From Quantified Self to Qualified Self

Reducing academic procrastination through the Qualified Self

Graduation Project Creative Technology

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Abstract

The phenomenon of the Quantified Self is a widely discussed topic over the past years. It has become a widespread movement which is increasingly supported by technology. Many areas of one's life can be tracked with all different kinds of measures with the ultimate aim of obtaining self-knowledge through numbers. However, the Quantified Self is lacking in the area of truly revealing the story behind one's data. It tracks us, but it doesn't reveal us. The Qualified Self, on the other hand, targets the subjective meaning behind one's data. It aims to provide the individual with better understanding into why their data is the way it is. Therefore, the Qualified Self can gather meaningful insights to qualify one's life.

Academic procrastination is a universal problem among students and has various negative consequences. Numerous factors are related to why one would engage in academic procrastination behavior. Many of these factors can be measured through self-tracking data. This graduation project focuses on tracking student's data of factors related to academic procrastination behavior. Specifically, how the student's emotional regulation and present-self connection plays a part in their academic procrastination behavior. The project aims to give students more insight in their academic procrastination behavior by having them reflect on the Quantified Self using self-tracking data, resulting in the Qualified Self. Moreover, the project explores whether such an approach has potential to reduce academic procrastination.

Based on these principles, a proof of concept was created where data was collected of one's academic procrastination, emotional regulation, and present-self connection. Additionally, journaling was used as a tool to support the student to engage in self-reflection. The data was manually processed and used to create a data visualisation for each individual. Subsequently, the proof of concept was evaluated through a usability test with nine participants. Resulting from the feedback it appeared that the concept has potential to give students insight in their academic procrastination behavior and possibly reduce it. However, correlations between the different factors significantly varied. Moreover, emotional regulation seemed a fairly stable factor among the participants. The participants benefited the most from the information retrieved about their present-self connection. In conclusion, the concept could lead students to a more Qualified Self, however, due to a narrow set of factors the insight that was provided is fairly limited.

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1. Introduction

1.1 The Quantified Self and the Qualified Self

There has been an explosion of interest in self-monitoring in the last several years. People are tracking all kinds of aspects of their life, health and activity. This phenomenon in self-tracking is called the Quantified Self. Tracking aspects of one's life is not a new phenomenon. Athletes, for example, have always recorded details of performance, diet, etc. However, what is new, is how widespread the movement has become in recent years, and the extent to which technology is supporting it (Fawcett, 2015). Wearable devices and self-tracking devices make the Quantified Self movement accessible to the user. The Quantified Self involves ordinary people recording and analyzing numerous aspects of their lives to understand and improve themselves. Swan (2013) defines the Quantified Self as "any individual engaged in the self-tracking of any kind of biological, physical, behavioral, or environmental information". A variety of areas can be tracked, for example, sleep quality, weight, energy level, mood, time usage, cognitive performance, and learning strategies. These variables can be measured with various measuring equipment, extending from a simple pen and paper to mobile applications, and advanced sensors in wearable devices (Swan, 2013). By measuring and storing certain variables, the user can interpret and analyze the data to ultimately improve oneself in certain aspects of life.

The self-tracking technology supports the user to obtain "self-knowledge through numbers" (Quantified Self Institute, 2016). An important aspect of self-tracking is that it links the quantitative and the qualitative in the sense that Quantified Self activity includes the collection of objective data can transition this into a subjective interpretation of these data. The cycle of experimentation, interpretation, and improvement can transition the Quantified Self into the Qualified Self (Swan, 2013). Thus, the Quantified Self focuses on the collected objective data while the Qualified Self targets the subjective meaning behind this data. The Qualified Self gives the user insight into why the self-tracked data is the way it is; it looks for context and meaning behind the collected data. It asks, in what way? How? And even - why? For example, why did I lose weight? Why did I sleep well? Why do I feel stressed? There are many contributing factors that can affect certain data, and some of them may be overlooked by the user. Supported by the right knowledge assisted by technology the Qualified Self can make sense of the collected data and gather meaningful insights to qualify our life. The Qualified Self aims to provide a clear understanding of the collected data and all its contributing factors, since the Quantified Self is lacking in that area; the Quantified Self tracks us, but it doesn't reveal us.

1.2 Academic procrastination

Each year, many first-year students in higher education are not successful in their courses and may have to drop out of school. There are many reasons for academic failure. One of the causes is academic procrastination (Steel, 2007). When students procrastinate, they are passive in starting or completing academic tasks. Procrastination involves knowing that one is supposed to perform an activity, and perhaps even wanting to do so, yet failing to motivate oneself to perform the activity within the desired or expected time frame. Procrastination typically involves delaying the start of a task until one experiences distress about not having performed the activity earlier (Senécal, Koestner & Vallerand, 1995). Academic procrastination can be defined as "the tendency to delay intended academic tasks, even though this may result in negative consequences" (Zacks & Hen, 2018).

Various studies clarified that academic procrastination is a very prevalent problem among students. Research estimates that 80–90% of undergraduate college students experience some form of academic procrastination (O'Brien, 2002). Other research shows that nearly all students admit to procrastinating at least occasionally and that 42% usually or always procrastinate (Zarick & Stonebraker, 2009). Academic procrastination can have negative consequences for students, both personal and financial. Even though academic procrastination is so common and contributes to so much hardship among those affected, research concerning interventions for academic procrastination is currently scarce (Steel & Klingsieck, 2016) although it is an important issue that affects many individuals.

There are many factors related to academic procrastination. A variety of these factors can be measured through self-tracking data. Examples of factors are lack of goal-management, lack of time-management, self-regulation failure, emotional regulation failure, low mindfulness, low energy, and anxiety. Many of existing interventions and solutions aimed to decrease academic procrastination only measure and target one or a few of these factors. Besides, none of the currently existing solutions look at the Qualified Self. However, by tracking the student's data of several factors related to academic procrastination, one could give a better insight in their academic procrastination behavior and its contributing factors. This could be done through the Qualified Self.

1.3 The Qualified Self and academic procrastination

As mentioned, there are many different factors related to why one would procrastinate. The Quantified Self can track data from certain factors related to academic procrastination. The Qualified Self aimed at academic procrastination can give the student insight in this data. By looking for the story behind this data, the transition to the Qualified Self can help the student understand and give insight to the contributing factors of academic procrastination. To help the student understand and reflect on these data of factors related to study productivity and academic procrastination it can improve one's study habits and help decrease one's academic procrastination.

Within this graduation project, The Quantified Self will involve the numbers and data that is collected, related to one's academic procrastination behavior. The data that is collected will be established through background research, state-of-the-art-research, and an expert interview. The Qualified Self will concern the data output that is visualized and presented in such a way that the student gains insight in their academic procrastination behavior. Moreover, the proposed product will aim to help them understand their procrastination behavior, and to motivate for change, resulting in a Qualified Self.

1.4 Challenges

The first challenge that was encountered, was defining the Quantified Self and the Qualified Self, and the transition between those two. Especially the Qualified Self is a term that is little known in research. By doing this project, one of the goals is to get more insight into the Qualified Self in relation to academic procrastination, such that it can benefit the student.

Furthermore, there are several existing solutions to reduce academic procrastination. Most of them take the form of an intervention program, but there are also other tools available. However, as mentioned, these solutions do not target the Qualified Self. By tapping into the transition from Quantified Self to the Qualified Self aimed at data of factors related to academic procrastination, the student could get better insight in his study efficiency and it can help reduce the student's academic procrastination.

Since so many factors are related to academic procrastination, it will be a challenge to choose the relevant factors for this project. There are various personal, situational, and contextual factors related to academic procrastination. Within this project not all factors related to academic procrastination can be implemented, so it will be a challenge to select the most relevant to this graduation project. For example, since this project looks for the Qualified Self, personal factors are most likely to be included, rather than situational or contextual factors.

1.5 Goal and research questions

The goal of this graduation project is to give the student more insight and help the student reflect on data related to and academic procrastination by making the student aware of the transition between the Quantified Self and Qualified Self aimed at academic procrastination. This aim leads to the following research question:

How can academic procrastination be reduced by having the student reflect on the Quantified Self using self-tracking data, resulting in the Qualified Self?

In order to answer the main research question, several sub-research questions have to be answered:

- What is academic procrastination?
- What causes academic procrastination?
- What are existing solutions for academic procrastination?
- What quantitative data can be used to reduce academic procrastination?
- What qualitative data can be used to reduce academic procrastination?

1.6 Structure of the report

In Chapter 2, background research will be conducted where causes and consequences of academic procrastination behavior will be explored and current solutions will be discussed. Furthermore, state-of-the-art research will be carried out where existing applications aimed at reducing procrastination will be examined. Additionally, an expert interview is conducted to gain more insight in academic procrastination behavior and to explore possible solutions to the issue. Chapter 3 will consist of the ideation phase, where various design concepts are explored. Subsequently, these design concepts are discussed in another expert interview. The specification phase will be described in Chapter 4. There, a more detailed design concept will be constructed, resulting in a proposed product. Additionally, the choice of data will be discussed and specific requirements will be set up. Chapter 5 will involve the realisation phase, where the creation of the proof of concept will be explained in detail. The evaluation of the concept will be taken up in Chapter 6. In this phase, the proof of concept will be tested with target users. The set-up of the usability test is explained and the results are presented. The conclusion of this graduation project will be discussed in Chapter 7. Finally, a discussion, limitations, and recommendations for possible future work will be considered in Chapter 8.

2. State of the Art

In this chapter, background research will be carried out where the causes and consequences of academic procrastination will be explored. Furthermore, existing studies and interventions aimed at reducing academic procrastination will be discussed. Besides, a state-of-the-art research will be executed where nine apps aimed at reducing procrastination will be examined and evaluated. Additionally, an interview with an expert in the field of academic procrastination was conducted in order to gain more insight in academic procrastination and the possibility to use the Qualified Self in a solution to reduce academic procrastination. Finally, an overview of conclusions will be presented at the end of this chapter.

2.1 Background Research

In the background research, academic procrastination will be discussed. Besides, the causes and consequences of academic procrastination will be examined. Various factors correlated to academic procrastination will be discussed. Furthermore, existing studies and interventions aimed at reducing academic procrastination will be explored.

2.1.1 The causes and consequences of academic procrastination

Research distinguishes the factors related to academic procrastination into three categories; personal, situational, and contextual factors (Visser, Schoonenboom, & Korthagen, 2017). Among personal factors, research has shown that personality traits are related to procrastination. Essential personality traits predicting procrastination are impulsiveness and (lack of) self-control. These traits have moderate to strong correlations with procrastination (Steel, 2007). Students who are more impulsive are more likely to procrastinate and students who have more self-control are less likely to procrastinate. Conscientiousness shows a negative relation with academic procrastination (Van Eerde, 2003). Students who are more conscientious are less likely to procrastinate. Besides personality traits, academic procrastination is also influenced by a student's low self-esteem. For example, negative thoughts often result in the delay of tasks (Pychyl & Flett, 2012). Self-efficacy, believing in one's capability to perform a given task, is important in order to carry out the responsibilities students face. Students with high self-efficacy and high self-esteem are less likely to procrastinate (Steel, 2007). When students have to do a task, it is important that they have a certain level of planning, organization of materials, and task monitoring (Rabin et al., 2011). A student is more likely to procrastinate if the student has poor planning skills, task-management skills, or a low level of perseverance. It is also important that students are motivated for the task (Grunschel et al., 2013). Further research indicated that procrastination was also strongly predicted by low achievement goals, self-regulated failure (Steel, 2007), low goal management abilities (Gustavson, Miyake, Hewitt, & Friedman, 2014),

low mindfulness (Sirois & Tosti, 2012), fear of failure (Haghbin et al., 2012), maladaptive perfectionism (Rice, Richardson, & Clark, 2012), low energy (Gropel & Steel, 2008), depression (Uzun Özer, O'Callaghan, Bokszczanin, Ederer, & Essau, 2014), and anxiety (Spada, Hiou, & Nikcevic, 2006).

Besides personal factors, there also several situational and contextual factors related to academic procrastination. These factors can be task characteristics, such as task difficulty and attractiveness, plausibility of the assignment, and teachers' characteristics. When a student experiences a task as unpleasant, the student is more likely to postpone or delay this task than to start it. The unpleasantness of a task, a person's boredom, and lack of interest can be reasons to procrastinate on a task (Visser et al., 2017). Steel (2007) states that the lack of interest in a task (task aversiveness) is the contextual factor found to be most strongly and consistently associated with procrastination. Another important situational factor is the quality of teachers, if the teachers are well-organized, it is easier for students to perform their task. Unorganized and negligent teachers can be a reason for a student to procrastinate. Teachers with high expectations increase a student's class enjoyment and interest and decrease a student's academic procrastination (Visser et al., 2018).

There are many consequences of academic procrastination for students. For example, low grades on tests and final exams, an increased risk of dropping out, under performance (Visser et al., 2017), and these students are less successful in their degree programs (Visser et al., 2018). In academic settings, procrastination does not only affect the student, it also affects the instructor, and sometimes even the organization (Patrzek, Sattler, van Veen, Grunschel, & Fries, 2015). Besides academic failure and its effect on the academic environment, other negative outcomes of academic procrastination include psychological distress, anxiety, decrease in health condition, negative health behaviors, reduced well-being, regret, and avoidance of social relations (Kim & Seo, 2015; Krause & Freund, 2014; Sirois & Pychyl, 2013; Steel & Ferrari, 2013). Academic procrastination thus has many negative consequences and it can be viewed in a situational and a developmental perspective; it is clearly bad for the individual and for society and therefore should be addressed by agencies as well as by the procrastinators themselves (Zacks & Hen, 2018). One of the ways this issue is addressed is through so called interventions.

2.1.2 Interventions to reduce academic procrastination

Structured goal setting, breaking down assignments, and changing cognitive styles such as fears of failure or success are familiar strategies used to help students reduce their academic procrastination. Nowadays, a more multifaceted intervention is used frequently which is beneficial given that academic procrastination involves a complex interaction of behavioral, cognitive, and affective components (Kachgal, Hansen & Nutter, 2001). There are several examples of interventions for academic procrastination. Behavioral and cognitive behavior

therapy (CBT) techniques seem to be more effective than general counseling and psychotherapy techniques when it comes to decreasing academic procrastination (Balkis & Duru, 2007). A study using these techniques (Tuckman & Schouwenburg, 2004) found success with group intervention. There, student participants were taught how to reduce academic procrastination using one of two programs. One of the programs concentrated on behavior modification as a technique to control environmental stimulants that acts as antecedents to procrastination. The second program focused on improving students' time management skills. The program had students practice better time utilization techniques and implement long-term study planning. Both programs resulted in students performing better and achieving better academic results as a result of decreased procrastination. One similar study (Uzun Özer, Demir & Ferrari, 2013) applied the Ellis ABC model to construct a group counseling intervention. The ABC model states an *activating* event (A) concluding in a *consequence*-behavior and/or feeling after (C) being processed through the individual's *belief* system (B). The study concerned five 90 minute sessions which were held weekly and they focused on understanding procrastinatory patterns, dealing with irrational thoughts and productive thinking. This resulted in a decrease in student's academic and general procrastination scores. However, there are certain limitations to these types of interventions. First of all, these therapeutic methods require trained therapists to convey and control the interventions. For the average academic institution, hiring such trained professional may financially not be an option. Besides, the interventions explained above are carried out in group settings as a part of a stand-alone program. Such programs require additional hours, which may be impractical for both students and the academic institute (Zacks & Hen, 2018).

Teacher intervention methods may be more practical and simple to implement. These intervention methods do not require a professional therapist to instruct the students. The interventions take place within the framework of the course elected by the students and do not require attendance at sessions or participation in any specialized therapeutic intervention programs. For example, weekly spot quizzes contributing to the student's grade on textbook chapters were found to motivate students to study continuously over the entire course (Tuckman, 1998). Another study that used a variation of in-class quizzes (Perrin et al., 2011) found that students studied more consistently when standard online study material was only accessible as a contingent of completing the previous study module. The intervention acts as a form of negative reinforcement increasing preparedness for in-class quizzes and to decrease academic procrastination. Another study (Isbell & Cote, 2009) used personal instructor communication to increase performance on course exams. If the student had the first assignment submitted late, the student would be called for a personal meeting with the course instructor. During the meeting the instructor would discuss the consequences of late submissions and the student would construct a plan to complete the consecutive assignments. The students who had this intervention handed in fewer late assignments and had higher overall grades. Another study (Davis & Abbit, 2013) examined the possible use of an SMS reminder system. This system would remind students of

their academic tasks. Completion of tasks would result in the discontinuing of the repetitive SMS messages. As a result of completing the academic tasks, procrastination was reduced.

There are also interventions that focus on the individual. One study (Visser et al., 2017) reported positive effects on a strengths-based training approach to overcome academic procrastination. The goal of this training was to make the students who experience academic procrastination frequently aware of their personal strengths and to teach them how to use their personal strengths in situations in which they usually tend to procrastinate. A later study (Visser et al., 2018) compares learning characteristics and self-regulation behavior of groups of students with different levels of academic procrastination. Certain learning characteristics and self-regulation behaviors may play out variously in students with different levels of academic procrastination. Their results show that for low and average procrastinators their self-chosen goal works as a strong intrinsically motivational drive to work on and finish study activities. High procrastinators lack the intrinsic motivation and starting and/or continuing study activities is a problem for them. A final study (Hensley & Munn, 2020) worth mentioning uses journaling as a tool to decrease academic procrastination. In this intervention, the students who self-identified as procrastinators maintained biweekly journals and participated in a one-on-one, semi-structured interview about their experiences. The journaling tool built upon principles of self-monitoring and reflective writing to bring greater awareness to students' behavior. Findings indicated that journaling stimulated four crucial processes: understanding procrastination, making changes in the moment, motivating action, and finding direction for change.

2.1.3 Background research conclusions

Factors correlated with academic procrastination can be divided into personal, situational, and contextual factors. Many different personality traits play a role in academic procrastination behavior. Besides personality traits, academic procrastination is caused by low self-esteem, low self-efficacy, and self-regulation failure. Further research indicated that procrastination was also influenced by, among others, poor task-management skills, lack of motivation, low mindfulness, low energy, depression, and anxiety. Situational and contextual factors involve, for example, task characteristics and teacher's characteristics. Academic procrastination is a prevalent problem that has negative consequences for the individual and society. Several interventions aimed at reducing academic procrastination exist in order to diminish this issue. CBT techniques seem to be effective and various group interventions have found success using these techniques. Teacher interventions often make use of in-class quizzes, reminder systems, or types of negative reinforcement. Individual interventions generally focus on the individual's personal traits, learning characteristics, and self-regulation behavior. Journaling was also found to be a helpful tool to help reduce academic procrastination. It stimulates students to understand procrastination, to make changes in the moment, to motivate action, and to find direction for change.

2.2 State of the Art Research

The following section will discuss the potential of smartphone-based interventions. Furthermore, existing mobile applications that implement certain approaches and factors to decrease academic procrastination will be explored. A total of nine apps from the Google Play store for Android were selected and evaluated.

2.2.1 Potential of smartphone-based interventions

Computer-based therapy has been shown to be highly effective by delivering treatment in high-dosages while simultaneously providing adequate, cost-effective, scalable, and user friendly interventions that can easily be dispersed. However, computer-based interventions targeting academic procrastination are scarce (Lukas & Berking, 2018). Besides, programs that run on smartphone apps hold benefits as smartphones (a) are ubiquitous and commonly available, (b) cause almost no maintenance costs, (c) are owned by a large number of people and therefore easy to disseminate, (d) are able to interact with the user allowing data input using multiple input channels, and (e) are generally designed to be easy to use (Lukas & Berking, 2018). Because of these advantages, smartphone-based interventions have great potential in the treatment of academic procrastination.

2.2.2 Review of mobile applications aimed at reducing academic procrastination

A systematic review in the Google Play Store for Android searched for currently existing apps that focus on procrastination and promote academic self-regulation. Due to practical reasons, Android was chosen instead of iOS. It was not possible to search in the Google Play Store in a refined way, this was only possible with keywords. After typing in a keyword, a list of both paid and unpaid apps was displayed and had to be included and excluded manually. The apps must be aimed at reducing procrastination, but not specifically for the target group ‘students’. Otherwise too many apps would be excluded. On March 29th 2020, the apps for the research were obtained via the search terms ‘procrastination’ and ‘study coach’. The apps were selected and ranked on the amount of downloads (minimum of 1 million) and its positive review score (minimum score of 4 out of 5). Apps that have the sole purpose of blocking certain features of the user’s phone were excluded since they do not fit the aim of this graduation project. Another criteria point of selection is that the apps have to collect either self-tracked or self-reported data or both. As a result, a total of nine apps were selected. These apps are described, illustrated, and evaluated in the tables below.

Table 1: Description and evaluation of the Forest app.

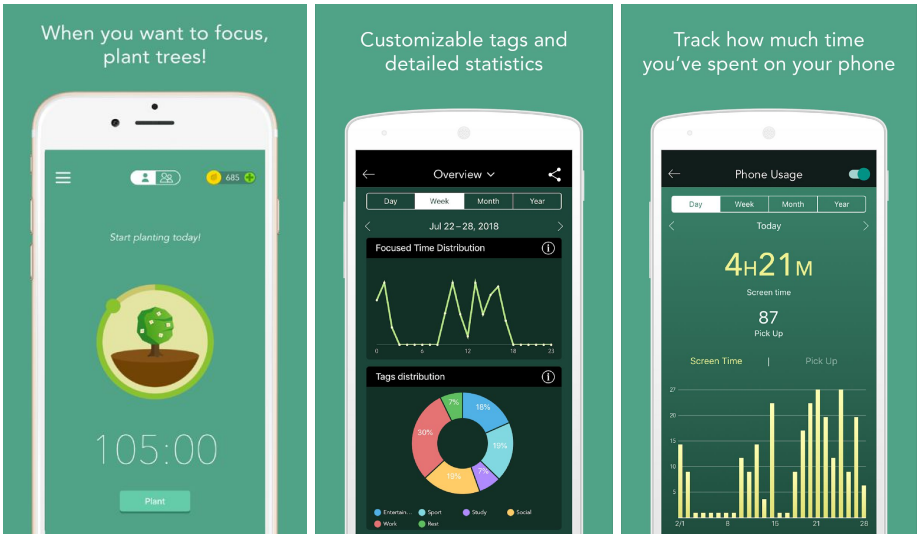
Name	Forest: Stay focused *(Pro version costs 1.99 euros)* (https://play.google.com/store/apps/details?id=cc.forestapp&gl=NL)
Amount of downloads and review score	Over 10 million downloads and rated 4.6/5.
Description	The app Forest aims to help users focus through a gamified timer. The user can plant a seed in the Forest. In the next 30 minutes, this seed will gradually grow into a tree. However, if the user starts to browse on their phone, the tree will wither away. With this mechanism, the sense of achievement and responsibility will drive the users to stay away from the distractions. The app provides a timeline which displays how much time is spent. The time spent on certain tasks can be tagged and is visualized in the tag distribution.
Screenshots	 *Figure 1: Screenshots of the Forest app.*
Measures	Time focused, time spent on the user's phone.
Factors related to (academic) procrastination	Time-management.
Evaluation	Forest is the most popular app in the Google Play Store in the category 'productivity'. The app is fairly simple and has an appealing design. Planting various trees is a nice way of motivating the user and gamifying their time productivity. Even though it is such a popular app, it only addresses one factor related to academic procrastination, so it is limited in that aspect. The user can reflect on their succeeded and failed tasks through the amount of trees that are grown or absent, which is an interesting visual representation.

Table 2: Description and evaluation of the Fabulous app.

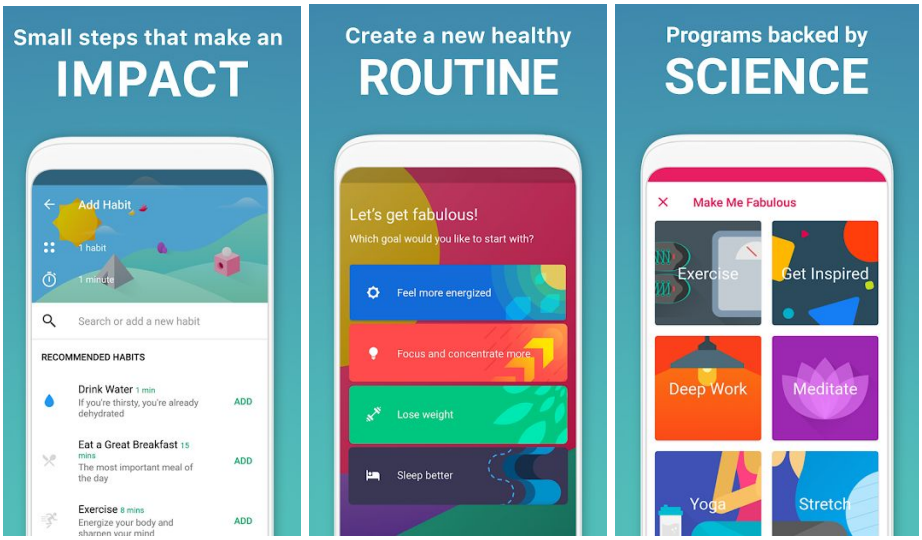
Name	Fabulous: Self Care *(After free trial 42.99 euros per year)* (https://play.google.com/store/apps/details?id=co.thefabulous.app&gl=NL)
Amount of downloads and review score	Over 5 million downloads and rated 4.5/5.
Description	Fabulous is an app that aims to help the user build healthy rituals into their life by providing science-based and daily activities. The app will act as a life coach, building the user's motivation so he/she can focus on developing habits that reduce mental health issues like anxiety, and improve the user's daily productivity. The app is based around the concept of 'journeys'. Each journey allows the user to set a routine up in small steps. The user can add more habits, chaining them together to create a complete routine.
Screenshots	 *Figure 2: Screenshots of the Fabulous app.*
Measures	Daily activities, goals, habits.
Factors related to (academic) procrastination	Mindfulness, goal-management, physical health, mental health, sleep cycle.
Evaluation	The app has visually pleasing imagery and vibrant colors. However, it is quite expensive which may be a barrier for students to purchase it. The content of the app is extensive and it addresses many factors related to academic procrastination. The app only tracks the user's daily activities, goals and habits, but it does provide information and exercises on other topics as well, such as mental and physical health. Unfortunately, planning the habits and daily activities within the app is rather inflexible.

Table 3: Description and evaluation of the Focus To-Do app.

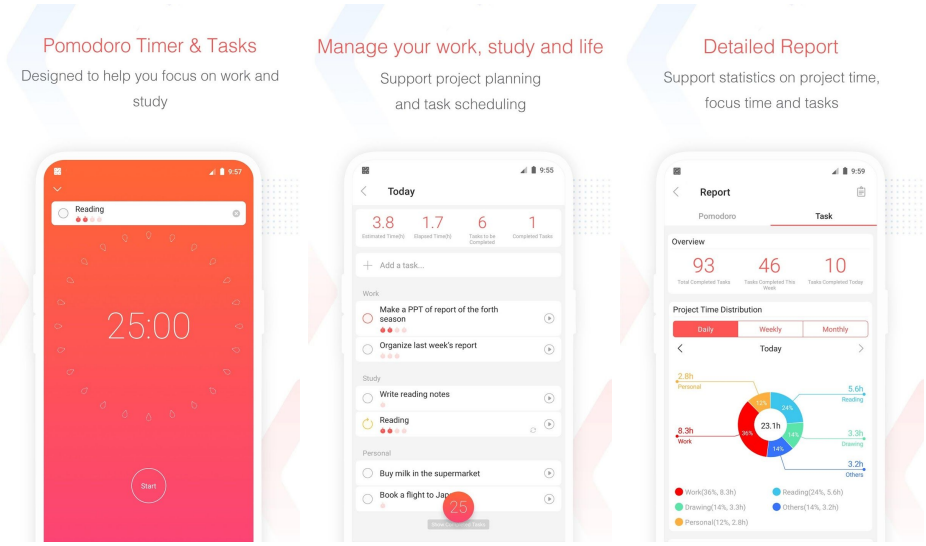
Name	Focus To-Do: Pomodoro Timer & To Do list *(Free)* (https://play.google.com/store/apps/details?id=com.superelement.pomodoro&gl=NL)
Amount of downloads and review score	Over 1 million downloads and rated 4.7/5.
Description	Focus To-Do is a time and task management application that helps the user to manage tasks anywhere and anytime, and helps the user to perform tasks efficiently. The app is based on the Pomodoro technique. The app helps the user analyze the work time and the completion of the tasks, the time spent on tasks every day/week/month and the time ratio of the user's projects.
Screenshots	 *Figure 3: Screenshots of the Focus-To Do app.*
Measures	Time focused, completed tasks, time distribution.
Factors related to (academic) procrastination	Time-management, task-management, task priority.
Evaluation	Focus-To Do is a fairly simple app, it solely focuses on time and tasks. The interface of the app is elegant and easy to use. This app has one of the highest review scores in the category 'productivity' which indicates many people enjoy using the app. It provides convenient ways of managing and tracking user's tasks. The feedback report function makes time traceable and is convenient in aiding the user to analyze their time and tasks.

Table 4: Description and evaluation of the Wysa app.

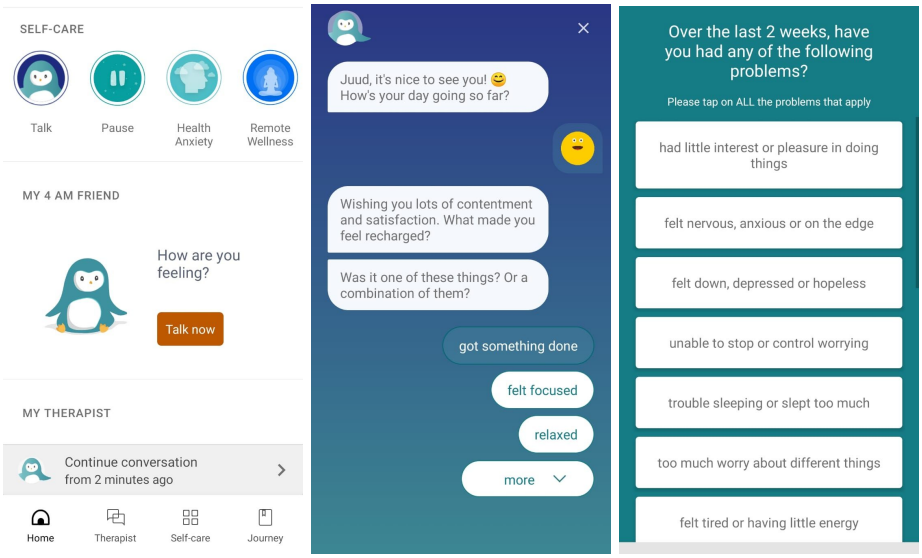
Name	Wysa: stress, depression & anxiety therapy chatbox *(Free, Premium version costs 49.99 euros per year)* (https://play.google.com/store/apps/details?id=bot.touchkin&gl=NL)
Amount of downloads and review score	Over 1 million downloads and rated 4.7/5.
Description	Wysa portrays a happiness buddy through a friendly and caring chatbot. The app is packed with daily spiritual meditation that aims to improve mental health. The app helps the user keep track of their mood with friendly chats and helps fight stress and anxiety with its proven techniques and calming meditation and mindfulness audios. The app uses CBT and DBT based techniques. The app also provides the user with several exercises.
Screenshots	 *Figure 4: Screenshots of the Wysa app.*
Measures	Mood, happiness, stress, anxiety.
Factors related to (academic) procrastination	Anxiety, stress-management, self-esteem, mindfulness.
Evaluation	Wysa is quite different from the other selected apps, since it focuses on more emotional aspects rather than factors related to time and tasks. The design portrays a playful and friendly AI penguin that has skills in CBT and restructuring thoughts which is quite appealing to the user. The app is easy to use and it provides the user with a good amount of options to input their personal data, such as mood, etc. The AI penguin then provides feedback, tips, and/or exercises in order to help the user deal with their emotions.

