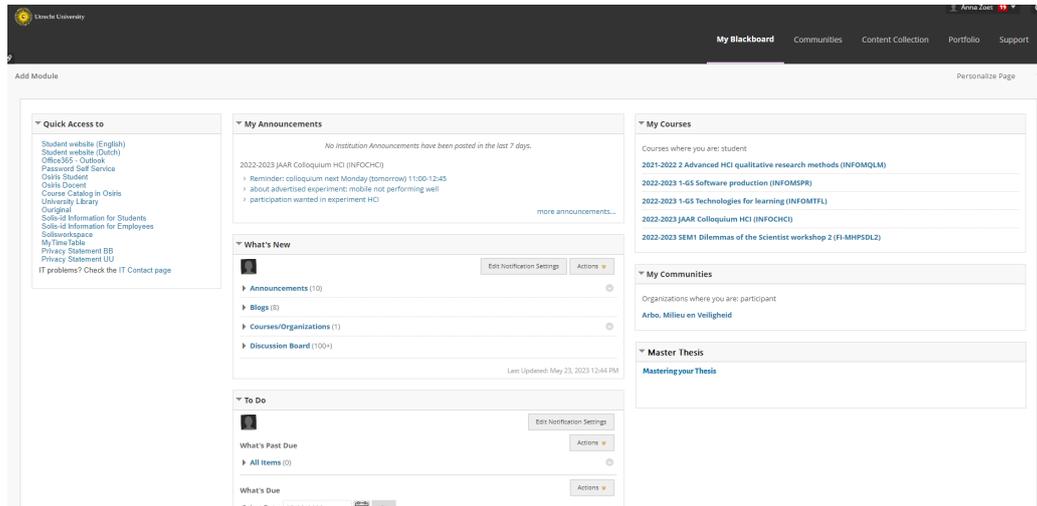
Figure 23. *Blackboard Homepage including Tool*
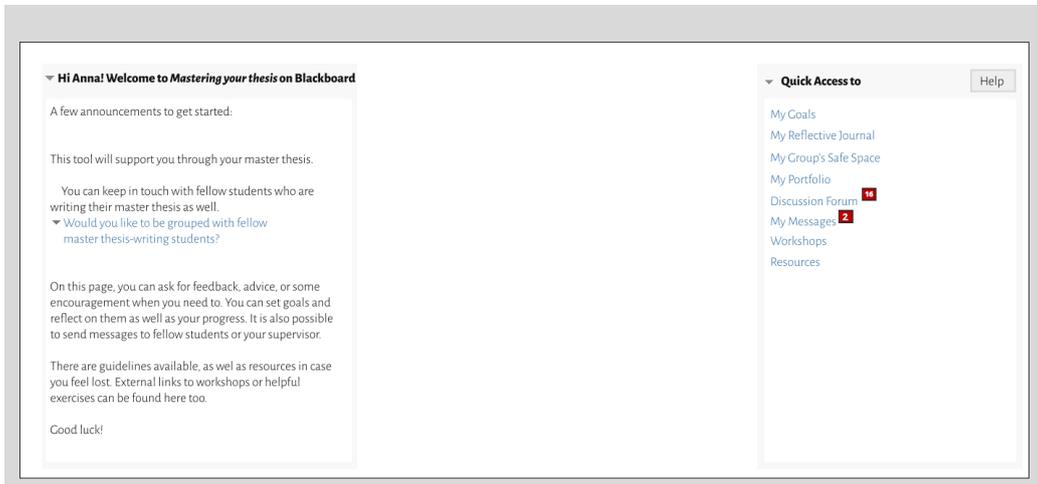
Figure 24. *Using the Tool for the first time*
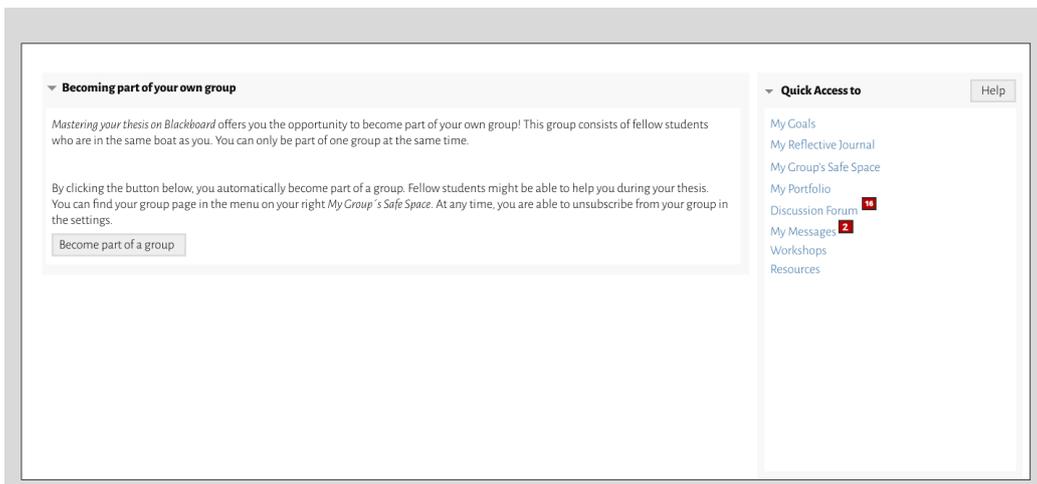
Figure 25. *Subscribing to a Group*

