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Reducing academic procrastination: Designing an artifact to aid students

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Abstract

Procrastination, the act of voluntarily delaying an intended course of action despite expecting to be worse off for the delay, is a widespread and troubling phenomena [27]. It is especially prevalent in students and can be detrimental to both academic performance and mental health. In this study, a mobile application will be developed with the objective of creating a tool to help students reduce academic procrastination. Research into the literature surrounding the psychology of procrastination is conducted in order to gain insight into underlying factors influencing the behavior, and possibilities of designing to reduce academic procrastination are then explored. Based on this insight, a concept for the mobile application is created. The app is then designed and developed to be highly functional, and tested by users in real environments over a three week period through a diary study. Data collected in the diary study is analyzed and findings relating to the user experience of the app and its effectiveness as a tool to reduce procrastination is presented. Furthermore, recommendations and considerations when designing to reduce procrastination will be discussed to contribute to future research in the field.

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1 Introduction

Procrastination can be described as the act of delaying an intended task despite expecting to be worse off for the delay [27]. It is a highly prevalent phenomena that affects a large number of people in the general population [27, 7]. Despite often being looked at as just a bad habit, the harmful nature of procrastination should not be understated as a variety of studies have revealed the significant negative impact it has on subjective well-being [11]. Although procrastination appears to be on the rise, it is by no means a new phenomenon. References to procrastination can be found all throughout history tracing back to ancient times, and consistently it has been viewed as something unwanted, problematic, and harmful [27]. Despite its prevalence today and evidently throughout history, it is not only strange that researchers just recently started addressing the phenomena, but also slightly ironic. During the last five or so decades however, procrastination has been subject to intensive research and attracted interest from a variety of different fields. Although this newfound research attention has given us a lot of insight, there is still a great deal we do not yet understand regarding the causes of procrastination [27]. According to Ferrari, procrastination remains “one of the least understood human miseries” [5].

There is however one aspect of procrastination that is well documented, the fact that it is extremely prevalent in students. Whereas 15-20% of adults in the general population are chronically affected by procrastination, more than 70% of college students are estimated to procrastinate regularly and a staggering 50% do it consistently and problematically [27, 23, 11]. A number of studies over the last few decades have revealed that procrastination not only results in lost time, but poorer health, decreased individual performance and long-term learning, lower self-esteem, and heightened levels of stress and anxiety [29, 27]. These findings suggest that procrastination should be considered a serious problem in the academic domain as it decreases the learning ability of students while increasing the severity of various negative outcomes. Although procrastination is prevalent and problematic in the general population, it is considered especially troublesome for students due to its high prevalence rate and impediment to academic success. The resulting need for intervention to reduce

student procrastination is clear, backed up by the fact that almost all students who consider themselves procrastinators express a wish to reduce it [27].

As procrastination appears to be a form of self-regulation failure and a way to cope with negative emotions, current intervention strategies mostly focus on eliminating the problem through psychological treatment [27]. Although few studies have managed to demonstrate effective intervention strategies, psychologists tend to look at cognitive behavioral therapy (CBT) as one of the more promising [21]. In CBT procrastinators are taught about the underlying causes and how to combat them by identifying and changing irrational thought patterns. While studies have shown how effective CBT can be in the right circumstances, almost half of those who start it to overcome procrastination drop out before any progress is made [4]. A common problem with current intervention strategies are that they often require a significant amount of practice and effort, something that can be particularly challenging for procrastinators [21]. Such intervention strategies are arguably not realistically applicable considering the target group of procrastinators, and there should be more focus on exploring alternative, more proactive solutions. Designers might be able to help in this regard by creating user experiences that counteract the underlying causes of procrastination in the moment. Instead of teaching procrastinators about strategies to reduce it, designers can attempt to incorporate these methods through designed interactions and create environments that directly minimize risk factors leading to procrastination.

The intention of this research is to design and create a fully functional mobile application that students can utilize as a tool to help reduce their own personal procrastination in academic contexts. This research will contribute to the field of interaction-design by producing an artifact as well as present a set of recommendations and considerations when designing with the intent of reducing procrastination. As a large body of research on the causes, correlations, and outcomes of procrastination exists, strategies to potentially reduce it have been identified and covered extensively, however these strategies are primarily aimed to be used in the context of psychology. The guidelines that will be presented here are specifically intended to be used by designers when designing user experiences to reduce procrastination, especially in regards to students as the target group.

1.1 Research question

This master thesis will explore how a digital aid can contribute to reducing personal procrastination in students by designing for positive behavioral change.

RQ: How can a digital aid be designed to counteract the negative aspects of academic procrastination?

To address the research question, relevant literature within the domain of procrastination research will be covered to establish the underlying factors contributing to the behavior. Based on this insight, a concept for the digital aid is created and a focus group is conducted to gain feedback about it. A mobile application is then developed as the digital aid, and a diary study is conducted to gain longitudinal insight about the app when used by students in natural contexts of interaction. Findings from the diary study will be assessed and presented to examine the user experience of the app and its effectiveness as a tool to reduce procrastination.

1.2 Short description of the mobile application

The artifact presented in this thesis is a mobile application designed to help students reduce study-related procrastination. Rather than a high-fidelity prototype, the app may be considered a Minimum Viable Product (MVP)¹ or beta version as it is highly indicative of the intended final product in terms of technical requirements, functionality, and design, but lacks some planned features for a full release. Developed as a native android application² it can be installed directly onto any smartphone device running android, and it is sufficiently viable for real world usage.

The app operates much like a typical study planner or to-do list app as users can keep track of assignments and due dates by adding them into the app. However, it differs from similar apps by being specifically designed to reduce student procrastination through various means.

¹ A minimum viable product is the version of a product containing only the core features needed to satisfy early adopters.

² A native application is an executable program that is developed solely for use specific platform or device, and therefore is able to utilize system-specific functionalities.

More precisely, it is designed to negate underlying factors that promote procrastination tendencies in order to minimize the prospect of it occurring. There are primarily three methods incorporated in the app to reduce academic procrastination:

Adding and dividing assignments: When adding an assignment into the app, the user is taken through a series of steps where the assignment continuously gets broken down into smaller, more manageable tasks. The purpose of this is to lessen the overall discomfort associated with larger assignments which is one of the major contributing factors to student procrastination.

Overview of tasks and deadlines: The home-screen of the app provides a clear overview of all tasks and their deadlines. The interface is heavily focused on emphasizing only the most important information such as what needs to be done today or this week. Maintaining order and structure has been shown to reduce procrastination in multiple ways, which is why a considerable amount of time has gone into designing the home-screen interface.

Focus Mode: Minimizing distractions has been suggested as one of the most effective methods of reducing procrastination for impulsive individuals. To tackle this, the app includes a feature named “Focus Mode” to eliminate smartphone-related distractions. When toggled on, the user will temporarily not receive notifications or be able to access other apps for a predetermined amount of time. The user will however always be able to turn it off prematurely if necessary, and it is completely optional to use.

Instructions for how to download and install the app on an android smartphone can be found in appendix C. For a more detailed overview of the app, see chapter 5.

2 Background

This chapter will cover the background for choice of research topic, define procrastination in the context of this study, and summarize the research on causes and correlations of procrastination.

2.1 Prior work on procrastination

The idea of developing a tool to help reduce procrastination originated from personal procrastination on a prior school assignment. The description of this assignment was to develop a prototype of an intelligent communication-system utilizing artificial speech, and the day before a concept had to be pitched I sat empty handed. Annoyed at myself for procrastinating yet again, the idea hit me: *What if I try to develop a tool that stop me from procrastinating on future assignments?*. This is how *Masebotten* came into being, roughly translated to *Nagging-bot* in English, a mobile application that audibly nagged at the user whenever he or she postponed tasks. As postponement increased so did the frequency and intensity of the nagging, for example: *“You haven’t worked at the book report today either? Pull yourself together, there are only two days remaining now until deadline.”*. Due to the assignment constraints, the *Nagging-bot* was intended to be more of a fun project rather than a serious attempt at effectively reducing procrastination. It was obviously heavily flawed in its execution as using negative reinforcement like nagging would likely only do more harm than good in practice. However, the research and development of it produced a lot of ideas and laid down the foundation for what I wanted to do with my master thesis.

2.2 Defining procrastination

The authors in one of the earliest books researching procrastination stated that “a major difficulty in studying, understanding, and treating procrastination may involve variations in

its subjective definitions” [6], a statement that still holds true over two decades later. To this day, no commonly shared definition of procrastination has been established despite numerous attempts by different researchers to refine our collective understanding of the term. As no single agreed upon definition exists, the term procrastination is used to describe differing phenomena of delay. While most researchers tend to use the term exclusively for dysfunctional types of delay, some use it in a positive sense, e.g., Chu and Choi (2005), and consider some forms of procrastination to be productive and beneficial. With these definitional variations within the academic literature, it is highly important to clearly state what procrastination means in the context of this thesis to minimize any subjective interpretations.

Dr. Piers Steel, presumably the world’s leading researcher and expert on the psychology of procrastination, published a study (2007) reviewing all previous research on the subject in an effort to examine and summarize what is currently known about procrastination. The goal of the study was to establish a definition of the term, explore when and why it occurs, and lastly how to prevent it. Steel concluded his findings with this suggested definition:

“Procrastination is the act of voluntarily delaying an intended course of action despite expecting to be worse off for the delay”

— Piers Steel

I consider this to be a fairly accurate and descriptive definition based on our current understanding of the phenomena, and it is the definition of procrastination that will be used in the context of this thesis. To further expand on it, procrastination means that you engage in irrational behavior as you voluntarily postpone doing something despite knowing it will have negative consequences in the future. According to Silver and Sabini (1981), the two key features of procrastination are *postponement* and *irrationality*. The latter being a useful distinction when considering the difference between procrastination and strategic delay, i.e., rational delay. Deliberate delay of an intended action does not in itself constitute procrastination unless it is also irrational, needless, or even harmful [11]. A study break is an example of strategic delay, although lost time or other negative consequences might be expected, it is not procrastination if the individual is confident that the positive consequences will outweigh the negatives. If we continue this perspective, procrastination can not be used in a positive sense as that contradicts the very definition of it in conventional terms. Arguably, researchers who suggest positive forms of procrastination actually refer to strategic delay

considering the absence of irrationality³ in the delay, unfortunately this only helps to further obfuscate the term and the difficulty in studying it.

The terms “academic procrastination” or “student procrastination” will also be used interchangeably throughout this thesis in reference to procrastination in the context of study-related tasks or activities. In line with Steel’s (2007) definition, these two terms will be defined as: “the act of voluntarily delaying an intended *study-related* course of action despite expecting to be worse off for the delay”.

2.3 Consequences of academic procrastination

As mentioned, procrastination is particularly prevalent in students with estimates pointing to at least 70% of college students regularly engaging in it [23, 27]. Furthermore, half of college students are estimated to procrastinate problematically in a consistent manner [11, 27]. Although these estimations tend to vary a bit in studies, academic procrastination is clearly a prevalent problem that is detrimental to academic performance for a large number of students. Numerous studies have shown that procrastination not only leads to lower grades, but also several health-related negative consequences [28, 19]. Students who procrastinate display increased stress, exhaustion, sleep-related problems and illness. Other emotional consequences include anxiety, sadness, dissatisfaction, anger, guilt, feeling pressure, or shame [28]. At college or equivalent level, evidence suggest that students who regularly procrastinate are more dissatisfied with their student life [19]. That is to say procrastination does not only negatively impact academic performance, but also the general student well-being. Despite the behavior usually reducing with repetition and age, students do not seem to overcome the problem as procrastination is found to increase throughout the years of college [27, 19]. A possible explanation for this is that students experience a constantly increasing high-demand environment where they are held to firmer deadlines and critical evaluations, thus developing methods to overcome procrastination keeps getting more challenging, especially for those who already struggle with it. Regarding the evidently lower grades of student

³Chu and Choi, the main advocates for positive procrastination, describe individuals who prefer to work under pressure and benefit from their procrastination as *active* procrastinators. These individuals procrastinate with a clear sense of purpose, i.e., to plan and structure, and do not display the typical characteristics of traditional procrastinators. This is by all means a strategic and rational type of delay, whether delay by itself is procrastination or not is still entirely subjective and open to various interpretations.

who engage in irrational delay, the notion of procrastinators being less intelligent or talented has been brought up. This notion has however been refuted, which in turn shows that procrastination itself is most likely to blame for the worse academic performance displayed [29].