Table 5: Description and evaluation of the Habitbull app.

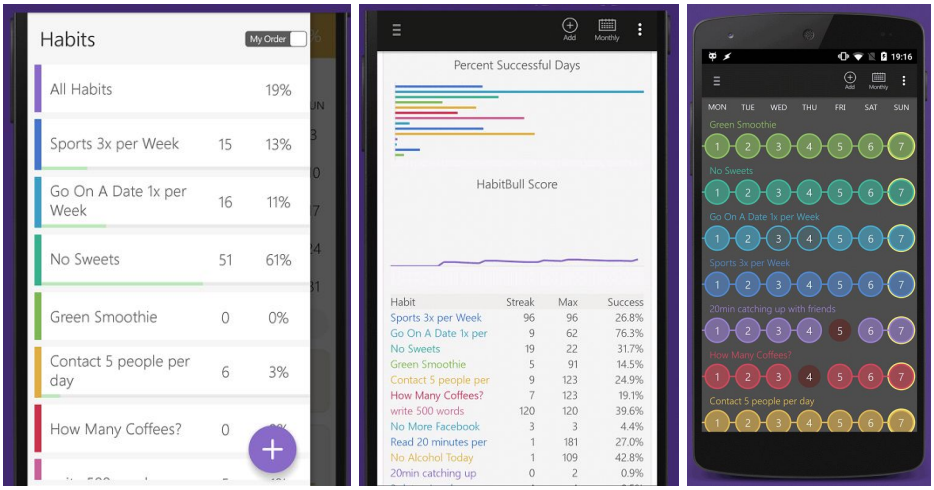
Name	Habitbull *(Free, Premium version costs 3.99 euros)* (https://play.google.com/store/apps/details?id=com.oristats.habitbull&gl=NL)
Amount of downloads and review score	Over 1 million downloads and rated 4.5/5.
Description	Habitbull aims to build positive habits or break negative habits, and these can be any habits for the user to fill in. The app can help the user organize their life by giving them an overview of everything they need to do on a regular basis. Within the app the user can build a "streak" of successful days. The streak works as a motivator for the users to continue with positive habits. The app also provides the user with various graphs of their tracked goals and habits of the day, week, and month. The app will remind the user to complete their goals throughout the day.
Screenshots	 *Figure 5: Screenshots of the Habitbull app.*
Measures	Habits, daily activities.
Factors related to (academic) procrastination	Goal-management, task-management.
Evaluation	Habitbull has a simple interface and is easy to use. The user can set up new habits that they want to track or form. The feature of adding little extras to the habits, like reminders and streaks, is nice to help motivate the user to complete their habits. The way that the user can create any new habit is valuable because this way the user can easily personalize their goals and tasks. The app offers interesting graphs to visualize the users achievements, success, and process. However, the app is limited to two factors related to academic procrastination.

Table 6: Description and evaluation of the Brain Focus Productivity Timer app.

Name	Brain Focus Productivity Timer *(Free)* (https://play.google.com/store/apps/details?id=com.AT.PomodoroTimer&gl=NL)
Amount of downloads and review score	Over 1 million downloads and rated 4.5/5.
Description	Brain Focus is a time-management application helping the user to get things done. Within the app, the user can start a work session and schedule a break for after each work session. The app is based on the Pomodoro technique, but the user can adjust the work session duration to fit their needs. The user can keep track and analyze their productivity.
Screenshots	 *Figure 6: Screenshots of the Brain Focus app.*
Measures	Time spent focused, time distribution.
Factors related to (academic) procrastination	Time-management.
Evaluation	Brain Focus is quite simple and only focuses on the time-management aspect of academic procrastination. The app gives the user an easy overview of the time spent focused and time spent on breaks. The time distribution can be viewed for each task, category, week, and the past six months. The time for study and breaks can be adjusted. Taking only time-management into account, the app is very limited in addressing the factors related to academic procrastination.

Table 7: Description and evaluation of the My Study Life app.

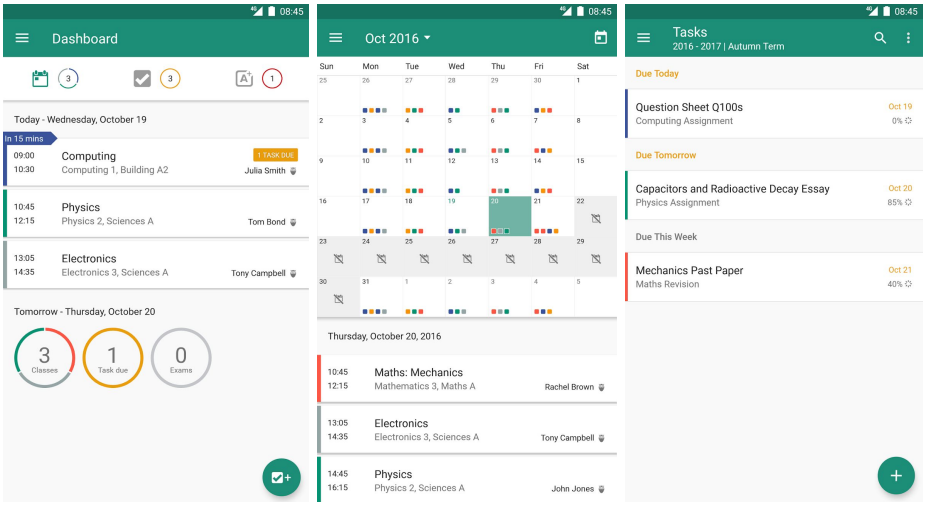
Name	My Study Life - School Planner *(Free)* (https://play.google.com/store/apps/details?id=com.virblue.mystudylife&gl=NL)
Amount of downloads and review score	Over 1 million downloads and rated 4.5/5.
Description	My Study Life is a cross-platform planner for students, teachers and lecturers designed to make their study life easier to manage. The app allows the user to store their classes, homework and exams in the cloud making it available on any device. The app will remind the user of unfinished tasks, upcoming exams and classes. The app aims to optimize work for academic tasks with support for week and day rotation schedules.
Screenshots	 *Figure 7: Screenshots of the My Study Life app.*
Measures	Academic tasks, classes.
Factors related to (academic) procrastination	Task-management, time-management.
Evaluation	My Study Life is more focused on study rather than tasks like most of the other apps do, so it is more appealing to students. The app can include a student's homework, exams and classes to personalize their planning. Within the app, the user can also track their assignment progress which is a nice asset. Unfortunately the app doesn't provide the user with an overview of past tasks and time distribution. The app is more focused on the future of the user rather than the past. It does not allow the user to reflect on their task- and time-management.

Table 8: Description and evaluation of the Habitica app.

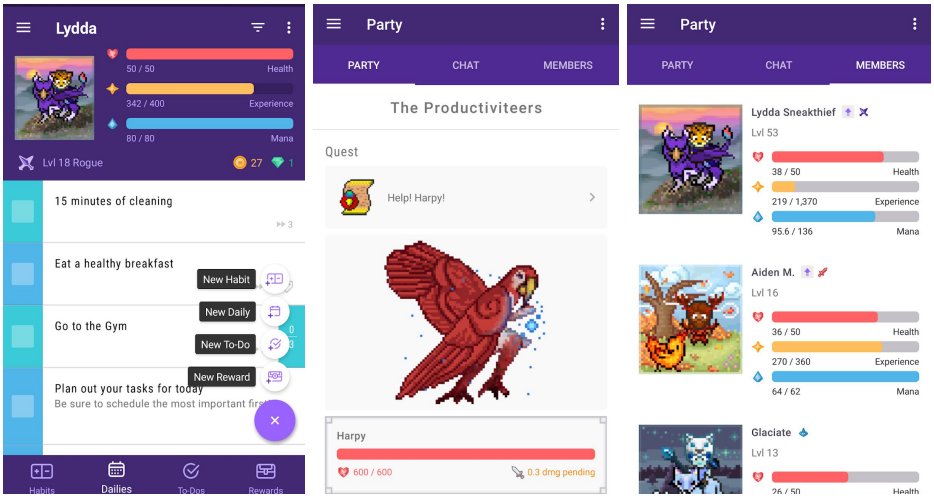
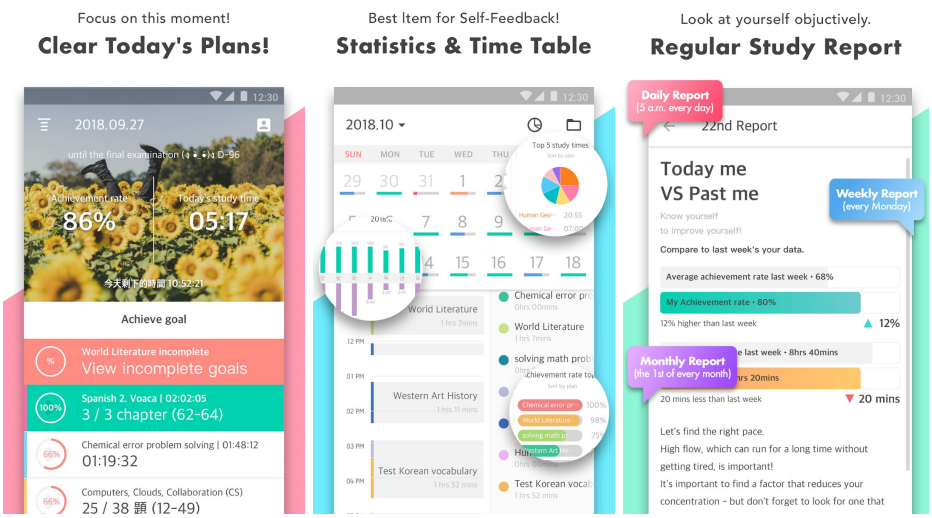
Name	Habitica: Gamify your Tasks *(Free)* (https://play.google.com/store/apps/details?id=com.habitrpg.android.habitica&gl=NL)
Amount of downloads and review score	Over 1 million downloads and rated 4.2/5.
Description	Habitica is a free habit-building and productivity app that gamifies the user's tasks and goals. The app uses in-game rewards and punishments to motivate the user. Habitica aims to help the user achieve their goals to become healthy, hard-working, and happy. The app tracks various tasks and goals to help the user stay accountable. The user can check off tasks to level up their Avatar and unlock in-game features. The app also provides a social network for the user to interact with.
Screenshots	 *Figure 8: Screenshots of the Habitica app.*
Measures	Habits, daily activities, goals, tasks.
Factors related to (academic) procrastination	Task-management, goal-management.
Evaluation	Habitica takes an interesting approach by gamifying the user's tasks. The app aims to make tracking habits, daily activities, goals and tasks fun. The app intends to motivate the user to complete their tasks by giving them rewards to unlock in-game fun features such as battle armor, mysterious pets, magic skills, and quests. The app addresses two main categories: health & fitness, and school & work. However, the task list is fully customizable so the user can shape it to their needs. Each habit and task can also be adjusted in terms of difficulty and habits can be categorized as either negative or positive. Unfortunately the user is not really able to reflect on their past activities.

Table 9: Description and evaluation of the Todait app.

Name	Todait: Smart study planner *(Free, Premium version costs 4.62 euros/month)* (https://play.google.com/store/apps/details?id=com.autoschedule.proto&gl=NL)
Amount of downloads and review score	Over 1 million downloads and rated 4.1/5.
Description	Todait is a study planner to help the user utilize their time optimally. The app aims to help students with productivity and effective time management. Todait automatically plans and divides the user's study materials over a specific period of time while providing detailed feedback about the user's study habits. The app emphasizes studying rather than planning. There is also a Study Diary to allow the user to reflect upon their daily performance for each task.
Screenshots	 *Figure 9: Screenshots of the Todait app.*
Measures	Academic tasks, time spent on academic tasks.
Factors related to (academic) procrastination	Time-management, task-management.
Evaluation	Todait has various features to help the user plan their academic tasks and to give feedback on the user's performance. The user can organize and categorize their tasks, can set reminders for each task to accomplish, and add a to-do list for the day. To help the user reflect, the app provides a memo where the user can write about their task, a news feed about how the user spent their day, and a calendar to keep track of the user's schedule. The premium version can give personalized feedback based on data and the user can take a look at yesterday's data to adjust today's tasks. Reflection features are a great addition, but unfortunately detailed feedback is only provided in the premium version.

2.2.3 State-of-the-art research conclusions

There are various mobile apps on the market aimed at reducing procrastination, but very few specifically target academic procrastination. Most of them focus on the task- and time-management factors correlated to procrastination. Many have an in-built timer to help the user be more productive in a certain time window, derived from the time-restriction theory. Various apps use gamification as a motivation for the user to complete their tasks. Several apps allow the user to track their activities, habits, and goals. Only one of the selected apps focuses on emotional and cognitive factors correlated with academic procrastination. Besides, few apps give the user the option to reflect on their data. Furthermore, all of the selected apps have users self-report their data, none use self-tracking sensors.

2.3 Expert Interview

An interview with Dr. Lennart Visser was held on the 9th of April 2020 in order to gain more insight in academic procrastination and the potential to use the Qualified Self in a solution to reduce academic procrastination. Dr. Lennart Visser has a PhD in academic procrastination and is the author of the research papers, among others, *A Field Experimental Design of a Strengths-Based Training to Overcome Academic Procrastination: Short- and Long-Term Effect* (2017) and *Differences in Learning Characteristics Between Students With High, Average, and Low Levels of Academic Procrastination: Students' Views on Factors Influencing Their Learning* (2018). Today, he still gives training courses to students to help them overcome their academic procrastination behavior.

2.3.1 Interview with Dr. Visser

Dr. Visser explained that there are different angles when it comes to factors related to academic procrastination. For example, in the area of self-regulation there is the lack of taking control of one's behavior and as a result people are doing other things than they should be doing and there are often multiple factors behind it. These factors can lay outside the student (contextual and situational factors), but they can also be within the student (personal factors). Dr. Visser focused mainly on the psychological side, the personal factors. One of his studies examined how academic procrastination academic procrastination affected first-year students. For example, one's belief in their own abilities is very important. However, it is often a tangle of many things at once. Dr. Visser stated that it is therefore difficult to say which factors correlated with academic procrastination are most important to be solved, because factors also depend on the individual. Dr. Visser believes that it is essential that students gain insight in their own behavior. He combined CBT techniques with insights from positive psychology. Students learned that they actually have everything they need in their own potential to complete their (academic) tasks. Many studies focus on the negative side, when the student doesn't succeed in

completing their academic tasks, while Dr. Visser focuses on the positive side, to look at situations when the student does succeed in completing their academic tasks. Dr. Visser calls the potential within the student 'core qualities'. When the student leaves their core qualities, they end up in procrastination behavior. The moment they realize that, they should be able to take themselves back and make contact with those qualities to overcome their procrastination behavior and learn to deal with it. Dr. Visser was one of the first to research this approach with an experimental design. He mentioned that there are a lot of studies and self-help books, but most of it has never been researched if it really works in practice.

When current solutions were discussed, Dr. Visser stated that he doesn't believe that the cause of academic procrastination lies in task- and time-management. He tells his students that they can already stick to a schedule or planning. He mentioned an example of the moment students go on vacation, they are able to pack their suitcase, bring enough stuff, and catch that plane. Only in that situation of studying they are not used to sticking to their schedule. Mobile applications that solely focus on task- and time-management are less valuable in Dr. Visser's opinion because according to him the cause of academic procrastination behavior lies in one's emotional regulation and self-regulation. Looking at a new solution, Dr. Visser mentioned that it is an important addition that data of students is not only collected when things go wrong, but also at moments when the student is productive in completing their academic tasks. It is essential that students learn about themselves and learn to understand their behavior and thus why they act the way they do.

Dr. Visser stated that one way of measuring someone's level of academic procrastination is the Academic Procrastination State Inventory. Dr. Visser mentioned that the disadvantage of many studies on procrastination is that it is all self-assessment. So a limitation is that it is actually measured behavior, but it is filled in by the students themselves and how they assess it. It would be a much more direct way of measuring if you could use, for example, eye-trackers or cameras. Dr. Visser mentioned that you could combine that with the academic procrastination score and link a behavior to it. In his research, Dr. Visser used a difference between whether the student was in the present-self of the procrastination-self in order to try and give students insight into the different selves that play a role in academic procrastination. This was found to be very recognizable for students. Dr. Visser would present the students with fairly simple scales which was about 'how much present are you at this moment?'. When the students wandered off, they would take those scales and assess themselves in terms of being present. This was a way of interim reflection, and Dr. Visser believes that works very well when dealing with procrastination.

One type of quantitative data that could be used when designing or evaluating a solution to reduce academic procrastination is the same questionnaire Dr. Visser used in his studies; the Academic Procrastination State Inventory. This assessment method measures a certain status and

contains three different scales; a fear of failure scale, a lack of motivation scale, and a procrastination scale. Dr. Visser believes that the procrastination scale could be helpful to collect quantitative data and see if that connects with other data. For example, the students could fill it in everyday at the end of the day. Dr. Visser said that he can also imagine that the students of the research sample are selected based on their level of academic procrastination. He said that this is often not the case and students are usually recruited based on 'who suffers from academic procrastination and wants to participate in a research study.' Dr. Visser deliberately measured his sample group of first-year students and he divided them into different groups based on their level of academic procrastination.

Dr. Visser hasn't heard about studies that, for example, measure if your heart rate is higher or lower when someone shows signs of procrastination. What has been emerging in recent years and what is seen more and more at conferences, for example, are the neurological aspects of procrastination behavior. To see how the brains of procrastinators relate to the brains of non-procrastinators. Unfortunately, that is not very useful at the moment when it comes to self-tracking.

There is various qualitative data that can be collected when it comes to academic procrastination. Dr. Visser mentioned that qualitative data is also how one feels, such as stress and emotion or the degree to which someone is motivated to do something. This can be written down verbatim. Dr. Visser said that in the area of procrastination, very little of such qualitative research has been done. He mentioned that there are a number of psychologists who do research in a psychological way with questionnaires, pre-measurement and post-measurement and so on, which is a lot of correlation research. Dr. Visser said that results in very nice research papers, but what people can do with it in practice is a bit difficult.

Dr. Visser can see a connection between his strengths-based training and the Qualified Self approach. In his research the students are taught what their psychological capital is; what core qualities they have and how they can use those to complete their academic tasks. The students also learn how to deal with themselves when they fail. Dr. Visser aims to give the students insight in their behavior patterns and to make them more aware on a cognitive and emotional level. He also mentioned that it is important to include mindfulness so students are more aware and in the present-self. It is essential that students gain insight into what triggers their academic procrastination behavior. Dr. Visser stated that it is also important that students learn how to deal with negative thoughts and emotions when encountering academic procrastination. Not only the cognitive side, but also the motivational and emotional side of self-regulation is an essential aspect. Dr. Visser believes students would benefit from both reflection on behavior, but also from regular reminders for the students to be more aware of their current process and to encourage them to be in the present-self.

Dr. Visser mentioned it is important to make a choice in which factors to take into account when it comes to conducting research concerning academic procrastination. He believes it is better to have a lot of insight in a few things rather than to have very little insight in many things. However, there are a lot of factors, and each one works differently for each individual. For example, one person's motivation is extremely relevant to them and the other person's negative feelings and how to deal with them is essential. There is no 'one size fits all' approach. Dr. Visser believes personal, situational and contextual factors related to academic procrastination could be combined into one solution. He also mentioned it is important for students to stay in touch with their goals. Usually, the moment students have to do a task, they don't really realize how that task helps them to achieve their end goal. In this aspect, goal-setting theory can be helpful to aid students in completing their academic tasks. Dr. Visser stated that time restriction is also an interesting insight and that it is very recognizable for students.

Dr. Visser said that he really likes the approach of the Qualified Self aimed to reduce academic procrastination. He doesn't recognize it in the things that he sees around him yet, while he is an expert in the field, so he appreciates this new angle. Dr. Visser said there are many opportunities to continue with this, since procrastination is recognizable for so many people and it has the potential to help a lot of people. A solution can aid numerous people to learn to deal with themselves better, because so many find it difficult in this time where so many stimuli come at you every day to make choices. It makes it difficult for individuals to have a clear vision of what they want to do in a day and what they want to achieve.

2.3.2 Expert interview conclusions

Contributing factors to one's academic procrastination behavior can be different for each individual. Besides, it is often a tangle of various things at once. Dr. Visser believes that the cause of academic procrastination doesn't lie in low task- and time-management skills, but rather in failure of (emotional) self-regulation. It is essential that students gain insight in their behavior and are in contact with their present-self. Looking at creating a solution, data of students should be collected not only when things go wrong, but also when the student is successful in completing their academic tasks. Interim reflection can be helpful to make the student more aware of their behavior and present-self. One type of quantitative data that can be collected is a student's level of academic procrastination behavior through the Academic Procrastination State Inventory. Also various qualitative data can be collected, focused on emotional and cognitive aspects of academic procrastination. Dr. Visser can see a connection between strengths-based training and the Qualified Self approach; both aim to give the student insight into their academic procrastination behavior. It is important that students become more aware of cognitive, motivational, and (emotional) self-regulation aspects in order to reduce their academic procrastination behavior.

2.4 Conclusions

It is clear that there are many different factors related to academic procrastination, which can be categorized into personal, situational, and contextual factors. It is different for each individual which factors play a role in one's academic procrastination behavior. There are several interventions that address these factors in order to reduce academic procrastination behavior. Cognitive behavior therapy techniques seem to be more effective than general counseling and psychotherapy techniques. However, it is also essential to take self-regulation and emotional regulation into account when designing a solution to overcome academic procrastination. It is important that students gain insight into their behavior and into which factors may cause their academic procrastination behavior. A strengths-based training approach shows that making students aware of their personal strengths and teaching them to use these personal strengths in situations in which they usually tend to procrastinate can help them overcome their academic procrastination behavior. Besides, learning characteristics and self-regulation behaviors play out variously in students with different levels of academic procrastination. Journaling is also proven to be a useful tool to help students reflect and gain insight into their behavior to reduce academic procrastination.

Smartphone-based interventions have great potential when it comes to creating a solution to reduce academic procrastination. There are several mobile apps currently on the market, but most of them focus on the factors time- and task-management. The user can track and reflect on their time spent focused in order to help them improve their time-management skills. Besides, some apps use time-restriction theory to help users accomplish their tasks in a certain time window. Apps that focus on task-management aid users in organizing and optimizing their tasks and schedules in order to help them complete their academic tasks. Other apps plan and track users' daily activities and habits to aid them in accomplishing those activities. Some of these apps gamify tasks, daily activities and habits in order to motivate the user and to make it more enjoyable. Only very few existing applications take the (emotional) self-regulation aspect into account. The app Wysa does include CBT and DBT based techniques to help users cope with emotions, anxiety, stress, low self-esteem and mindfulness. However, this app does not focus on students and their academic tasks. Besides, most apps that aim to reduce academic procrastination are limited in the reflection aspect. Only few existing apps provide the user the option to reflect on either their time, tasks, daily activities, habits, or emotions.

Even though many apps focus on task- and time-management, this is not where the cause of academic procrastination behavior lies. The explanation of academic procrastination behavior is often a tangle of many things where self-regulation plays a crucial role. It is essential to give students insight in their behavior patterns and to make them more aware on a cognitive and emotional level. It is essential that students reflect, learn about themselves, learn to understand

their behavior, and grasp which factors contribute to their academic procrastination behavior. Besides, interim reflection can aid students to be more connected to their present-self instead of their procrastination-self. When designing a solution to overcome academic procrastination, it is also important to collect data both in situations where the student doesn't succeed and where the student does succeed in completing their academic tasks. The Academic Procrastination State Inventory can be used to measure students' academic procrastination level. This quantitative data can be collected to examine if it connects with other (qualitative) data. It can also be used as a requirement when selecting a sample group.

In conclusion, there is a lack of addressing emotional and cognitive aspects, and (interim) reflection within mobile applications. There is a need to take (emotional) self-regulation into account when designing new solutions aimed at reducing academic procrastination. Besides, there is no "one size fits all" approach, therefore, an effective approach to overcome procrastination should target various perspectives on procrastination, trying to tap into essential aspects of procrastination for each individual student. Moreover, there lies potential in designing a solution that applies the Qualified Self in order to reduce academic procrastination behavior. Such an approach does not yet exist, but it could possibly help many people in the future. The Qualified Self can help students reflect on their behavior, make them more aware on an emotional and cognitive level, and give insight in their academic procrastination behavior and its contributing factors.

3. Ideation Phase

Within the ideation phase, various design concepts will be explored to help solve the issue of academic procrastination behavior. The information gathered from the background research, state-of-the-art research and the expert interview is used to substantiate the design concepts. Furthermore, another expert interview was held with Dr. Visser to discuss and review the potential of the design concepts.

3.1 General directions

Based on the conclusions from the background research, the state-of-the-art research, and the expert interview, a variety of general directions for possible designs can be set up.

Table 10: General directions resulting from Chapter 2.

General directions	**Arguments resumed**
Smartphone-based application	Smartphone-based applications have great potential in the treatment of academic procrastination.
Aim to improve self-regulation	Self-regulation failure is one of the main causes of academic procrastination behavior.
Aim to improve emotional regulation	Resulting from the expert interview, emotional regulation failure is another crucial cause of academic procrastination behavior.
Acquire automatically tracked and/or self-reported data	The Quantified Self to Qualified Self approach requires the collection of various data. This can contain either or both automatically tracked data and self-reported data.
Reflect on gathered data	Reflection can help the student become more aware of their behavior. Besides, interim reflection can stimulate the student to stay in contact with the present-self.
Give insight in behavior	In order to reduce a student's academic procrastination behavior it is necessary that they gain insight in their academic procrastination behavior and learn what factors trigger it.
Result in the Qualified Self	The Qualified Self has potential to reveal one's academic procrastination behavior and help reduce it. Besides, it is a new approach in the field of academic procrastination.

The design concepts will build around the idea of a smartphone-based application. The solution should improve the student's self-regulation and emotional regulation. Both self-regulation failure and emotional regulation failure are main causes of academic procrastination behavior. Besides, there are currently few existing smartphone-based applications that address these factors. The solution should gather automatically tracked or self-reported data, or both. It is important to note that data should be collected both in situations where the student fails to succeed and where the student does succeed in completing their academic tasks. The student should be able to reflect on their data, providing them with insight in their academic procrastination behavior and its contributing factors. This should result in the Qualified Self of the student, aimed to reduce academic procrastination behavior.

3.2 Design concepts

The following design concepts are results from an individual brainstorm, which is a common technique used in Creative Technology courses. This was supplemented with a dual brainstorm session with K. Bardsen (2019). The design concepts will all be based on several of the general requirements mentioned above. It is important to note that all design concepts are meant for the individual student, because there is no "one size fits all" approach when dealing with academic procrastination behavior. The final design concept should target various perspectives on procrastination, trying to tap into essential aspects of procrastination for each individual student.

3.2.1 Design concept A: improve self-regulation

Self-regulation refers to managing one's learning, which includes elements of planning, goal setting, strategy implementation, summarizing, and monitoring one's progress. Self-regulation failure is correlated to academic procrastination behavior. Furthermore, internal self-regulatory knowledge can enhance a student's learning (Schraw, 2007). The aim of this design concept is to improve the student's self-regulation in order to reduce their academic procrastination behavior. Moreover, it aims to have the student find correlations between their self-regulation and their academic procrastination.

The data that is collected can be split into two categories; where one is focused on data correlated to self-regulation and the other on data correlated to achievement of academic tasks and study efficiency. Examples of data collected correlated to self-regulation are planning of tasks, set goals, strategies, personal strengths, awareness, and motivation. Data collected correlated to achievement of academic tasks and study efficiency involves academic task performance, completion of academic tasks, time spent studying, time spent on non academic tasks, etc. The data will be collected through self-reporting using scales, because this is a common and validated technique in previous research for measuring and evaluating a person's self-regulation (Lee, Lim & Grabowski, 2010; Toering et al., 2012; Barnard et al., 2009;

Pitkethly & Lau, 2015) and academic procrastination behavior (Visser et al., 2017; Visser et al., 2018; Eckert et al., 2016; Uzun Özer et al., 2013). There are various types of self-regulation questionnaires using scales, among others, Self-Regulation of Learning Self-Report Scale (SRL-SRS, Toering et al., 2012), the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991), and the Self-Regulation Questionnaire (SRQ; Brown, Miller, & Lawendowski, 1999). Examples of academic procrastination behavior questionnaires using scales are the Academic Procrastination State Inventory (APSI; Schouwenburg, 1995), the Academic Procrastination Scale (Milgram & Toubiana, 1999), Procrastination Assessment Scale—Students (Solomon & Rothblum, 1984), and the Tuckman Procrastination Scale (Tuckman, 1991). The data collection will take place at the end of a student's study session.

The application can compare these data in order to help the student find correlations between their self-regulation and academic procrastination behavior. The data will be collected over a period of time. Besides, metacognitive support and feedback can be provided to the student. At the same time, by addressing elements of self-regulation, the application aims to improve the student's self-regulation in order to reduce their academic procrastination behavior. The application will give the student the opportunity to reflect on their data and the found correlations so the student can gain insight in their academic procrastination behavior, resulting in the Qualified Self.

A sketch of the application can be seen in the figures below.

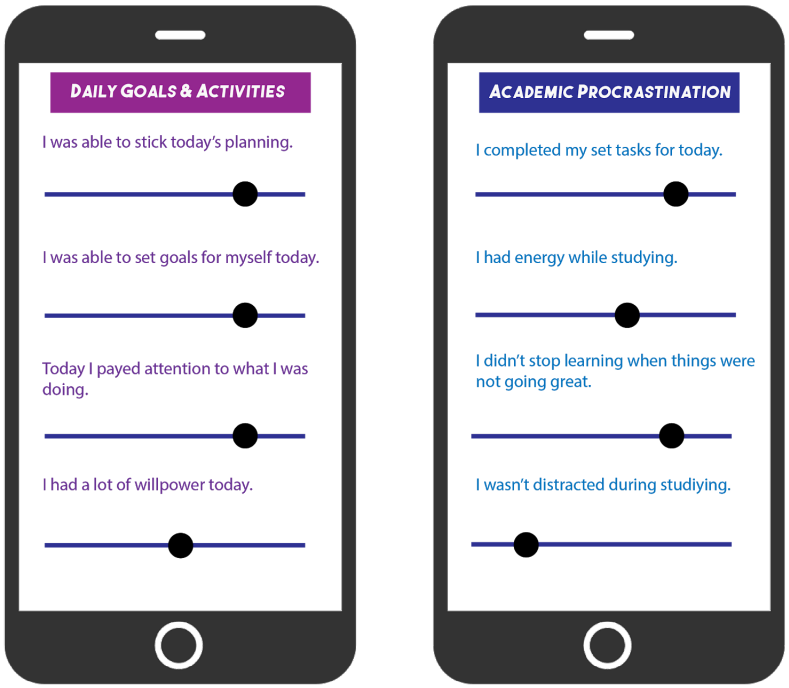


Figure 10 (Left): Sketch of scales for measuring the student's self-regulation.