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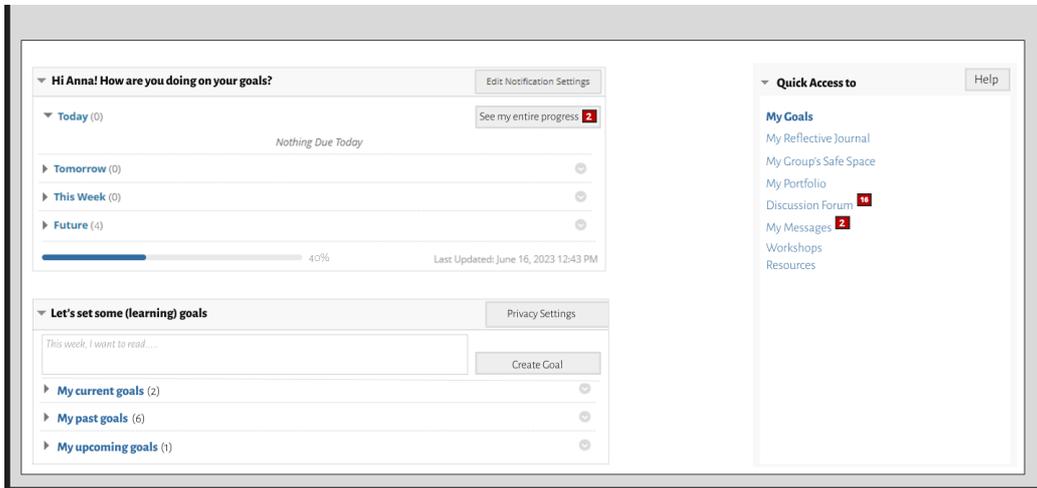
Figure 26. *My Goals page of the Tool*
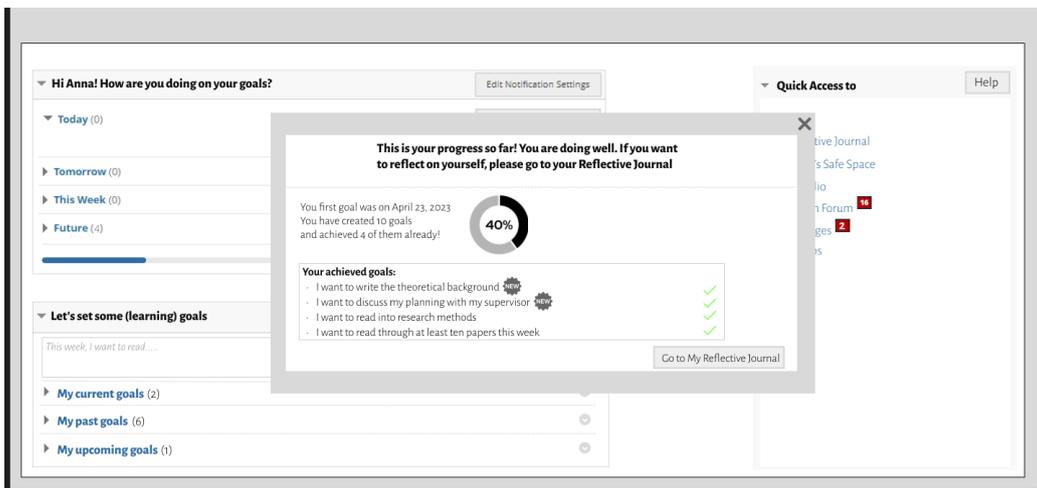
Figure 27. *My Goals page Progress of the Tool*
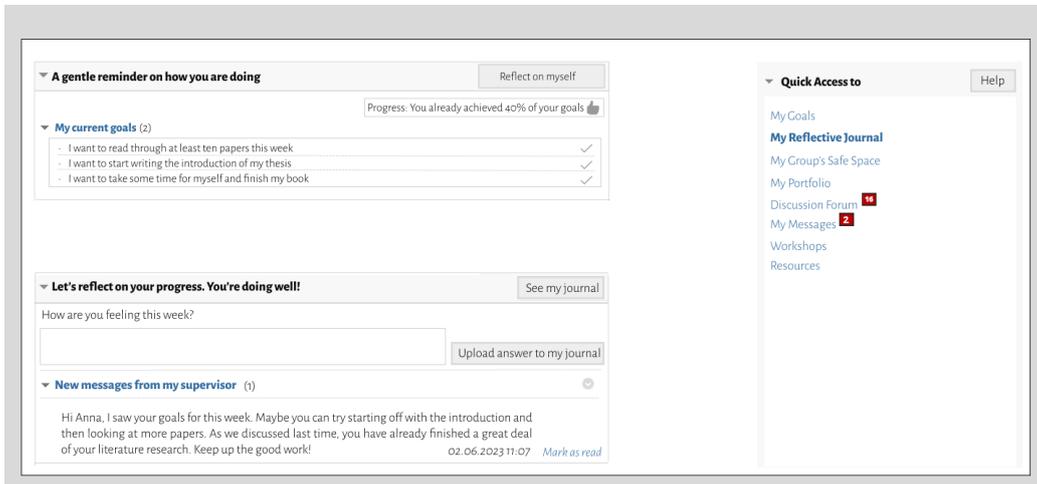
Figure 28. *Reflective Journal page of the Tool*
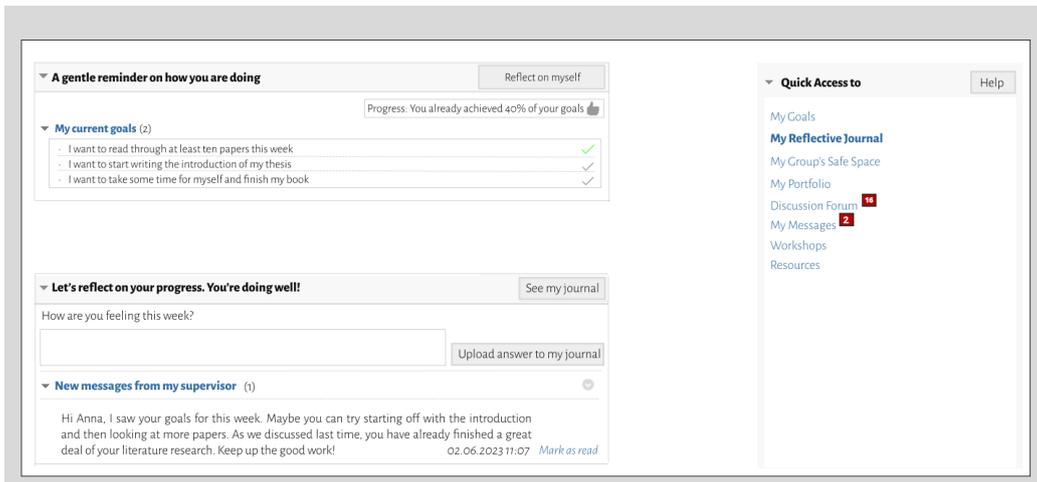