Although procrastination, academic or otherwise, is by the definition of this study inherently dysfunctional, for the sake of transparency possible benefits as found in the literature will be covered. Firstly, it does appear that procrastination brings short-term benefits. Procrastinating students usually exhibit less stress during the beginning phases of a project, possibly because they put it “out of sight, out of mind”. In contrast, non-procrastinating students who immediately get to work are found to have higher levels of stress and other negative psychological reactions during the early stages of a project. As long as the proximity of a deadline is distant, procrastinators are generally better off in terms of emotional distress [29]. This largely explains why procrastination occurs in the first place, it is beneficial as a short-term mood repairer [30]. However, it is only a temporary fix and procrastination does not simply push the negative psychological reactions to an unpleasant task to a later stage, it increases the amount of stress and illness further [29]. It is a behavior that favors short-term gain and long-term costs over short-term costs and greater long-term gain. It is worth emphasizing that these benefits do not outweigh the costs which is why procrastination is usually considered dysfunctional as engaging in it only exacerbates the problems it is supposed to address [29, 11].⁴

Other benefits as found in the literature are associated with functional forms of procrastination which, as mentioned, relates to other phenomena of delay and therefore do not apply to procrastination as defined in this thesis. However, for transparency purposes I will summarize the main findings with relevance to academic procrastination. According to a self-report study by Schraw et al. (2007), most students rarely felt that their procrastination had a negative impact on learning or the quality of their work. These students explained that procrastination enabled them to reflect and plan before beginning to work, and it relieved boredom and lack of motivation felt early on in projects with distant deadlines. Instead of spreading out workload attempts to produce quality work with as little effort as possible allowed students to have a life outside of studying. Most participants in the study reported to be satisfied with the grades they received despite procrastinating. Chu and Choi (2005)

⁴ Although procrastination involves a voluntary decision to delay, this does not mean that the procrastinating individual is aware of his or her real motives for doing so. To engage in the behavior does not imply an awareness of it as a method to regulate your emotions, even if that might be the true nature of it.

reported similar findings suggesting two types of individual procrastinators, one as the typical dysfunctional type, and the other as functional and beneficial. The participants who benefited from their procrastination did not necessarily delay at a lesser extent, but they felt a greater sense of control over their time usage and therefore directed their attention to more urgent matters as a result. These students showed confidence in their ability to finish tasks in time despite of delay as they are driven to achieve as much as possible in the least possible time. In contrast to their dysfunctional procrastinating counterparts, the students who benefited from procrastination used their time while delaying to prepare and were therefore not paralyzed by indecision as the deadline approached, resulting in tasks being completed to a level of their satisfaction. The findings in these two aforementioned studies show that functional forms of delay exists that certain students can benefit from, particularly when it comes to balancing studying with other life activities. However, if procrastination entails expecting to be worse off for the delay, then these summarized findings cannot be considered benefits of procrastination as the participants who benefited expected more positive than negative outcomes from their delay.

2.4 Influencing factors of procrastination

In order to reduce procrastination we first need to understand the psychology behind it and identify the various underlying factors that contribute to the behavior. With this insight we can start to explore methods for how an app can influence user behavior in ways that minimize the factors that increase the tendency to procrastinate and strengthen behavior that reduce the likelihood of its occurrence.

A large amount of research has been done on the causes and correlations of procrastination in an attempt to explain why people do it, as such we are aware of a few internal (e.g., personal, psychological and biological) and external (e.g., environmental and situational) factors that can predict its occurrence and explain why some are more prone to it than others. People often assume that procrastination is caused by poor time-management, laziness, or general lack of willpower. In reality the behavior is far more complex than that. Procrastination can best be described as the result of self-regulatory failure, more specifically a failure in regulating ones emotions appropriately [27]. It is often considered to be a coping-mechanism to avoid unwanted emotions such as stress or anxiety as engaging in procrastination will temporarily function as an escape from these negative feelings [30].

2.4.1 Internal factors

Studies indicate that there is a biological or genetic component to procrastination as the level of peoples procrastination displays an apparent consistency over time and situation [27]. People who procrastinate more than the average are not necessarily lazier, but have specific personality traits that make them more prone to it.

Neuroticism

Neuroticism is one of the personality traits within the Five-Factor Model of personality (FFM), and it is associated with anxiety, guilt, frustration, low self-esteem, and depression. Individuals who score high on the neuroticism scale have a tendency to experience psychological distress and are more prone to the develop various psychiatric disorders [15]. Although neuroticism generally has a weak correlation to procrastination, there are a few specific aspects associated with it that make an exception [27]. Two notable aspects are low self-efficacy, which means you doubt your ability to perform well, and low self-esteem which means you have a low feeling about your overall worth. Although these two aspects arguably have a direct association with procrastination alone, when they both exist together the correlation is significant [27].

Fear of failure is a manifestation of low self-efficacy and low self-esteem, and it is one of the stronger predictors of procrastination because it increases task aversiveness as the task will be perceived as too challenging for your own ability [27]. Further on these procrastinators might feel that they are doomed to fail, so instead of trying and facing the anticipated failure they hinder their own performance. This is called self-handicapping and is a method for managing your emotional reaction to failure, so when you do eventually fail to accomplish a task it feels like less of a failure because you knowingly did not perform at your best [27].

Extroversion

The term extroversion refers to the character trait associated with being outgoing, energetic, optimistic, excitable, and impulsive. Several facets of being an extrovert means you are less prone to procrastination such as being energetic and optimistic. Lethargy and low motivation are both known predictors for procrastination, which extroverts display the opposite characteristics of [27]. However, one of the characteristics related to extroversion is suggested as possibly the strongest predictor of procrastination: Impulsiveness [27].

When compared to their non-procrastinating counterparts, it seems like procrastinators have a lower ability to delay gratification which leads to “giving in to feel good”, and they appear to have a higher preference for immediate rewards [30]. This coincides with impulsivity being one of the strongest predictors for procrastination. People who score high on the impulsivity-scale mostly act on their impulses in the current moment without too much consideration for how their decisions impact the future, and they also have a shorter attention-span. This naturally aligns with a higher tendency to procrastinate as being impulsive means you are intrinsically motivated by the pursuit of current happiness, even if that means sabotaging greater future rewards [27].

Conscientiousness

Conscientiousness, another personality trait within the FFM, is associated with being well-organized, diligent, careful, and achievement-oriented [15]. According to Lay and Brokenshire (1997), the lack of conscientiousness is essentially the source of procrastination as a trait. Compared to other personality traits, conscientiousness has a different relationship with procrastination in a few ways. For one, other personality traits only have a significant relation to procrastination through certain associated facets (e.g., neuroticism), in contrast, all the facets of conscientiousness show a strong correlation [28, 27]. Another difference is that conscientiousness influence the degree of procrastination while other personality traits mostly influence how it manifests, meaning the extent of a persons procrastination is predominantly determined by his or hers conscientiousness [28]. While highly conscientious individuals have a lower predisposition for procrastination, those low in conscientiousness engage in the behavior more frequently and with more severity. Given this connection, it is not surprising that procrastination largely appears to be representative of low conscientiousness [27, 28, 12].

Steel and Klingsieck (2016) recommends addressing conscientiousness and its facets as the backbone of all procrastination interventions considering the traits universal and powerful connection with the phenomena. Especially two aspects associated with the trait, impulsiveness and self-discipline, are important to address. Self-discipline or self-control is a facet of conscientiousness and can be described as the ability to not let impulses or feelings inhibit your behavior. As previously mentioned, impulsivity is considered to be one of the strongest predictors for procrastination, and although it is usually considered a facet of extroversion it also relates to conscientiousness through self-discipline as highly conscientious individuals seem to be able hold impulsive behavior in check [15]. To address impulsivity, stimulus control has been suggested as a possibly effective solution [28, 21]. As procrastination involves a deliberate choice of competing actions, e.g., video-games over writing term papers, limiting the amount of temptations is essential. Stimulus control can be used to remove the number of possible activities that can interfere with starting or progressing an intended action, and it can also be used to reduce the degree of temptation felt. Rozental and Carlbring (2014) suggests disabling notifications on the smartphone or computer to eliminate distractions while working, and to have a designated workplace free from distractions and tempting activities. While it is difficult for an app to remove most environmental distractions in the workplace, it is definitely possible to eliminate the smartphone as a temptation through an app. As seen in the app Forest, the phone can temporarily silence notifications and block users from interacting with other apps for a predetermined length of time (see subsection 2.6.1). Besides eliminating notifications as a distraction while working, this solution also address behavior of low self-discipline where notifications are not necessarily needed to trigger impulsive smartphone usage such as “quickly checking social media” which can easily go on for longer than intended.

2.4.2 External factors

Besides individual differences, situational contexts also influence the occurrence of procrastination. When we procrastinate, it involves a deliberate decision to delay a certain task or action in favor of a more desirable alternative. Unless we assume people procrastinate at random, we can conclude that the characteristics of the task itself has to play a part in why we decide to postpone it or not. There are two notable factors of a task that impacts how likely it is to be postponed: *Timing of rewards and punishments*, and *task aversiveness* [27]. Furthermore, as procrastination appears to be on the rise with prevalence rates increasing

with the year of publication, environmental stimuli has been suggested as a possible explanation for its growth [21, 27]. With modern technologies such as the internet, computers, and smartphones, instant gratification is becoming increasingly more available and easy to obtain. According to Rozental [2014], these technologies has exacerbated the difficulties of self-regulation in some individuals and might be one explanation for the seeming increase in prevalence.

Timing of rewards and punishments

The greater the time span until an event comes to realization, the less impact it has on our decisions. If an event is close to happening, it will influence our decisions related to it more than it would if it was further away. This partly explains why students are more prone to procrastinating on study-related work than other groups of people. For one, the time between you reap the benefits, whether it be in the form of grades or future job-prospects, and the work you put into studying can be quite lengthy. Say you are a student starting a three-year bachelor, it can be hard to let the potential of a good future job impact how well you study when it is so long until the work you put in actually comes into fruition.

It also explains why students procrastinate more on assignments with due dates further away. It is usually not because the workload of such assignments are smaller, but when the time until it needs to be delivered is further away it is only natural that it will have less of an impact on your motivation for working on it [23].

Task aversiveness

In procrastination research, *task aversiveness* typically refers to the extent in which a task is perceived as unpleasant. Basic psychology tells us that humans seek to avoid aversive stimuli, and consequently the greater the perceived aversiveness the more we avoid it [27]. It is not surprising, therefore, that the level of unpleasantness associated with a task has been demonstrated to clearly reflect its tendency to be avoided [1]. However, pinpointing the reason for why a particular task is perceived as aversive is not always as easy. For example, task difficulty alone can affect task aversiveness in multiple ways. If a task is deemed too difficult, it can lead to a fear of failure or uncertainty in how to progress. On the other

hand, if a task is too easy it can become boring, uninteresting, or feel meaningless, resulting in it being perceived as a worthless pursuit [1]. According to Blunt and Pychyl (2000), the underlying dimensions of aversiveness also vary with the progression of a task. If we apply this to a typical student assignment, the begging stages might be affected by issues related to decision-making such as where and how to start, issues that would be absent in later development stages. Continuing this perspective, in the middle stage of an assignment aversiveness is more affected by the extent to which an individual feels he or she is able to structure and organize the project. When an assignment gets closer to its endpoint, i.e., the later stages, overall aversiveness usually increases by higher levels of boredom, frustration, and a fear of evaluation [1].

Although a variety of personal characteristics influence the degree to which a task is perceived as aversive, when task aversiveness is associated with the previous concept, timing of rewards and punishments, it is possibly the strongest environmental factor to trigger procrastination. It is however important to note that task aversiveness alone primarily predict task avoidance, only when the aspect of time is included it also predicts task delay and thus procrastination. Students are especially prone to procrastination as an outcome of these two factors (task aversiveness and timing of rewards and punishments).

2.5 Designing for users

2.5.1 Human-Computer Interaction

In the early 1980s, computers started to move out of laboratories and into the homes and offices of everyday people. This was a dramatic shift as computers transitioned from being huge machines only used by highly trained technicians, to the now *personal* computers that could be used by anyone regardless of technical knowledge. Suddenly the ease of use became a necessary concern in order to prevent product failure as a result of computers being too difficult to operate. As a consequence of this shift, studying the interaction between humans and computers became important, which led to the field of Human-Computer Interaction (HCI) emerging [13].

The initial HCI research during the 1980s mostly related to peoples interactions with simple office programs, such as word-processors or statistical software. Since then, major changes

have occurred in computer technologies and completely transformed the way we interact with them. During the early to mid 90s the internet and World Wide Web started to become widely adopted, and today our computers are ubiquitous and affect nearly all aspects of our lives. As a result, the field of HCI has had to continuously develop and have expanded to cover almost all forms of information technology design. The research focus has also shifted beyond the simplicity of studying interface interactions and is now more nuanced and broad in scope. Like the inventor of the computer mouse said, Douglas Engelbart: “If ease of use was the only valid criterion, people would stick to tricycles and never try bicycles” [20]. HCI is now largely concerned with observing and understanding the entire interaction including, but not exclusive to, the environment an interface will be used in, the human emotions related to the interaction, how learnable a system is, and how errors or unexpected occurrences are handled [13, 8].

2.6 Similar applications

This section will cover existing applications which are similar to the mobile application presented in this thesis.

2.6.1 Forest

Forest is a mobile application intended to help people maintain focus while they work by putting away their phone. Users of the app set a timer in which they would like to work, and during this time they are not able to use other apps on their phone. Additionally, while this timer is running a virtual tree will grow and eventually be planted in the users personal forest on the condition that they complete their session. If the user however decide to open other apps and stop the timer, their tree will instead wither and die [24]. The feature named “Focus Mode” included in the app presented in this thesis was heavily inspired by the design of Forest.



Figure 2.1: Left to right: The timer interface and virtual garden in Forest.