Figure 11 (Right): Sketch of scales for measuring the student's academic procrastination behavior.

The data that represents the student's self-regulation skills and their academic procrastination behavior can be visualized in various ways. For example, the data can be visualized over time in a line graph, where tags can be added so the student can write down their own correlations and personal notes. The line graph can be used to show trends and analyse how the data has changed over time. Another way the data can be visualized is by using bar charts. The data representing the student's self-regulation can be presented per day, where the student can fill the color of the bar chart related to their self-regulation. This way the student can indicate how they felt about that day and their self-regulation. This option let's the user interact with their data and find personal correlations within the overview.

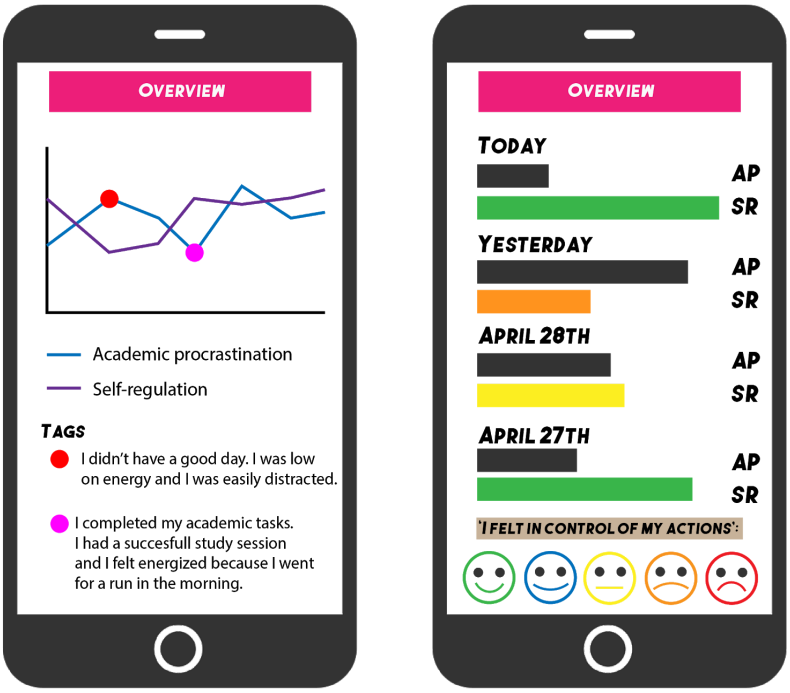


Figure 12 (Left): Option 1; The data related to the student's self-regulation and academic procrastination is visualized in a line graph over time. Tags can be added to personalize the data.

Figure 13 (Right): Option 2; The data related to the student self-regulation (SR) and academic procrastination (AP) is visualized and compared using bar charts. The student can interact with the data using colors associated with how the students felt about that day.

3.2.2 Design concept B: improve emotional regulation

Emotional regulation may be defined as the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features. Emotional regulation skills include, among others, the ability to be aware of one's emotions, to identify and label emotions, to understand the prompts emotions, and to actively modify negative emotions in order to feel better (Eckert et al., 2016). The aim of this design concept is to improve the student's emotional regulation in order to reduce their academic procrastination behavior. Besides, it aims to have the student find correlations between their emotional regulation and their academic procrastination. This approach is similar to design concept A, but it addresses emotional regulation instead of self-regulation.

The data that is collected can be split into two categories; where one is focused on data correlated with emotional regulation and the other with achievement of academic tasks and study efficiency. Examples of data collected correlated to emotional regulation are emotions, mood, awareness, negative feelings, etc. Data collected correlated to achievement of academic tasks and study efficiency involves academic task performance, completion of academic tasks, time spent studying, time spent on non academic tasks, etc. Comparable to design concept A, the data will be collected through self-reporting using scales. Similar to academic procrastination behavior and self-regulation, emotional regulation is often measured using scales as well. Examples of emotional regulation questionnaires using scales are the Emotion Regulation Skills Questionnaire (ERSQ; Berking & Znoj, 2008), the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), and the Interpersonal Emotion Regulation Questionnaire (IERQ; Hofmann, Carpenter & Curtiss, 2017). The data collection will take place at the end of a student's study session in order to assess their process.

The application can compare these data in order to help the student find correlations between their emotional regulation and academic procrastination behavior. The data will be collected over a period of time. At the same time, by addressing elements of emotional regulation, the application aims to improve the student's emotional regulation in order to reduce their academic procrastination behavior. The application will give the student the opportunity to reflect on their data and the found correlations so the student can gain insight in their academic procrastination behavior, resulting in the Qualified Self. Within the overview, the student is also able to add tags to their data overview in order to make it more personal.

A sketch of the application can be seen in the figures below.

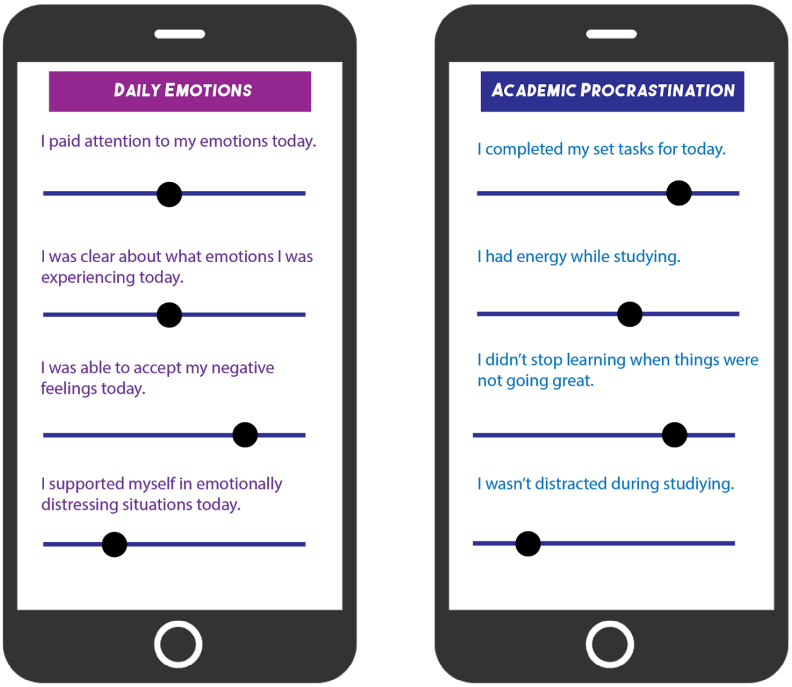


Figure 14 (Left): Scales for measuring the student's emotional regulation are presented.

Figure 15 (Right): Scales for measuring the student's academic procrastination behavior are presented.

The data that represents the student's self-regulation skills and their academic procrastination behavior can be visualized in various ways. Concept B deals with similar ways of collecting data compared to concept A, both involve data collection using scales. Thus, the data of concept B can be visualized similarly, using either a line graph or bar charts to represent and interact with the data. The line graph can be used to show trends and analyse how the data has changed over time. Bar charts can represent the student's data per day, where the student can also indicate how they felt about that day and their using regulation, using colors.

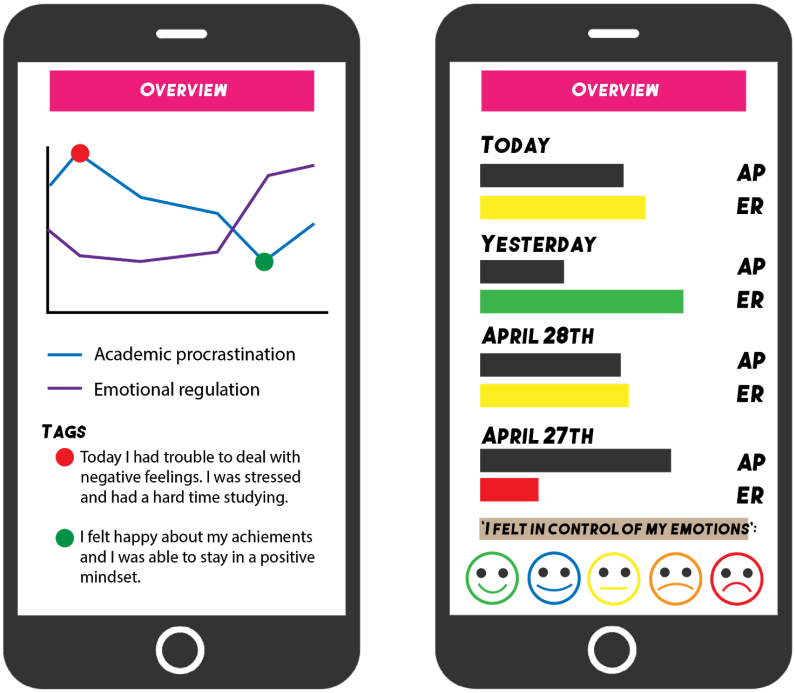


Figure 16 (Left): Option 1; The data related to the student's emotional regulation and academic procrastination is visualized in a line graph over time. Tags can be added to personalize the data.

Figure 17 (Right): Option 2; The data related to the student emotional (ER) and academic procrastination (AP) is visualized and compared using bar charts. The student can interact with the data using colors associated with how the students felt about that day.

3.2.3 Design concept C: connect with the present-self

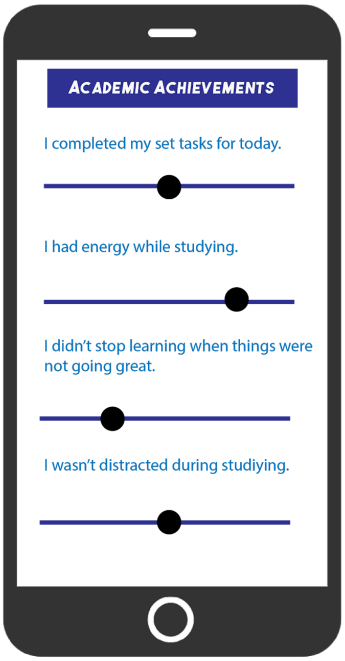
There can be a distinction between the present-self and the procrastination-self. In the present-self, the student is in the here-and-now and aware of their behavior, as well as of choices he or she can make in their study situation. In the procrastination-self, the student is distracted and unaware of their behavior in their study situation which leads to academic procrastination (Visser et al., 2017). The aim of this design concept is to remind the student to stay in the present-self in order to reduce their academic procrastination behavior and to reflect on moments when their procrastination-self was in charge, or their present-self.

The application will provide the student with prompts throughout their study session, where reminders of being in the present-self are valuable. These prompts will present the student with one or a few scales on which they can indicate how present they are at the moment in order to remind the student to be in the present-self. This can be done using a virtual assistant. Besides,

the prompts will have the student self-question their study progress in order to make them more aware of their choices and behavior. At the end of their study session, the student is asked to fill in a short questionnaire about their academic procrastination behavior in order to be able to compare those entries with the student's awareness of the present-self. At the end of the week, students can reflect on study situations when their present-self was in charge or when their procrastination-self was in charge. This last option is based on the principles from Visser et al. (2017) strengths-based training. This reflection exercise can be recorded through a voice memo within the application so the student is able to discuss these matters with themselves and listen to it later for reflection.

The data that is collected involves level of presence, level of awareness, study progress, and academic procrastination behavior. Similar to concept A and concept B, data related to academic procrastination behavior will be collected using scales. Data concerning the present-self can be collected through a virtual assistant device in order to make the required interaction during a student's study session as minimal as possible. The virtual assistant will ask the student a few questions about their level of presence, level of awareness, and study progress. This data concerning present-self awareness will be saved and later compared to the entries of their academic procrastination behavior in order to reflect on and to find correlations between the student's present-self and their academic procrastination behavior over time. Besides, the student can reflect on study moments when the present-self or the procrastination-self was in charge through recorded voice memos. These moments can be highlighted using tags as well within the overview, to make the data visualisation more personal. The student can gain insight in their academic procrastination behavior, resulting in the Qualified Self. At the same time, by addressing the present-self, the application aims to have the student be more in their present-self, resulting in a decrease of academic procrastination behavior.

A sketch of the application can be seen in the figures below.



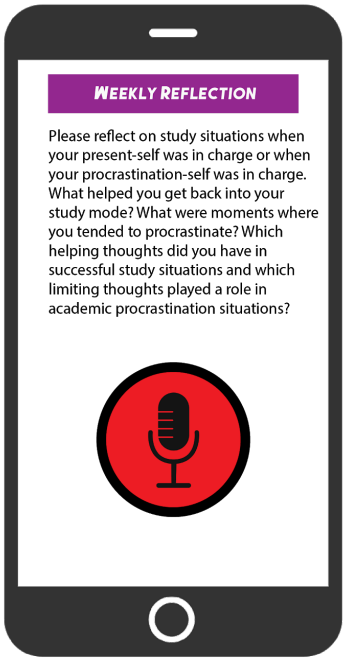


Figure 18 (Left): Scales for measuring the student's academic procrastination behavior are presented.

Figure 19 (Right): The student can audio record their weekly reflection of study moments when the present-self or the procrastination-self was in charge.

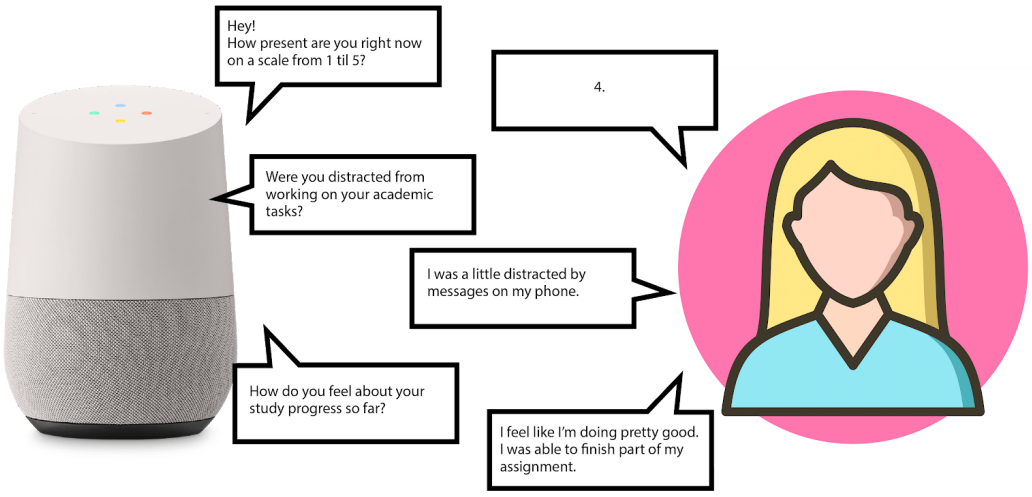


Figure 20: Example of the interaction between a virtual assistant device and the student. The virtual assistant will ask the student questions concerning their presence and awareness. Besides, it will self-question the student's progress in order to make them more aware of their choices and behavior

The data that represents the student's academic procrastination behavior and the connection to their present-self can be visualized in various ways. Since the present-self is measured multiple times each day, this data can be visualized over a day, using bar charts. Notes can be added by the student to personalize their data. An example can be seen in the figure below.

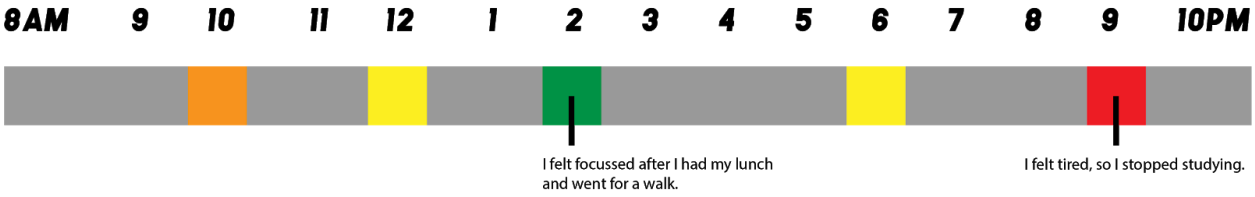


Figure 21: The connection with the student's present-self is visualized using colors indicating their awareness reported in their various notification prompts. Notes can be added to personalize their data.

This data of the student's present-self could be connected with an academic procrastination score, resulting from the academic procrastination questionnaire scales. An overview can be given over time to give the student insight in which days connected with their present-self and the relation with their academic procrastination behavior.

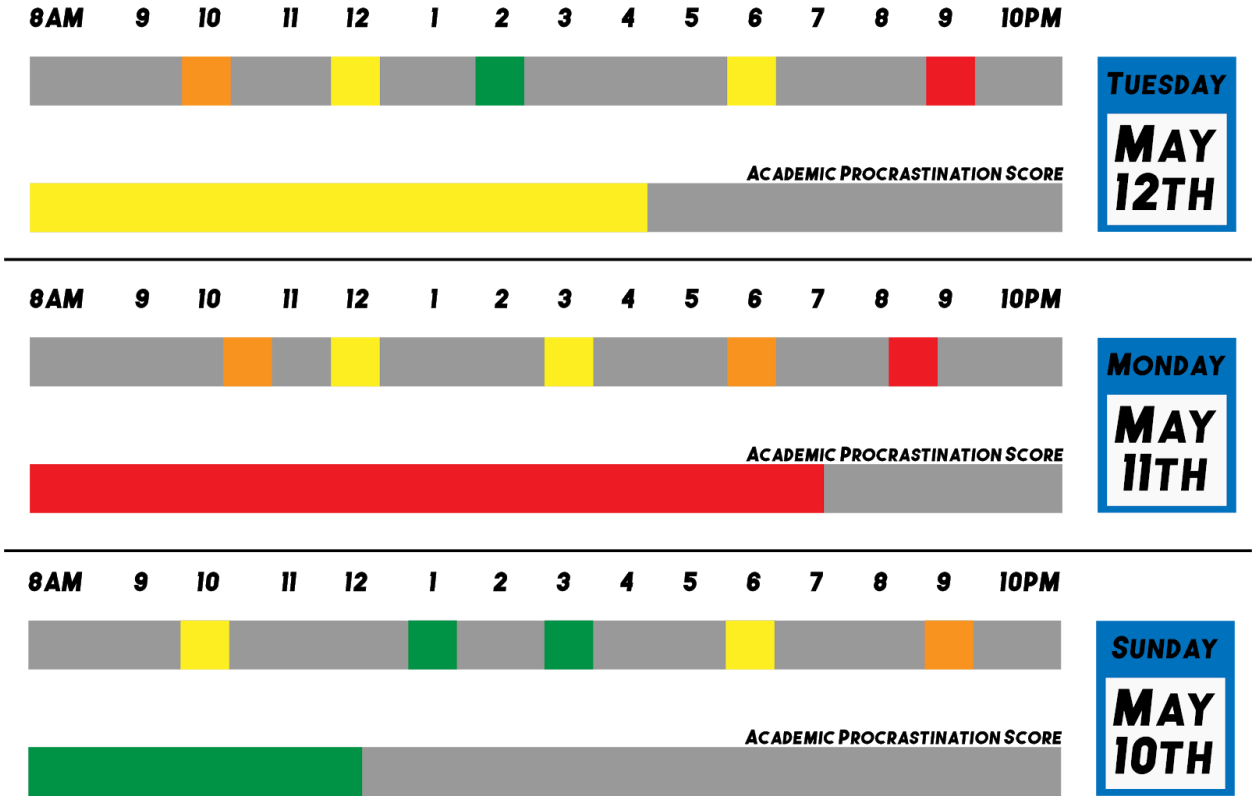


Figure 22: An overview is given where the data related to the student's present-self and academic procrastination is visualized and compared. Colors are used to support the score of academic procrastination.

3.2.4 Design concept D: journaling as a tool

Journaling is found to be a helpful tool to help reduce academic procrastination. In the past, using paper and a pen was the primary tool for journaling. However, increased popularity and use of technology by individuals, have given rise to a variety of technological approaches to journaling. Electronic forms of journaling can overcome resistance, because no additional resources are required or need to be purchased (King & LaRocce, 2006). Therefore, this design concept is smartphone based as well and the aim of this concept is to have the student keep a journal about their activities, emotions, and study progress in order to make them more aware of their behavior and give insight in their academic procrastination behavior. The application could stimulate students to understand procrastination, to make changes in the moment, to motivate action, and to find direction for change.

The application will provide the student with one journal log containing several open entries at the end of their day, since filling in these entries will take more time. The student can write about and report, among others, their mood, emotions, activities, goals and study progress. There will be questions within the app that encourage the student to reflect on their own learning style, including strengths and weaknesses. These kinds of questions have the potential to promote awareness, and that awareness can culminate in more engaged learning. The student can reflect on their journal entries to help reflect on and self-monitor themselves and their behavior. Writing and self-monitoring can illuminate goals, tendencies, and opportunities for change and can function together as a powerful tool to reduce academic procrastination.

The data that is collected involves written journal entries, goals, mood, emotions, activities, and study progress. The data will be collected over time so the student is later able to reflect on their data and find correlations between their journal entries concerning their daily journal and their academic journal. This aims to give the student insight in their academic procrastination behavior, resulting in the Qualified Self. These correlations or other found observations by the students can be written down under 'personal notes'. The student will be able to highlight certain words as well to support their personal notes and correlations. Furthermore, the data will be accessible to the student for reflection at all times in a journal overview, so the student can look back on their study days of choice.

A sketch of the application can be seen in the figures below.

Figure 23 (Left): Open journal logs are provided for the student to engage in reflective writing about their daily activities and emotions.

Figure 24 (Middle): Open journal logs are provided for the student to engage in reflective writing about their academic tasks, study progress, and academic procrastination.

Figure 25 (Right): An overview of journal entries is provided with the option to select, look back and reflect on a certain day.

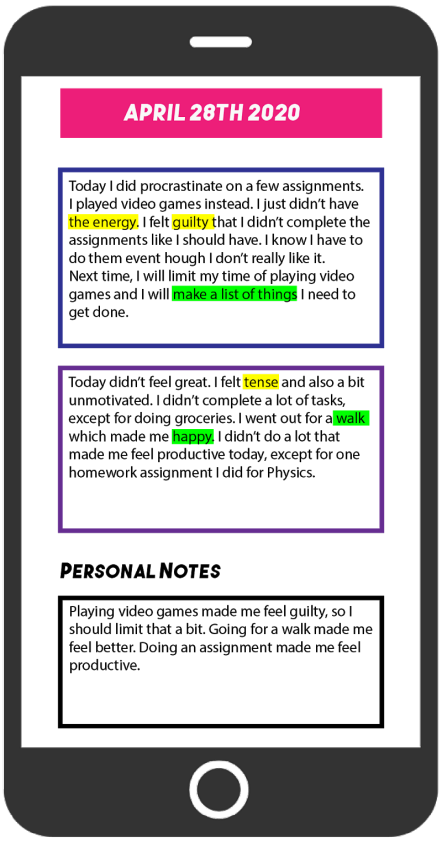


Figure 26: An overview of the selected day is provided where daily journal entries can be compared with academic journal entries. Personal notes can be added, encouraging students to find correlations. The student can also highlight certain words.

3.2.5 Design concept E: improve mindfulness

Research implicates that avoidance of unpleasant thoughts, feelings, and actions contribute to both procrastination itself and the stress associated with this behavior. Approaches that focus on acceptance of unpleasant states and thoughts can therefore be beneficial for reducing academic procrastination behavior. Mindfulness is known to encourage greater awareness of difficult thoughts and feelings, reduce stress, enhance task persistence, and improve health. Besides, mindfulness is suggested to enhance self-regulation (Sirois & Tosti, 2012). It can therefore be a helpful tool to involve in a design concept that aims to reduce academic procrastination behavior. Two design concepts were created, both their aim is to improve the student's mindfulness and give insight into one's academic procrastination behavior, in order to reduce their academic procrastination behavior. One design concept is solely smartphone-based and the other design concept is supported by wearables.

3.2.5.1 Improving mindfulness through an app

The application will provide the user with possible data entries about, among others, their mood, awareness, and perceived stress, these data are related to one's mindfulness. The application will also ask the student to enter data about their study activities to include measuring their academic procrastination behavior. Besides, the application will encourage the student to be more aware, in the moment, and focused through encouraging messages. This aims to keep the student more mindful throughout their day. Furthermore, the application will provide the student with various exercises aimed at improving mindfulness. The student can opt to set a reminder of completing a mindfulness exercise each day. The exercises can take the form of a guided audio track, supported by video infographics.

Mindfulness is a habit and a mind-training skill that requires regular practice and continuous effort to be effective. This is a challenge for app-based mindfulness training. Interactiv, aesthetically pleasing and well-designed apps are likely to be more effective in engaging the user in regular mindfulness practice. Besides, participation in an app community can help motivate users to engage such activities. A supportive app community can help users share and discuss their mindfulness experiences and the challenges of regular practice (Mani et al., 2015). That said, an online mindfulness community for students may be beneficial for motivating students to regularly practice their mindfulness.

The data that is collected involves mood, emotions, awareness, perceived stress, and study activities. A popular scale for measuring mindfulness in positive psychology is the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) which is developed to assess a core characteristic of dispositional mindfulness. The student's academic procrastination behavior will be measured using scales. The application will provide the student the option to reflect on their data entries over a period of time in order to have them find correlations between their mindfulness and academic procrastination behavior. This aims to give the student insight in their academic procrastination behavior, resulting in the Qualified Self. Besides, improving the student's mindfulness can enhance their self-regulation, which is also beneficial for reducing academic procrastination.

A sketch of the application can be seen in the figures below.

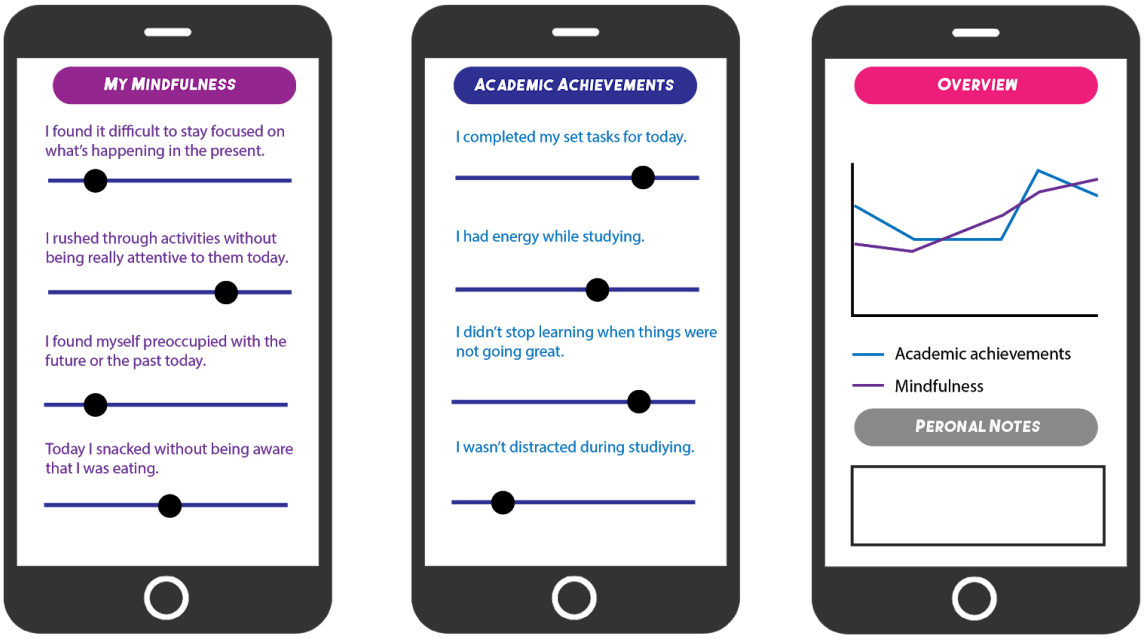


Figure 27 (Left): Scales for measuring the student's mindfulness are presented.

Figure 28 (Middle): Scales for measuring the student's academic procrastination behavior are presented.

Figure 29 (Right): An overview is given where the data related to the student's mindfulness and academic procrastination is visualized and compared. Personal notes can be added by the student to personalize their data and note their own correlations. .

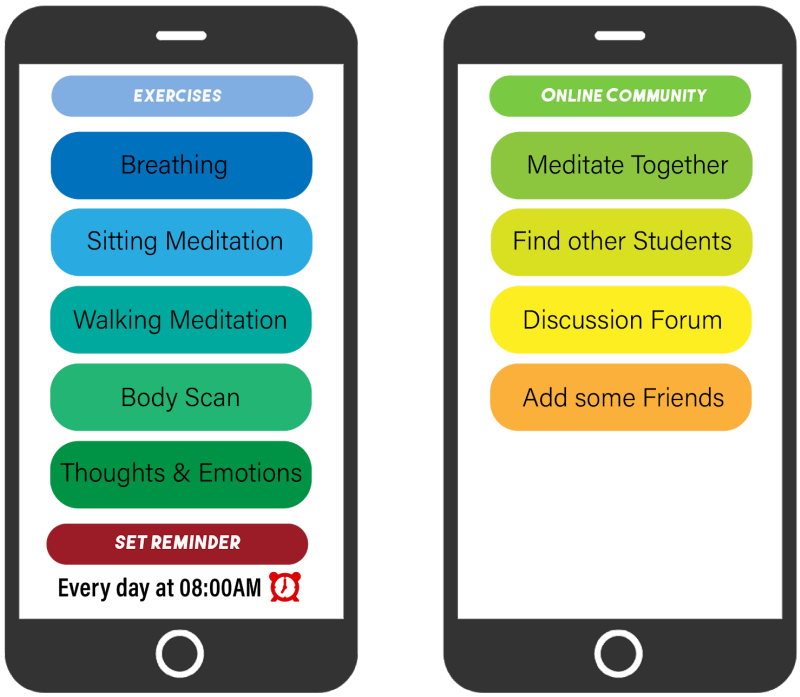


Figure 30 (Left): Various exercises to help improve the student's mindfulness are presented. The student can opt to set a daily reminder for performing an exercise.

Figure 31 (Right): An online community is provided within the app in order to help motivate students to regularly practice their mindfulness.