Figure 29. *Reflective Journal Check page of the Tool*
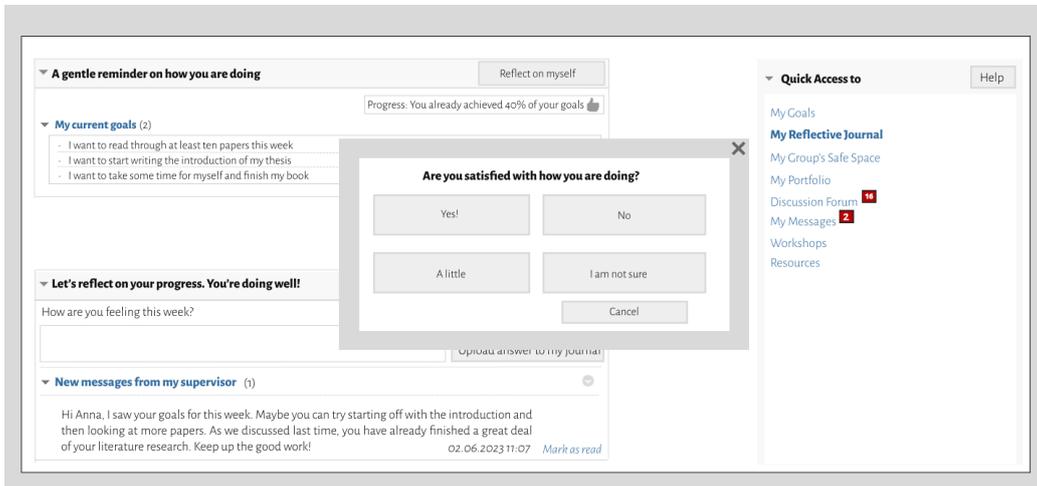
Figure 30. *Reflective Journal Pop-up page of the Tool*
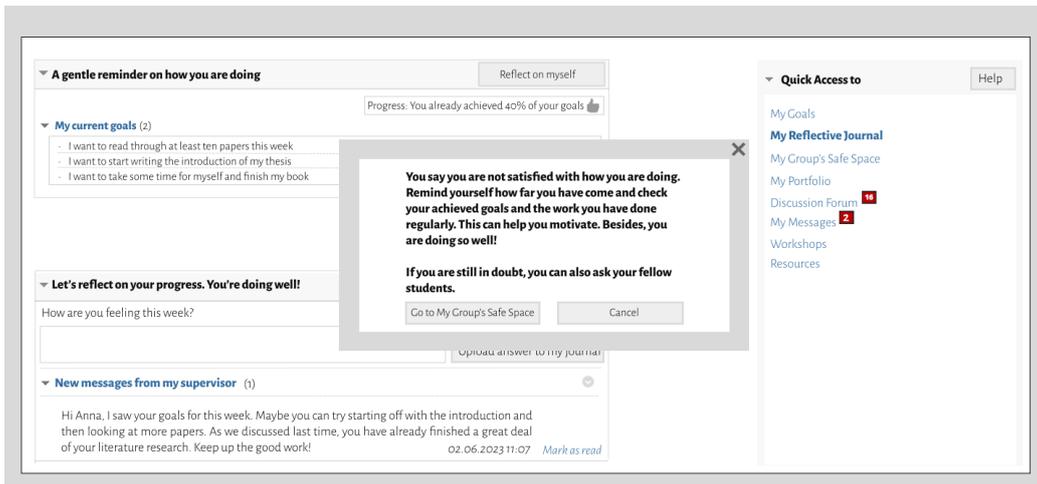
Figure 31. *Reflective Journal Pop-up page 2 of the Tool*