2.6.2 Hold

Hold is a mobile application similar to Forest, but instead of setting a predetermined amount of time in which other apps can not be accessed, in Hold the timer goes indefinitely by counting up and users gain points every 20 minutes of not using other apps. These points can then be accumulated and exchanged into various rewards such as a cup of coffee or a scratch card. Users are also not blocked from accessing other apps like in Forest, instead they have a brief period of time to go back to Hold whenever the app is closed to let the timer continue running, otherwise it will stop and have to be started from zero again [10]. As a similar app to Forest which inspired the design of “Focus Mode”, Hold was also explored for inspiration but implementing an indefinite timer appeared to be an inferior design choice as users would not have an end-goal.

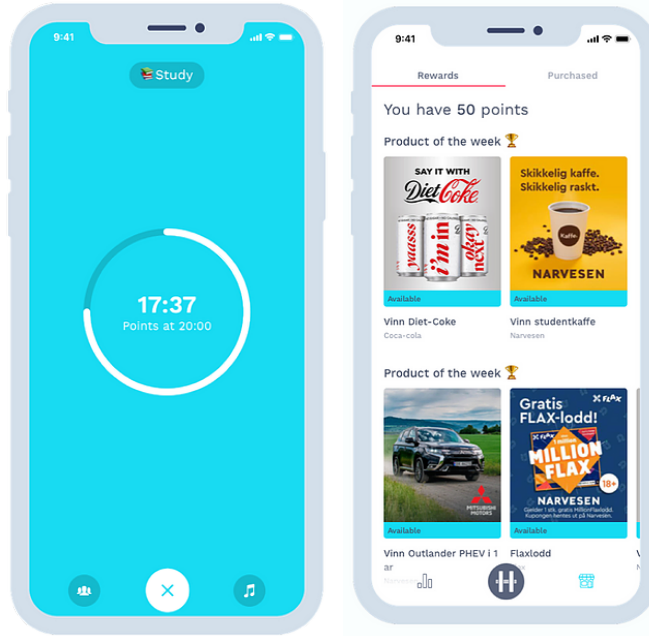


Figure 2.2: Left to right: The timer interface and the rewards page in Hold.

2.6.3 Todoist

Todoist is an application for organizing tasks which can be accessed in a web browser or installed on a wide-range of different devices. At first glance it appears quite simple, just add a few tasks and complete them, but as you keep using it you will recognize the many functionalities it provides. Just to name a few: users can group tasks into categories, add sub-tasks, due dates, priority levels, label task progress, and even use the app in collaboration with a team to delegate tasks. It is also possible to personalize the task overview and choose whether you want a list view or a Kanban-style board with cards. Todoist presents itself as an all-around task manager intended to improve productivity and avoid feeling overwhelmed [3]. As I consider the design and functionality of Todoist to be quite good, it was explored for inspiration when designing the task overview in my app.

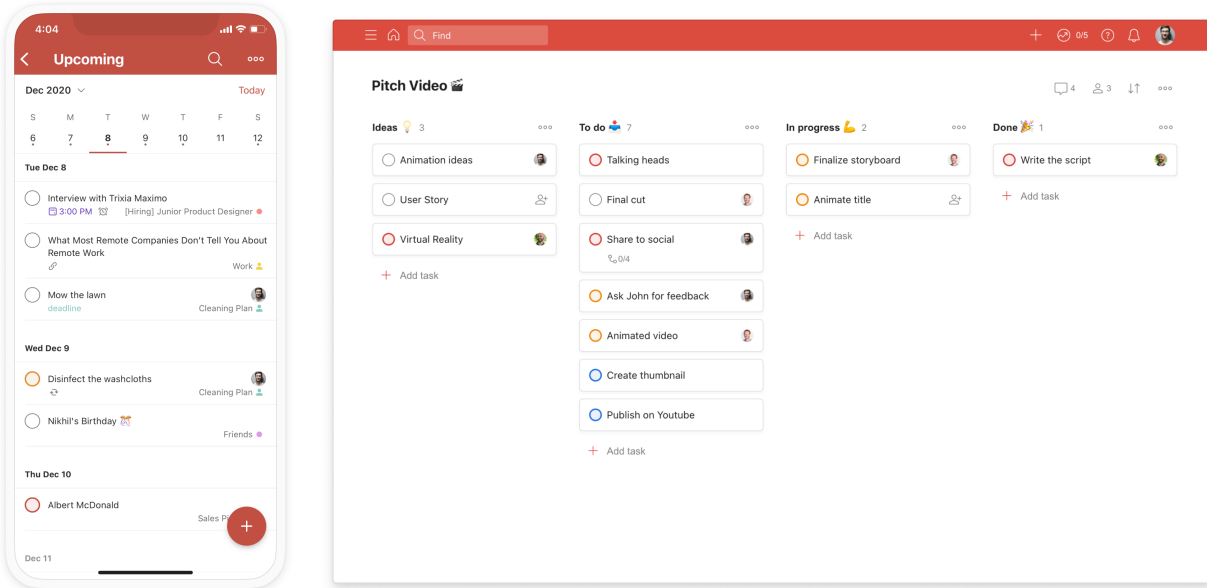


Figure 2.3: Left to right: Upcoming tasks (mobile) and Kanban board (browser) in Todoist.

3 Methods

3.1 Research methods

This thesis used a multidisciplinary research technique by combining insights into procrastination from the field of psychology with HCI research methods to explore solutions and provide answers to the research question. This section will cover the methods and methodologies used in this thesis as situated in the field of HCI.

3.1.1 Research through design

The main purpose of all scientific research is to contribute knowledge that adds value to a field of study. In HCI, research contributions usually fall into one of seven types: empirical, artifact, methodological, theoretical, or dataset [31]. In 2007, Zimmerman et al. published a paper and argued that the practice of designing is in itself a method of producing knowledge. He proposed a new model for research within HCI called Research through Design (RtD) that describes an approach for how interaction designers can make research contributions through the actual design process. While this idea was not new at the time, no standards existed for what RtD consisted of or how it can produce valuable contributions [33]. In order to help formalize this research method, Zimmerman et al. proposed a set of criteria for evaluating research contributions in interaction design using RtD:

Process: A critical part of evaluating research contribution is the process. Interaction design researchers must document their process with enough detail for it to be reproducible⁵, and furthermore they must provide a reasoning for the methods applied in their research.

⁵Reproducibility usually refers to the extent in which consistent results can be attained when a different research team reproduce a study. In this case, “reproducible” means the ability to reproduce the *process*, but there is no expectation that two different interaction designers will produce the same results when given the same problem and process.

Invention: The interaction design researchers must produce an invention to address a specific situation, and be able to demonstrate its significance. In order to do this, extensive literature review must be performed to gain insight in the current state of the art, and to demonstrate how their contribution advance the research field.

Relevance: Within scientific research there is usually a strong focus on *validity*. In RtD, the criteria of *relevance* serves a similar purpose and is instead used as a more suitable requirement. To demonstrate relevance, interaction designers must articulate what their design attempts to achieve or improve in the world, and also provide a rationale for why this state is preferred. Without a claim to impact the world, the research can not be considered anything but a personal exploration.

Extensibility: To ensure that knowledge derived from their work can be utilized by other researchers in the field, interaction designers must provide sufficient documentation for their research. The ability to either apply the same process for a future design problem, or use the knowledge obtained through the design research is imperative for designers using a RtD approach.

To summarize in the words of Zimmerman and Forlizzi (2014): “In Research through Design (RtD), researchers generate new knowledge by understanding the current state and then suggesting an improved future state in the form of a design.” This research will use a RtD approach to contribute knowledge by developing a functional mobile application as a design artifact. As seen in chapter 2, the scientific literature surrounding procrastination has been covered, giving detail for the current state of the world in which the artifact is situated, as well as the preferred state as an intended outcome of the artifact. The design and functionality of the mobile application will be presented, demonstrating the design decisions that went in to address specific problems. Methods used in this research will be accounted for, as well as the process that lead to the resulting artifact. Finally, the effect and performance of the app will be evaluated in near natural circumstances through user testing, and these findings will be analyzed and presented.

3.1.2 Focus group

Focus group is a qualitative research method used to gather insights about user needs, wants and feelings about a certain topic. A focus group will generally consist of a small number of

participants gathered in a session where they will be asked questions about a topic, product, system, or interface. The session is run by a moderator who is responsible for asking the group questions, as well as encouraging to an open discussion where participants can discuss freely. It is also the moderators responsibility to steer the discussion back on track if the conversation goes off topic, while simultaneously ensuring that the discussion does not feel too structured or rigid. Another important part of the moderators job is to avoid one participant taking over and dominating the conversation, all participants need to be included and be able to express their opinions [16].

Although focus groups have several advantages, there are also some limitations and disadvantages that comes with a group dynamic. For example, Nielsen [16] consider focus groups a poor method for evaluating interface usability. In a group setting it is difficult for each individual to fully explore a system on their own, preferably usability testing should instead be done one user at a time with direct observation. The strengths of focus groups do not lie in assessing design usability, but in discovering what users want [16]. Through group discussions, participants build on each others inputs, and the input from one participant might spark a memory or thought in another leading to new insight. Some also find it easier to voice critical opinions in a group setting, compared to a one-on-one with a moderator [14].

Early on in the project, when the concept for the mobile application was in place, a focus group was conducted to gain feedback about the concept from a few people who fit the target group. Three participants were recruited in total, all bachelor-students in their twenties. One of them also participated in the diary study later on. The main goals of the focus group was to find out if the concept described to the participants sounded like something they themselves would find useful, what parts of the concept they liked or disliked, and to find out if they felt something was missing from the application.

The insights gathered from the focus group helped in understanding what the users wanted from the application, something that was used to finalize the concept. The focus group also highlighted some issues with certain parts of the application where they could see themselves potentially having a poor user experience, this insight was taken into account when creating the design of the application.

3.1.3 Diary study

A diary study is a qualitative research method where data is collected over an extended period of time by having participants keep a diary to log information about the activities being studied. In HCI, the research method has been adopted from various other fields, and is used to collect data about user experiences, activities, and behaviors over time [13]. Diary studies are often referred to as the “poor man’s field study” as they can provide a lot of the same insight as a true field study, are cheaper and easier to conduct, but will likely not provide the same amount of detail and complexity in the data [22]. Although there are some disadvantages with the method, diary studies offers some unique insights compared to other HCI research methods due to the context in which data is collected. Unlike observations in a lab or natural setting, participants in a diary study are not confined to a specific environment or situation, and researchers are also not physically present with participants which can potentially affect their natural behavior [13]. Instead, participants can continue living their lives like normal while documenting experiences whenever convenient or as they occur in the moment, which makes the method especially good at studying user patterns over time and across multiple environments and scenarios [13].

In order to examine the mobile application, both in terms of user experience and its effectiveness as a tool to reduce academic procrastination, a diary study was conducted when the development stage ended (see chapter 6). There were several reasons that made a diary study stand out as the most suitable method. For one, to assess the app in relation to its impact on procrastination and overall academic performance, it had to be tested over an extended period of time in natural contexts. The app is also designed to be used in multiple environments and, besides adding and dividing assignments, mostly for brief periods of interaction, e.g., to check your daily tasks or to toggle on Focus Mode to remove distractions, which made direct observation methods impractical. Due to these aforementioned reasons, a diary study was selected as it seemed like the best approach in this particular case.

3.1.4 Semi-structured interview

According to Lazar et al. (2017), a diary study should ideally be combined with other methods in order to strengthen the findings. Following this recommendation, individual

post-study interviews were performed with each participant from the diary study after the reporting period concluded. Interviews are often described as either fully-structured, semi-structured, or unstructured, in reference to the degree in which a script is followed rigidly during the interview. Fully-structured interviews stick to a predefined script by asking specific questions in a specific order, and leave no room for the interviewer to ask additional questions. Unstructured interviews are more like a conversation as the interviewer might have some discussion topics in mind, but have no specific questions prepared beforehand and instead let participants talk about what they find important while steering the conversation in line with the research by asking open-ended questions. Semi-structured interviews are, as the name implies, an in-between of the other two types as some structure is maintained, but they also allow for some degree of deviation from the script to ask additional questions or change the order in which they are asked [13].

A semi-structured approach was chosen for the follow-up interviews with participants from the diary study. There are advantages and disadvantages with each type of interview structure, however as I had some specific questions to ask about, but also wanted the possibility of further discussing topics brought up by participants, a semi-structured interview was ideal here.

3.2 Design principles

Design principles are widely applicable pieces of advice intended to guide designers towards important aspects to consider in their design. These principles, acting as general design guidelines, are derived from the accumulated knowledge gained through research and practice in design and design-related fields. Many different principles have been endorsed, however the most common ones according to Sharp et al. (2002) are: visibility, feedback, constraints, mapping, consistency, and affordances. These principles were used during the process of designing the interface for the mobile app.

Visibility: The more visible an element is, the more likely it is that users will be able to find and use it. Of equal importance is also the opposite, less visible elements are more difficult to find and know about. In theory this might seem like a simple principle to follow, but in practice designers cannot rationally make everything equally visible. Consider the

interface of mobile applications as an example, if all elements were to be visible at all times the interface would likely be cluttered and less visible as a result. When working within the limitations of a design, the ability to prioritize visibility is essential for a good user experience [25].