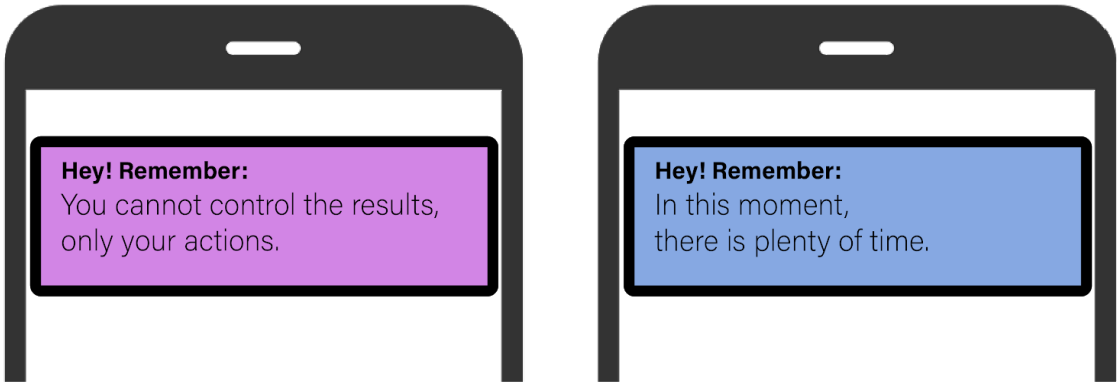


Figure 32: Examples of an encouraging message that appears on the student's phone.

3.2.5.2 Improving mindfulness using wearables

Quantified mindfulness involves monitoring individuals and supporting them with advice resulting from data that is collected associated to one's mental state, such as respiratory data and heart-rate. There are already some digital mindfulness apps that offer real-time sensing of user performance and provide adaptive feedback. Through sensing technology and wearables, digital mindfulness apps can utilize rich user data including physiological performance to individualize coaching and allow users to track their bio-psychological dynamics and increase awareness thereof through biofeedback (Zhu, Hedman & Li, 2017).

Deriving from this approach, this concept is smartphone-based as well, but it is supported by wearables. Biodata associated with one's mental state can be tracked and compared to one's academic procrastination behavior data in order to find correlations between them. For example, a student could measure their breathing patterns using wearables. The application could sense respiratory patterns to detect mental state changes, for example, tensed, calm and focused. When the breathing pattern indicates the student is stressed, the application can show a notification prompt to remind the student to breathe deeply. Sensing breathing patterns can result in respiratory data which can be compared to academic procrastination behavior data entries. Comparing these data, the student can find correlations between their mental state and their academic procrastination behavior. The application will aim to give the student insight in their academic procrastination behavior, resulting in the Qualified Self.

A sketch of the application can be seen in the figure below.

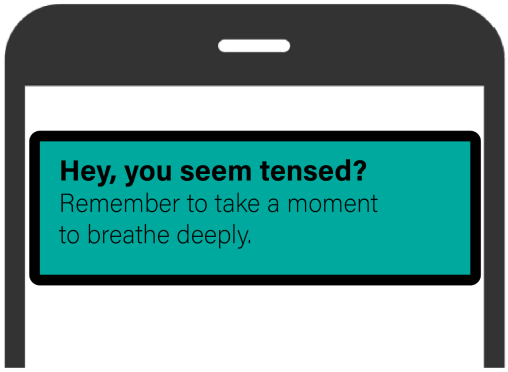


Figure 33: Example of a notification prompt to remind the student to breathe deeply when sensing stress. The student can opt to open up the notification and to enter a personal about why they are feeling stressed.

The data that represents the student's academic procrastination behavior and the connection to their present-self can be visualized in various ways. Since the present-self is measured multiple times each day, this data can be visualized over a day, using bar charts. Notes can be added by the student to personalize their data. An example can be seen in the figure below.

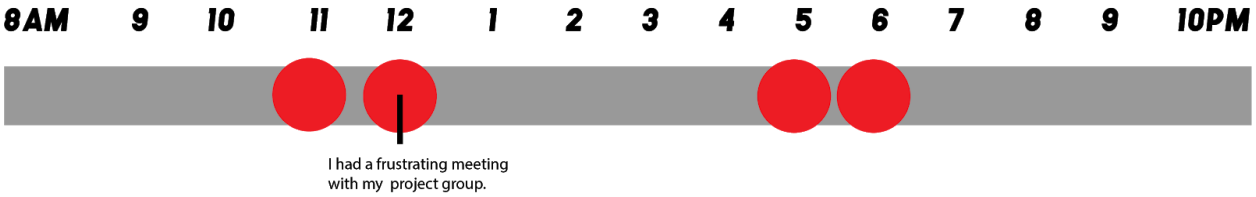


Figure 34: The student's stress pattern is visualized using red bubbles, personal notes that were reported in the notification prompts are added as well.

This data of the student's stensed stress could be connected with an academic procrastination score, resulting from the academic procrastination questionnaire scales. An overview can be given over time to give the student insight in stressful days and the relation with their academic procrastination behavior.

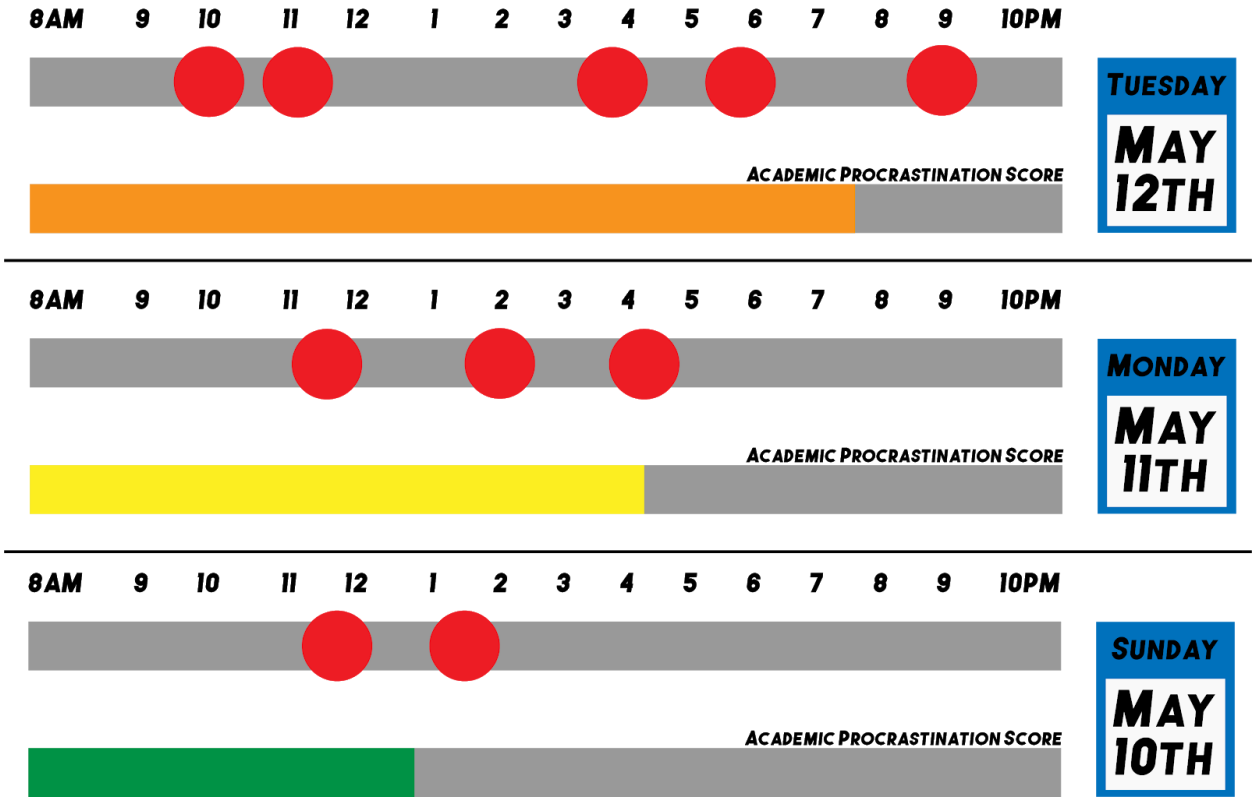


Figure 35 : An overview is given where the data related to the stress pattern and academic procrastination is visualized and compared. Colors are used to support the score of academic procrastination.

3.3 Conclusions

3.3.1 Overview of design concepts

In order to be able to find possible combinations between the various design concepts, a clear overview of all the concepts will be given. This way, the elements, differences, and parallels will be visible between the concepts.

Table 11: Overview of the design concepts.

Description	**A**	**B**	**C**	**D**	**E.1**	**E.2**
Improve **self-regulation** through collecting data correlated with self-regulation using **self-reported scales**. **Compare** self-regulation data with academic procrastination behavior data **over time** in order to find correlations between the student's self-regulation and academic procrastination behavior. Use **tags** to **reflect** on moments, making data more personal. **Colors** can be used to support the data. Aims to give the student insight, resulting in the Qualified Self.	X					
Improve **emotional regulation** through collecting data correlated with self-regulation using **self-reported scales**. **Compare** emotional regulation data with academic procrastination behavior data **over time** in order to find correlations between the student's self-regulation and academic procrastination behavior. Use **tags** to **reflect** on moments, making data more personal. **Colors** can be used to support the data. Aims to give the student insight, resulting in the Qualified Self.		X				
Connect the student with their **present-self**, using **notification prompts** through a **virtual assistant**. Collect data related to awareness and presence of the student and data related to academic procrastination behavior, in order to **compare these data over time**. Data related to the present-self can be visualized over a day, using **bar charts**. Have the student **reflect** on moments when their procrastination-self was in			X			

charge, or their present-self. Aim to give the student insight, resulting in the Qualified Self.						
Use **journaling** as a tool. Encourage **reflective writing** about daily activities and academic activities, using **open journal logs**. Data will be collected **over time** in order to find correlations between the daily journal and the academic journal. **Personal notes** and **highlights** can be added by the student. Aims to give the student insight, resulting in the Qualified Self.				X		
Improve **mindfulness** through assessing the student's mindfulness, using **self-reported scales**. **Compare** mindfulness data with academic procrastination behavior data **over time** in order to find correlations between the student's mindfulness and academic procrastination behavior. Encourage the student to be more mindful through **inspiring notifications**. Options for **reminders** of mindfulness **exercises** and online community. Aims to give the student insight, resulting in the Qualified Self.					X	
Use **quantified mindfulness**, supported by **wearables** measuring data correlated to the student's mental state. **Compare** mindfulness data and academic procrastination behavior **over time** in order to find correlations between the student's mental state and academic procrastination behavior. When a distressed pattern is sensed, a **notification prompt** is shown. Aims to give the student insight, resulting in the Qualified Self.						X

3.3.2 Combining concepts

Data collection using self-reported scales has the potential to be combined with notification prompts. On this note, design concept A or B could be combined with concept C, since both A and B use self-reporting scales which can be supported with notification prompts from C used to connect the student with their present-self. This can result in an enhanced design concept, improving both the student's self-regulation or emotional regulation, depending on the choice between A and B, and making the student aware to stay in their present-self, reducing academic procrastination behavior. Visser et al. (2017) found that the state of being in which students are present in the here-and-now and aware of their behavior, as well as of choices they can make in the (study) situation, is beneficial to overcoming academic procrastination. However, Visser et al. used a different approach than notification prompts, focusing on core reflection of the student based on positive psychology principles.

To enhance the design concept further, an element of journaling could be added to improve facilitating reflection, promote personal growth, and precipitate change. One journaling log could be provided within the design concept subsequently to the self-reported scales to provide the student with the option to write down personal notes and reflect on their day and study session. Hensley and Munn (2020) had college students who self-identified as procrastinators maintain biweekly journals in order to engage students in self-monitoring and reflective writing to bring greater awareness to students' academic procrastination behaviors. Different from Henley and Munn, this graduation project will ask the students to write a daily journal entry to have them reflect on their (academic procrastination) behavior. This element will aim to help students understand procrastination, gain insight in their behavior, motivate action, and find direction for change.

Furthermore, a choice will have to be made between the focus of design concept A (self-regulation) and design concept B (emotional regulation). Since emotional regulation involves more specific elements compared to self-regulation, it is more realistic to incorporate in this graduation project. Besides, Eckert et al. (2016) tested the hypothesis that the availability of adaptive emotional regulation skills prevents procrastination. In this study, procrastination was measured with the Academic Procrastination State Inventory (APSI) and emotional regulation skills were measured with the Emotional Regulation Skills Questionnaire (ERSQ). The participants were asked to rate how often they engaged in the behavior during the previous week. However, this graduation project will aim to evaluate the student's emotional regulation skills and academic procrastination at the end of each day. Findings of Eckert et al. indicate that emotional regulation skills are associated with procrastination, so there lies potential in including both measuring emotional regulation skills and academic procrastination behavior in a final design solution, using the ERSQ and APSI.

On a further note, the target group should be taken into account carefully. The target group consists of students who deal with academic procrastination behavior. For example, design concept E.2 requires the use of wearables such as breathing sensors. There are few students who own such a device, so design concept E.2 is less practical for students. A design concept that solely requires the use of a smartphone is more likely to be accepted by students for everyday use.

3.3.3 Expert review

An interview with Dr. Lennart Visser was held on the 11th of May 2020 in order to discuss the general directions acquired from the literature background research, state-of-the-art research, and previous expert interview. Furthermore, the design concepts from the ideation phase were discussed and possible combinations were explored.

Dr. Visser explained that it is important to note that the themes from design concept A through E (self-regulation, emotional regulation, present-self, journaling, and mindfulness) intertwine with each other. Thus, he believes there lies potential in a combination of the various design concepts. He pointed out that different combinations could be tested as well, with different intervention groups. For example, include a journaling aspect with one group and leave it out with the other group to examine if there is a difference.

Dr. Visser explained that self-regulation is a very large and complex process that involves a number of aspects. Self-regulation as a whole is overarching, so it may be difficult to clearly measure it. He believes it would be good to select some more specific aspects, like emotions, motivation, or goals. Dr. Visser stated that emotional regulation is the most underexposed aspect in this field of research, so he believes there lies the best chance to really achieve something.

Dr. Visser said that it is wise to look at existing scales and questionnaires to check how they can be used. Despite the fact that the original scale of the APSI is actually intended to measure one's academic procrastination behavior per week, Dr. Visser said it could be converted to a daily scale. He mentioned that weeks of students vary often because they tend to work towards exam weeks. When students are in the week before the exams, they score differently than when their academic procrastination behavior is measured six weeks in advance. Dr. Visser noted that, also seen in other studies, researchers often choose one of the three APSI subscales and he agreed that not too much should be asked of the students, addressing the number of questions.

When notification prompts about the present-self were discussed, Dr. Visser mentioned that he doesn't believe those notifications would be interruptive. He thinks that, for example, when a student feels very much aware and present, it could be extra motivating when he can confirm that within the application. When the student is out of touch with their present-self, it could be a stimulans to help them reconnect with their present-self. Dr. Visser explained that you can make students more aware through an incentive, for example by asking a question. Which questions ought to be asked, of course, depends on what information should be collected about the student. Dr. Visser pointed out that scale questions have more depth than yes-no questions, because on scales students have to consciously give themselves a valuation.

4. Specification Phase

In the specification phase, a more detailed design concept will be constructed, resulting in a proposed product. The requirements resulting from the ideation phase will be established. Subsequently, user requirements will be constructed, derived from a persona and a user scenario. Furthermore, the choice of data is explained and how this data will be collected is examined. Additionally, system requirements will be established. Finally, specific requirements resulting from the specification phase will be set up.

4.1 Initial requirements

Resulting from the ideation phase, a more detailed set of requirements can be set up. However, there are still some specific requirements to be determined in the specification phase. For example, how and which data will be tracked and how the data will be presented to the student. Besides, both user requirements and system requirements will have to be specified.

Table 12: Requirements resulting from the ideation phase.

Requirements resulting from the ideation phase
Should be a smartphone-based application
Should aim to improve emotional regulation
Should aim to connect with the present-self
Should acquire automatically tracked data and/or self-reported data
Should include one or several journaling log(s)
Should provide option to reflect on gathered data
Should give insight in behavior
Should result in the Qualified Self

4.2 User requirements

4.2.1 Persona

A persona is created in order to conceive a realistic representation of the target user group. This way, the major needs and expectations of the target user group can become clearer.

Table 13: Persona.

Persona:	First-year student
Photo:	 (https://depositphotos.com/stock-photos/girl.html)
Fictional name:	Tessa Peters
Major responsibilities:	Communication Science student at the University of Twente
Demographics:	- 18 years old - Female - Single - Lives in Enschede - Studies Communication Science - Member of sports association Euros
Goals and tasks:	She is a busy student and enjoys spending time with her friends rather than studying. However, she realizes she needs to be successful in her academic tasks in order to be able to keep studying at the University of Twente. She is a hard worker, but sometimes finds it difficult to focus. Study goals and tasks: - Study for exams - Finish homework assignments - Combine fun student life with academic tasks - Procrastinate less on assignments

	- Focus better while studying
Environment:	She lives in a fairly busy student house, so she often studies in the library. She usually studies with friends, but sometimes also by herself. She carries her smartphone with her all the time so she can check her messages frequently. Besides, she uses her laptop for studying and completing her homework assignments.
Quote:	"I don't really understand why I procrastinate."

4.2.2 User scenario

A user scenario is constructed in order to visualize how the user may use the proposed product. It focuses on the user's motivations, and documents the process by which the user might interact with the design.

Tessa is a first-year Communication Science student at the University of Twente. She is working hard to keep up her studies, but she also engages in a very active student life. She is a member of the student rowing association and she works part time at a restaurant on the weekends. She has found a lot of great friends in her first year at university and she enjoys spending her free time with time. Since she has such a busy student life, she sometimes finds it hard to find enough time to study. Occasionally, whenever she sits down to study, she finds it difficult to concentrate on her academic tasks. She'd rather just be with her friends, but she knows she needs to pass her courses in so she can keep studying at the University of Twente. She does enjoy her studies, but just not as much as hanging out with her friends or going rowing. Besides, she finds herself watching YouTube videos or checking Instagram frequently when studying. This all leads to her procrastinating on her tasks once in a while. Whenever she works on her assignment last minute or even submits it late, she gets frustrated with herself. Sometimes she wishes she would just work on it in time, instead of leaving it to the last minute. She would like to procrastinate less, but she doesn't really know how. She has tried to make schedules before, but she always had a hard time sticking to them.

One day, Tessa heard about this new app that aims to reduce students' academic procrastination behavior by collecting data and presenting this data in such a way so that she can learn from it and improve her behavior. Since she is looking for a way to work on her academic procrastination behavior, she decides to give it a try. Everyday, the app asks her several questions regarding her emotions and her academic progress and procrastination behavior. Besides, it sends her reminders about being more aware and to connect with her present-self. She can evaluate herself, using easy-to-use scales. At the end of each day, she is asked to write down a short text to reflect on her day and study prograss, using a journaling log. After using the app for two weeks, she feels more aware when studying. Each day she takes the time to reflect and be more conscious of her emotions. When looking at the data output of the app, she discovers that the way she deals with her emotions is connected to her

academic procrastination behavior. Furthermore, she finds that she has become more attentive over time. Finally, keeping a journal about her study process and tasks helped her understand procrastination and find direction for change. The app gave her a new perspective on her academic procrastination behavior and it helped her understand and adjust her behavior. It made her realize that it is not just about making schedules, but that being more mindful about your emotions and presence is of great importance as well.

4.2.3 Resulting user requirements

Resulting from the persona and the user scenario, the following user requirements can be set up:

- The application should be smartphone-based, able to be used on a daily basis;
- Using the application shouldn't take more than 15 minutes per day;
- The front-page load time shouldn't be more that 2 seconds for users;
- The application should be accessible from 8AM till 11PM each day;
- The application should collect data related to academic procrastination;
- The application should make use of fairly simple ways for collecting data, for example using scales;
- The user interface of the application should be menu driven;
- The application should provide a journal log to engage the user in reflective writing;
- The application should provide clear data output to help give the user insight;
- The application should provide an overview of data to help the user find correlations;
- The data visualisation should be evident to help the user find possible correlations between their academic procrastination and related factors.

4.3 Choice of data

A selection of the data that will be tracked is made. The choice of data is explained; which data will specifically be collected and why.

4.3.1 APSI

As mentioned in *Chapter 3 Ideation Phase*, there are various methods to measure one's academic procrastination behavior. For example, the Academic Procrastination State Inventory (APSI; Schouwenburg, 1995), the Academic Procrastination Scale (Milgram & Toubiana, 1999), Procrastination Assessment Scale—Students (Solomon & Rothblum, 1984), and the Tuckman Procrastination Scale (Tuckman, 1991).

Resulting from the expert interview and other research (Eckert et al., 2016; Lukas & Berking, 2018; Visser et al., 2017; Visser et al., 2018) it becomes clear that the APSI is a suitable

and valid method to assess the student's academic procrastination behavior within this graduation project. The APSI was constructed by H. Schouwenburg (1995) and it involves a state inventory of study behaviors associated with academic procrastination. It is used in previous research to measure one's academic procrastination.

On the original scale, the items on the APSI ask the respondents about their study behavior of the previous week. Each item begins with the question "How frequently did you... last week?" On a five-point Likert scale ranging from never (1) to always (5), the student indicates his or her assessment of how often something happened. Higher scores indicate a higher tendency to procrastinate. For the purpose of this graduation project, the respondents will be asked about their study behavior at the end of each day.. Sample questions include the following: "How frequently did you drift off into daydreams while studying today?" and "How frequently did you give up when studying wasn't going well today?".

The APSI is a self-report instrument with a total of 23 items and it is divided into three subscales; $APSI_{procrastination}$, $APSI_{fear\ of\ failure}$, and $APSI_{lack\ of\ motivation}$. The first scale applies to academic procrastination behavior and the second scale measures fear of failure. Finally, the third scale measures lack of study motivation. The APSI and its subscales are both reliable and valid. The $APSI_{procrastination}$ scale provides a measure of academic procrastination behavior, the items of this scale are a mixture of postponing and doing other things procrastinatory behavior (Schouwenburg, 1995).

Within this graduation project, the $APSI_{procrastination}$ scale will be used to measure the student's academic procrastination and will serve as the input method for collecting this data. The $APSI_{procrastination}$ scale consists of 13 self-report items. The minimum score for this scale is 13 points (13*1) and the maximum score is 65 (13*5). Lower scores indicate a lower tendency to engage in academic procrastination behavior. Each day the student's score can be computed and compared to other data, for example to the score from the ESQR. This way, correlations can be found by the student. Moreover, questions on which the student scores particularly badly over time can be notified to the student to help them be more conscious of these actions.

The complete APSI and its subscales can be found in Appendix I.

4.3.2 ERSQ

As mentioned in *Chapter 3 Ideation Phase*, there are various methods to measure one's emotional regulation. For example, the Emotion Regulation Skills Questionnaire (ERSQ; Berking & Znoj, 2008), the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), and the Interpersonal Emotion Regulation Questionnaire (IERQ; Hofmann, Carpenter & Curtiss, 2017).

Resulting from research (Eckert et al., 2016; Lukas & Berking, 2018) it becomes clear that the ERSQ is a suitable and valid method to assess the student's emotional regulation skills within this graduation project, combined with the APSI. Eckert et al. (2016) used both the APSI and the ERSQ in the study where they found that emotional regulation skills are associated with academic procrastination behavior. Lukas and Berking (2018) used both the APSI and the ESQR as measures where they had students participating in a smartphone-based treatment. Participating in the smartphone-based treatment was associated with a significantly greater reduction of procrastination than was participating in the control condition and they concluded that a smartphone-based intervention may be an effective treatment for procrastination.

The ERSQ is developed by translating the German-based SEK-27 into English. Both German Versions of the SEK-27 were compared to reveal and eliminate any arising inconsistencies. This was done by Grant et al. (2018). As no significant discrepancies between each item of both versions were identified, the English translation was confirmed as the final English version. It is used in previous research to measure one's emotional regulation skills.

On the initial scale, the items on the ERSQ ask the respondents to fill in statements about a variety of emotions they may have experienced in the last week and about how they dealt with these emotions. Each item is preceded by the stem "Last week I …". On a five-point Likert scale ranging from not at all (1) to almost always (5), the student indicates his or her assessment. Higher scores indicate higher emotional regulation skills. For the purpose of this graduation project, the respondents will be asked about their behavior at the end of each day. Sample questions include the following: "Today I was able to consciously pay attention to my feelings" and "Today I could endure my negative feelings".

The ERSQ is a self-report instrument and consists of 27 items. Emotional regulation skills are assessed through the following nine subscales with three items per skill: awareness, sensations, clarity, understanding, modification, acceptance, tolerance, readiness to confront distressing situations when necessary to attain personally relevant goals, and self-support.

Eckert et al. (2016) found that all ERSQ subscales are correlated with the APSI and its subscales, except for $ERSQ_{awareness}$. An overview of the intercorrelations is presented in Table 14 below.

Table 14: Descriptive statistics and intercorrelations between procrastination (APSI) and the subscales of the ERSQ. Retrieved from Eckert et al. (2016), p. 12.

	M	SD	1	2	3	4
1 $APSI_{total}$	58.0	14.52*		0.86***	0.80***	0.69***
2 $APSI_{academic\ procrastination.}$	33.9	8.33**			0.48***	0.35***
3 $APSI_{fear\ for\ failure}$	13.6	4.94				0.63***
4 $APSI_{lack\ of\ motivation}$	3.7	1.97				
5 $ERSQ_{awareness}$	3.5	0.81	−0.15***	−0.11***	−0.10***	−0.19***
6 $ERSQ_{sensation}$	3.8	0.70	−0.27***	−0.20***	−0.17***	−0.28***
7 $ERSQ_{clarity}$	3,9	0.76	−0.34***	−0.27***	−0.21***	−0.34***
8 $ERSQ_{understanding}$	3.9	0.79	−0.32***	−0.21***	−0.23***	−0.35***
9 $ERSQ_{acceptance}$	3.7	0.69	−0.40***	−0.32***	−0.33***	−0.28***
10 $ERSQ_{resilience}$	3.7	0.77	−0.53***	−0.42***	−0.49***	−0.40***
11 $ERSQ_{self\text{-}support}$	3.8	0.75	−0.43***	−0.33***	−0.42***	−0.31***
12 $ERSQ_{r.t.confront}$	3.6	0.82	−0.26***	−0.17***	−0.25***	−0.30***
13 $ERSQ_{modify}$	3.4	0.76	−0.29***	−0.22***	−0.26***	−0.21***

Note. N = 162; APSI = Academic Procrastination State Inventory (Schouwenburg, 1995; German version: Helmke & Schrader, 2000); ERSQ = Emotion Regulation Skills Questionnaire (Berking & Znoj, 2008); r.t.confront = readiness to confront aversive emotions. ∗ $p < 0.05$. ∗∗ $p < 0.01$. ∗∗∗ $p < 0.001$.

Looking at the table, the most significant correlations between the $APSI_{procrastination}$ and the ERSQ subscales are $ERSQ_{resilience}$, $ERSQ_{self\text{-}support}$, $ERSQ_{acceptance}$ and $ERSQ_{clarity}$. These four subscales together consist of 12 items, three items each. This can be an interesting set of items and is proportional in size compared to the $APSI_{procrastination}$. The minimum score for this set scale is 12 points (12*1) and the maximum score is 60 (12*5). Lower scores indicate lower emotional regulation skills. Moreover, lower scores on the ERSQ predict higher tendency to procrastinate. Just like the $APSI_{procratination}$ scores, the student's score can be computed and compared to other data each day. Furthermore, statements on which the student scores particularly badly over time can be notified to the student to help them be more conscious of these matters.

The complete ERSQ and its subscales can be found in Appendix II.

4.3.3 Present-self

To encourage the student to stay connected with their present-self, notification prompts are sent throughout the day. These prompts will present the student with a scale question about their presence at the moment. Scale questions will be used since this is more in depth compared to closed yes-no questions, inspired by the expert interview. On scales, students will consciously have to give themselves a valuation about their presence. This will also provide the student with a moment to reflect and consider their presence in connection to their study progress.

The notification prompts will ask the student to indicate their level of presence on a 5-point Likert scale ranging from not at all (1) to completely (5). These notification prompts will be sent regularly throughout the student's study session. Sample questions include the following; "How present are you at the moment?" and "How connected are you to your present-self at the moment?". The times on which the scale questions are answered will be saved as well in order to visualize the student's present-self connection data over time. This will provide the student to reflect on moments and days on which they were more connected to their present-self and on which they were less connected to their present-self, in relation to their academic procrastination behavior.

4.3.4 Journaling

In order to help the student understand procrastination, motivate action, and find direction for change. A journal log is provided at the end of each day. This journal log will stimulate the student to engage in reflective writing concerning their emotions and academic procrastination behavior.

The student will reflect on recent experiences with procrastination by responding to several questions, divided into two categories; questions concerning one's emotional behavior and questions concerning one's academic procrastination behavior. Sample questions about the student's emotional behavior include: "What moments made you feel good today, and why?" and "Was there a moment today in which you felt bad? What did you do to make yourself feel better?". Sample questions about the student's emotional behavior include: "What assignments did you procrastinate on, and why?" and "What were the results of procrastinating in terms of how you felt?".

4.4 System requirements

Following the user requirements and the choice of data, various system requirements can be established:

- The system should be compatible with Android and iOS smartphone devices;
- The system should be accessible from 8AM till 11PM each day;
- The system should send notification prompts, concerning:
    - a scale question about present-self awareness (four times per day);
    - a reminder to fill in the data entries and journal log (at 8PM each day);
- The system should collect data related to academic procrastination behavior using APSI scale questions;
- The system should collect data related to emotional regulation skills using ERSQ scale questions;

- The system should collect data related to present-self using scale questions;
- The system should provide the user with a journal log;
- The system should send a notification about badly scored questions each week, concerning APSI and ERSQ scale questions;
- The system should be protected from unauthorized access to the system and its stored data;
- The system should process the collected data into a data visualisation;
- The system should update the data visualisation each day;

4.5 Final requirements

Resulting from this specification phase, a more detailed set of requirements can be set up. These are described in the table below.

Table 15: Requirements resulting from the specification phase.

Requirements resulting from the specification phase
User requirements
The application should be smartphone-based, able to be used on a daily basis
Using the application shouldn't take more than 15 minutes per day
The front-page load time shouldn't be more that 2 seconds for users
The application should collect data related to academic procrastination
The application should make use of fairly simple ways for collecting data, for example using scales
The user interface of the application should be menu driven
The application should provide a journal log to engage the user in reflective writing
The application should provide clear data output to help give the user insight
The application should provide an overview of data to help the user find correlations
The data visualisation should be evident to help the user find possible correlations between their academic procrastination and related factors
System requirements
The system should be compatible with Android and iOS smartphone devices

The system should be accessible from 8AM till 11PM each day
The system should send notification prompts, concerning - a scale question about present-self awareness (four times per day) - a reminder to fill in the data entries and journal log (at 8PM each day) - badly scored APSI and ERSQ questions (once a week)
The system should collect data related to academic procrastination behavior using APSI scale questions
The system should collect data related to emotional regulation skills using ERSQ scale questions
The system should collect data related to present-self using scale questions
The system should provide the user with a journal log
The system should be protected from unauthorized access to the system and its stored data
The system should process the collected data into a data visualisation
The system should update the data visualisation each day

4.6 Proposed product

The final proposed product will take the requirements mentioned above into account. Thus, it will take the form of a smartphone-based application, aimed for daily use. It should be supported by both Android and iOS devices. The application will measure and evaluate the student's emotional regulation skills using subscales from the ERSQ. Besides, it will measure and evaluate the student's academic procrastination using the subscale $APSI_{procrastination}$. Both the data collection of these measures will take the form of computing scores and comparing these scores in order to help the student find correlations between their emotional regulation skills and their academic procrastination behavior. The application will stimulate the student to connect with their present-self through notification prompts. The student will indicate their presence using scales during their study session. This data will be saved as well and can later be visualized to help the student find correlations between their present-self connection and their academic procrastination behavior. Furthermore, a journal log will be added to help the student engage in reflective writing concerning their emotions and academic procrastination behavior. The system will send notification prompts to remind the student to fill in the data entries at the end of each day. All these aspects together will collect data which the system will convert into a data visualisation to help the student reflect on the gathered data and find (possible) correlations. This data visualisation should be updated by the system each day. The application intends to give the student insight in their behavior and to motivate them for change. This can result in the Qualified Self, aimed at reducing academic procrastination behavior.