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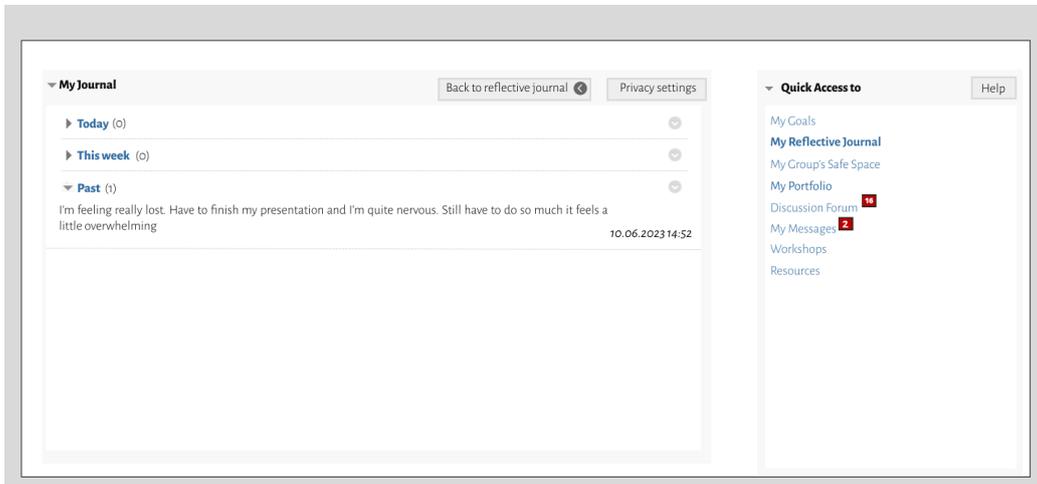
Figure 32. *My Journal page of the Tool*
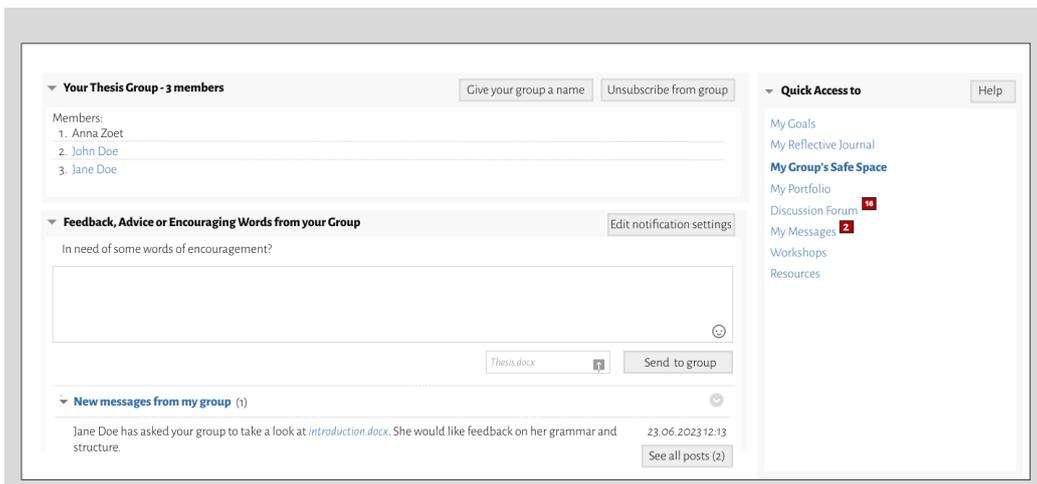
Figure 33. *Group page of the Tool*