Feedback: When users interact, they need information about what action has been done and what it achieved. Feedback is all about communicating the results of an action in order to avoid uncertainty and let users carry on their activity. It relates to visibility as feedback provides clarity in the user interaction. Various kinds of cues can be given to provide feedback: visual, audio, verbal, tactile, or a combination of these. Either way, feedback has to be immediate and unobtrusive. Appropriate use is essential as receiving too much or too little feedback can both be equally confusing and annoying [25, 17].

Constraints: By limiting the amount of permitted actions, the user interactions that are available becomes easier to interpret and the chance of making mistakes is reduced. A common use of constraints in graphical interfaces is to gray out options to signify that they are restricted at this stage. By using constraints and presenting certain options as restricted, users can logically deduce that further action is required for the option to become available [25].

Mapping: The principle of mapping refers to the relationship between controls and the effects as they correspond with the world. Good use of mapping takes advantage of what feels natural. Think of the scroll-bar as an example. Whenever you move up or down a page, the scroll-bar will move correspondingly at the same rate. This feels natural and easy to use because the controls and effects are mapped closely together. Gestalt psychology, e.g., elements that control similar functions should be grouped together, also relate to mapping. Although it requires some thought and understanding of human behavior, mapping is important to incorporate in the design of interfaces as natural expectations can be taken advantage of to improve interactions [17].

Consistency: A key design principle is the concept of consistency. When designing interfaces, similar actions should be achieved using similar elements and operations. This applies both functionally and visually. For example, the method of navigating to the previous screen in an app should look and behave the same way across the entire design. In terms of visual consistency, colors should follow a standard and be used to represent similar circumstances. If red is used for a “delete”-button, using the same color for a “submit”-button will lead to

confusion. It is also important to acknowledge established design standards and not divert too far from them⁶. Consider the asterisk (*) as often used to denote required fields. Using this symbol to represent optional fields instead would be problematic as it does not align with prior user experiences. Consistent interfaces benefit from being easier to learn and use [25].

Affordances: An affordance describes the perceived possible uses of an object as determined by its attributes. A good way of looking at it, is that affordances allows people to automatically know how they should, or can, use an object without instruction as the design itself invites its uses. Think of a coffee mug, the handle invites people to how they should hold it. Affordances are also affected by personal attributes. A chair for example invites sitting, but it can also be carried if the person is strong enough. Norman (1999) who popularized the term argues that affordances in screen-based interfaces are not real, but rather perceived. Physical objects can be grasped, pulled, pushed, etc., which is not possible using screen-based interfaces. Instead, perceived affordances are essentially learned conventions. For example a button in a graphical interface is only *perceived* to be clickable due the elements visual representation which, through learned conventions, appears to afford clicking [17, 25].

3.3 Development method

An agile method was intended to be used during development in order to have an iterative process of designing, development, and user testing. However as development ended up taking longer than expected, iterating upon user feedback during development of the app did not happen. However, a loose form of agile might be considered to have been used as the app was developed in several iterations. In total, three versions of the app was developed as experienced gained during development resulted in new knowledge about improvements to make which were used to iterate upon the app.

⁶ Jakob's law: "Users spend most of their time on other sites. This means that users prefer your site to work the same way as all the other sites they already know." (See: <https://lawsOfux.com/jakobs-law/>)

4 Artifact development

This chapter will cover the process of developing the app in regards to the design and technical aspects, i.e., programming. The intention is to provide sufficient information for the process to be reproducible.

4.1 Concept development

As mentioned in 2.1, the concept of creating a tool to reduce procrastination was inspired by a prior project. The previous research and development meant I had some insight into procrastination, as well as some general ideas for a concept. This insight showed how particularly prevalent procrastination is in students, and that there are a vast amount of factors which influence the occurrence of the behavior [27]. On the basis of this information the target group of students was selected and the objective narrowed down to solely focus on reducing academic procrastination. Additional research was then conducted to gain a deeper understanding of the phenomena before starting the concept development.

Using a mobile application as the artifact medium was decided quite early. Although I have a background in web development, there were two reasons for not deciding to create a mobile website instead. The first reason related to a personal interest as I wanted to learn app development, and secondarily because there are a lot of advantages with a native mobile application compared to web applications. Not only will a native app be faster and easier to use as no internet browser is required, but you will also have access to integrated device and system features such as notifications, vibration, swipe gestures, etc. which is not possible with a web-based mobile app. This was an important factor as I wanted to create a tool that actually could be applied by real users in natural environments to reduce procrastination, and a native application seemed more suitable for actual use cases.

The research insights regarding procrastination lead to two methods which appeared to not only be effective in reducing academic procrastination, but also seemed realistically possible

to apply in an app: “reducing discomfort associated with assignments” and “reducing distractions”. A brainstorming session was conducted to explore ways in which an app could incorporate these two aspects. To reduce distractions, implementing a feature similar to the app Forest (see 2.6.1) seemed like a good solution. To reduce discomfort associated with assignments, there were several methods that appeared suitable: Creating a work-plan, breaking up larger tasks into several smaller tasks, using gamification to reward productive behavior, and setting personal goals to strive for.

The brainstorming session resulted in a loose concept of reducing procrastination in two ways, one relating more to prolonged delay such as not starting to work on an assignment until the deadline approaches, and the other relating to procrastination that happens in the moment, e.g., by checking social media during a study session. To reduce extended procrastination users of the app would divide assignments into smaller tasks that the app would organize and create a study plan from. To reduce procrastination that happens while actively studying, the app would include an “anti-distraction” feature to block users from accessing other apps, and possibly also block unproductive websites which can be accessed using a computer. In order to gain feedback about the concept, a focus group session was conducted (see 3.1.2).

4.1.1 Focus group results

After describing the app concept to participants, they were asked about whether they thought it would be helpful for reducing their procrastination when studying. All of them then answered by saying they might find the anti-distraction feature helpful, but did not think the functionality for dividing assignments and creating a study plan would be useful for them. One participant further explained that he would probably find this functionality useful if his deadlines were publicly available to friends as that would pressure him to complete them in time. However, all participants expressed distractions on their phone and computer as the greatest source of their procrastination.

When further inquired about why they did not expect the study plan part of the app to be useful, several reasons were given. For one, it appeared cumbersome and time-consuming to divide assignments into tasks. This would have to be easy and fast in order for them to do it. One participant suggested that assignments could be divided by selecting tasks from

a list instead of having to manually type them, however another participant did not think this would be practical and said that the list would have to be extremely long to cover all types of tasks. Another reason for not expecting the planning functionality to be useful was because assigning suitable deadlines to the tasks they created would be difficult and require them to predict how much time they would need to finish them. It was therefore important for the study plan to be flexible and that deadlines were not set in stone and instead could be changed later. Furthermore, one participant said he would have preferred if the app could be used on a day-to-day basis instead of a plan intended to be used over a long period of time such as an entire semester, and the other participants seemed to agree with him.

Regarding the feature to reduce distractions, two participants described their phone and computer as equally distracting, and one found his computer to be the most distracting. When asked about whether they would want this feature to be manually toggled on or automatically on a fixed schedule, the participants were not certain. They saw both options as having their advantages and disadvantages. They considered automatically enabling it on a fixed schedule as possibly being more effective, but also saw how it could be more annoying. One participant mentioned that either way he would want it to turn off automatically after a set duration instead of having to manually toggle it off. He compared it to Hold which he had used previously with some success, however he disliked that the timer just kept counting up and experienced having no end-goal as sort of defeating the purpose of it. The other participants also agreed with this statement and would prefer if it turned off automatically rather than go indefinitely.

The participants also had some suggestions for additional features. They would have liked if they could use it in collaboration with others, and not necessarily just when working on group projects to distribute the workload. As mentioned, one participant would have liked for friends to see his progress, he suggested that the app could have groups where everyone could see each others progress when working individually. This could be used to push each other to stay productive. Another participant suggested that the app also could incorporate a leaderboard to encourage competition between friends. Besides the collaboration aspect, statistics was suggested as it would be motivating to see your progression over time. Integrating the app with other services such as Trello was also mentioned, this could be used import tasks from Trello into the app.

4.1.2 Finalizing the concept

Insights from the focus group were helpful in finalizing the concept. Although there were mixed feelings about whether the anti-distraction feature should toggle on automatically, the insights showed how it could easily be experienced as being forced upon users. Always requiring it to be manually turned on therefore seemed like a safer option. As suggested by participants, it was decided that it should also turn off automatically after a length of time selected by users.

As computer distractions appeared to be equally problematic as smartphone-related distractions, one idea I had to tackle this was to create a browser extension which synchronized with the app. Whenever the anti-distraction feature got enabled on the smartphone, it could then also block unproductive websites through the browser extension. This would however take too much time to develop and was therefore not implemented.

Although the focus group participants reported that dividing assignments and having a study plan would likely not help them reduce procrastination, the insights gained from researching the psychology of procrastination disagreed with this. Breaking down a large task into smaller tasks should in theory reduce procrastination due to the perceived difficulty of the assignment being reduced. Setting goals, creating deadlines specifically, has also been found to be an effective method of preventing procrastination [27]. On the basis of this insight, I did not want to remove this part from the app despite focus group responses expecting it not to be useful. The participants did however provide valuable insight regarding the importance of designing the process of dividing assignments to be as friction-less as possible in order for it to be useful.

As suggested by a participant, the app would also include a dedicated page for statistics. This did not get implemented however due to time constraints. The idea was to show statistics and graphs for a variety of different aspects in the app, e.g., the total number of tasks completed, time spent using Focus Mode, and progression of assignments over time.

4.2 The design process

Adobe XD is a design tool for creating interactive prototypes. It was used to create, explore, and iterate different designs for the user interface of the app. A vast number of different

designs were explored and iterated upon before ending up with the final version of the design seen in the app now. Both the desktop and mobile version of Adobe XD was used in combination. It was a process of designing using the desktop application, and then use the mobile version to display it in order to get a feel for it on a physical device, and then go back to the desktop version to iterate on the design.

With a prior bachelor in web development I have some experience creating responsive websites and designing within the limitations of mobile devices and smaller screens. It was however surprisingly challenging and a different experience altogether to design the app compared to a mobile website. Despite their similarities, mobile apps and websites tend to be designed for different purposes. Websites will usually have a greater focus on content and conveying information, mobile apps are instead often designed as tools for achieving a specific task and will have more focus on functionality rather than content. When designing websites for mobile the challenge is mostly due to the limited horizontal space as vertical scrolling is in most cases necessary and unavoidable. However, designing the app was experienced as challenging both horizontally and vertically as I could not rely as much on vertical scrolling without it having a negative impact on the user experience.



Figure 4.1: The initial wireframe of the home-screen.

4.2.1 The home screen

The initial focus went into designing the home-screen interface. It had to include a calendar, list of tasks, a method of accessing Focus Mode, and possibly also some form of progress visualization regarding task completion. Ideally, all these elements should be visible and accessible without requiring the user to scroll. The list of tasks would however require scrolling given enough tasks, but I wanted at least a few tasks with the closest deadlines to be visible without the user having to scroll. Designing the interface on these requirements without cluttering it was not an easy task. Elements needed enough size and space between them to be visible, usable, and aesthetically pleasing, but they could also not take up too much space. It was all about creating a balance.

Considering the list of tasks to be the most important information needed to be accessed in the home-screen, I decided to start with designing the task cards and then design the other elements e.g., the calendar afterwards based on the remaining space available. Initially the idea was to organize the list by assignments, i.e., instead of having a list of tasks it would be a list of assignments with all associated tasks underneath (see figure: 4.2). This was however changed as it proved to be a poor method of organizing. Just consider a situation where you have two assignments, X and Y, each containing a long list of tasks with individual due dates. If your next two task due dates were associated with assignment X and Y respectively, you would then have to scroll past the entire list of tasks in assignment X before finding the next upcoming task in assignment Y. As mentioned by focus group participants, they would rather have a plan which could be used on a day-to-day basis, and using a list of tasks would therefore be preferable.

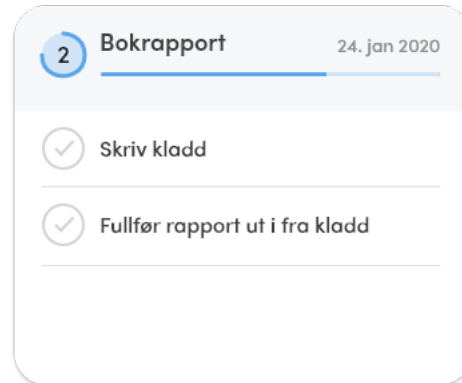


Figure 4.2: The initial card design with tasks sorted into assignments.

The task cards were designed to be as compact as possible with only the most necessary information. Each task card had to include the name of it, the assignment it is situated in, the deadline, a checkbox to mark it complete, its due date, an associated color code to find it in the calendar, and a method of editing it. Numerous different designs were explored to find the best method of incorporating all these components into one card design.