5. Realisation Phase

Due to time restrictions and the implications of programming such an application as described in Chapter 4, a proof of concept will be made instead. A proof of concept is a realisation of the idea in order to demonstrate its feasibility with the aim of verifying that the concept has practical potential. In the realisation phase chapter, the design of the proof of concept will be explained. The dataset of the proof of concept will be discussed and the data collection method will be established. Furthermore, the data visualisation software will be explained and the final data visualisation of the proof of concept will be discussed.

5.1 Dataset

The dataset of the proof of concept consists of the results of:

- the daily questionnaire concerning APSI and ERSQ scale questions;
- the multiple daily scale questions concerning the present-self;
- daily journal log entries concerning academic procrastination and emotional behavior;

A simplified overview of the tracked data can be seen in Table 16 below.

Table 16: Dataset overview.

Tracked data
APSI scores
ERSQ scores
Present-self connection
Journal log entries

5.2 Data collection

The data will be collected through the use of online questionnaires. The daily questionnaire will be sent to each participants' email account at 8:30PM each day. This time was chosen because almost all participants explained they usually study during the day. The APSI scale questions, the ERSQ scale questions, and the journal question logs will be included in this daily questionnaire. The online tool SurveyMonkey will be used to create and distribute the questionnaires. Furthermore, the SurveyMonkey database will be used to collect and store the

data resulting from the questionnaires. This data can be downloaded manually in a comma separated file. To collect data of the participant's present-self connection, notification prompts will be sent using SurveyMonkey at predefined moments each day; at 10AM, 1PM, 4PM, and 8PM. The notifications will take the form of an email notification. One scale question will be included each time a notification is sent. Subsequently, the participant will have to open their email to be able to answer the question through SurveyMonkey. The present-self data will be downloaded in a comma separated file as well. The data from the daily questionnaire and the data from the present-self notification questions can be compared using timestamps. All data, except for journal log entries are expressed in numerical values. Journal log entries will include written text. A representation of the data flow can be seen in Figure 36 below.

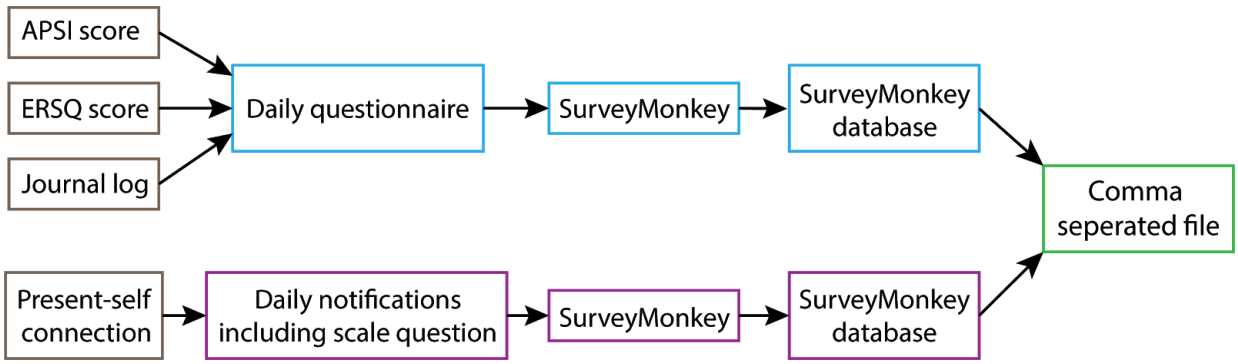


Figure 36: Data flow.

5.3 Data preparation

The data in the final comma separated file will be seperated in Excel in two sheets; one sheet concerning the data from the daily questionnaire and one sheet concerning the data from the present-self connection data resulting from the notifications. The data is separated into two sheets because two visualisations will be created; one will involve a weekly overview (resulting from the data from the daily questionnaire) and the other will involve a present-self connection overview (resulting from the data from the present-self notifications questions).

Before the data is stored in an Excel Worksheet for each individual, some computations will be done to compute the percentage scores of each factor; academic procrastination, emotional regulation, and present-self connection. This is done to facilitate the findings of possible correlations. By using percentage scores, the factors will be relatively easier to compare. It is important to note that therefore the scores of participants cannot be compared to each other, this would be psychometrically incorrect. The percentage scores of the factors and the way they will be presented together in one visualisation have the purpose to help the participants find meaning and possible correlations in their own data. An explanation of the content of the final Excel Worksheet will be given in the figure below. Notice that the term 'academic proactivity' is

used instead of 'academic procrastination'. This is because emotional regulation and academic procrastination have an intercorrelation; lower scores on the ERSQ predict higher tendency to procrastinate. Therefore, the inverse of the APSI scores was used to compute the percentage scores of academic proactivity to help individuals find correlations between their emotional regulation and academic proactivity.

Table 17: Formulas to compute the percentage score per day for each factor.

Academic proactivity = *(65 (maximum score is 13*5 points) - APSI score day x) / 65 * 100%*
Emotional regulation = *(ERSQ score day x / 60 (maximum score is 12*5 points) * 100%*
Present-self connection = *(present-self score day x / 20 (maximum score is 4*5 points) * 100%*

Tabel 18: Example Excel Worksheet of the daily questionnaire data.

Date	**Academic Proactivity**	**Emotional Regulation**	**Present Self connection**	**Journal question A**	**Journal question B**	**Journal question C**	**Journal question D**
03/06	(65 - score day 1)/65 * 100%	(score day 1 /60) * 100%	(score day 1 /20) * 100%	...	...	...	...
04/06	(65 - score day 2)/65 * 100%	(score day 2 /60) * 100%	(score day 2 /20) * 100%	...	...	...	...
05/06	etc.	etc.	etc.	etc.	etc.	etc.	etc.

Table 19: Example Excel Worksheet of the present-self connection data.

Date	**Present-self score**
3-6-2020 10:00	5
3-6-2020 13:00	4
3-6-2020 16:00	2
3-6-2020 20:00	3
4-6-2020 10:00	4
4-6-2020 13:00	etc.

5.4 Data visualisation

5.4.1 Software

The software program Tableau Desktop will be used to create the data visualisations for the proof of concept. Tableau Desktop can be used to create various colorful data visualisations that can be presented in one dashboard, together. This way, both the visualisation representing the weekly overview and the visualisation representing the present-self connection overview can be viewed simultaneously. Furthermore, Tableau Desktop provides the designer with multiple graph options to use for their data visualisations.

An Excel worksheet will be created for each individual with, as mentioned before, two sheets; one for the daily questionnaire data and one for the present-self connection data. This Excel worksheet can be uploaded to Tableau Desktop as a data source where the data of both sheets can be used to create the data visualisations for each individual. Within Tableau, two worksheets will be used to create a data visualisation on each. Later on, these can be viewed together on one dashboard.

5.4.2 Visualisation

For the proof of concept, two data visualisations will be created in Tableau Desktop which will be presented together on a dashboard. One data visualisation will represent a weekly overview, resulting from the data collected from the daily questionnaire. The other data visualisation will involve a present-self connection overview, resulting from the data collected from the present-self notification questions.

For the weekly overview data visualisation, the percentage scores of academic proactivity, emotional regulation, and present-self connection will be represented in a side-by-side bar graph. In this graph, the percentage scores can be compared best, side by side, together in one graph. This way, the height of the bars can be easily compared with one another. The percentage score will be on the y-axis and the three different factors will be represented on the x-axis of the graph. Moreover, the date of each day will be visible on the top header of the graph. Additionally, the journal questions and the answers to those questions will be presented using a tooltip. These questions and their answers will be visible per day and will show when the user hovers the mouse on the side-by-side bar graph. An example of a four day overview and an example of the tooltip can be seen in the figures below. These examples were created with test data before the user testing took place.

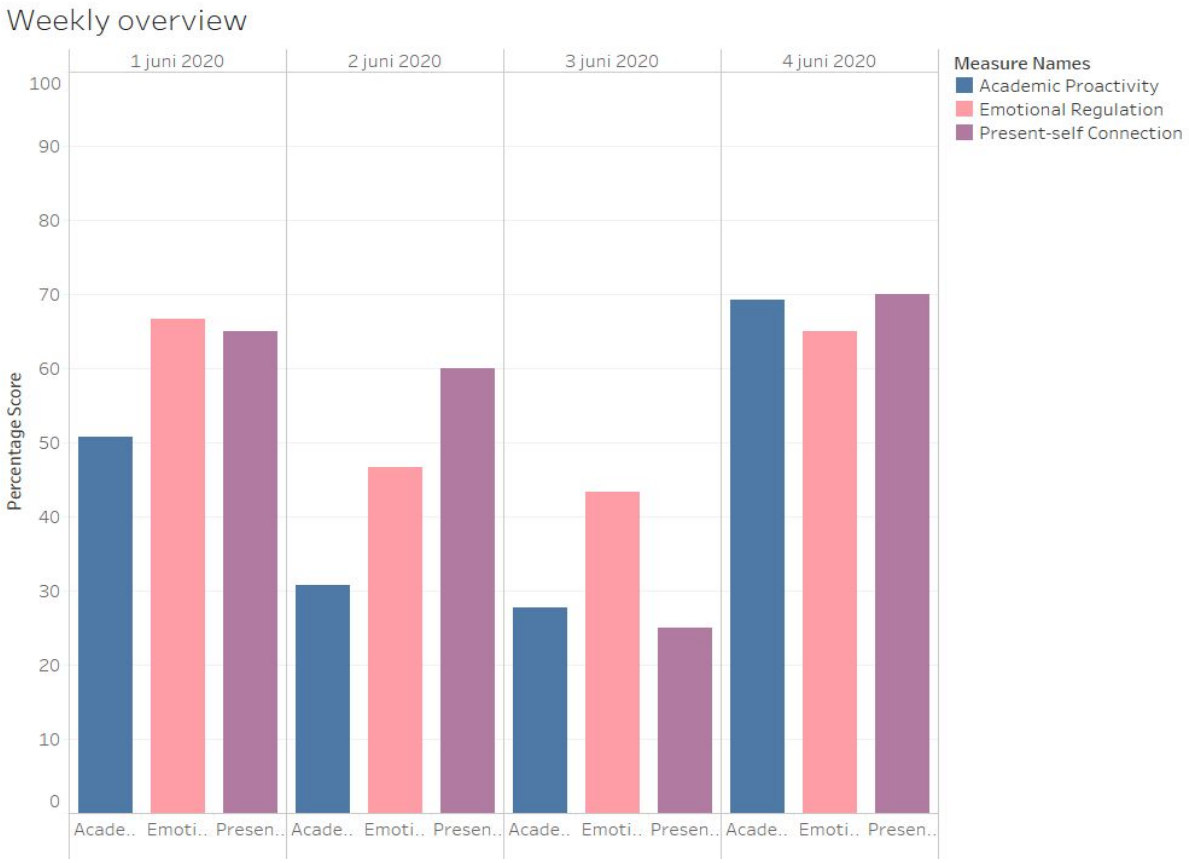


Figure 37: Example of a four day overview. This was created before the user testing took place. The tooltip will be visible when the user hovers the mouse over the bar graph.

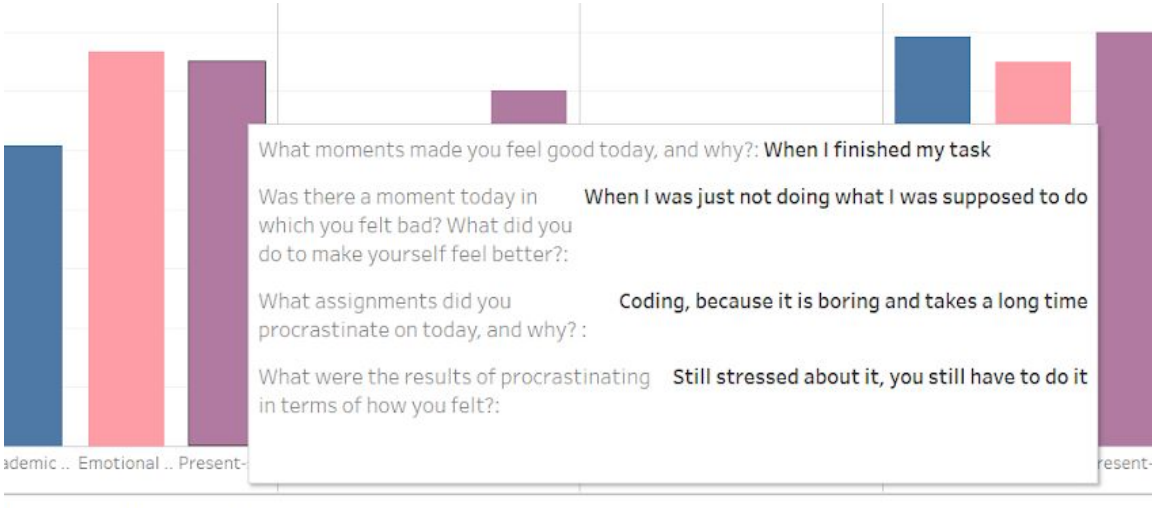


Figure 38: Example of the tooltip, which will be displayed when the user hovers over the visualisation with the mouse. The questions and answers are visible per day.

For the present-self connection overview, the individual time scores will be represented in a highlight table. The scores will range from 1 till 5, on a stepped red - gold - green color range. These colors were chosen to help the participants understand the visualisation sooner and more easily. Naturally, red stands for bad (procrastination self: 1) and green stands for good (present-self: 5). The present-self connection moments will be visible per day, supported by a header for the time and date. An example of a four day present-self connection overview can be seen in the figure below. This example was created with test data as well, before the user testing took place.

Figure 39: Example of a four day present-self connection overview. This was created before the user testing took place.

Both data visualisations of the weekly overview and the present-self connection overview will be combined into one dashboard to be able to be presented and viewed together. An example of a complete data visualisation of four days can be seen in Figure 40 below.

Figure 40: Example of a complete data visualisation on a dashboard that could be presented to a user. This was created before the user testing took place.

6. Evaluation

In the evaluation phase, the proof of concept will be tested with target users. A user evaluation will be used as a technique to evaluate the proof of concept by testing it on representative users. First, the set-up of the user evaluation will be explained followed by a description of the participants that were involved in the usability evaluation. Furthermore, the results of the usability test will be examined.

6.1 User evaluation

A user evaluation test will be used to evaluate the proof of concept. This is a common technique used in user-centered interaction design to assess a concept by testing it on target users. Moreover, a user evaluation can be used to identify problems and improve the concept as a result. The objective of this usability test is to evaluate the data visualisations, analyze possible issues of the concept, and to find out whether the users have gained more insight in their academic procrastination behavior, which could result in a Qualified Self.

6.1.1 Method

For the user evaluation, a usability test will be conducted together with an entry interview and an exit interview. Participants will be asked and selected to participate in the user evaluation. Requirements of participants are that they have to be an adult student, currently studying at college or university. The user evaluation will be carried out remotely due to COVID-19.

Semi-structured entry and exit interviews will be conducted with each participant. The entry and exit interviews will be transcribed, where emergent coding is used. A thematic analysis will be conducted to analyse the qualitative data and to establish the user evaluation results emerged from the exit interviews. Thematic analysis is a commonly used method for identifying, analysing, and reporting themes within qualitative data. Moreover, the questions from the exit interviews will be used as guidelines for presenting the results.

6.1.2 Set-up

The usability test lasted seven days, from June 3rd 2020 till June 9th 2020. The total user evaluation lasted for approximately ten days, including the entry and exit interviews. The entry interviews took place two days prior to the usability test and the exit interviews took place a few days after the usability test. Nine participants were involved in the user evaluation, five female students and four male students, including two MSc and seven BSc students. The set-up of the user evaluation is described in Table 20 below.

Table 20: User evaluation.

Number of participants	Nine
Diversity of participants	The participants involve five female and four male students, including two MSc and seven BSc students, studying different degrees.
Goals	- Identify problems in order to improve the concept in the future; - Examine correlations between academic procrastination (and/or proactivity), emotional regulation, and present-self connection; - Determine whether the user's consciousness has improved concerning their academic procrastination behavior, emotional regulation, and/or present-self connection; - Check whether the user has gained more insight in their academic procrastination behavior; - Assess whether this concept has potential to help students in the future with reducing their academic procrastination behavior.
Privacy	The study is complied with the General Data Protection Regulation (GDPR) and approved by the ethics committee EEMCS. Furthermore, the participants have read and signed the Information Brochure (See Appendix III) and Informed Consent Form (See Appendix IV).
Entry interview	The entry interview will take place online due to COVID-19. It will take place two days prior to the usability test. In the entry interview, the concept will be briefly explained, the terms 'emotional regulation' and 'present-self connection' will be made clear, the schedule of the questionnaires is announced, and the user's expectations are discussed. The entry interview will take place through Jitsi Meet.
Data collection	The daily questionnaire (See Appendix V) will be sent by email at 8:30PM each day for a period of seven days. The daily email notifications involving one present-self connection question will be sent four times a day; 10AM; 1PM; 4PM; and 8PM, and will also be sent by email (See Appendix VI). The SurveyMonkey database will be used to collect and store the data.

	The Wizard of Oz method is used for the data collection and the data preparation; the researcher manually operates the data collection through the use of SurveyMonkey and manually processes and cleans this data to create and present the data visualisation
Data preparation	The data will be retrieved from the SurveyMonkey database and cleaned in an Excel Worksheet for each individual participant. The data from each participant will be separated into one Excel Worksheet for each participant, including only the data of academic proactivity, emotional regulation, present-self connection, journaling questions, date, and time. Two sheets will be created within each Excel Worksheet; one for the daily questionnaire data that was sent at the end of each day and one for the daily present-self connection data. Subsequently, the data will be manually transferred into Tableau Software to create the data visualisation before it is presented to the participant.
Exit interview	The exit interview will take place online due to COVID-19. The participant will download Tableau Reader beforehand to be able to open the data visualisation during the exit interview. The participant's data visualisation will be sent no later than 15 minutes prior to the exit interview by email. The exit interview will take place through Jitsi Meet or Skype. Before the participant opens their data visualisation, their experience of the usability test week, working with the concept and the data collection will be discussed. Thereafter, the participant is asked to open the data visualisation dashboard in Tableau Reader and share their screen. The researcher will briefly explain the two data visualisations; one consists of a weekly overview involving the participant's academic proactivity, emotional regulation, and present-self connection; the other involves an overview of their present-self connection at different times each day. Subsequently, the participant is given time to explore and interact with the data visualisation for approximately 7 minutes to have them gather information and discover possible correlations. The interaction involves moving the mouse to hover over the visualisation to view the journaling questions and answers. Finally, the data visualisation will be discussed through a semi-structured interview where prepared questions are asked and where there is room for discussion. Correlations are

	examined, gathered information is discussed, improved consciousness is reviewed, and gained insight is considered. Furthermore, the potential of the concept is explored. This was accomplished through the use of the interview questions and, moreover, the participants shared their thoughts while viewing the data visualisation.
Other remarks	Both the entry interview and the exit interview are audio recorded for research purposes and follow the ethics protocol. The entry interview will take approximately 25 minutes, and the exit interview will take approximately 40 minutes.

6.1.2 Participants

Since the target group for this usability test are students, various requests were sent through Whatsapp group chats that involved students from different studies, genders and ages. Nine participants were selected as a result from these messages; five female students and four male students from different studies and ages to create a diverse usability test group. The information brochure (Appendix III) and the informed consent from (Appendix IV) were sent by email. The informed consent form was signed by both the researcher and the participant before the entry interview took place. A description of the participants can be found in Table 21 below. Besides some demographic information, during the entry interview the participants were also asked about their own evaluation of their academic procrastination behavior (low, medium, or high procrastinator), their experience with self-tracking, and their motivation for participating in this study.

Table 21: Participants.

Participant	**Gender**	**Age**	**Study and study year**	**Own evaluation of academic procrastination behavior**	**Experience with self-tracking**	**Motivation for participating in this study**
01	Female	22	Industrial Design First year master	Average procrastinator	‘I only track my weight in MyFitnessPal’	‘I am curious whether I can get something out of it that will motivate me more to study.’
02	Male	22	Industrial Design	High procrastinator	No experience with self-tracking	‘I am curious whether it has an effect on my

			First year master			academic procrastination behavior.'
03	Female	19	Business Information Technology First year bachelor	Average procrastinator	'Sometimes I track what I eat and I once had an app that tracked my mood but I deleted that after three days.'	'I am currently studying for exams and I think it can be useful to monitor your own behavior. It seems the concept can be motivating.'
04	Female	19	Health Sciences Second year bachelor	Average procrastinator	'I often track my steps.'	'It may be a little confronting but I look forward to whether it can be helpful to change my behavior.'
05	Male	21	Creative Technology Second year bachelor	Above average procrastinator	No experience with self-tracking	'I believe I am quite a high procrastinator so I hope that something interesting comes out of this.'
06	Female	21	Technical Medicine First year bachelor	High procrastinator	Little to no experience with self-tracking	'I know that if I experience fear of failure, I will engage in academic procrastination behavior. I wonder how that emotional side can help me because I believe it influences me.'
07	Male	21	Creative Technology Third year bachelor	Above average procrastinator	'I am used to tracking my sleep and sport activities.'	'I think it is important that I gain insight into how, when and hopefully why I procrastinate and to find out how I can improve on that.'
08	Male	20	Industrial Design	Average procrastinator	'I sometimes wear a	'I think it may be quite interesting

			Second year bachelor		smartwatch that tracks my heart rate.'	since I am busy with meditation and that may link to that present-self connection. I am curious whether it can help reduce my academic procrastination behavior.'
09	Female	20	Technical Medicine Second year bachelor	Average procrastinator	'I sometimes track how many hours I study each day, per course. Sometimes I also track my steps.'	'Hopefully it can help gain insight and possibly reduce my academic procrastination behavior.'

6.2 Results

After the usability test week, individual data visualisations were created for each participant. An exit interview took place online approximately three days after the usability test week. In this interview, the participant's experience was discussed, and the data visualisation was viewed and explored. Thereafter, the data visualisation was discussed through a semi-structured interview. Furthermore, correlations were examined, gathered information was explored, improved consciousness was reviewed, and gained insight was considered. Finally, the potential of the concept was examined. The audio recordings of the interviews were transcribed and emergent coding was used to analyze the themes emerging from the exit interviews. Furthermore, the questions were used as a guideline to study the results of the exit interviews. The outcome of the exit interviews is presented in Table 22 below. See Appendix VII for a complete overview of the participants' results and data visualisations. Often, multiple answers were given per question per participant, so in some cases there are more results than participants.

Table 22: Outcome of the exit interviews.

Questions before showing the data visualisation	**Results**
How did you experience the week of the experiment (usability test)?	- 5/9 said that it was a fairly normal week. - 3/9 said that the concept made them more conscious about what they were doing. - 2/9 said the notifications were a little confronting. - 1/9 said the notifications were motivating. - 1/9 said the questionnaires were a little much. - 1/9 didn't like filling in the questionnaires. - 1/9 said it was nice to have a periodic check up.
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	- 7/9 said their consciousness did improve - 2/9 said that their consciousness didn't really improve. *Remarks:* - 5/9 said only their consciousness concerning academic procrastination improved. - 2/9 said their consciousness improved concerning both factors. - 1/9 they started noticing quicker when procrastination thoughts came into their mind. - 1/9 found that they are a little easy on themselves.
Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	- 6/9 said their consciousness did improve. - 2/9 said that their consciousness improved a little. - 1/9 said that their consciousness didn't improve. *Remarks:* - 2/9 said their consciousness improved because of the notifications. - 1/9 said they noticed quicker whether they were distracted or not. - 1/9 said they thought about it more. - 1/9 said they are more aware about the things that they still need to do.

Would you remove, add, or change anything in the daily questionnaire?	- 5/9 said they felt like some questions were the same. - 1/9 said there were too many questions. - 1/9 said more questions about positive feelings instead of negative feelings would have been nice. - 1/9 said that they didn't like the questions concerning emotional regulation. - 1/9 said that each individual may interpret the scale differently.
How did you feel about the open journaling questions at the end of the daily questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	- 7/9 said the open questions helped with self-reflection. - 1/9 said they struggled with self-reflection. - 1/9 said the open questions weren't very useful. *Remarks:* - 2/9 said the open questions were motivating. - 1/9 said they noticed when they feel bad they tend to find distractions. - 1/9 said support sentences would have been helpful. - 1/9 said the questions helped reflect on how procrastination behavior made them feel and how they experienced their day. - 1/9 said they reflected on what things went wrong while studying. - 1/9 said providing these questions once every three days would have been sufficient.
Did the notifications help you connect with your present-self?	- 8/9 said the notifications helped to connect with their present-self. - 1/9 said the notifications helped a little bit to connect with their present-self. *Remarks:* - 2/9 said the notifications remind you whether you should study or not. - 1/9 mentioned it may not always be a good idea to keep your phone with you while studying. - 1/9 said the notifications were mostly helpful while studying

	- 1/9 said they were alerted for a moment when they received a notification. - 1/9 said they thought about it more.
Questions after showing the data visualisation	**Results**
What is your first impression of the data visualisation?	- 5/9 said the data visualisation matches what they experienced that week. - 4/9 noticed that their academic proactivity was lower than the other factors in general. - 3/9 noticed a low present-self connection in the evenings. - 2/9 said the overview is clear instantly. - 1/9 noticed a correlation between their present-self connection and emotional regulation.
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and present-self connection?	- 9/9 said the factors in the bar graph were clearly represented. - 5/9 said the present-self connection overview was clear. *Remarks:* - 4/9 didn't comment on the present-self connection overview here.
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	- 5/9 saw a correlation between their present-self connection and academic proactivity. - 3/9 saw a correlation between their present-self connection and their consciousness. - 3/9 said their emotional regulation seemed quite stable. - 3/9 saw a correlation between their present-self connection and time. - 2/9 saw a correlation between their academic proactivity and time. - 2/9 said they possibly see a correlation between their emotional regulation and present-self connection. - 2/9 said they didn't really see a correlation. - 1/9 saw a correlation between their emotional regulation, academic proactivity, and consciousness.

	- 1/9 said they possibly see a correlation between their emotional regulation and academic proactivity. - 1/9 said the correlations seem a bit arbitrary.
Did you learn anything from this data visualisation? If so, what did you learn?	- 6/9 learned which moments they are most present-self connected. - 2/9 learned that when they don't feel very good they are less academically proactive - 2/9 learned that when you are more present-self connected that you have a higher academic proactivity. - 1/9 learned that their emotional regulation and present-self connection are quite stable. - 1/9 said they need to improve on their academic proactivity. - 1/9 learned that it depends on your emotions how academically proactive you are. - 1/9 said it is interesting to see if they had broken a pattern.
Is this new information to you or is this something you were already familiar with? Please explain.	- 7/9 said it was new information *Remarks:* - 6/9 said that the present-self connection was new information. - 2/9 said they hadn't seen the information in this way before. - 1/9 said the retrieved information is unexpected.
Have you become more conscious of your academic procrastination behavior? In what way?	- 7/9 said they became more conscious of their academic procrastination behavior. - 2/9 said they didn't really become more conscious of their academic procrastination. *Remarks:* - 3/9 said they also became more conscious of their present-self connection through the notifications. - 2/9 said they noticed their academic procrastination behavior actions. - 2/9 they became more conscious of their

	academic procrastination behavior through the notifications. - 1/9 found that the problem lies in the organization of their studying. - 1/9 said the notifications were motivating. - 1/9 said they thought about it a lot more.
Have you become more conscious of your emotional regulation? In what way?	- 5/9 said they didn't become more conscious of their emotional regulation. - 2/9 said they became a bit more conscious of their emotional regulation. - 2/9 said they became more conscious of their emotional regulation.
Have you gained more insight into your academic procrastination behavior from this data visualisation? Please explain why or why not.	- 6/9 said they gained insight in their academic procrastination behavior. - 2/9 said they didn't gain insight in their academic procrastination behavior. - 1/9 said they gained a little insight in their academic procrastination behavior. *Remarks:* - 2/9 mentioned the text tooltip was helpful. - 1/9 mentioned they didn't see one clear line, since it was different each day. - 1/9 mentioned they had trouble connecting the academic proactivity bar to their academic procrastination behavior.
Do you think this concept has the potential to reduce one's academic procrastination behavior? If so, how?	- 9/9 said this concept has the potential to reduce one's academic procrastination behavior. *Remarks:* - 4/9 said the notifications have potential. - 4/9 said the present-self overview has potential. - 3/9 said the reflection part is important. - 3/9 said it depends on finding the right target group. - 2/9 suggested the app should generate conclusions or advice. - 2/9 suggested it may be useful to add goals of academic tasks each day. - 1/9 said it could work in an app, however not daily. - 1/9 was doubtful about the emotional

	regulation part. - 1/9 said it is important to use the concept over a longer period of time.
Do you believe such an application can be helpful for students in the future? Please explain.	- 8/9 believed the application could be helpful for students in the future. - 1/9 wasn't sure if the application could be helpful for students in the future. *Remarks:* - 2/9 said the emotional regulation part is valuable. - 2/9 said it is probably more helpful for people who really suffer from academic procrastination. - 1/9 said it is good to gain insight into your behavior.
Other general remarks	
2/9 said sometimes the emails ended up in their spam box.	
2/9 were missing three days or more in the data visualisation due to not filling in the daily questionnaire on all days of the usability test week.	
1/9 said the email notifications didn't work, so he set alarms instead.	
1/9 said it would be nice to add a list of activities in the text tooltip; a short overview so you know what you did that day.	
1/9 said it may be nice to regularly update the overview in the app; that it is accessible every day.	
1/9 said it may be effective for users to indicate when and for how long they study, to know when they should receive the notifications.	
1/9 said it may be good to create some variations in the times of the notifications that are sent, that it doesn't become standard and expected.	

6.3 Usability test conclusion

The goals of this usability test were to determine whether the user's consciousness has improved concerning their academic procrastination behavior, emotional regulation, and/or present-self connection; examine correlations between academic procrastination, emotional regulation, and present-self connection; check whether the user has gained more insight in their academic procrastination behavior; identify problems in order to improve the concept in the future; and assess whether this concept has potential to help students in the future with reducing their

academic procrastination behavior. All these objectives were discussed in the exit interviews with the participants, from which resulted in various insights and feedback.