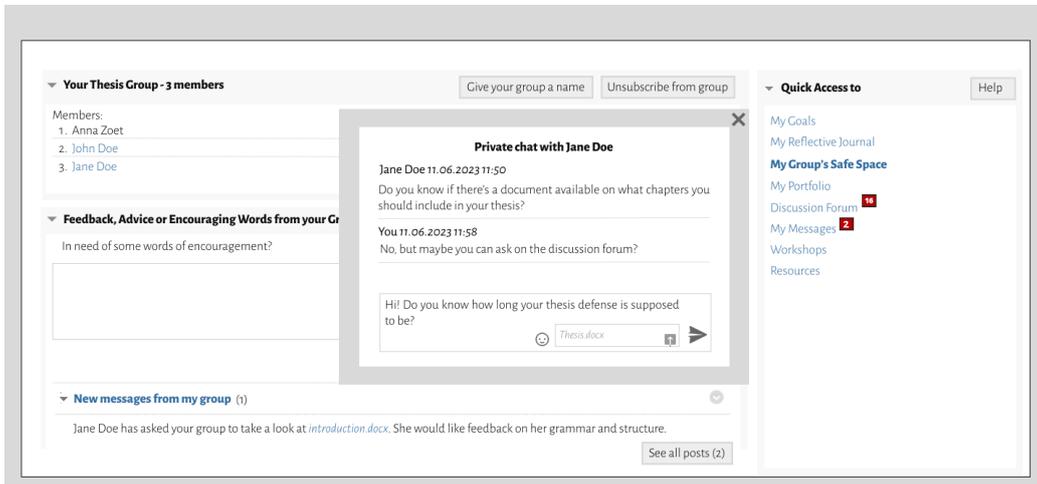
Figure 34. *Group page Chat of the Tool*
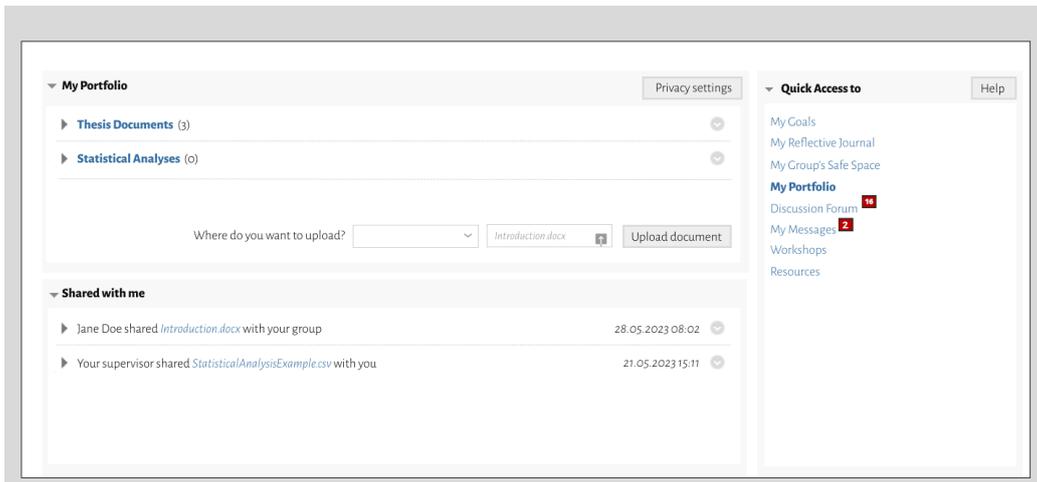
Figure 35. *Portfolio page of the Tool*
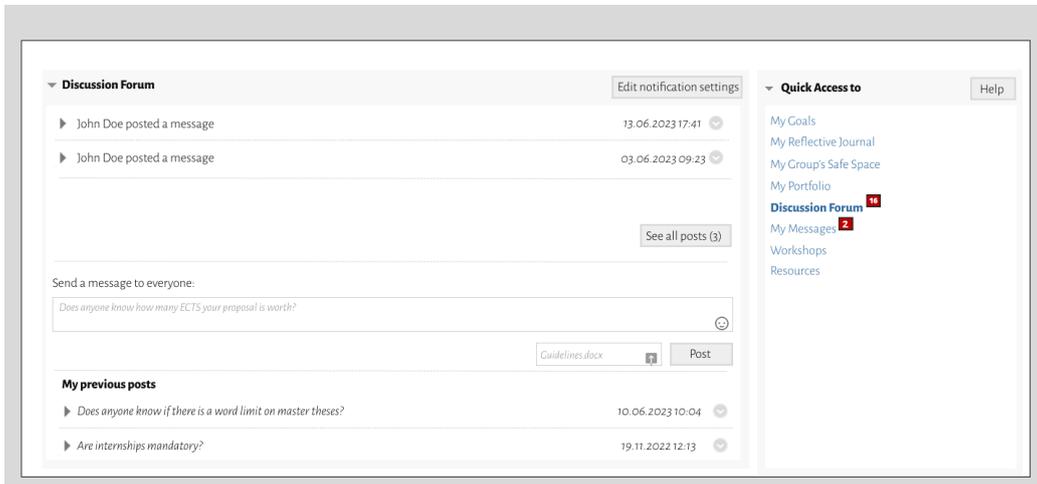
Figure 36. *Discussion Forum of the Tool*