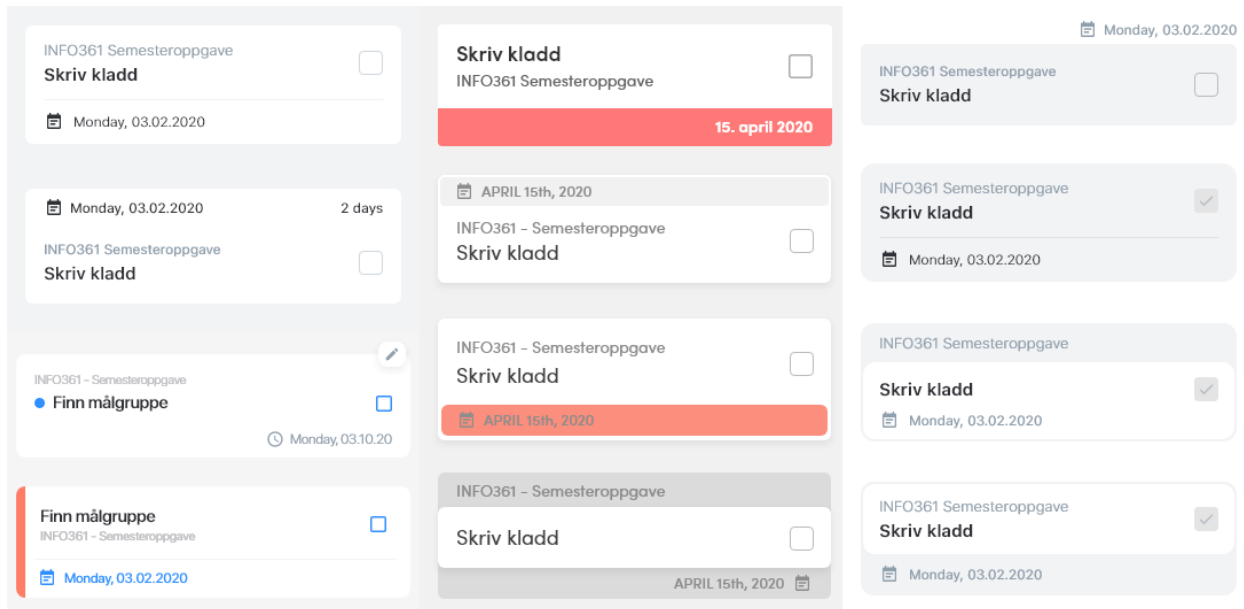


Figure 4.3: Some of the many iterations of the task card design (in no particular order).

Next up was the calendar design. On background of the home-screen being intended to use on a daily basis and to save screen-space, a week-calendar was chosen over the alternative of a full month-calendar. Ideally there would be an option to toggle between displaying a week or month calendar, but with the time available this was not implemented in the app. Later on, it was decided to display the calendar in a five-day format from Monday to Friday on background of the suggested task due dates when adding assignments excluding weekend-days.

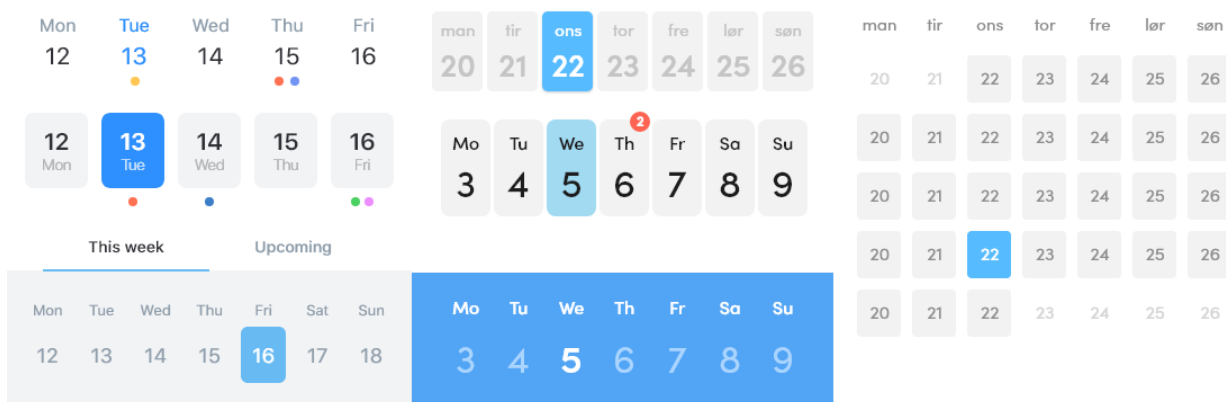


Figure 4.4: Some of the calendar designs that were explored.

To display due dates in the calendar, color codes were used in order to match them with specific tasks in the list. To make these colors visually distinguishable, *Kelly's 22 Colors of Maximum Contrast* were used (see figure 4.5). This is a set of colors proposed by Kenneth Kelly as the most distinct colors that can be used in a sequence, and 22 being the maximum number of colors that can be identified correctly when used in a code system [9].























Colour Serial or selection number	Colour sample matched visually to ISCC-NBS centroid colour	General colour name	ISCC-NBS centroid number	ISCC-NBS colour name (abbreviation)	Munsell notation of ISCC-NBS Centroid Colour	Colour Serial or selection number	Colour sample matched visually to ISCC-NBS centroid colour	General colour name	ISCC-NBS centroid number	ISCC-NBS colour name (abbreviation)	Munsell notation of ISCC-NBS Centroid Colour
1		white	263	white	2.5PB 9.5 / 0.2	10		green	139	v.G	3.2G 4.9 / 11.1
2		black	267	black	N 0.8 /	11		purplish pink	247	s.pPk	5.6RP 6.8 / 9.0
3		yellow	82	v.Y	3.3Y 8.0 / 14.3	12		blue	178	s.B	2.9PB 4.1 / 10.4
4		purple	218	s.P	6.5P 4.3 / 9.2	13		yellowish pink	26	s.yPk	8.4R 7.0 / 9.5
5		orange	48	v.O	4.1YR 6.5 / 15.0	14		violet	207	s.V	0.2P 3.7 / 10.1
6		light blue	160	v.LB	2.7PB 7.9 / 6.0	15		orange yellow	66	v.OY	8.6YR 7.3 / 15.2
7		red	11	v.R	5.0R 3.9 / 15.4	16		purplish red	255	s.pR	7.3RP 4.4 / 11.4
8		buff	90	gy.Y	4.4Y 7.2 / 3.8	17		greenish yellow	97	v.gY	9.1Y 8.2 / 12.0
9		gray	265	med.Gy	3.3GY 5.4 / 0.1	18		reddish brown	40	s.rBr	0.3YR 3.1 / 9.9
						19		yellow green	115	v.YG	5.4GY 6.8 / 11.2
						20		yellowish brown	75	deep.yBr	8.8YR 3.1 / 5.0
						21		reddish orange	34	v.rO	9.8R 5.4 / 14.5
						22		olive green	126	d.OIG	8.0GY 2.2 / 3.6

Figure 4.5: Kenneth Kelly's 22 colors of maximum contrast [9].

4.3 Technical development of the app

The majority of time spent working on this project went into the technical development of the app, i.e., programming it to be functional. Although I am familiar with programming in general, primarily in the context of web development, I had very little experience with mobile app development before starting this project. I therefore had to learn it by myself, which was expected to take some time but turned out to take much longer than anticipated.

The decision to develop the app as a native application instead of a hybrid application⁷ was ultimately a consequence of implementing Focus Mode. Without the additional capabilities of a native app, it would not be possible to detect other apps being opened and restrict users

⁷ A hybrid application is essentially a web application wrapped in a native app container, which means it can be installed like a native app on multiple platforms.

from interacting with them. Although this might have been possible with a hybrid app, it would require learning the development framework of several platforms which was not an option with the time available. Choosing Android over iOS was simply the result of it being easier during development as I already own an Android smartphone and would therefore not need to borrow an iOS device for debugging.

Android Studio is the official Integrated Development Environment (IDE)⁸ made by Google to develop apps for all types of Android devices. It was used to develop the app as it provides all the tools required into one environment, is specifically made for Android development, and is used in the official documentation for Android app developers. There are only a few programming languages supported by Android, two of which are covered by their documentation, Java and Kotlin. As I had no experience with either of them, some research was necessary to find which language to write the app in. Between these two alternatives, Kotlin was selected due to being the more modern language and also being designed to be fully compatible with Java. The mobile application was entirely written in Kotlin.

A form of an iterative approach was used when developing the app. The first phase consisted of learning Android mobile app development by creating several different apps. Some were quite simple, and some were a bit more complex as they related to specific components I had to learn before starting the actual development of the app described in this thesis. When I considered my skills to be decent enough, development shifted focused over to creating the app for this project. In total, three versions were developed. As my knowledge improved through the development process of the first iteration of the app, I reached a point of realization regarding the sub-optimal foundation of my code and concluded that it would be better to start from scratch as future development would be heavily limited if continued on the current code base. I therefore started a new iteration as it would probably save time in the long run. Despite taking extra precautions to avoid this happening again, during the second iteration I also realized how some of my implementations were quite ineffective and therefore started a new iteration. The third time developing the app from the ground up I had gathered enough experience to do it properly and met only minor obstacles along the way. Although the development cycle might sound ineffective, I do believe the experience gained from the first two times iterations were necessary for creating an app at this scale by myself.

⁸ An Integrated Development Environment (IDE) is software that combines various developer tools into a single graphical user interface to facilitate application development

4.3.1 Development tools

Android Studio is the official IDE made by Google to develop apps for all types of Android devices. This software was used to develop the mobile application.

Kotlin is a modern programming language designed to be fully compatible with Java. It is one of the few languages that are fully supported for Android, and was recently announced by Google to be the preferred language for Android app development. The mobile application was entirely written in Kotlin.

Git is a Version Control System (VCS) that tracks changes made to files for future reference and backup-purposes. It allows programmers to easily revert their code back to a specific version if needed, and it is often used to coordinate projects within a team. When developing the app, Git was used through the integrated VCS in Android Studio to maintain backups of changes made to project files over time.

Samsung Galaxy S8 is the android smartphone I personally own, and it was used during development to run the app and test code changes made in Android Studio. An Android Virtual Device (AVD) would have been favorable as it could have simulated the app on different devices in an emulator environment, however my computer did not have the required support for this and therefore the only option was to use a physical device connected to the computer via USB.

5 Final application features

This chapter will present the final version of the mobile application as used by participants in the diary study.

5.1 Adding an assignment

Adding an assignment in the app is a crucial part in how it attempts to reduce student procrastination. It involves a four-step process in which the assignment continuously gets broken down into smaller, more manageable, tasks. As suggested by several researchers, dividing a large task into smaller tasks is an effective method of reducing task aversiveness which in turn should reduce procrastination tendencies (see 2.4.2: Task aversiveness). Furthermore, by assigning a due date for each of these tasks individually, the timing of rewards and punishments should reduce and improve motivation as a result (see 2.4.2: Timing of rewards and punishments) [27]. Breaking up an assignment is inherently challenging and time consuming as it requires some reflection to do properly, this was also brought up by participants in the focus group regarding the app concept (see subsection: 4.1.1). In order to make this exercise seem less daunting it is therefore done sequentially in four steps, each with a specific goal that builds upon the previous step. The four steps of adding an assignment are:

1. Assignment details
2. Break down into tasks
3. Split tasks into smaller parts
4. Set task deadlines

Step 1 – Assignment details: The user is asked to fill in the name of the assignment and select a due date.

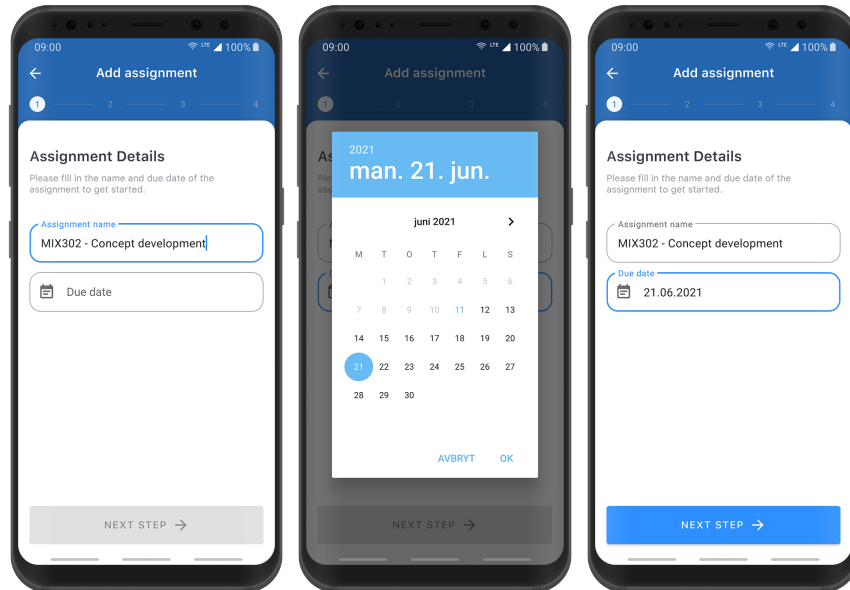


Figure 5.1: Add assignment - Step 1. From left to right: Title filled in, due date selection, all inputs filled in.

The first step of the app simply requires the user fill in the name and due date of the assignment in order to progress. Clicking the “Due date”-input will open a date-picker in which the user can select a date (see figure 5.1). The user will not be able to continue before both of these inputs are filled in, signified by the “Next step”-button at the bottom being grayed out and unable to interact with.