Seven participants believed their consciousness improved concerning their academic procrastination behavior. However, only two participants said that their consciousness also improved concerning their emotional regulation. Most of the participants said the concept didn't have much impact on the way they dealt with their emotions and some explained they had the feeling that their emotions were quite stable overall. Eight participants said that their consciousness of their present-self connection improved, or at least a little. Only one participant said it didn't improve their consciousness of their present-self. Furthermore, the notifications turned out to be very helpful to connect the participants with their present-self.

As regards to the questionnaire, five participants felt like various questions were similar, and one participant thought there were too many questions. These aspects should be improved on in the future. Even though proposing similar questions is a strategy for validated questionnaires, it may be good to adjust this aspect in an application design since similar questions can be confusing or annoying to the user. Seven participants thought that the open journaling questions were beneficial to self-reflection, and two even said they were motivating. However, one participant struggled with self-reflection and another thought that the open questions weren't very useful.

Overall, five participants thought that the data visualisation matched what they experienced that week. Four participants noticed that their academic proactivity was lower than the other represented factors. To three participants, the present-self connection overview was instantly apparent. All participants believed that it was clear how the different factors were represented in the visualisations. However, finding correlations was more difficult. Various correlations were found, so there doesn't seem to be a clear line. The most evident correlation that was found was between the present-self connection and academic proactivity. This correlation was found by five participants. Three participants could link their perceived consciousness of that week to their present-self connection as well. Two participants believed that their emotional regulations had a correlation with their present-self connection. There was one participant who mentioned a possible correlation between their emotional regulation and their academic proactivity. Moreover, three participants pointed out that their emotional regulation seemed quite stable. Besides, possible correlations were found between emotional regulation and other factors by only three participants. Therefore, emotional regulation seems to be an insignificant factor to some. Only one participant saw a correlation between all three factors.

It seems that the participants benefited the most from the information retrieved about their present-self connection. To most participants this was new information as well. Many

learned which moments they are the most present-self connected, which could benefit them academically. These moments seem to be the most effective times to study for each individual. Furthermore, most of the participants gained insight into their academic procrastination behavior from the data visualisation. A few mentioned that it was helpful to view the answers of the daily journaling questions in the tooltip to remind them of how they had experienced each day. Some had trouble gaining insight due to the fact that they didn't see a clear line in the data visualisation or that they had a hard time connecting the academic proactivity bar to their perceived academic procrastination behavior.

All of the participants believed the concept has the potential to reduce one's academic procrastination behavior, and most of them believed it could be helpful for students in the future. Four participants especially believed that the notifications concerning the present-self connection have potential, and the present-self overview that results from them. A few participants mentioned that they believed that the self-reflection part of the concept is important. Furthermore, three participants pointed out that it does depend on finding the right target group for the application. Even though there was positive feedback on the potential of the concept, some adjustments could be made. For example, some suggested that a possible final concept of an app should generate conclusions or advice resulting from the data collection and data visualisation. Moreover, it may be useful to add a list of goals or tasks to each day to keep track of. Furthermore, it may be essential to use the concept over a longer period of time in order to collect a sufficient amount of data. It could also be beneficial for users to have the data visualisation updated regularly and accessible at all times. Besides, it may be effective for users to indicate when and for how long they study, to know when they should receive the notifications.

7. Conclusion

It is apparent that academic procrastination is a prevailing issue among students. For many, academic procrastination behavior is recognizable and for each individual different factors play a part as to why one procrastinates. The aim of this graduation project was to give students more insight and help them reflect on data related to academic procrastination behavior, making them aware of the transition between the Quantified Self and Qualified Self, aimed at academic procrastination. The research question that followed was '*How can academic procrastination be reduced by having the student reflect on the Quantified Self using self-tracking and self-reported data, resulting in the Qualified Self?'*.

Furthermore, the following five sub-research questions were established:

- What is academic procrastination?
- What causes academic procrastination?
- What are existing solutions for academic procrastination?
- What quantitative data can be used to reduce academic procrastination?
- What qualitative data can be used to reduce academic procrastination?

The sub-research questions were answered through the literature background research, state-of-the-art research and the expert interview. Academic procrastination was defined as "the tendency to delay intended academic tasks, even though this may result in negative consequences". Besides, the causes of academic procrastination were examined and it was found they can be divided into personal, situational, and contextual factors. There are several existing solutions that aim to diminish the issue of academic procrastination. Various interventions can take the form of group, individual, and teacher interventions, and different techniques are used within these interventions. Furthermore, quantitative and qualitative data correlated with academic procrastination behavior was explored. Both quantitative data and qualitative data was found to be relevant. Examples of quantitative data related to academic procrastination behavior are APSI results and ERSQ results. Answers to journaling questions are an example of qualitative data that can be collected when creating an application to help reduce one's academic procrastination behavior.

Resulting from the background research, state-of-the-art research, and the expert interview it became clear that emotional regulation plays an essential role when it comes to one's academic procrastination behavior. However, very few existing solutions or applications focus on these emotional or cognitive aspects. Furthermore, journaling was found to be a supportive tool to help reduce academic procrastination. Emerged from the expert interview, it appeared that one's present-self connection plays an important role as well. In order to reduce one's academic

procrastination behavior it is essential that students gain insight in their behavior and stay more in contact with their present-self. Therefore, a proof of concept was created combining these aspects.

In order to retrieve data of one's academic procrastination behavior and emotional regulation, the self-report instruments APSI and ERSQ were found to be applicable methods to use in the creation of the concept. Additionally, open journaling questions were provided to the student to help them engage in self-reflection. To encourage the student to stay connected to their present-self, notifications were sent on set moments each day. The combination of these aspects can be considered as a new approach in the field of academic procrastination behavior, especially since it is used on a daily basis. A data visualisation was created, resulting from the data collection concerning the factors. Subsequently, the proof of concept was evaluated with nine participants in a usability test.

The results of the usability test indicate that the concept has the potential to give students insight in their academic procrastination behavior, through reflection and the collection and visualisation of self-tracked data related to one's academic procrastination behavior. However, for several, correlations between the different factors seemed unclear in the data visualisation. This could be an obstacle for the user to grow into a more Qualified Self. Furthermore, emotional regulation appeared to be quite stable for various participants. This indicates that emotional regulation is an independent factor for some students. Even though, according to the participants of the usability test the concept has potential to reduce one's academic procrastination behavior, there are flaws in the system. This, and the potential room for improvement will be discussed in the next chapter, concerning the discussion, and the recommendations that follow.

8. Discussion & Recommendations

8.1 Discussion

As mentioned, there are many contributing factors to why one would engage in academic procrastination behavior. Therefore, the question arises whether enough factors were included in the final concept. In order to properly give the student insight in their academic procrastination behavior, more contributing factors could have been included. This way, the student would have been provided with a more complete overview and a better understanding of why they may suffer from academic procrastination behavior. After all, there is no "one size fits all" approach when it comes to reducing academic procrastination, so the more factors are included, the more data can be explored of each individual.

Focusing on the factors that were involved in this graduation project, there are some doubts whether emotional regulation was the right factor to include in this concept. Using both APSI and ERSQ scales on a daily basis is a new approach in the field of academic procrastination and was considered to have potential since there was a fairly strong correlation found between the scales in a study by Eckert et al (2016). Even though emotional regulation seemed to be such an essential factor related to one's academic procrastination behavior, resulting from literature research and the expert interview, it appears that it may not be of great value in such an application. Resulting from the data visualisations and the exit interviews, it appeared that the participants' emotional regulation is fairly stable. Even though the usability test was done with a small sample group that cannot properly represent the whole target group of students, it is noteworthy that measuring one's emotional regulation on a daily basis wasn't particularly beneficial for these individuals.

Another point of discussion is self-tracking data through the use of self-reported instruments. All participants' data that was collected within this graduation project was done through manually self-reporting using online questionnaires, no automatically tracked data was used. This resulted in quite an effort from the participants' side in the usability testing, which may not be favorable in a final product. Ideally, self-tracking data would be close to effortless. Even though within this graduation project it was difficult to find other methods to collect data from academic procrastination, emotional regulation, and the present-self connection, it would be interesting to look at other ways to automatically track data from (possibly other) factors related to one's academic procrastination behavior.

Furthermore, not all requirements that were set up in the specification phase were met. Even though it involved a proof of concept and not a final working product, more requirements

could have been taken into account. The main issue was that the system wasn't available on an actual app, but was provided through email notifications and a data visualisation that followed after a week. Therefore, the data output wasn't updated and accessible to the users all day and each day. Other examples are that the user interface wasn't menu driven, the application wasn't completely smartphone based, and the data visualisation was created manually instead of automatically generated by the application. Besides the fact that not all requirements were met, the interaction of the concept could improve as well. In the final concept, the data visualisation is presented to the user, and the only interaction that takes place is hovering the mouse over the side-by-side bar graph to show the answers to the journaling questions. More interaction could be added in various ways to have the user personalize their data further, and make it more meaningful.

Finally, the ultimate question to ask is whether the final concept led the participants to a Qualified Self? Does the concept give the user insight into why the self-tracked data is the way it is? Does it look for context and meaning behind the collected data? Does it answer the question why one procrastinates? In a way, the concept makes sense of the collected data and supports the user to gather meaningful insights to qualify their life. The concept aims to provide a clear understanding of the collected data, however, more data could be collected to provide the user with a better and more complete explanation to why one procrastinates and help them truly understand their academic procrastination behavior. Besides, the cause of one's academic procrastination behavior is often a tangle of many things at once. Explicitly, the insight that was provided by the final concept is limited and may not fully extend to a Qualified Self.

8.2 Limitations

There were several limitations within this graduation project. First of all, there is a limited time window to finalize the whole project. The graduation project from start till finish consists of approximately 20 weeks, where the first ten weeks are reserved for the introduction, background research and the state-of-the-art research. Therefore, time is one of the reasons why, for example, a proof of concept was created instead of a working application.

Furthermore, during the course of this graduation project there was a global pandemic due to COVID-19. Because of this, no physical meetings were able to take place from March 2020 until the end of the graduation project. As a result, meetings with the supervisor and the critical observer had to take place online, and the interviews with all the participants also had to take place online. This especially had an impact on the exit interviews with the participants, since they would normally take place in person where the researcher and participant could discuss the concept and view the data visualisation, which would have been more personal.

Another limitation is the number of participants that were involved in this graduation project. Since all the data was prepared and visualized manually for each individual not many participants could participate in the user evaluation. As a result, the representation of the target group is lacking due to a limited number of participants.

8.3 Recommendations

For the future design of applications that aim to reduce academic procrastination behavior through the transition from the Quantified Self to the Qualified Self it is important to note several things. First and foremost, it would be valuable to take more factors related to one's academic procrastination behavior into account when establishing the collection of data. This way, the application has more potential to transition the user into a more Qualified Self, due to a more extensive insight that can be provided. Examples of other factors that would be interesting to include are stress, low energy, physical activity and sleep.

Moreover, it is recommended to look into automatically tracked data that could have an impact on one's academic procrastination behavior. Self-reported instruments require a fair amount of effort on the user's side and may therefore be less convenient to use. However, some factors that are related require the use of self-reported instruments, but a more wide-ranging approach to data collection can be suggested. For example, using wearable sensors that can track factors such as stress, sleep, and physical activity.

Furthermore, the interaction between the user and the data visualisation can be further explored. This may benefit the user in finding more, or at least more clear, correlations between various factors. Adding more personal notes or interacting with colors can be proposed. For example, color codes could be used by the participant to indicate how they feel about certain aspects of their data (visualisation). Besides, one participant mentioned that adding a list of activities or tasks to the data visualisation could be beneficial. Another application based interaction could be for the user to indicate when they start and end studying, to inform the application about when to send the present-self connection notifications.

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Appendices

Appendix I: The Academic Procrastination State Inventory

The original APSI by H. Schouwenburg (1995).

How frequently last week did you engage in the following behaviors or thoughts? (1 = not; 2 = incidentally; 3 = sometimes; 4 = most of the time; 5 = always)

Factor 1: Procrastination

1. Drifted off into daydreams while studying.
2. Studied the subject matter that you had planned to do.
3. Had no energy to study.
4. Prepared to study at some point of time but did not get any further.
5. Gave up when studying was not going well.
6. Gave up studying early in order to do more pleasant things.
7. Put off the completion of a task.
8. Allowed yourself to be distracted from your work.
9. Experienced concentration problems when studying.
10. Interrupted studying for a while in order to do other things.
11. Forgot to prepare things for studying.
12. Did so many other things that there was insufficient time left for studying.
13. Thought that you had enough time left, so that there was really no need to start studying.

Factor 2: Fear of failure

14. Had panicky feelings while studying.
15. Had doubts about your own ability.
16. Experienced fear of failure.
17. Wondered why you would study if this would mean so much trouble for you.
18. Felt tense when studying.
19. Gave up studying because you did not feel well.

Factor 3: Lack of motivation

20. Found the subject matter boring.
21. Felt that you really hated studying.
22. Doubted that you should have ever taken this course.
23. Felt, when studying, that you disliked the subject.

Appendix II: The Emotional Regulation Skills Questionnaire

The English version of the ERSQ, translated from the original German version SEK-27 (Berking & Znoj, 2008) by Grant et al. (2016).

Dear participant,

Below are some statements about a variety of emotions you may have experienced in the last week and about how you dealt with these emotions. Please fill in the answer that fits the best for you. Don't spend a lot of time on each question; the first answer that comes to your mind is probably the best.

Dealing with emotions: In the last week ...

1. ... I was able to consciously pay attention to my feelings.
2. ... I could consciously bring about positive feelings.
3. ... I understood my emotional reactions.
4. ... I could endure my negative feelings.
5. ... I was able to accept my negative feelings.
6. ... I could have labelled my feelings.
7. ... I had a clear physical perception of my feelings.
8. ... I did what I wanted to do, even if I had to face negative feelings on the way.
9. ... I tried to reassure myself during distressing situations.
10. ... I was able to influence my negative feelings.
11. ... I knew what my feelings meant.
12. ... I could focus on my negative emotions if necessary.
13. ... I knew what emotions I was feeling in the moment.
14. ... I consciously noticed when my body reacted towards emotionally charged situations in a particular way.
15. ... I tried to cheer myself up in emotionally distressing situations.
16. ... I did what I intended to do despite my negative feelings.
17. ... I was OK with my feelings, even if they were negative.
18. ... I was certain that I would be able to tolerate even intense negative feelings.
19. ... I was able to experience my feelings consciously.
20. ... I was aware of why I felt the way I felt.
21. ... I knew that I was able to influence my feelings.
22. ... I pursued goals that were important to me, even if I thought that doing so would trigger or intensify negative feelings.
23. ... I was able to experience my negative feelings without immediately trying to fight them off.

24. ... my physical sensations were a good indication of how I was feeling.
25. ... I was clear about what emotions I was experiencing.
26. ... I could tolerate my negative feelings.
27. ... I supported myself in emotionally distressing situations.

The statements above are answered on a five-point Likert scale ranging from not at all (1) to almost always (5).

ERSQ Subscales Items

Nr.	Subscale	Abbreviation	Items
1	Attention towards feelings	AE	1, 12, 19
2	Body perception of feelings	S	7, 14, 24
3	Clarity of feelings	CL	6, 13, 25
4	Understanding of feelings	UN	3, 11, 20
5	Acceptance of feelings	AC	5, 17, 23
6	Resilience: to tolerate and endure feelings	RS	4, 18, 26
7	Readiness for confrontation	RC	8, 16, 22
8	Self-support	SeS	9, 15, 27
9	Modification	MO	2, 10, 21
10	Total of emotion-regulation competences	TOTAL	1-27

Appendix III: Information Brochure

Dear reader,

In this letter, I would like to inform you about the experiment that will take place between June 3rd 2020 and June 10th 2020. In the proposed research for my graduation project, entitled 'From Quantified Self to Qualified Self, reducing academic procrastination through the Qualified Self', I will be testing a concept for a new tool, allowing users to become more reflective and more aware of their academic procrastination behavior. The aim is to discover how emotional regulation may affect your academic procrastination behavior and to make you more aware of your present-self in order to reduce your academic procrastination behavior. Moreover, the tool aims to actively engage you with these factors and give them insight in their behavior.

To achieve this, you will be asked to fill in an online questionnaire at the end of the day. This questionnaire can be filled in using your smartphone and will ask you questions about your emotional regulation and recent academic procrastination behavior. The questionnaire will include closed scale questions and some open questions. Besides, throughout the day you will receive notification prompts as a reminder to stay more present while studying. This aims to have you reflect on your awareness for a second and to reconnect with your present-self. Each notification prompt will have one scale question enclosed about your current awareness, which you will be asked to fill in.

SurveyMonkey will be used for creating and providing both the daily questionnaire and the various notification prompt scale questions. SurveyMonkey will send the questionnaire and notification prompt scale questions at predefined moments each day. In total, the daily questionnaire and notification prompt scale questions will take approximately 15 minutes to fill in. In addition, there will be a short entry interview that takes a maximum of half an hour and an exit interview that takes a maximum of 45 minutes. In the entry interview we will briefly discuss the topics emotional regulation and the present-self. Moreover, we will talk about expectations of the experiment. In the exit interview there will be a debriefing and a look at your data that was collected. The aim of the exit interview is to review your experience, talk about feedback, and discuss what you have learned and possibly gained from the participation. Both the entry and exit interviews will be recorded for review purposes and will take place through an online platform due to COVID-19. The recordings will be anonymized and used only for this graduation project. The total experiment lasts for 7 days, and the entry and exit interviews must be planned within three days of the start and finish of the experiment.

Please note that we, as part of the University of Twente, are obliged to comply with the General Data Protection Regulation. For this, we take measures with regard to the processing and inspection of personally identifiable data, such as your name, audio recording from the interviews, and the data from the SurveyMonkey questionnaires.

Yours sincerely,

Judith Kampen
Creative Technology BSc graduate student

Contact information researcher:
Langestraat 16C
7511HC Enschede
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Email: j.kampen@student.utwente.nl

If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Electrical Engineering, Mathematics and Computer Science at the University of Twente, P.O. Box 217, 7500 AE Enschede (NL), email: ethics-comm-ewi@utwente.nl).

Appendix IV: Informed Consent Form

'I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the research as described in the aforementioned information brochure 'From Quantified Self to Qualified Self, reducing academic procrastination through the Qualified Self'. My questions have been answered to my satisfaction. I agree with my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the experiment at any time. If my research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. My personal data will not be disclosed to third parties without my express permission. Furthermore, I am aware that I can decide to stop at any point in the course of the experiment without this having any consequences for myself and without giving any reasons. In addition, I am aware that I can still decide at the end of the experiment and up to 24 hours thereafter, that my data may not be included in the research. If I request further information about the research, now or in the future, I may contact Judith Kampen (telephone: +31614891957, email: j.kampen@student.utwente.nl).'

If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Electrical Engineering, Mathematics and Computer Science at the University of Twente, P.O. Box 217, 7500 AE Enschede (NL), email: ethics-comm-ewi@utwente.nl).

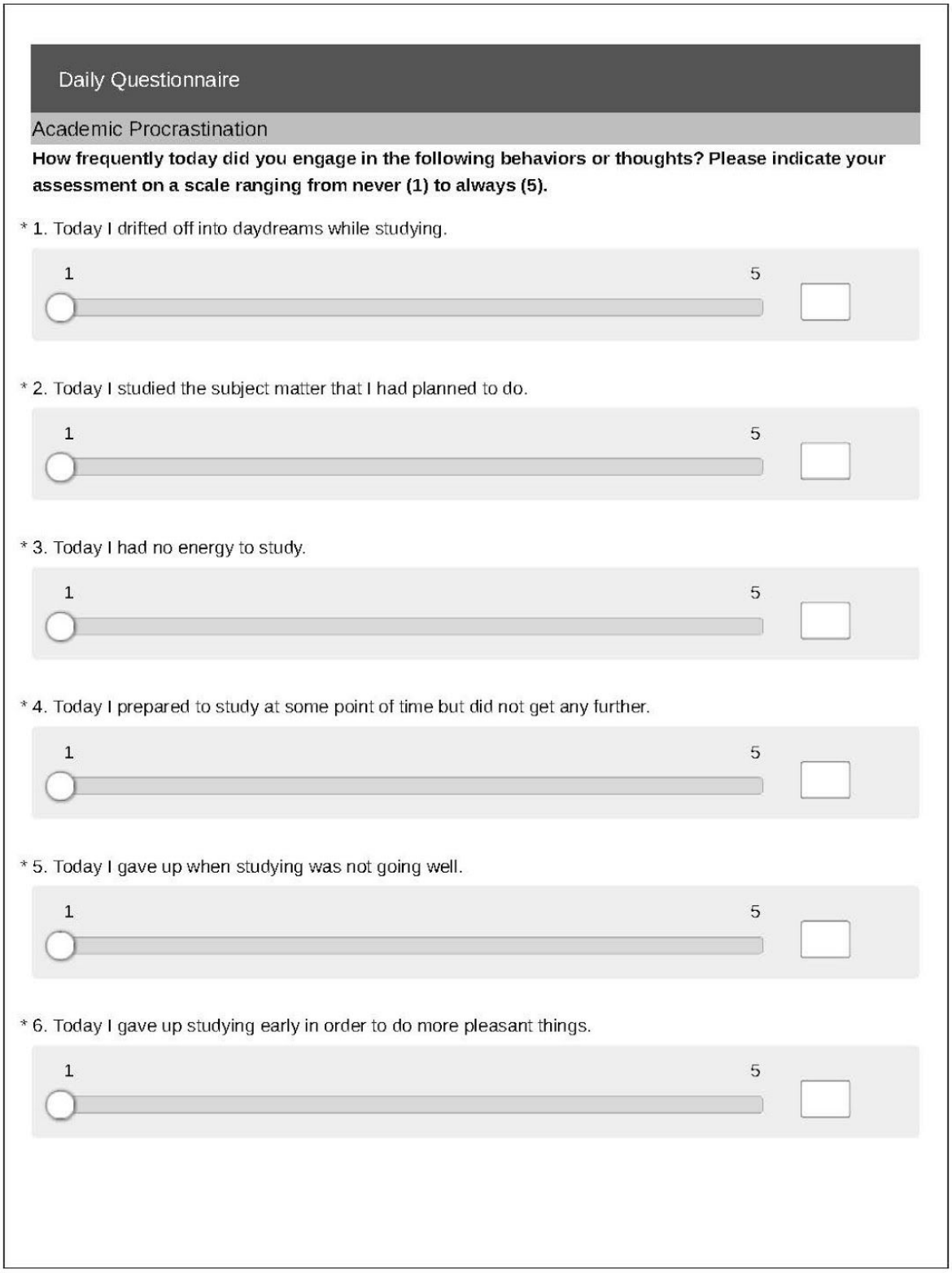
Signed in duplicate:

.....	.....
Name subject	Signature

'I have provided explanatory notes about the research. I declare myself willing to answer to the best of my ability any questions which may still arise about the research.'

.....	.....
Name researcher	Signature

Appendix V: Daily Questionnaire



Daily Questionnaire

Academic Procrastination

How frequently today did you engage in the following behaviors or thoughts? Please indicate your assessment on a scale ranging from never (1) to always (5).

* 1. Today I drifted off into daydreams while studying.

1 5

* 2. Today I studied the subject matter that I had planned to do.

1 5

* 3. Today I had no energy to study.

1 5

* 4. Today I prepared to study at some point of time but did not get any further.

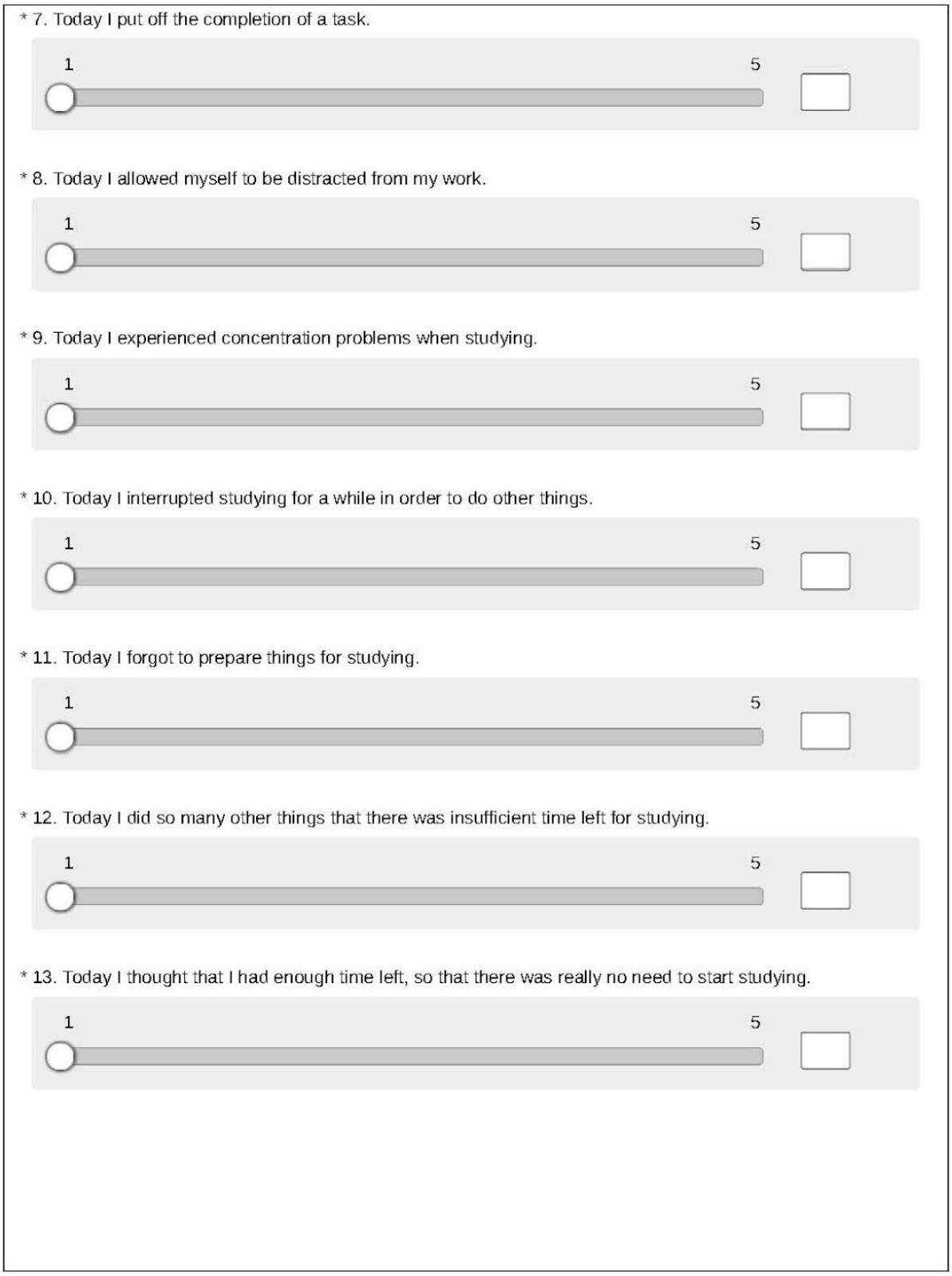
1 5

* 5. Today I gave up when studying was not going well.

1 5

* 6. Today I gave up studying early in order to do more pleasant things.

1 5


* 7. Today I put off the completion of a task.
1
5
* 8. Today I allowed myself to be distracted from my work.
1
5
* 9. Today I experienced concentration problems when studying.
1
5
* 10. Today I interrupted studying for a while in order to do other things.
1
5
* 11. Today I forgot to prepare things for studying.
1
5
* 12. Today I did so many other things that there was insufficient time left for studying.
1
5
* 13. Today I thought that I had enough time left, so that there was really no need to start studying.
1
5

Daily Questionnaire

Emotional Regulation

Below are some statements about a variety of emotions you may have experienced in the past day and about how you dealt with these emotions. Please fill in the answer that fits the best for you. Don't spend a lot of time on each question; the first answer that comes to your mind is probably the best.

* 14. Today I could endure my negative feelings.

1 5

* 15. Today I was able to accept my negative feelings.

1 5

* 16. Today I could have labelled my feelings.

1 5

* 17. Today I tried to reassure myself during distressing situations.

1 5

* 18. Today I knew what emotions I was feeling in the moment.

1 5

* 19. Today I tried to cheer myself up in emotionally distressing situations.

1 5

* 20. Today I was OK with my feelings, even if they were negative.

1 5

* 21. Today I was certain that I would be able to tolerate even intense negative feelings.

1 5

* 22. Today I was able to experience my negative feelings without immediately trying to fight them off.

1 5

* 23. Today I was clear about what emotions I was experiencing.

1 5

* 24. Today I could tolerate my negative feelings.

1 5

* 25. Today I supported myself in emotionally distressing situations.

1 5

Daily Questionnaire

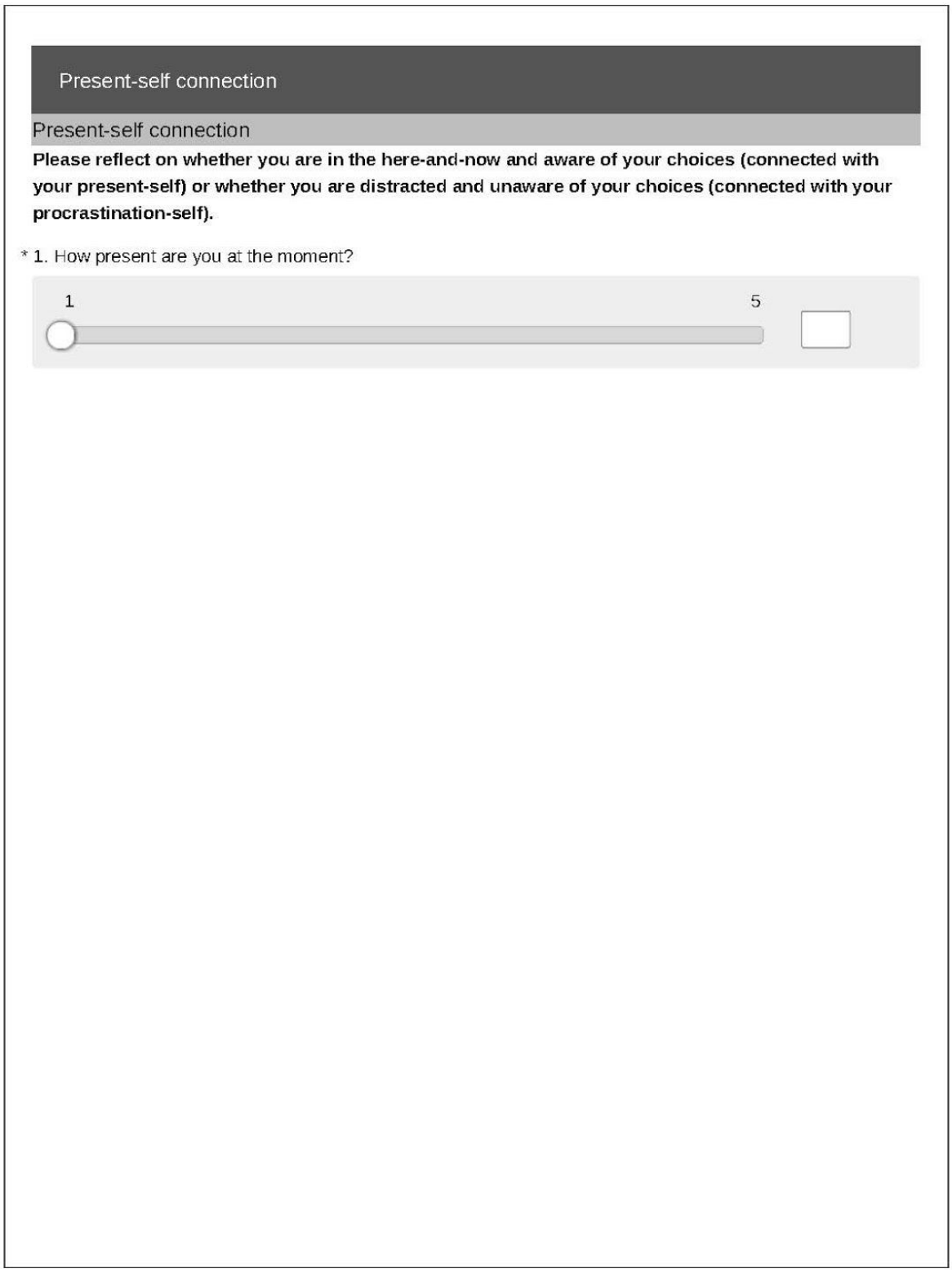
* 26. What moments made you feel good today, and why?