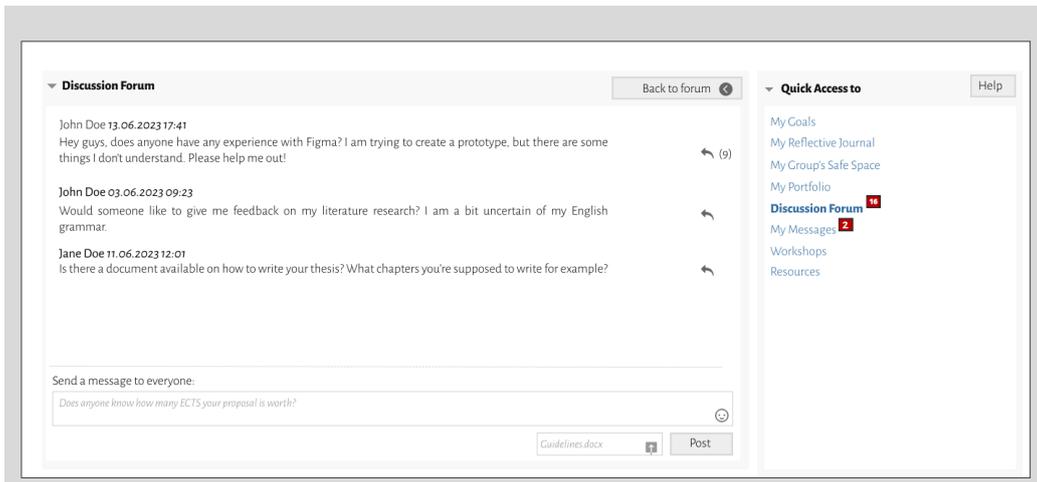
**Figure 37.** *Discussion Forum of the Tool - All Posts*
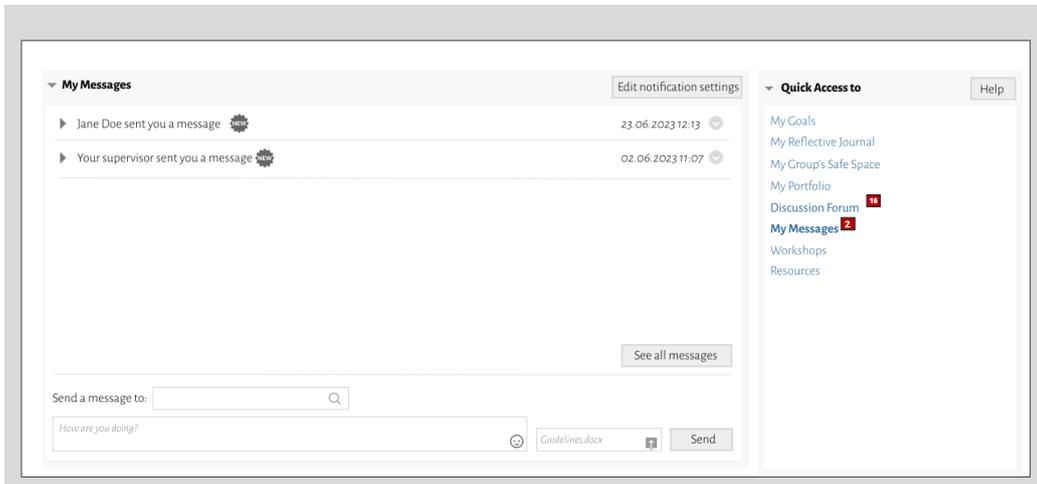
Figure 38. *Messages page of the Tool*
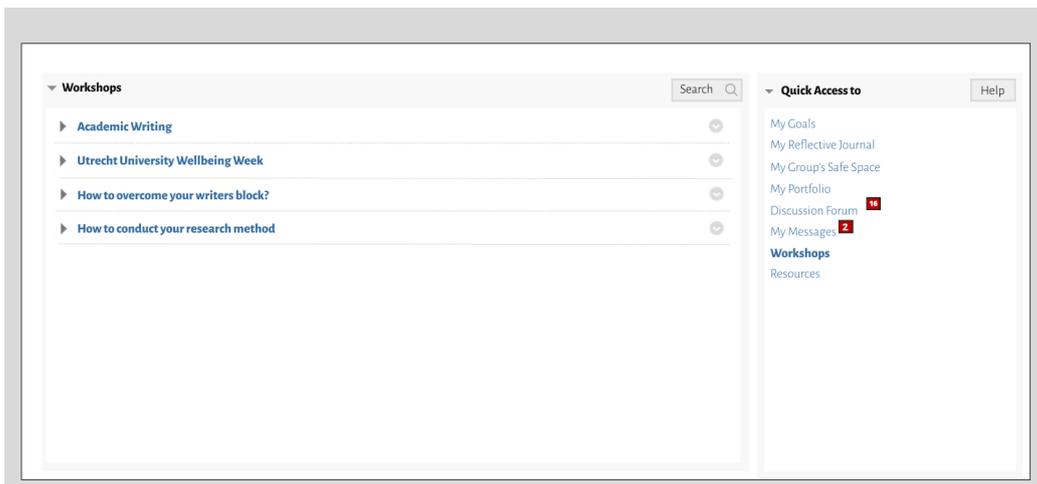