Step 2 – Break down into tasks: The user is asked to break down the assignment into tasks.

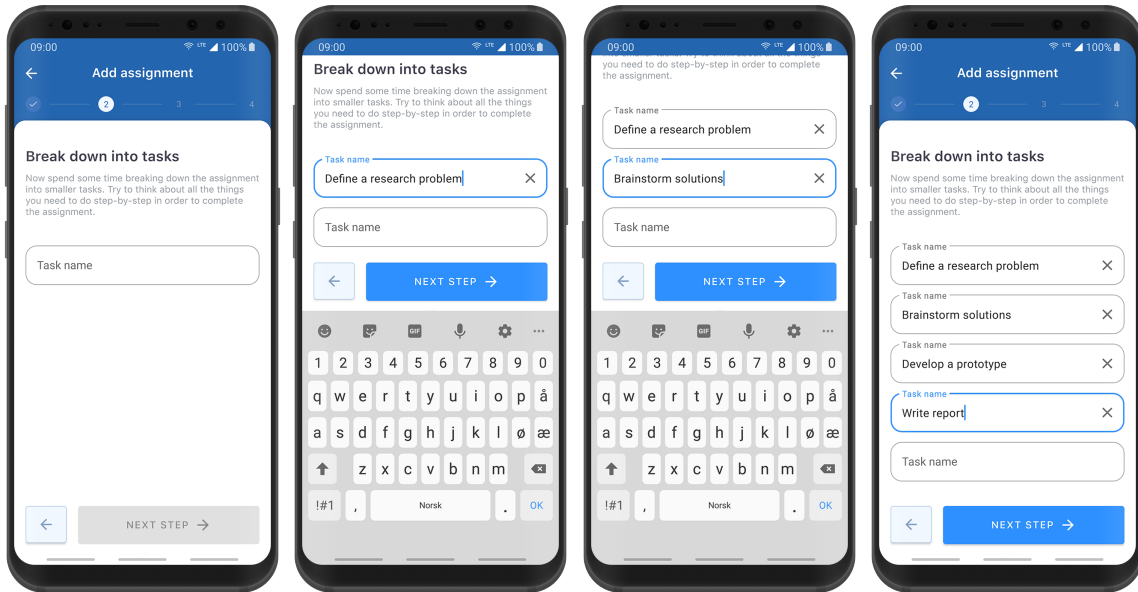


Figure 5.2: Add assignment - Step 2.

The description for this step encourage the user to spend some time doing this, and to try thinking step-by-step about every task which needs to be done in order to complete the assignment. To ease the process, whenever a task input is filled in a new one will automatically appear below. This ensures that there is always an empty input at the bottom which can be used to add another task if necessary. Initially, a button appeared instead of an empty input which had to be clicked in order to add another input. Through testing the process of adding an assignment, I found this to be an unnecessary action which only served to interrupted the thought process. The current design instead allows the user to continuously create new tasks without requiring any interactions outside the keyboard. Whenever a task name is filled in, clicking “Ok” in the on-screen keyboard will make the next input active and ready to be filled in, and as there always is an empty input below this can go on indefinitely.

Step 3 – Split tasks into smaller parts: The user is asked to divide the tasks created in the previous even further if possible.

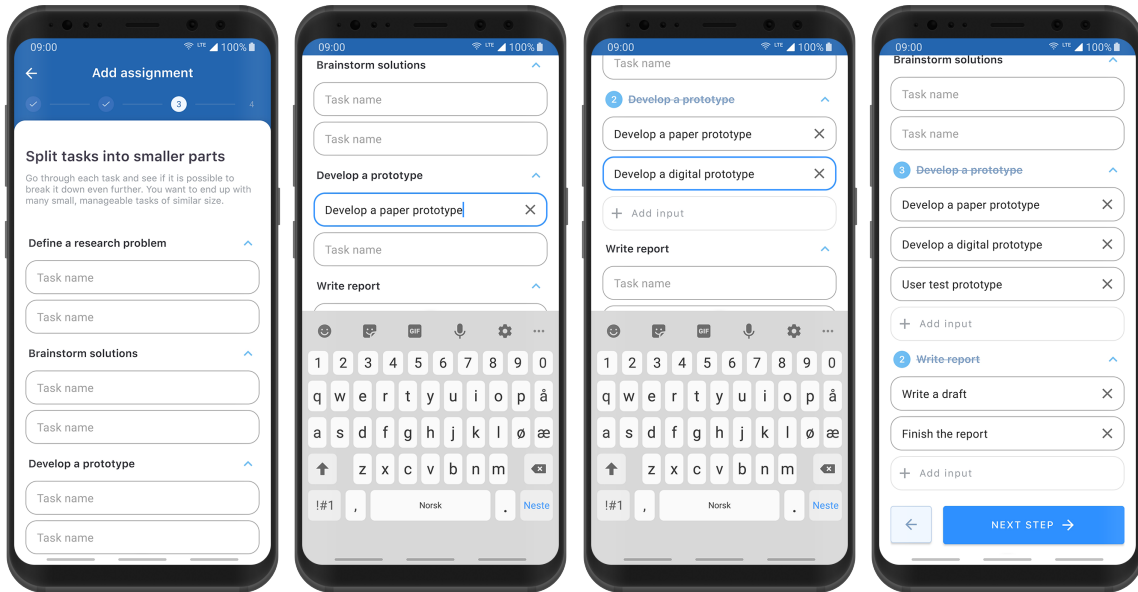


Figure 5.3: Add assignment - Step 3.

By “split tasks into smaller parts”, *parts* refer to tasks. Step 2 and 3 are essentially the same, but they are split into two stages in an attempt to make the user reconsider if it is possible to further divide the tasks they created into two or more smaller tasks instead. As this will not always be possible if the user was quite diligent when dividing previously, this step is completely optional.

Compared to the previous step, the design is a bit different in step 3. Although it is a recommended practice to keep the design consistent, it was a deliberate decision to do it differently here. As seen in figure 5.3, each task previously created will have two empty inputs below. This is intended to signify that two new tasks have to be filled in to replace the original one. Furthermore, when both of these two inputs are filled in the original task will be grayed out, have a line-through, and an icon will appear with the number of tasks it is replaced with (see the third and fourth picture in figure 5.3). All of this is intended to show how the user is not adding sub-tasks, but instead replacing the original task by further dividing it into several smaller tasks. However, it seems like the design could be improved in this regard as some participants in the diary study initially misinterpreted their dividing as adding sub-tasks. Compared to step 2, whenever users fill in two tasks a new input will not be added, instead a “+ Add input”-button will appear. This is because in contrast to the previous step, users are not expected to fill in a large number of new tasks.

Step 4 – Set task deadlines: Each created task will automatically be assigned a suggested deadline date that can be changed by the user.

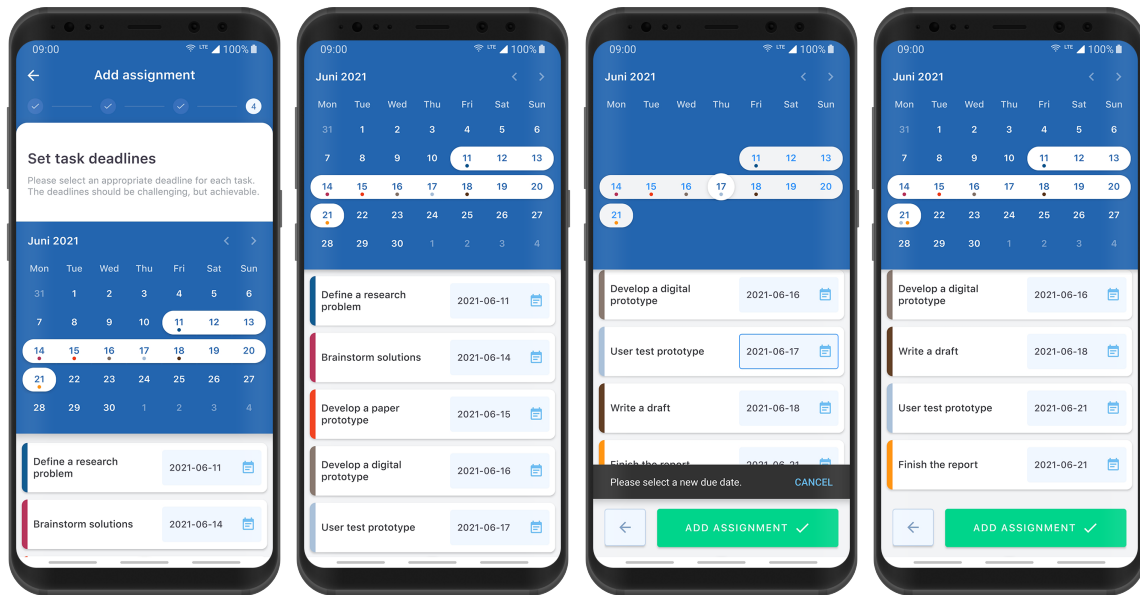


Figure 5.4: Add assignment - Step 4.

In the final step of adding an assignment, all the tasks created will be assigned suggested deadline dates to evenly distribute them between the current date and the final due date of the assignment as created in step 1. When distributing the deadlines, weekends are not included, i.e., Saturday and Sunday as I expected most users to prefer keeping these as days off. In the diary study, one participant reported to appreciate this decision to not include weekends. As users scroll down the list of tasks, the calendar will stick to the top of the screen in order to stay visible at all times.

As seen in figure 5.4, the calendar will display the days between the current date and the final due date of the assignment using a white background. The task deadlines will also be represented in the calendar with a colored dot corresponding with the color seen in the leftmost side of each task card. These colors are also automatically assigned using *Kelly's 22 Colors of Maximum Contrast* (see subsection 4.2.1). Before a task is assigned a color, the app will run a check to see which colors are already used by previously added tasks, and then assign each task a distinct color based on what is available. This will ensure that all tasks in the app will have a unique color code as long as there are 22 or less tasks in total, after this number has been reached color codes will have to be reused.

The assigned task deadlines can easily be changed by clicking the date input located in the right side of a task card. This will have two effects in the calendar, the currently assigned deadline will be highlighted in a circle, and dates outside the assignment range will be hidden, i.e., only dates between the current date and assignment deadline will be visible (see the third picture in figure 5.4). A new deadline can then be assigned by selecting it using the calendar. As deadline dates are changed, the list of tasks will change respectively and animate the order of tasks chronologically by due date.

As the last step in the process, clicking “Add assignment” will display a success-screen and then take the user back to the home-screen. If the user however attempts to exit adding an assignment after any changes have been made, a pop-up box will be displayed informing the user that if they leave all progress will be lost (see figure 5.5).

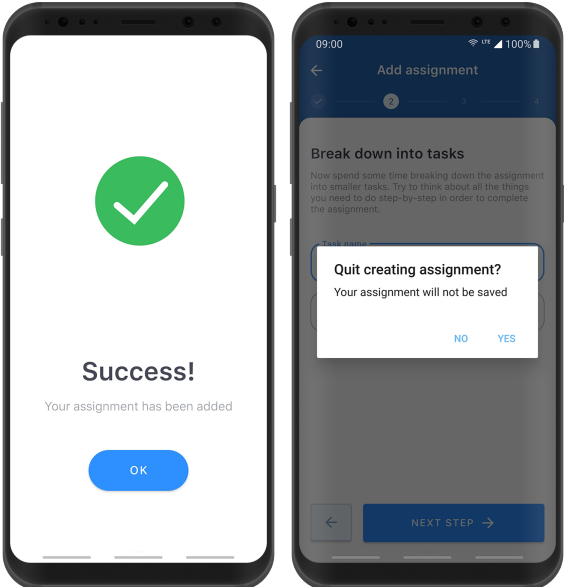


Figure 5.5: Left: Success screen displayed after adding an assignment. Right: Pop-up shown when attempting to exit after changes have been made.

5.2 Focus Mode

Focus Mode is the feature intended to reduce smartphone-related distractions by temporarily silencing notifications and blocking users from accessing other apps for a predetermined length of time. As Focus Mode uses two integrated system services which are not enabled

by default, it is necessary for the user to grant the app extra permission for Focus Mode to function. One of these allows the app to silence notifications, and the other allows overlays to be displayed outside the app and is used to block interactions with other apps.

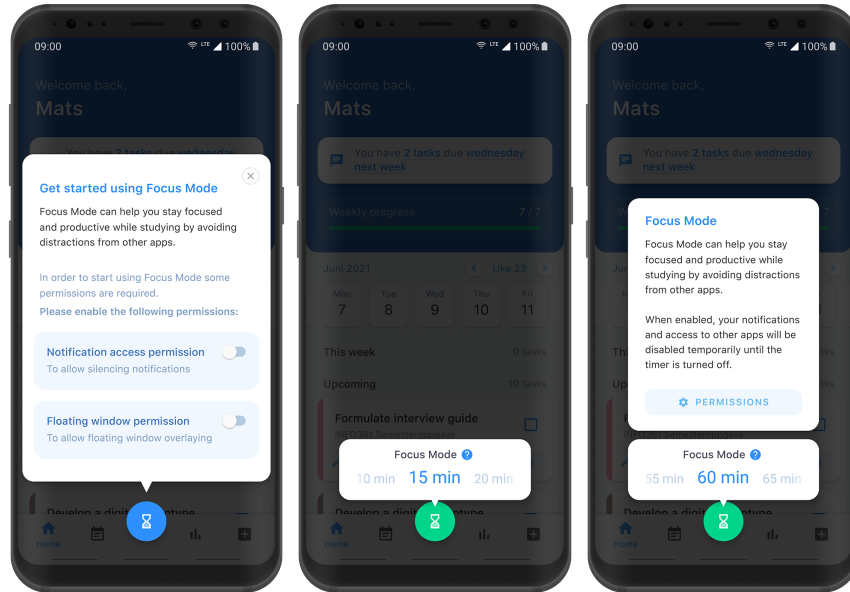


Figure 5.6: From left to right: The initial view displayed first time Focus Mode is used, duration selection, and additional info.