27. Was there a moment today in which you felt bad? What did you do to make yourself feel better?

* 28. What assignments did you procrastinate on today, and why? If you didn't procrastinate on any assignments, please indicate so, and why.

29. What were the results of procrastinating in terms of how you felt?

Appendix VI: Present-self connection question



Appendix VII: Individual Participant Results

Participant 01

Table 23: Participant 01's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 01**
How did you experience the week of the experiment?	'Last week I was a little less busy with my studies than this week so I am curious whether that will be visible. I have to say, I thought the questionnaires were a little much.'
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'I don't think I necessarily dealt with it differently. I'm not sure.'
Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'For me it didn't really make a difference when I was busy studying and a notification popped up. However, I can imagine that when you're on your phone instead of studying and you get a notification that it may motivate you to start studying again. For me that happened a few times, which had a positive influence.'
Would you remove, add, or change anything in the daily questionnaire?	'It was a bit long and I had the feeling that some questions were the same. Most of the questions addressed negative feelings or behavior, but maybe it is nice to include positive things as well in the scale questions.'
How did you feel about the open journaling questions at the end of the daily questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	'I liked the open questions more than the closed questions because they really helped me reflect on the things I achieved or didn't achieve today.'
Did the notifications help you connect with your present-self?	'Yes, because it reminds you whether you should study or not. In the evening it wasn't very useful for me, but the ones I received during the day were helpful.'

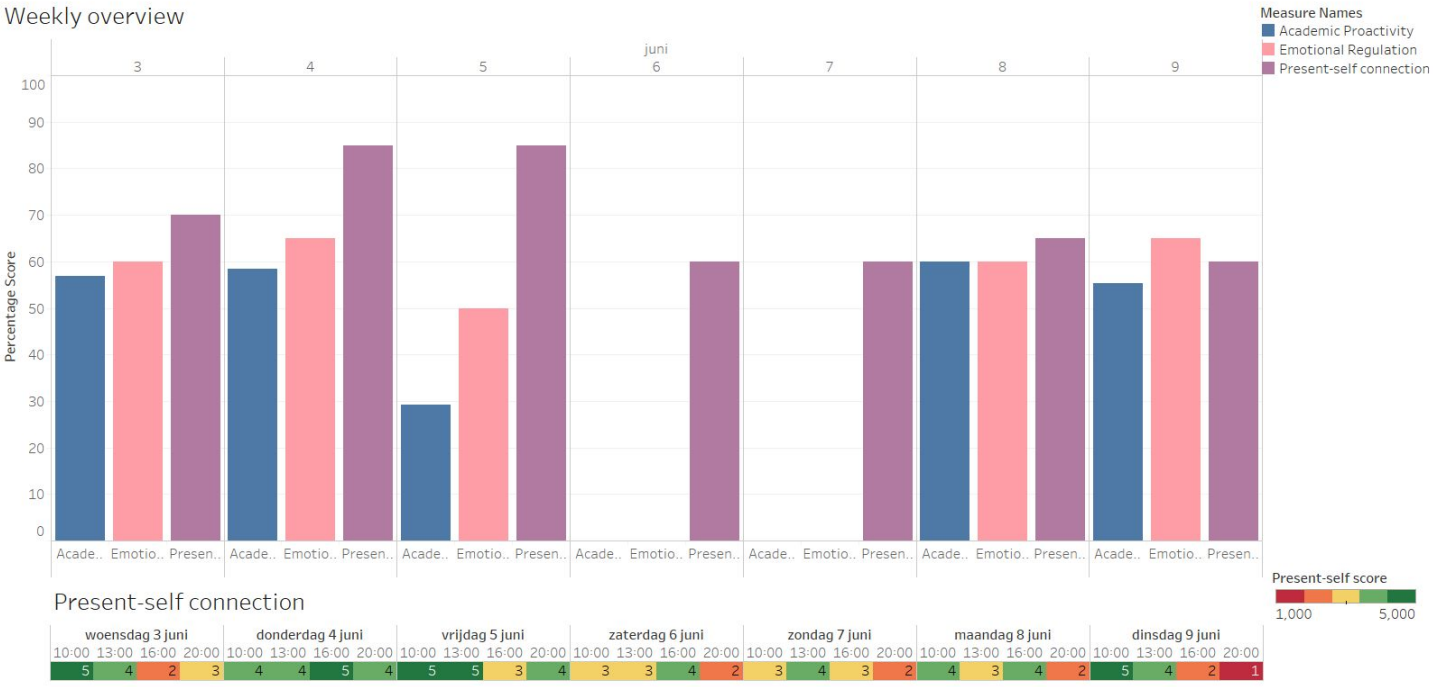


Figure 41: Participant 01's data visualisation.

Table 24: Participant 01's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 01**
What is your first impression of the data visualisation?	'It is pretty clear to me. For example on Friday I wasn't really feeling very well and that is visible in my academic proactivity. However I was quite present in how bad I felt that day. On the weekend I didn't study, so there is no emotional regulation and academic proactivity. I see that in the evening I'm not very present.'
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and present-self connection?	'Yes, you mean the bar graph? Academic proactivity and emotional regulation probably came from the survey and present-self connection from those notifications.'
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	I was a bit more conscious of the present-self connection on the first few days than the last few days. On Friday I had kind of a bad day. June 3rd, 4th, 8th and 9th are similar when it

	comes to academic proactivity and emotional regulation. On June 3rd and 4th I was more present because I had less to do and I had more time to think.'
Did you learn anything from this data visualisation? If so, what did you learn?	'I see that whenever I don't feel very good that I do less for my studies. I usually study during the day and I do fun things in the evening and that is also visible in my present-self connection. I am not sure about the relation to academic proactivity since that is kind of the same on June 3rd, 4th, 8th and 9th so I don't know what information I can retrieve from that.'
Is this new information to you or is this something you were already familiar with? Please explain.	'The present-self connection was completely new to me. So that information was new and interesting to me.'
Have you become more conscious of your academic procrastination behavior? In what way?	'I already know that when deadlines are approaching that I study more. I don't see a lot of difference in my academic proactivity so I'm not sure if there is a correlation. I did become more conscious as a result of the notifications.'
Have you become more conscious of your emotional regulation? In what way?	'This is maybe only visible on June 5th, since I had kind of a bad day then. But the other days seem quite stable.'
Have you gained more insight into your academic procrastination behavior from this data visualisation? Please explain why or why not.	'If I have more time, I tend to procrastinate more, than when I have deadlines. But I'm not sure whether I got that specifically from this experiment. It has been helpful to remind me to go back to studying once in a while. I think it was interesting to see that on June 3rd and 4th I was more present. My pink and blue bars are quite close to each other so I'm not sure whether I can see a correlation there. However, it is clear that my emotional regulation is quite close to my academic proactivity so maybe there is a correlation.'

Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'It really depends how you approach it. I think it could work in an app, but not every day. Maybe once a week. It is difficult to say, because now we only did this for a week. Maybe if you find the right motivated people that want to do this more long term, they will learn from it. Maybe the app should also generate conclusions for the individual, come up with tips for example.'
Do you believe such an application can be helpful for students in the future? Please explain.	'I think it has more potential for students who know they procrastinate to possibly help them gain insight in their behavior. You need students who are willing to download and fill in the app.'

Participant 02

Table 25: Participant 02's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 02**
How did you experience the week of the experiment?	'It was a pretty average week for studying. I didn't have any exams that week.'
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'Not really when it comes to my emotional regulation. Maybe I became a bit more conscious of my academic procrastination. I started noticing quicker when procrastination thoughts came into my mind.'
Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'Yes, in the aspect of noticing when I get distracted or not; when I'm not on the moment anymore. That is something I noticed quicker.'
Would you remove, add, or change anything in the daily questionnaire?	'Not in the daily questionnaire itself, but maybe the way it is provided. Sometimes the email got into my spam box. An actual app notification would have worked better. Also, some questions seemed the same.'
How did you feel about the open journaling questions at the end of the daily	'They do make you think about self-reflection, but once every three days

questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	instead of everyday would have been sufficient. Especially the one about which assignments you procrastinated on, that is not necessary to ask every day.'
Did the notifications help you connect with your present-self?	'It was a good reminder for me when I wasn't busy studying, that I should be studying.'

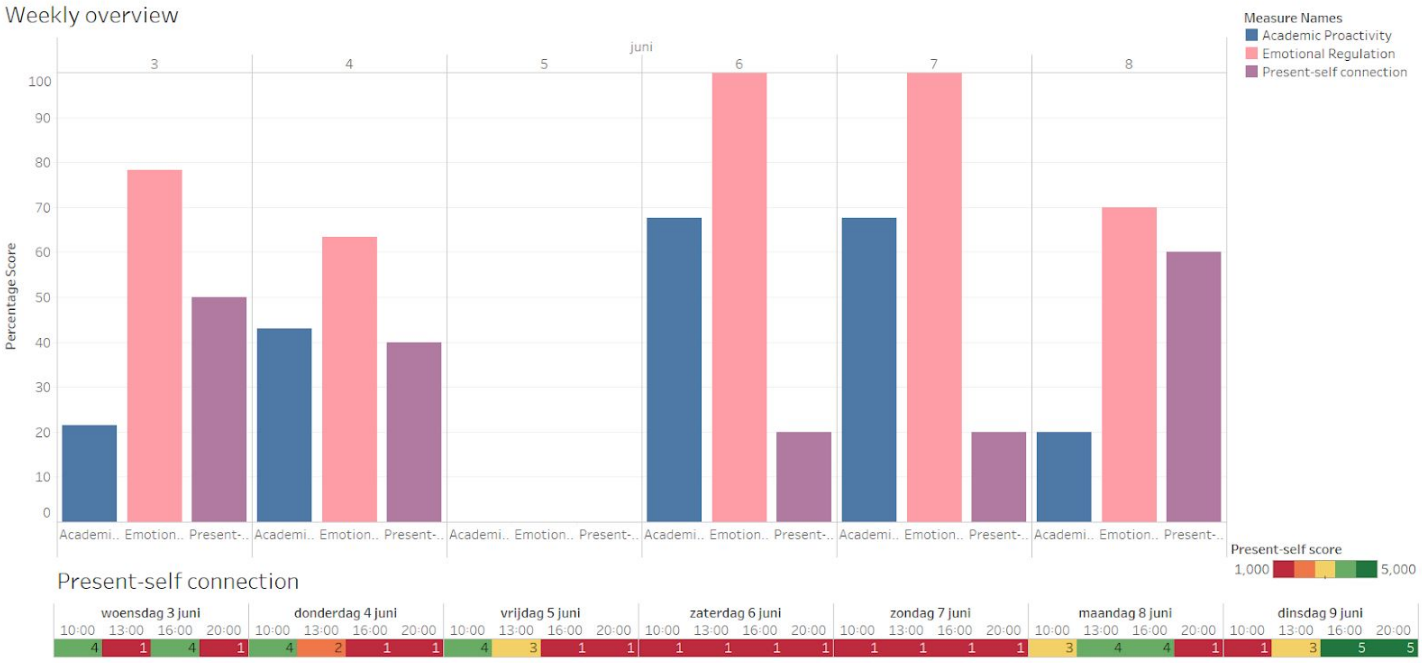


Figure 42: Participant 02's data visualisation.

Table 26: Participant 02's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 02**
What is your first impression of the data visualisation?	'I notice that both days on which I decided not to study, June 6th and 7th, I also did not procrastinate which I filled in. Stress free days, so also high emotional regulation. I also see that the further the week progresses, the higher my productivity. On mondays I'm not very productive and I know that about myself. That is something I can see.'

Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and present-self connection?	'I filled in a 1 for the present-self connection on the weekend because I didn't study on those days. I think the factors are clearly visible.'
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	'Yes, when I don't study I am also not very present-self connected. That is a clear correlation I can see. My productivity at the beginning of the week seems higher than at the end of the week. That I can be productive for a longer period of time. They seem a little arbitrary but they are recognizable when I look back at the past week.'
Did you learn anything from this data visualisation? If so, what did you learn?	'What my peaks are in a day; when I get most things done for my studies. That is something I hadn't noticed before.'
Is this new information to you or is this something you were already familiar with? Please explain.	'The productivity peaks in a day is new information for me.'
Have you become more conscious of your academic procrastination behavior? In what way?	'Yes. I noticed that I tend to relax during the day, watch videos, etc. When I got the notifications I became conscious that I was procrastinating in those moments.'
Have you become more conscious of your emotional regulation? In what way?	'No, not really.'
Have you gained more insight into your academic procrastination behavior from this data visualisation? Please explain why or why not.	'Yes, because of the notifications you get confronted in those moments and not later on. That was beneficial for me.'
Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'Yes, but I'm not sure about the part of emotional regulation; whether that is of added value. What may be useful is to add goals of what you want to achieve with your academic tasks that day, and that the notification will remind you with the present-self connection to work and check on those tasks.'
Do you believe such an application can be helpful for students in the future? Please explain.	'Yes, definitely. I know that I am not the only one who procrastinates. I have become more conscious so I think it can be useful for

	others.'

Participant 03

Table 27: Participant 03's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 03**
How did you experience the week of the experiment?	'I find it a little difficult to say, normally I wouldn't pay much attention to how things are going. Through using this service you tend to think more about it; about what you are doing. It was a fairly normal week for me.'
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'Yes, I did think about it more. I think it also influenced my academic procrastination behavior, especially in the beginning because of the notifications. However, I am usually quite productive myself.'
Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'Yes, I think so because you think about it more. Besides, you want to do the best you can.'
Would you remove, add, or change anything in the daily questionnaire?	'A lot of the questions were about negative feelings, but I don't necessarily feel negative emotions while studying. Sometimes I'm quite happy when I'm studying. So when there were questions about negative feelings, I didn't always want to fill those in because I didn't necessarily feel negative emotions that day.'
How did you feel about the open journaling questions at the end of the daily questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	'The questions about whether there was a moment in which you felt bad and how you dealt with that, and which moments made you feel good today were fun to fill in because then you reflect on your day. It was interesting because I noticed that when I feel bad I tend to find distractions. The questions helped to motivate me before going to sleep.'
Did the notifications help you connect with your present-self?	'Yes, but it wasn't always convenient while studying because I don't think it is a very good idea to keep my phone near me when

	I'm studying. The notifications were a little distracting to me.'
Other remarks	'I think a sort of tasks list would work better for me. Maybe it would be nice to check and reflect on those tasks at the end of the day in an app. The notifications could be based on the tasklist.'

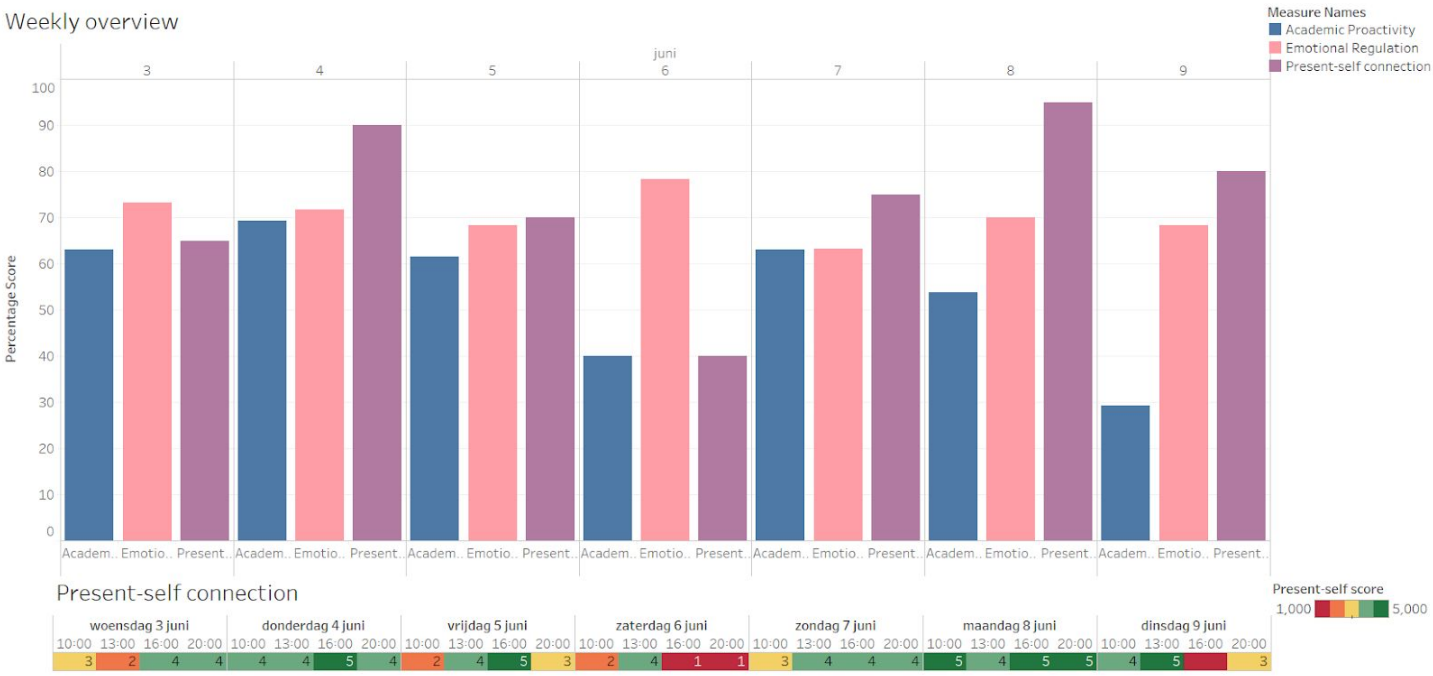


Figure 43: Participant 03's data visualisation.

Table 28: Participant 03's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 03**
What is your first impression of the data visualisation?	'I think it is funny to see but when I read this I don't exactly remember those days. I think it is funny that the blue bar is always lower than the pink one. Apparently I am better at emotional regulation.'
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and	'Yes, it is pretty clear. I read here that I went shopping with my sister so my academic proactivity is lower that day, and I also wasn't

present-self connection?	very present because I wasn't busy studying.'
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	'Yeah, I think for the most part the present-self connection and academic proactivity are close to each other so I think there lies a correlation there. I'm not sure about emotions because when I have to do something I just force myself to do it. It may have a correlation, but I see it is kind of the same most days, except for the day that I was low in academic proactivity and present-self connection, my emotional regulation was quite high. That it is kind of funny to see. I don't know if there is a correlation, it could be a coincidence.'
Did you learn anything from this data visualisation? If so, what did you learn?	'I think I already knew that if you are more connected to your present-self, you are generally more concerned with what you are doing. I don't quite see the connection with emotion yet.'
Is this new information to you or is this something you were already familiar with? Please explain.	'Some things turned out a bit lower than I expected because I thought I always worked hard and I wasn't distracted, but there were a few moments in which I did something else. For example on Saturday I didn't plan to study and it seems I was distracted but that was not the intention.'
Have you become more conscious of your academic procrastination behavior? In what way?	'Yes, definitely because I thought about it a lot more. I think I also stopped myself earlier because I thought that I had to do well. If I hadn't participated I wouldn't think about it. So now I was more conscious.'
Have you become more conscious of your emotional regulation? In what way?	'Uhm, yes, but I don't have the feeling I am always very conscious of my emotions so often it is kind of standard; not very sad or very happy, kind of in the middle. I'm not sure, I don't think about it a lot.'
Have you gained more insight into your academic procrastination behavior from this	'Yes, I think so because you see connections, also when I look at the text. I often see study days as somewhat the same. When I

data visualisation? Please explain why or why not.	procrastinated I usually was aware when I did it, so I was able to stop procrastinating. I wonder what I see in this visualisation whether that is something I would do normally or if it is influenced. I think it was good to reflect at the end of each day.'
Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'It depends on the academic procrastination behavior. But when you, for example, watch a video and you get a notification, you will feel bad. Also with those colors; I would aim for more green squares in the data visualisation, so that may be motivating. Red squares could make someone feel bad. So I think it has the potential to help someone.'
Do you believe such an application can be helpful for students in the future? Please explain.	'I'm not sure, because I may have stopped using this app after a week. I haven't really found the added value in it for me, but it may be helpful for people who suffer more from academic procrastination than me. That is a big difference, and I think it would influence them more.'

Participant 04

Table 29: Participant 04's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 04**
How did you experience the week of the experiment?	'It was a little confronting when I got the notifications but I enjoyed keeping track of the information that was asked. This week was fairly normal for me, except for the fact that bars and clubs are closed so now I sometimes also study in the evening.'
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'Yes, I think my consciousness improved but I'm not sure about emotional regulation. I usually don't have many outliers; that I have very negative or very positive thoughts. Sometimes when I feel a little nervous I try to calm myself down, so then I was more aware, but otherwise I wasn't very conscious about it.'

Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'Yes, I think so.'
Would you remove, add, or change anything in the daily questionnaire?	'I felt like there was a double question about negative feelings. Maybe that was a mistake?'
How did you feel about the open journaling questions at the end of the daily questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	'I liked filling in the question about whether I had procrastinated on an assignment and how I felt about that, and how I could possibly change something about it.'
Did the notifications help you connect with your present-self?	'Yes, I think I thought about it more. Sometimes I found it difficult when I didn't look at my phone and I got a notification that I had to fill it in a bit later. My evaluation may have been different half an hour ago, for example.'

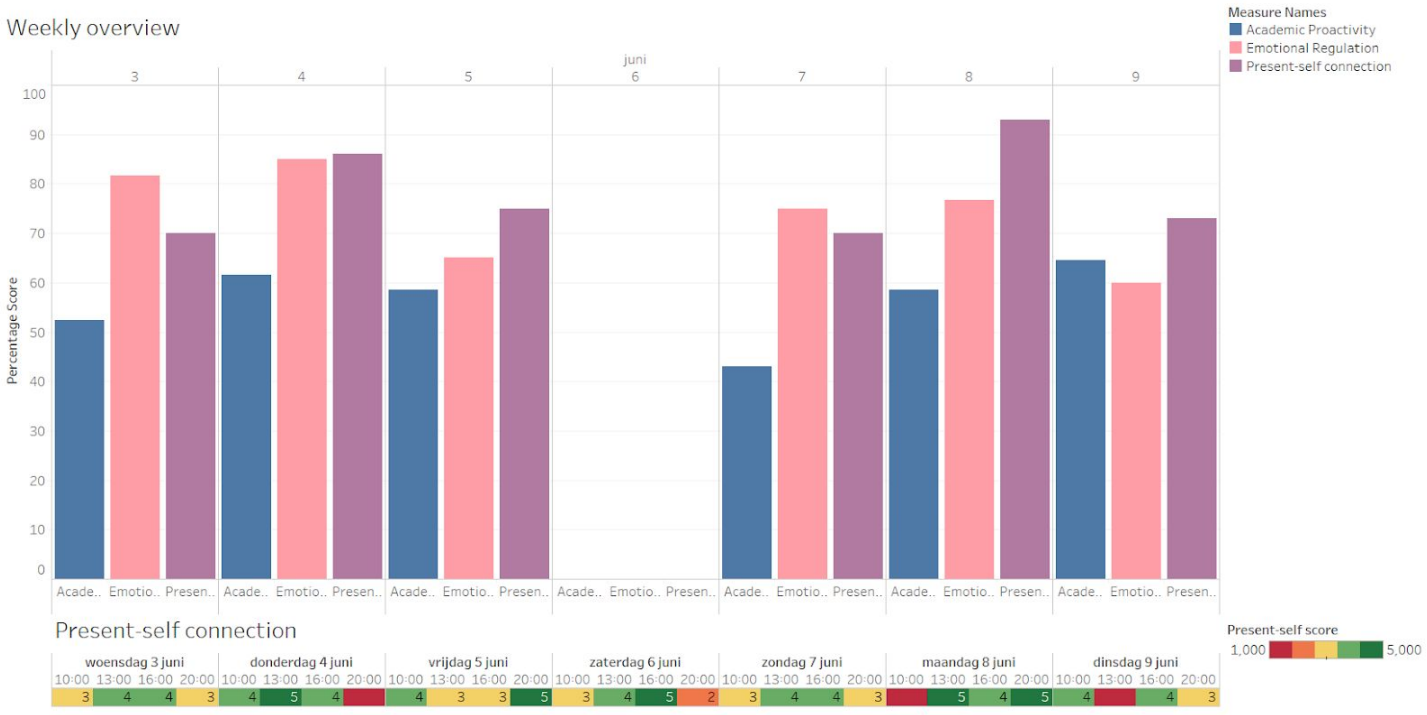


Figure 44: Participant 04's data visualisation.

Table 30: Participant 04's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 04**
What is your first impression of the data visualisation?	'I notice that when I have a high present-self connection that I also have a high emotional regulation. I think it is odd that my academic proactivity sometimes is a little low when my present-self connection is quite high. I also see that I have a low present-self connection in the evenings.'
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and present-self connection?	'Yes. The present-self connection moments were on those days.'
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	'I see that I am usually productive in the morning. I can also see that I am more conscious of the choices that I'm making then. I'm also pretty productive during the middle of the day, but I'm less conscious in the evening. I see that my academic proactivity is a little lower on the weekend. I see that during the week I suffer from stressful moments more often than on the weekend. '
Did you learn anything from this data visualisation? If so, what did you learn?	'That it depends on your emotions, how proactive you are with studying and conscious of your choices.'
Is this new information to you or is this something you were already familiar with? Please explain.	'I already knew that my academic proactivity is higher in the morning and a little lower on the weekend. I didn't know about the present-self connection yet.'
Have you become more conscious of your academic procrastination behavior? In what way?	'I noticed that I try to move things forward on the weekend and that I then have to catch up during the week. Those kinds of things.'
Have you become more conscious of your emotional regulation? In what way?	'I don't often experience very negative feelings or that I am very stressful, usually I can motivate myself to just keep going. However, I can see that on the days I was feeling tired that my emotional regulation was

	a bit lower.'
Have you gained more insight into your academic procrastination behavior from this data visualisation? Please explain why or why not.	'Usually when I get started with an assignment I can continue working on it, so that is not when I tend to procrastinate. But sometimes I do procrastinate on the little things that should have already been done. I think I gained more insight in that; that I just have to also do those little things on the day itself. I got that from the answers to the journaling questions.'
Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'I think if you fill it in every day and really pay attention to the open journaling questions that it can be helpful. Just the notifications are not enough I think. The reflection part is important. I think if you reflect every day on whether you did everything you wanted to do and didn't procrastinate or if you know the reason why you procrastinated, it may reduce your academic procrastination behavior.'
Do you believe such an application can be helpful for students in the future? Please explain.	'Yes, if this was really an app and for example the user can indicate when and for how long they study that they receive the notifications, and that maybe emotions can be linked to those notifications that it could be useful.'

Participant 05

Table 31: Participant 05's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 05**
How did you experience the week of the experiment?	'Hard to say, the questions or notifications weren't a lot of fun. Fortunately, the notifications only concerned one question but the daily questionnaires each day were a bit long. I had a conference on the weekend, so I was busy there from 9AM till 10PM, so that was why I wasn't able to fill in the questionnaires of those days. I also pushed the last ones [emails] a bit forward, so that is a bit missing as well.'

Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'No, not really I think. I don't think this stimulated a lot. I don't think it was very beneficial for me.'
Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'No, not really. I am already quite conscious, even when I'm not working I am aware that I am not working, so to say. I don't think it really made a difference.'
Would you remove, add, or change anything in the daily questionnaire?	'This is not really my type of research; the first few questions are fine, but the second half about emotions I didn't enjoy at all. The first set of questions, 1 till 13 was fine, but the second half about emotions was tougher. I don't really care for my emotions while studying.'
How did you feel about the open journaling questions at the end of the daily questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	'For me this wasn't very useful. Most think I just don't think about it a lot. I don't really get excited when I solve a problem for example. I don't attach much emotional value to it.
Did the notifications help you connect with your present-self?	'A little bit. Sometimes I was studying really hard and I got a notification so I filled in that I was doing well and I evaluated it with a five. Or when I was doing something else it reminds you that you are doing something else. I still knew what I was doing.'

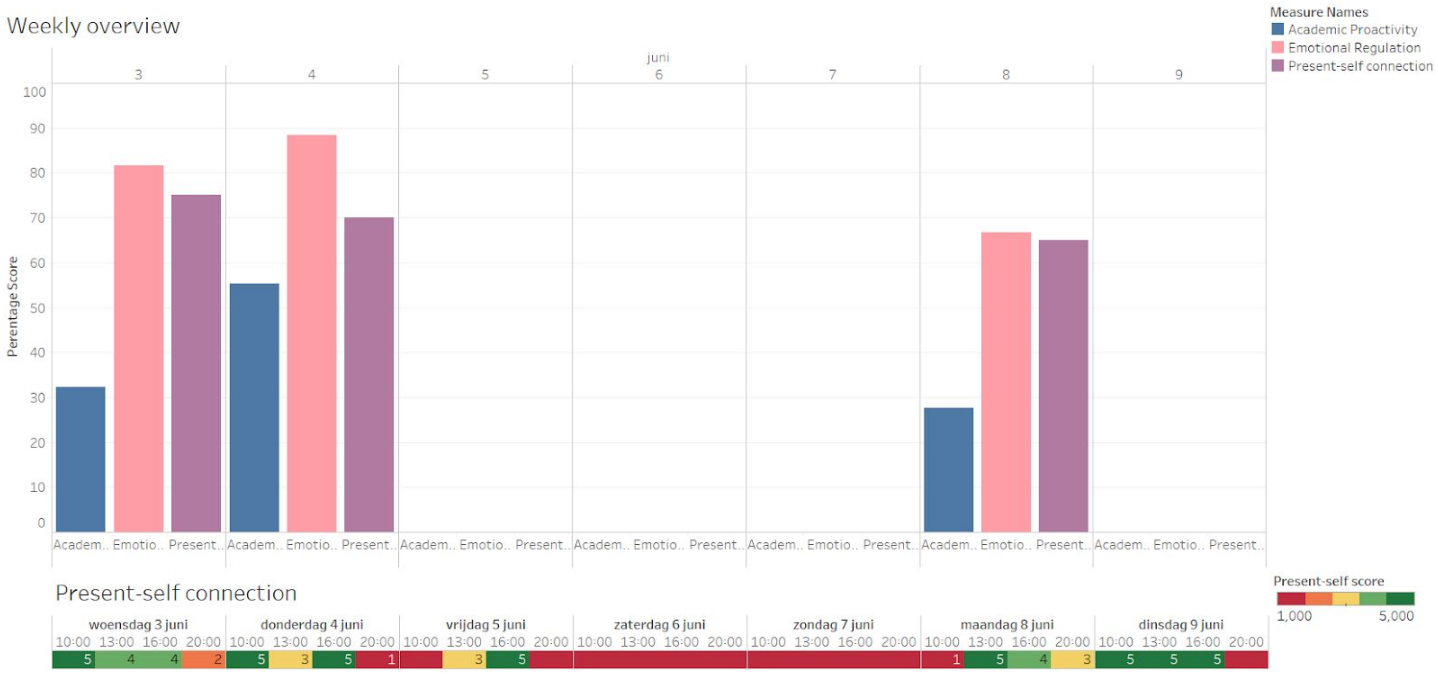


Figure 45: Participant 05's data visualisation.