**Figure 39.** *Workshops page of the Tool*
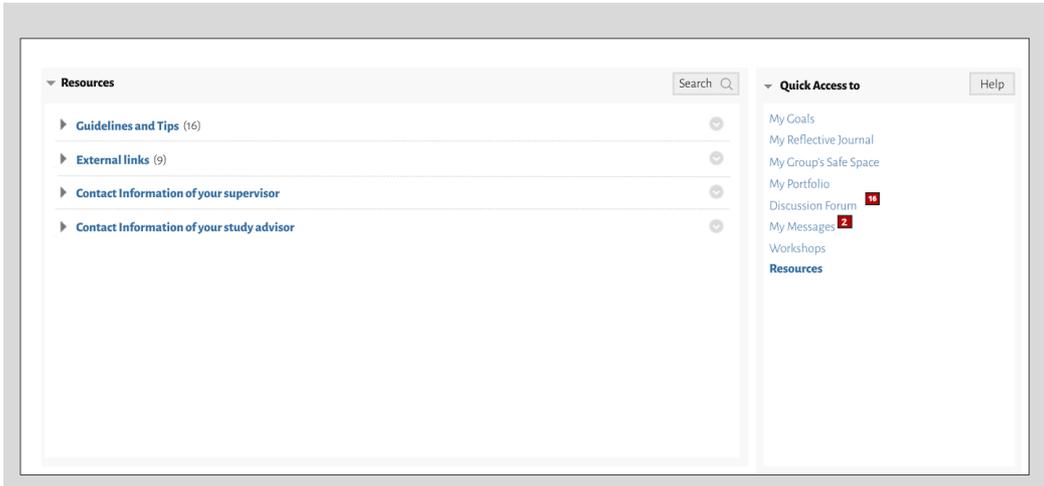
Figure 40. *Resources page of the Tool*