The first time Focus Mode is used, users will therefore be met with a “Get started using Focus Mode” screen explaining that some permissions have to be enabled before this feature can be accessed (see the first picture in figure 5.6). To ease the process, clicking the toggle buttons will redirect the users to system settings where they can grant the app permission.

After the initial setup, Focus Mode can be accessed at any point by clicking the button located in the center of the bottom navigation bar. This will then bring up the interface for selecting a duration (see the second picture in figure 5.6). By swiping left or right, the user can decrease or increase the duration. By clicking the “?” icon, some additional information about Focus Mode is provided (see the third picture in figure 5.6). And finally, by clicking the Focus Mode button the timer will start running.

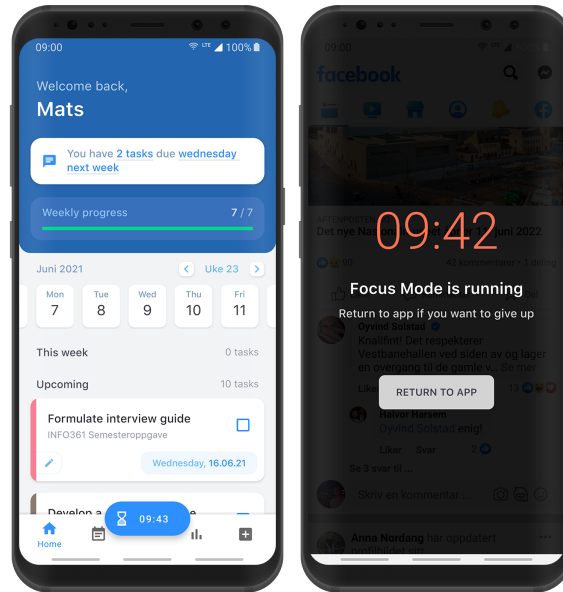


Figure 5.7: Left: Timer displayed in the app while Focus Mode is running. Right: Displayed when other apps are opened while Focus Mode is running.

5.3 The home screen

The home screen is the main part of the app and used for everything except adding assignments. At the top of the screen, a small message box will inform the user about the next upcoming task, e.g., “You have 3 tasks due today” or “You have 1 task due friday next week” (see figure 5.8). Just below this, users can see their weekly progress displayed in the number of tasks completed and remaining in addition to a progress-bar visualization of it.

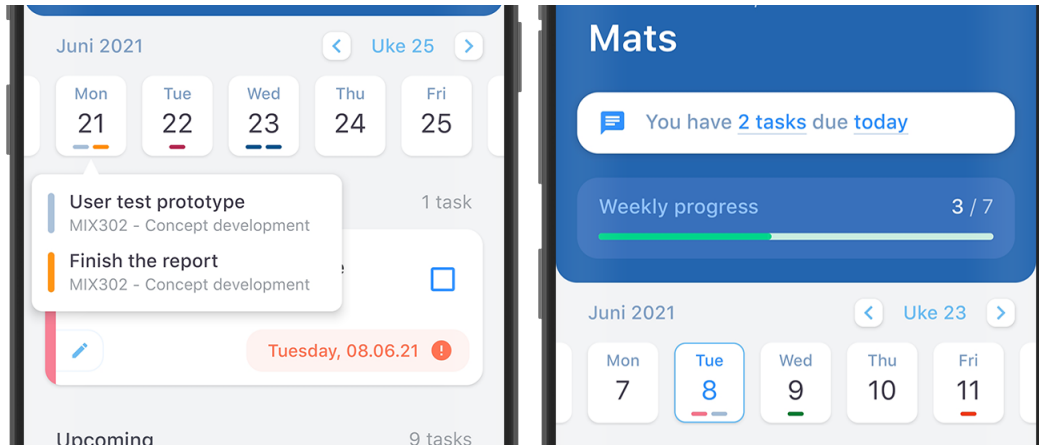


Figure 5.8: Left: Calendar task list pop-up. Right: Upcoming task message and weekly progress.

A weekly calendar is also displayed which will show upcoming task due dates using color codes corresponding to tasks. Additionally, calendar dates can be clicked to display a small pop-up containing the tasks that are due (see figure 5.8).

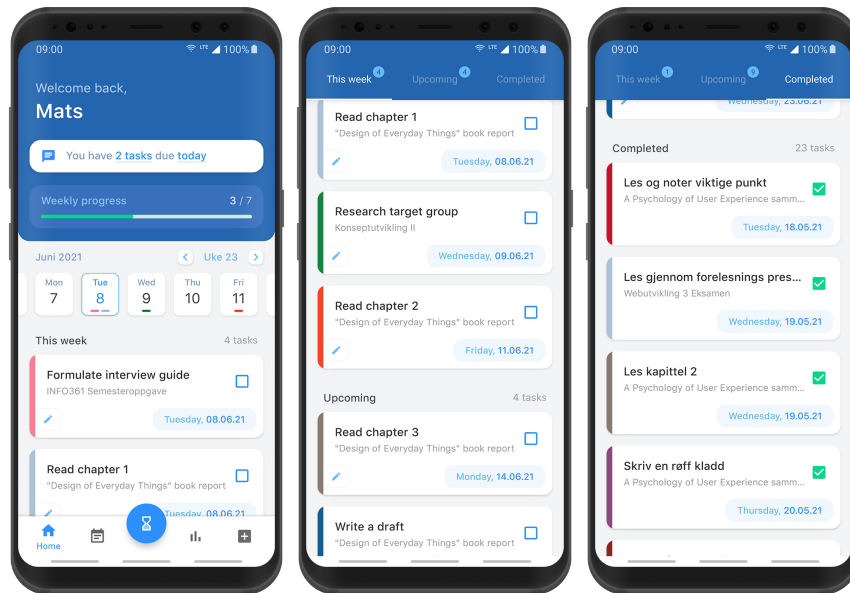


Figure 5.9: The task overview in the home screen as seen when scrolling down.

6 Diary study of the mobile application

This chapter will describe the diary study procedure, data analysis method, and results. Before conducting the diary study, approval from NSD was obtained for this project to ensure that personal data is collected, stored, and shared in a safe and legal manner.

6.1 Sample

Participants for the diary study were selected on the requirement of being students currently enrolled in a school of higher education. The reasoning for excluding students at lower levels of education is because procrastination tend to increase at a college or equivalent level as students experience a more demanding environment [19]. However, potential candidates were not asked about their procrastination tendencies or selected based on a perceived predisposition for it. Additionally, due to technical limitations, only people with an android smartphone would be able to participate as the app does not support other platforms. This severely limited the pool of possible candidates since the study required them to install and use the app on their own smartphones.

Three participants were recruited in total, all male, two studying towards their bachelor's degree, and one currently working on his master's. Although there were several more who showed an interest in participating, only three had an android smartphone. Considering the number of participants, results from the diary study will not be representative of the target group of students as a whole, but the findings will give in-depth insight into a few personal experiences with the app which can give some indications on a broader scale. Ideally however, recruiting a greater number of participants with an equal amount of male and female individuals would have strengthened the findings as there appears to be a small difference between genders and procrastination. Women seem to procrastinate slightly less than men, possibly because they tend to possess a greater sense of self-control [27].

6.2 Procedure of data collection

Traditionally, a physical notebook sent from researchers to participants were used as a diary in which data were to be collected, however it is becoming increasingly common to use digital mediums such as web questionnaires and video- or audio-recorders instead. In this case a web questionnaire was used as it would be an easy method for participants to record entries and easy to analyze later on. Using a set of predefined questions also helps in keeping the insight provided by participants relevant to the study. As recommended by the university in which this thesis is situated, <https://skjemaker.app.uib.no/> was used to create the digital survey which diary entries were recorded in.

Before conducting the diary study, potential participants were given a brief description of the app and asked if they were interested in testing it on their own while providing feedback. Those who were interested received a letter of information and consent which described all necessary detail about the study and their rights should they decide to participate (see appendix A). After obtaining consent, participants received instructions for how to install the app and a link to the web questionnaire which functioned as their personal diary journal. They were informed that although the app was in an unfinished state, their focus should not be on providing technical feedback concerning bugs they encounter, instead they should report on their overall experience using the app in its current state.

The reporting period lasted for three weeks, and as I wanted organic insight about their use, participants were told that they could use the app exactly how they wanted during this time. Although there were no requirements for how they used it, or how much, they had to write at least three entries in their diary each week. Participants were encouraged to record entries in the moment whenever the app left a special impression on them, or at the end of each day they used it. Alternatively, they could write in their diary on a fixed schedule, e.g., Monday, Wednesday, Friday, and reflect on their experience since the last entry. As recommended when conducting a diary study, participants were periodically reminded to help them remember to fill in their diaries.

Their diary, or questionnaire, involved a few open-ended questions intended to gain insight about their context of use, motivations, attitudes, and general experience with the app throughout the study (see appendix B). As adding and dividing assignments was assumed to be a pain point as it requires time and effort, one question was specifically about their

experience with this. The other questions related to how they had used the app since their last entry, if any occurrences had made an impact on them in a positive or negative sense, and if they had achieved what they wanted from using the app. Additionally, an optional text-box was included which could be used to write anything they wanted in case they had any thoughts which could not be expressed using the other questions.

After the reporting period, post-study interviews were performed with each participant individually. An in-depth evaluation of the data collected through diary entries was first conducted to identify interview topics, then a collective list of questions relevant to all participants was created. Using this list, individual interview guides were formulated with additional questions pertaining to each participant respectively. The broad objective of conducting these interviews was to make participants reflect on their overall experience after having used the app for a while. More specifically, I wanted to understand their motivations for using it, their attitudes about it, how they applied it, how the different parts of the app benefited them or not, and most importantly, whether it reduced their academic procrastination or affected them academically in any other way. As their diaries showed to not provide enough insight into their study habits, the secondary goal of the interviews was to learn about their study routines and to which extent they maintain structure and organize their work. The interviews were performed using a semi-structured approach as described in 3.1.4.

6.3 Procedure of data analysis

This section will describe the procedure of analyzing data collected from the diary study and post-study interviews. A form of content analysis was used as the information provided by participants were grouped in categories and analyzed in several iterations to find emerging themes which conclusions could be drawn from.

6.3.1 First iteration

The first iteration consisted of a preliminary read-through of the diary entries without taking notes or analyzing. The objective during this phase was purely to gain a thorough understanding of the participants and familiarize myself with the data set in order to prepare for

upcoming analysis. Before the next iteration, the following categories were created for the purpose of structuring summarized data into groups:

- Adding assignments and dividing
- Focus Mode
- Tasks and deadlines overview
- Overall design feedback (navigation, interface, aesthetics, etc.)
- Other

The category “other” was included in case any findings did not fit into the other categories.

6.3.2 Second iteration

The second iteration is where analysis started. All journal entries were reviewed from start to finish for each participant separately while summarizing the data according to the aforementioned categories created in the previous phase. At this stage of data analysis, the focus was purely on the individual participants without drawing comparisons between them.

6.3.3 Third iteration

Notes from post-study interviews, the previous analysis, and a new review of the journal entries was used in this phase. The previous categories was used again, but as the findings in “other” all essentially related to individual differences between participants regarding how they used the app and for what purpose, this category got replaced with “User habits”. The focus in this round of analysis moved away from the individuals and over to finding patterns in the overall data. As the summarized data from the previous iteration was quite extensive, this round also focused on encapsulating the data into a more condensed format. Before analysis started, the following patterns were created:

- Commonalities/differences
- Changes over time
- Success/benefits

- Barriers/problems encountered

Each of the categories used in the previous analysis (except “Other” as replaced with “User habits”) were used again to look for these patterns. At this point, interview guides were formulated for each participant based on the current analysis. Interviews were conducted and the insights obtained was used to resolve any prior assumptions made about the participants. For example, one participant reported in his diary to find Focus Mode very helpful but gave insufficient insights as to why, it could therefore only be assumed that he probably finds his smartphone distracting while studying. As often the case with self-reported data, the information can lack in detail and only provide surface-level insights [13]. The interviews were therefore used to ask follow-up questions to fill gaps in the data, and the new insights obtained was used to finalize the data analysis.

6.4 Diary study findings

This section will present the findings from the diary study as gathered from the final phase of analysis.

6.4.1 Adding assignments and dividing

Despite expecting general negative attitudes towards this part of the app as breaking up assignments can be challenging and time-consuming, most participants were surprisingly positive about it. Only one participant experienced the process as difficult and not being worth the time required, while the other two had positive attitudes about it and reported finding it beneficial in the long run despite recognizing the effort it requires. The participant who did not find it beneficial did however express faith in the concept of dividing assignments into smaller chunks, but explained that he would rather do it on paper or alternatively on a computer as he generally dislikes typing on his phone.