Table 32: Participant 05's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 05**
What is your first impression of the data visualisation?	'It does visualize when you are there in the moment. For me, the evening is a problematic time. In the afternoon I am fairly aware, but in the evening there is a bad present-self connection. So that is quite interesting. I expected those scores on academic proactivity. I think this was quite a normal week for me.'
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and present-self connection?	'Yes, these are very clear to me. It is a visualisation in which you can find correlations, which is the nice thing about them. I can see in an instant that my emotional regulation and present-self connection are quite close to each other each time. The academic proactivity is a little lower, and that is something I recognize for myself so that fits as well. I think it is very

	clear.'
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	'My academic proactivity doesn't seem to have a connection with my emotional regulation, it is a lot lower. However, emotional regulation and present-self connection lie close to each other so they have more to do with each other. My emotional response is usually quite steady and my present-self connection idem, so maybe there is a link. I find it a bit difficult to precisely name correlations, but this is what I can get from the visualisation.'
Did you learn anything from this data visualisation? If so, what did you learn?	'That I am quite stable, emotionally and that the same goes for my present-self connection. My academic proactivity is mediocre and less, so to say. This is more a confirmation for me. Also, my present-self connection apparently isn't very good in the evening. I find that interesting.'
Is this new information to you or is this something you were already familiar with? Please explain.	'The bar graph information is something I already knew. The present-self connection is something I hadn't paid attention to before, but it does make sense. There is a face to the name, so to say. Now I am more conscious about it.'
Have you become more conscious of your academic procrastination behavior? In what way?	'Not more conscious, because I was already very conscious of my academic procrastination behavior.'
Have you become more conscious of your emotional regulation? In what way?	'No.'
Have you gained more insight into your academic procrastination behavior from this data visualisation? Please explain why or why not.	'Not really so far.'
Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'I think you can create a nice insight because if you see certain things it is easier to come up with targeted solutions, to work on it. For example, I now know that I procrastinate a lot until the last moment, then it is easy to say,

	looking at the academic proactivity which days went well and which days did not go well. Then I can focus, for example, in the afternoons, because then I have the most present-self awareness, to work on my studies, instead of doing that in the evening when I get easily distracted and quickly lose my present-self connection. In that respect it would be quite interesting to see that. Maybe some sort of plan or advice could result from the data collection.'
Do you believe such an application can be helpful for students in the future? Please explain.	'It is definitely interesting to see the data output, what the data shows. I believe if it does not benefit, it does not harm either. It is good to gain insight into your behavior and it is always good to know how you handle things and to know what your most effective moments during the day are. Maybe that is beneficial to others as well. For some people this may be more beneficial than for others.'

Participant 06

Table 33: Participant 06's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 06**
How did you experience the week of the experiment?	'The first day you are a little surprised when you get the notifications, but after you are a little prepared in some way. It is constantly in your mind that you should do something because you want to do well. I thought it was quite interesting.'
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'I did become more conscious of my academic procrastination behavior. I found out I am a little easy on myself; that I allow myself moments when I am not studying. But that is not very convenient because if you just do a little everyday you don't have to do a lot in the end. I have become more conscious about that. Concerning emotional regulation, that is a bit tricky. I'm not sure. When I don't

	feel very good I tend to find distractions.'
Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'I think it has improved because I am more conscious while doing things, and I am also more aware about the things that I still need to do.'
Would you remove, add, or change anything in the daily questionnaire?	'There were often the same questions, but worded a little differently. That wasn't really necessary in my opinion.'
How did you feel about the open journaling questions at the end of the daily questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	'I thought those were nice, you can write down your own story with these open questions and that way you really reflect on how your day went; how it actually went. I didn't do that before. You can also find out whether you were productive or not.'
Did the notifications help you connect with your present-self?	'Honestly, sometimes they came in my spam box, so sometimes I saw the notification a little later. But yeah, when you get such a notification it reminds you to pay attention to what you are doing in the moment.'

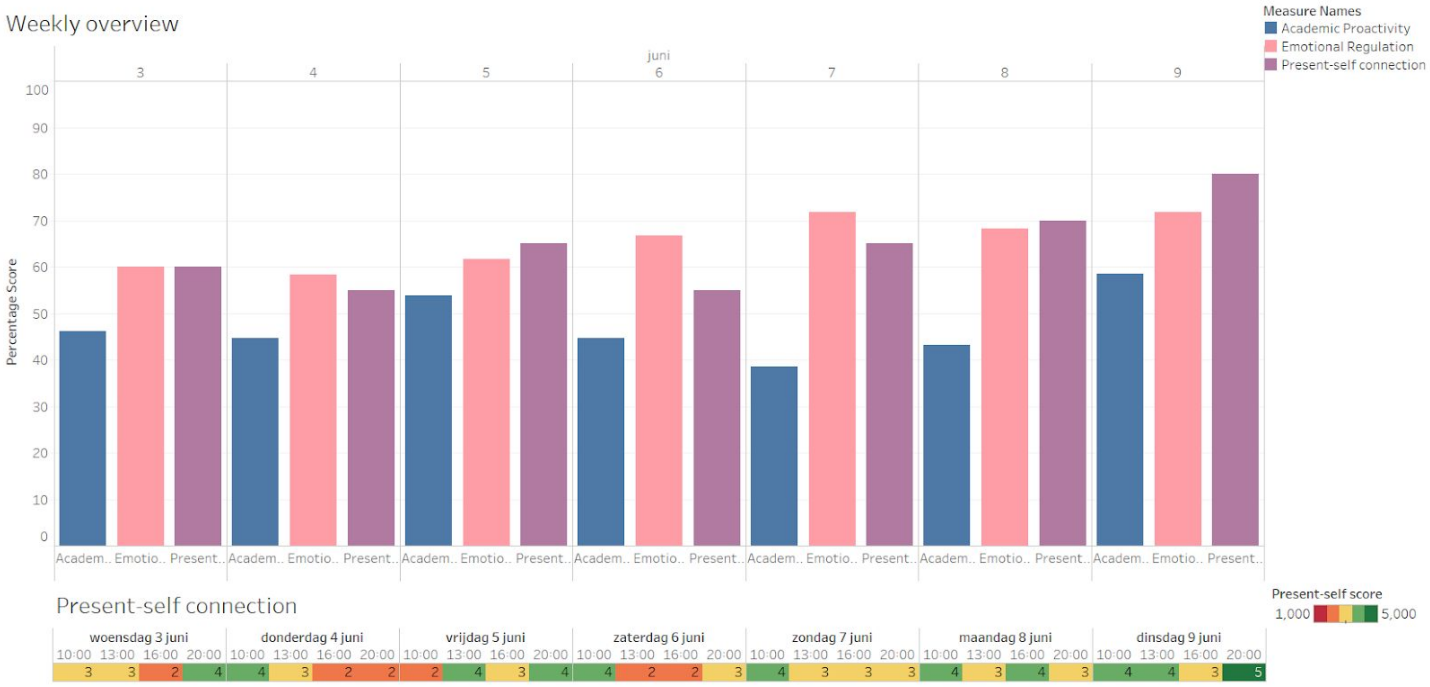


Figure 46: Participant 06's data visualisation.

Table 34: Participant 06's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 06**
What is your first impression of the data visualisation?	'What strikes me is that the blue bar is lower in general than the other two. I also see that how active I am studying is lower even though I am aware of what I am doing. '
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and present-self connection?	'Yes, I think so. You have 0 till 100 and a 100 is always everything perfect. And yes, it is also clear where the factors are represented.'
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	'I was looking at the present-self connection and it is quite noticeable that I was more present-self connected as the week progressed, because I became more conscious about it. Also, I felt more pressure from my studies later on in the week because of deadlines. That is when it went better with my

	present-self connection. In general, in the weekly overview I see that the blue bar and the purple bar are proportional to each other, there is about a ten percent difference each day. That is kind of funny to me.'
Did you learn anything from this data visualisation? If so, what did you learn?	'Maybe I am not that active as I thought, in my studies. My academic proactivity should be higher. In the present-self connection I see that the times that things are better is usually at the end of the afternoon or in the evenings. That is a confirmation for me, that I am more aware of what I am doing in those moments.'
Is this new information to you or is this something you were already familiar with? Please explain.	'It is partly new, because I already knew that I usually study better in the evenings, but I wasn't conscious of my present-self yet. So that's something new I learned. I also learned that my academic proactivity is a little low and that should be higher.'
Have you become more conscious of your academic procrastination behavior? In what way?	'Yes I think so, because my academic procrastination occurs when I allow myself to procrastinate, while that is actually not the intention. I didn't notice it before that I thought about this so easily. That is something I am more conscious about now, that I sometimes make it too easy for myself and that I have to push myself to just start learning. Rather a day earlier than a day later.'
Have you become more conscious of your emotional regulation? In what way?	'When I don't feel very good it turned out that I am not able to do that much, that I cannot get alot done. That has become extra clear. I become demotivated when I don't feel very good and that influences my study behavior.'
Have you gained more insight into your academic procrastination behavior from this data visualisation? Please explain why or why not.	'Just looking at this data visualisation, yes I gained more insight. However, sometimes it is a little difficult because it is different every day; there is not one clear line. In general, I can retrieve quite some information from this.'

Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'Yes I think so, but then it must be going on for a longer period of time. You do become more conscious of what you are doing each day, whether it is well spent. So I think if you let this go on for a longer period of time it might help to make people more aware of what they are doing and what they are putting off, and that they could change that.'
Do you believe such an application can be helpful for students in the future? Please explain.	'Yes I think so because you also look at your emotional regulation. I think that a lot of students don't really think about the emotional side. I think they just don't feel like it or are demotivated; that only those aspects are recognizable. While you have many emotions during the day and that is also being looked at and I think it works well for students; this combination.'
Other remarks	'It may be good to create some variations in the times of the notifications that are sent, that it doesn't become standard and expected.'

Participant 07

Table 35: Participant 07's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 07**
How did you experience the week of the experiment?	'As you probably noticed, I am quite forgetful when it comes to answering your emails. When I set alarms for myself it was nice to have a periodic check up of how you are doing. If you are distracted or not present which is a reason to go back to work.
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'Yes I think so, I have been more aware of it. Not a whole lot, but that is probably because of the stress. It is nice to have a little confrontation whether you are being productive and present. Sometimes you just have a bad mood and think screw it, I'm just gonna go watch TV for an hour. In general, I think it has improved.'

Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'Yes, I think that fits in a bit with that.'
Would you remove, add, or change anything in the daily questionnaire?	'I think that the biggest issue was that a lot of questions looked alike and I wasn't sure what nuance there was between the different questions. For example the question about whether you were able to control or endure your negative feelings. I felt that this question was asked several times in different ways. I wasn't sure about the difference between the questions.'
How did you feel about the open journaling questions at the end of the daily questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	'I'm not very good at self-reflection so I was usually pretty short about it. Maybe give some support sentences with examples to remind people to think about certain things; a little guidance to stimulate a little more to engage in self-reflection.'
Did the notifications help you connect with your present-self?	'Yes, even though my email notifications weren't working, the goal is the same so that was helpful.'

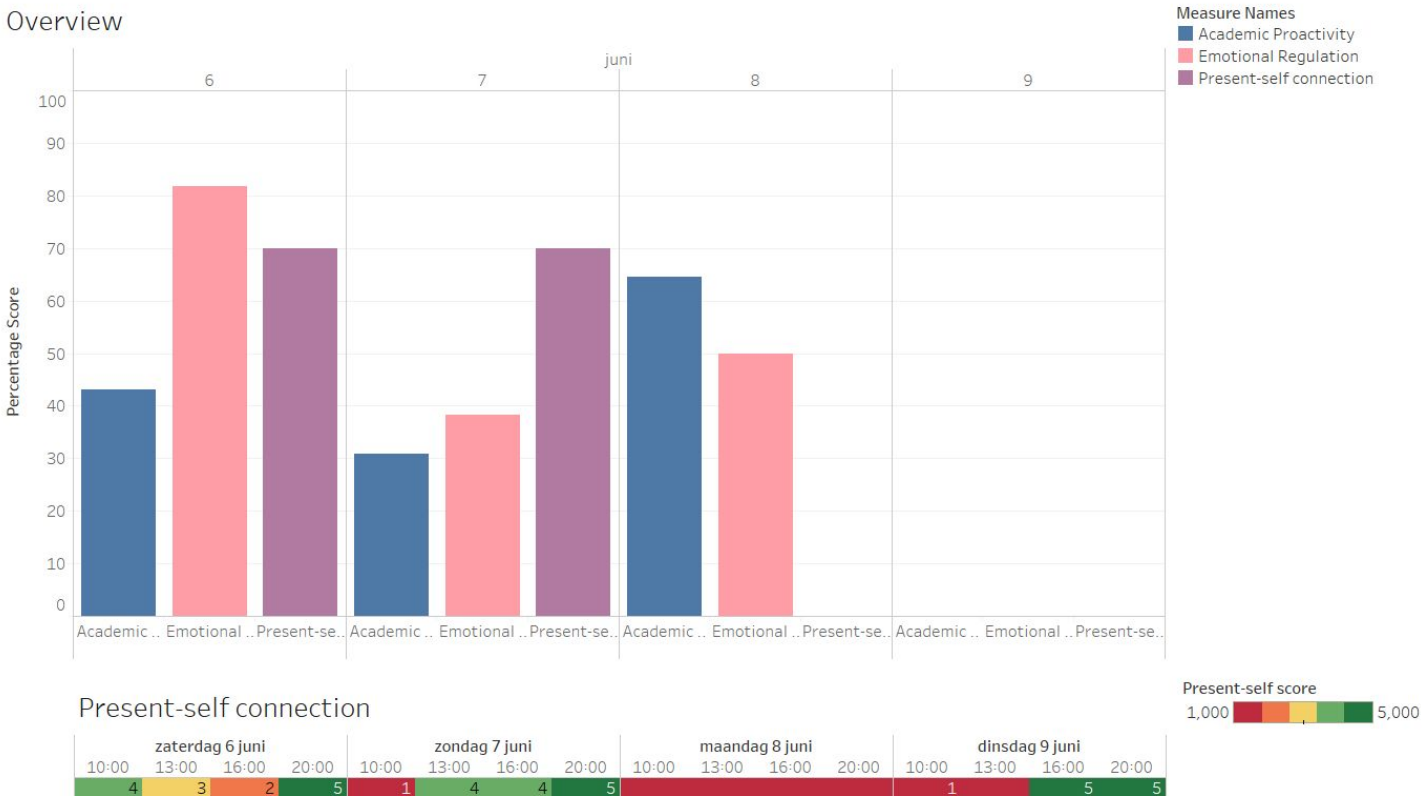


Figure 47: Participant 07's data visualisation.

Table 36: Participant 07's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 07**
What is your first impression of the data visualisation?	'At first sight it seems quite simple, but you have dig a bit deeper to find where the statistics came from and why I filled that in. If I had designed it, I think I would have added a list of activities in the text tooltip; a short overview so you know what you did that day. In general, the overview is clear. I enjoy seeing that those three bars are related to each other.'
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and present-self connection?	'I'm not exactly sure what the numbers mean, but I can see how they relate to each other. For example, I see that on that day I was fairly present but not busy studying, that was a conscious decision. And on that [other] day I see that I tried my best.'

Which correlations do you see and can you name them? Do they seem arbitrary, or not?	'I think that is pretty much it, when you look at one color over the entire week you can see when days were better or worse. You can compare the relative heights of the bars. I don't see a clear correlation between the factors right now, but that is also because I'm missing a few bars, which is kind of my own fault.'
Did you learn anything from this data visualisation? If so, what did you learn?	'It is nice to see how you decide to go and work each day, definitely because there are also two weekend days. Usually I don't work on the weekend but apparently I decided here to do something anyway so that is where I broke a pattern. It is interesting to see the effects of that because some people are very pattern and routine bound.'
Is this new information to you or is this something you were already familiar with? Please explain.	'I hadn't seen it this way before. It is nice to see how it correlates with different factors each day, because giving yourself just a number between 1 and 10 is a bit mediocre. This way you can get more information out of it.'
Have you become more conscious of your academic procrastination behavior? In what way?	'Yes, more conscious. It is actually very simple; if I get such a notification then it is another kick for me that I have to go do something again. It is a bit like those apps that remind you to drink water each hour.'
Have you become more conscious of your emotional regulation? In what way?	'I am quite aware of that myself, but I do believe that this helps. Also to compare it over several days.'
Have you gained more insight into your academic procrastination behavior from this data visualisation? Please explain why or why not.	'I don't think so because I'm not more conscious about why I am procrastinating. It's more of an accountability to that app of oops I'm procrastinating again.'
Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'I think so, but you have to be open to it, so you already have to be looking for a helpful solution. I think if you are a stubborn and grumpy student and you never really feel like working and you don't really want to do

	anything about it, then you probably won't feel like it. But that applies to almost all tools.'
Do you believe such an application can be helpful for students in the future? Please explain.	'Yes, I think so. It is probably not for everyone but I can think of a few people that would like to add self-reflection to their study behavior. So in that way this can definitely help.'
Other remarks	'It may be nice to be able to check these kinds of overviews regularly, for example over two days, instead of having to wait for a weekly report. Maybe also be able to have a check up besides the notifications, for example when you catch yourself being distracted.'

Participant 08

Table 37: Participant 08's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 08**
How did you experience the week of the experiment?	'Normally I am aware when I am procrastinating but now I was even more aware that it might be a problem. Especially that I didn't have my things in order. I started making lists of the things I need to do every day. Overall, it was a fairly normal week; a little busy because it was at the end of the module. What might be useful to say is that my Pfeiffer has come back, so sometimes I was very tired and I couldn't do much.'
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'Especially academic procrastination, but my emotional regulation was fine. Studywise, I have come to some new insights.'
Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'Reasonable, because I also continued with meditation, so that helped.'
Would you remove, add, or change anything in the daily questionnaire?	'Maybe instead of a scale from 1 till 5 you can make it a bit more concrete. For example,

	what could be a 4 for me could be a 3 or a 5 for someone else, so to say. Instead of 5 you can for example say I am this present. Others may experience their present-self differently.'
How did you feel about the open journaling questions at the end of the daily questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	'Yes it was quite convenient because you think about what things went wrong while studying, instead of just filling in a number. That's how it becomes more clear for yourself.'
Did the notifications help you connect with your present-self?	'When I was studying, yes. However, sometimes they came when I was eating for example and then I am present, but not procrastinating.'

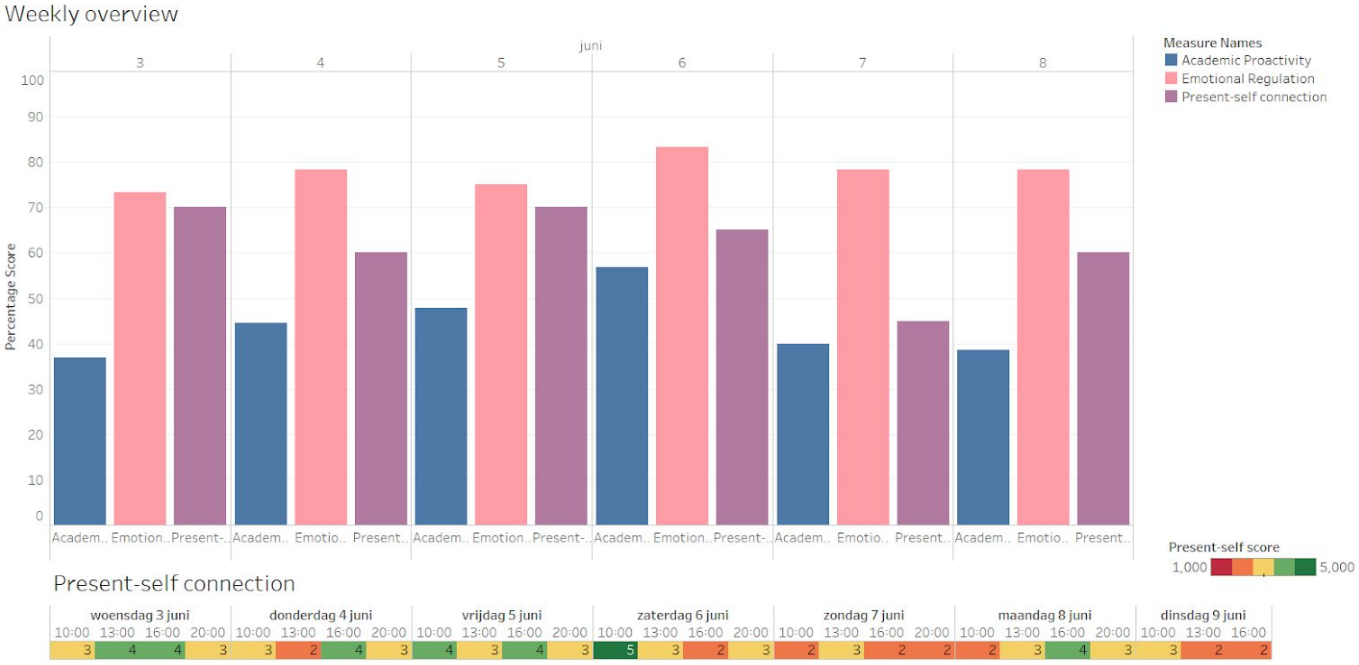


Figure 48: Participant 08's data visualisation.

Table 38: Participant 08's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 08**
What is your first impression of the data visualisation?	'It is quite clear when I felt tired. In the evenings I am not very present. You really see that there was a period where I couldn't be productive. My emotional regulation seems to be the best out of those three.'
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and present-self connection?	'Yes, blue is academic proactivity, pink is emotional regulation, and purple is the present-self connection.'
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	'My academic proactivity isn't very high compared to the others. On the days that I am not very present, my academic proactivity is also quite low, and the present-self connection as well. So the present-self connection and academic proactivity seem to have a correlation.'
Did you learn anything from this data visualisation? If so, what did you learn?	'Yes, when you are more present-self connected, you have a higher academic proactivity.'
Is this new information to you or is this something you were already familiar with? Please explain.	'It sounds logical, but I never really thought about it before. There have also been studies about people who meditate more and who therefore score higher at uni. That also has to do with the present-self connection.'
Have you become more conscious of your academic procrastination behavior? In what way?	'That the problem is not so much the procrastination but more the organization of studying that week was not quite right. That is why I started with those checklists, which gives you a nice feeling when you can fill in something you are done with.'
Have you become more conscious of your emotional regulation? In what way?	'That stayed the same.'
Have you gained more insight into your academic procrastination behavior from this	'Yes, when you are less present-self connected that you are also less academically proactive. That is the main thing I get out of

data visualisation? Please explain why or why not.	this.'
Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'Yes I think so. There are many people who don't meditate yet, for example I get notifications from such another app as a reminder to be present. I think if you really focus that on study aspects, you can help a lot of people with that. I believe it is very useful to be mindful of that present-self connection and your emotional regulation, and improving your academic proactivity in that way.'
Do you believe such an application can be helpful for students in the future? Please explain.	'So, yes.'

Participant 09

Table 39: Participant 09's answers to the questions before showing the data visualisation.

Questions	**Answers of participant 09**
How did you experience the week of the experiment?	'Fine actually. I noticed that sometimes I thought "oh a notification is coming, so I have to be more productive". It had a stimulating effect.'
Do you believe your consciousness improved this week concerning your academic procrastination behavior and emotional regulation? Please explain.	'Yes I think consciousness of my academic procrastination behavior did improve. I became more aware of it every time I received such a notification about whether I was procrastinating or not. I'm not sure about emotional regulation, I didn't notice much of that I think.'
Do you believe your consciousness improved this week concerning your present-self connection? Please explain.	'Yes I think so, I was more conscious about when I was procrastinating.'
Would you remove, add, or change anything in the daily questionnaire?	'No, not really I think.'
How did you feel about the open journaling questions at the end of the daily	'Yes I think so. It helped you reflect on how procrastination behavior made you feel and

questionnaire? Did they help you engage in self-reflection? Was this beneficial in any way? Please explain.	how you experienced your day. That is quite useful to think about.'
Did the notifications help you connect with your present-self?	'Yes I think so, I was conscious about whether I was procrastinating when I received a notification; you were alerted for a moment.'

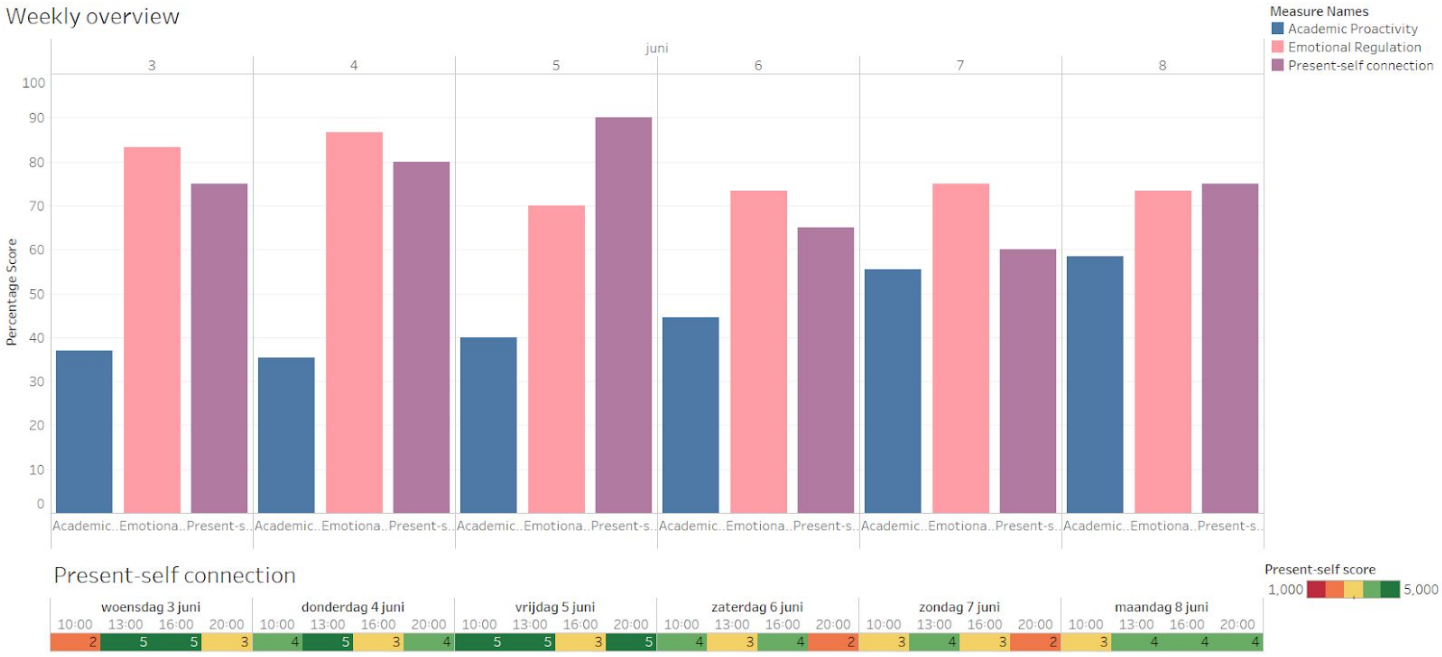


Figure 49: Participant 09's data visualisation.

Table 40: Participant 09's answers to the questions after showing the data visualisation.

Questions	**Answers of participant 09**
What is your first impression of the data visualisation?	'I especially feel like I am not productive in the afternoon, less anyways. In the evening a little more connected to the present-self. I usually don't study in the evenings, so I was more in the moment I think.'
Are you able to explain the representation of the different factors, concerning academic proactivity, emotional regulation, and	'Yes, here they are right [pointing at the bar graph]? Out of a score of 100 about how well you did on presents-self and your emotional

present-self connection?	regulation.'
Which correlations do you see and can you name them? Do they seem arbitrary, or not?	'I find that a bit difficult. I especially think that these two [emotional regulation and present-self connection] are always so high and that that one [academic proactivity] is a little lower, but that it increases as the week progresses.'
Did you learn anything from this data visualisation? If so, what did you learn?	'Especially when you look at the timeline you can see that I am more in the moment in the evenings, so I may be more productive then to study. I'm not sure about the rest, I find it a bit difficult. I see that when I am more connected to my present-self that the other scores are a bit higher as well, maybe because then you are more conscious of your emotions and about what you are doing.'
Is this new information to you or is this something you were already familiar with? Please explain.	'This is new to me. I hadn't thought about it before. I see that I'm usually more conscious in the evening and in the morning, and not so much in the afternoon. I am also pretty conscious of my emotional regulation present-self. I'm not sure how to interpret the blue bar [academic proactivity].'
Have you become more conscious of your academic procrastination behavior? In what way?	'Yes, I have become more conscious about the fact that I suffer quite a lot from academic procrastination.'
Have you become more conscious of your emotional regulation? In what way?	'Not really, I think. I'm not sure why.'
Have you gained more insight into your academic procrastination behavior from this data visualisation? Please explain why or why not.	'Especially with those present-self moments, that is insightful. But I'm not sure how I can link that [the bar graph] to my academic procrastination, specifically. I think when you are more conscious of your present-self that you are also more conscious of your procrastination behavior, which could help you do something about it.'
Do you think this concept has the potential to reduce one's academic procrastination? If so, how?	'Yes I think so. Especially when you get those notifications you become aware and it is like a reality check if you are procrastinating,

	maybe I should do something. Also in the evening, you can reflect on your day and think about maybe tomorrow I should be more productive. Those kinds of things.'
Do you believe such an application can be helpful for students in the future? Please explain.	'Yes I think so. An app that sends notifications, not necessarily the questionnaire at the end of the day, but those notifications about the present-self.'