A.4 Evaluation

A.4.1 Informed Consent User Test

Date: June 26, 2023

Research Participant Information Sheet

Study into a supportive tool on the development of soft skills during one's master thesis

UTRECHT UNIVERSITY

What is the purpose of this study?

This study will look into the possibility of a tool on a Learning Management System to aid students who are working on their master thesis by focusing upon their soft skills.

What will I do if I choose to be in this study?

I would like you to participate in an evaluation that will take about 20 minutes. We will be doing a user test. This is an evaluation method where I ask you questions about functionalities of the tool, to which you answer truthfully. You can reflect on the tool together with me.

What are the possible risks or discomforts?

My study contains no possible risks, but feeling discomfort is the last thing I want my participants to experience. If so, please feel free to tell me.

Will information about me or my participation be kept confidential?

Yes. I will record the evaluation, so I can focus on the test and our conversation, instead of remembering all the information. I can then listen back to the tests afterwards. However, I will make sure that all the information will be anonymised. Furthermore, all collected data will be deleted permanently after my research has been finished.

What are my rights if I take part in this study?

You have the right to prohibit me from recording the evaluation if you feel like your privacy would be neglected. If you feel this is the case, your participation will not be possible anymore. However, do note that everything I record will thus be anonymised and everything you share is safe with me.

Who can I contact if I have questions about the study?

If you have any further questions, please feel free to ask me in person or by email. My email address is *a.zoet@students.uu.nl*

PLEASE SIGN HERE

A.4.2 Questions User Tests

The following questions are about the functionalities of the tool in relation to the needs from students according to the survey and interviews. Please answer on a scale of 1-5 and then give a short explanation.

1. On a scale of 1-5, how do you think an overview of your goals could enhance your motivation?

2. On a scale of 1-5, how do you think an overview of your goals could enhance your motivation?

3. On a scale of 1-5, how well do you think the button 'See my entire progress' helps with reminding yourself on how you are doing?

4. On a scale of 1-5, how do you think this reflective journal can motivate you?

5. On a scale of 1-5, how do you think this reflective journal can decrease your insecurity?

6. On a scale of 1-5, how do you think your journal can help you?

7. On a scale of 1-5, how do you think your group page can decrease your insecurity?

8. On a scale of 1-5, how do you think your group page helps with feedback?

9. On a scale of 1-5, how well do you think your group page helps to feel more connected with students?

10. On a scale of 1-5, how well do you think the discussion forum helps to feel more connected with students?

11. On a scale of 1-5, how well do you think the messages page helps you feel more connected with your supervisor?

12. On a scale of 1-5, how well do you think the messages page helps you feel more connected with your fellow students?

13. On a scale of 1-5, how well do you think the accessibility of files/goals helps with the connection you feel with your supervisor?

14. On a scale of 1-5, how do you think it could help with your insecurity to have all available workshops accessible through this tool?

15. On a scale of 1-5, how do you think this resources page will help with your need for guidelines?