The process and steps required to add an assignment also appeared to be an intuitive process, however some minor usability issues were encountered the first time this was done as some participants reported to misinterpret their dividing as adding tasks instead of breaking up

a task. When dividing a task into two smaller tasks, they expected to keep the original task with two sub-tasks added, but in actuality you remove the original task and only keep the two new tasks it was divided into. Having gone through this process once however, all participants fully understood it and had no further problems, and those who initially misunderstood the process managed to quickly realize and resolve their issue.

In the last step of adding an assignment, all created tasks get assigned a suggested deadline which are evenly distributed until the final due date of the assignment. This was reported to be liked by participants, and furthermore changing the due dates were described as intuitive and easy. The fact that you can see your current and remaining steps was also reported by one participant to be helpful as it gave insight into his progression.

The insights also indicated some improvements that could be made for a better experience. For instance, two participants reported adding assignments which they felt were unnecessary to break up and therefore wished this feature was optional. Another possible improvement which had been considered but ultimately dismissed due to time constraints, was to incorporate a system for assigning an estimated time or effort required for each task. Despite not bringing this up to participants, all of them either expressed a want for this or suggested different methods in which this could have been implemented. One participant suggested using a point-system when adding tasks where each task got assigned a point based on the effort needed to complete it. Another suggested a similar system to Kanban⁹ for managing the progress of tasks by assigning them colors to signify how close they are to being completed. For example red could be used to signify tasks that had not been started on yet, orange could mean a task is half-way done, etc. The fact that this was brought up unsolicited by all participants indicate that the user experience could be improved by implementing a system for assigning tasks with an estimated work effort required.

6.4.2 Focus Mode

The insights indicate that Focus Mode achieves its intended purpose, which is to reduce smartphone-related distractions while studying for individuals who experience this as a problem. Although only participant appeared to find this feature useful, he was also the only

⁹ Kanban is a workflow management method usually used by teams where work is organized into cards of “to do”, “doing”, and “done” (or a similar system) in order to visualize progress and facilitate collaboration.

participant who reported to be negatively affected by impulsive smartphone use in academic contexts. In the post-study interviews, participants were asked about their usual phone usage and how it affects them while studying. As expected, the participant who most often used Focus Mode described experiencing his smartphone as a major distraction while studying as he often finds himself impulsively checking his phone to the point of it being a habit that happens without even realizing it. On the other hand, the two other participants reported to rarely, almost never, experience their smartphone as a distraction while studying. Although they reported to check their phone once in a while when receiving notifications, they described having no problems putting it away and continuing their work afterwards. This seems to explain why these two participants only used Focus Mode on a few occasions throughout the study despite both of them reporting positive experiences with it, they simply had no need for reducing smartphone-related distractions. One of them reported that he would rather have a similar function for his computer as he rarely get distracted by his smartphone, but instead often experience his computer as a distraction while studying.

However, the participant who did find Focus Mode useful almost exclusively used the app for this feature, and applied it frequently in a variety of different situations. In the beginning he utilized it while doing homework, as this was found beneficial he then also started to use it for other study-related activities such as during lectures. After using the app for around two weeks he also started to use it in situations outside studying, e.g., while watching TV in order to not get disturbed. He reported to find it very helpful and after the diary study concluded said to still use it occasionally. When using it while studying he reported that completing a Focus Mode session gave him an sense of achievement, and afterwards felt like he could take a well-deserved break. Although he did not explicitly report to use The Pomodoro Technique¹⁰, he described using Focus Mode in a similar fashion as he usually applied it in intervals of work with breaks in between.

Despite this feature being intended to temporarily block users from accessing other apps for a length of time, they can always disable it prematurely. This was a deliberate decision both as a security measure in case users require access to their phone, and because it is not intended to be forced upon users which likely would have been experienced negatively. However, to ensure that it is effective, it was purposely designed to feel slightly bad if you do decide to end a session before the time is up. If users attempt to open other apps while

¹⁰ The Pomodoro Technique is a time management method in which work is broken down into intervals of a defined length of time, and separated by short breaks in between.

Focus Mode is running, they are met with a black screen showing the remaining time and this text: “Return to app if you want to give up”. If they do return to the app they are then met with this text: “Are you sure you want to give up?”, and are required to hold down a button for a few seconds to do so. This seemed to function exactly as intended, the participant who found Focus Mode to be helpful described a few occasions in which he impulsively opened up his phone to check social media while Focus Mode was running, and in his own words then felt “scolded” by the app which made him pull himself together and continue working.

For the most part the overall user experience with Focus Mode appeared positive for all participants. Setting it up, which requires giving the app permissions through system settings, was reported as an easy process without any issues. All participants also understood what Focus Mode was and how to use it without any instructions outside the app. There was however one participant who had a particularly bad experience with Focus Mode as the app crashed whenever he tried to toggle it on. This was especially frustrating as there were no way for him to understand why this happened or how to fix it, and external intervention was therefore required. Updating the android operating system on his phone resolved the issue as it was caused by using a very old version which did not have the required support for the feature. The user experience could be improved here by informing users on older versions of android that an update is needed to access Focus Mode. Another participant also expressed a wish for being able to whitelist certain apps in order to allow them to be used while Focus Mode is enabled. He further explained that he needs to check an app regularly for health-related reasons, and being able to do this without prematurely turning off Focus Mode would be favorable.

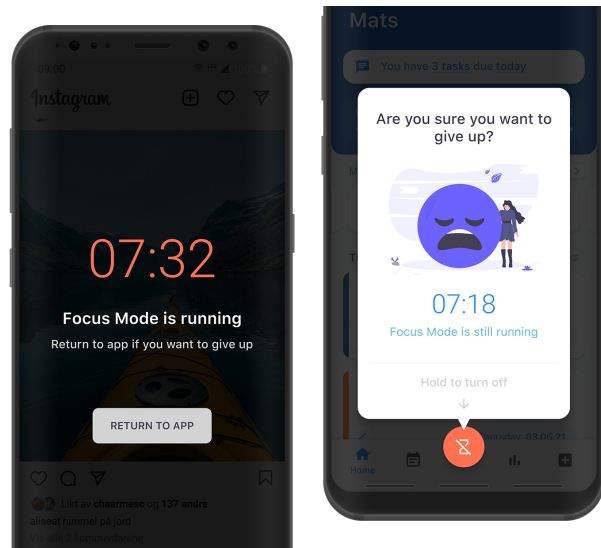


Figure 6.1: Left: When attempting to access other apps while Focus Mode is running. Right: Turning off Focus Mode prematurely.

6.4.3 Tasks and deadlines overview

This section will cover the findings associated with the tasks and deadlines overview located in the home-screen. Similarly to Focus Mode, the participants utilized this part of the app in various amounts. Two of the participants added all their assignments into the app and used it to keep track of all their coursework during the diary study, and they reported a greater sense of control as a result. Between these two participants, one appeared to have a more hectic study schedule than the other as he had several upcoming assignments and exams during the diary study. He reported the app to be tremendously helpful during this hectic time as he usually struggles with maintaining structure. By using the app he had a plan which gave him insight into his current progress and what he should be working on. The other participant who also reported to find the task overview helpful seemed to find it less beneficial in comparison as a result of having less assignments to keep track of. He mostly just studied for an upcoming exam and only had a few tasks to add into the app. Although he reported to find the overview helpful, he also described how it would probably be more beneficial for him in the future as he usually has more assignments to keep up with.

One participant did not take advantage of the tasks and deadlines overview through the app as he mostly did not add his assignments into it. This can primarily be explained by the fact that this participant generally disliked using his smartphone, especially typing in it. He was therefore very reluctant about incorporating his smartphone into his study routine which impacted his overall user experience with the app. He also appeared to be the participant who maintained the most structure as a student, and described having established methods and routines similar to what the app intends to help with. Despite not utilizing the app for organizing his assignments, he emphasized that he liked the design of it and found the app to be highly user friendly but explained that changing his study routines was neither necessary nor desired for him personally, particularly by using a mobile app.

As mentioned, one of the methods intended to reduce procrastination in the app is to make assignments less daunting. This is done by breaking them up into several smaller tasks, and then assigning a short deadline for each of them. As there are no real repercussions for not following these deadlines there was a bit of uncertainty about how effective they would be. One participant seemed to follow them strictly and described knowing deadlines were about to become overdue pushed him to complete them. However, he found having small tasks from dividing assignments to be much more helpful at reducing his procrastination. In his

own words, having a list of small tasks which can be completed quite quickly made him not feel as extremely overwhelmed, something he described to often feel when faced with a large project. By using the app he managed to stay on top of his workload instead of continuously delaying tasks until they eventually had to be done. He reported on several occasions to finish tasks sooner than he normally would, and expressed this as giving him a sense of accomplishment as a result. Another participant found the tasks to often take much longer than he anticipated when adding them to the app, and therefore appeared to not find these deadlines as useful. Like previously mentioned in 6.4.1, implementing a system in which users could assign an expected effort required to finish a task, e.g., a point system, could possibly make it easier to follow deadlines.

The fact that users do not receive notifications to remind them about tasks with upcoming deadlines also appeared to have a large impact on how strictly they were followed. All participants expressed a want for this, and some described forgetting tasks as they expected the app to remind them about tasks that were about to become overdue. They did however have differing opinions on when notifications should be received, one wanted them about a week before, another said a day or two, which seems to indicate that the users should be able to decide this for themselves in the app to fit their needs.

The user interface for the task overview appeared to work well. Two participants specifically mentioned how they liked the use of colors, and one further explained that the color codes used for tasks were great and that the overall colors on the task overview-screen highlighted what was important. There was however some mixed feelings regarding the calendar. One participant liked that the weekend-days were hidden from the calendar, but also found it to not be centered at the current date to be a bit frustrating. Another wanted to be able to toggle between a week- and month-calendar as he found the calendar as of now to be limited and not give him a clear overview of tasks further ahead in time. There was also a desire for being able to synchronize the calendar with other services, e.g., Google Calendar or learning platforms, as one participant described how he prefers to avoid using multiple apps and instead organizes everything into his Google Calendar.

6.4.4 Overall design feedback

The overall design appeared to be liked by all participants. “Easy”, “simple”, and “clean” were repeatedly used to describe it. After the first week of use, participants reported the

app as pleasant to use and look at, and one participant specifically mentioned the usability as very good. Later on, another participant described the learning curve of the app as very small and experienced that the more he had used it, the more he understood how easy and natural it is to use. The design appeared to be aesthetically pleasing for all participants as well. The color scheme and animations were mentioned multiple times as especially visually pleasing.

One participant liked the consistency of the design as it made getting used to it a straightforward process. He compared it to Canvas, the learning management system he uses, and described how much cumbersome it is to use as the teachers themselves can decide the design of their course pages. This created an inconsistent experience as he was required to navigate through various different designs to find the information he was looking for. Although it should be mentioned that Canvas serves a different purpose than the app, this participant described how much easier he found navigating through the app was compared to Canvas which he normally would use to keep track of his assignments.

6.4.5 User habits

A fortunate coincidence was that the three participants had quite different motivations for using the app and therefore engaged with it in contrasting ways as they found various features to be more personally beneficial. In order to explain their individual differences and how it relates to their user experience with the app, they will be referred to as P1, P2, and P3 in this section to improve the readability.

P1 appeared to be the least organized and structured participant, and therefore found the app to benefit him most in this regard. He described maintaining structure as something he has always struggled with throughout his life, especially as a student. During hectic periods where he had several upcoming assignments, he experienced the overview of tasks and deadlines in the app as particularly helpful and giving him a sense of security. Through the app he had all his assignments organized into one place which made it easy to make sure nothing was forgotten, check his current progress, and to have a plan for his upcoming work. Although he found the improved structure to be very helpful, he reportedly found dividing assignments as the most beneficial part of the app for reducing his procrastination. Focus

Mode was rarely used by P1, which seems to be the result of him not finding smartphone-related distractions problematic while studying. Compared to the other participants, he also appeared to have the highest tendency for procrastination, and described this as a major personal problem he faces as a student. Both P1 and P2 found the app as a helpful tool for reducing academic procrastination, albeit in different ways. However, possibly because P1 reported to find procrastination more problematic than the other participants, he appeared to benefit the most from the app. He also reported to still use the app after the diary study concluded, which indicate that the app can be sufficiently viable in real world circumstances.

P2 differed from the other two participants by being the most negatively affected by smartphone-related distractions. While P1 and P3 rarely used Focus Mode and found it only slightly beneficial, P2 almost exclusively used the app for Focus Mode and experienced it as very helpful. While studying, not only did P2 find it difficult to resist the temptation of checking his phone when receiving notifications, he also reported to often find himself impulsively picking up his phone to check social media without any notification triggering this impulse. He described this as something he does not do deliberately, it is instead more of a bad habit that happens without him even realizing it. Whether this behavior can be regarded as procrastination is debatable, although he describes irrational delay of an intended action, he also describe it as not deliberate. Irregardless, he did find Focus Mode to be helpful in reducing his impulsive and unproductive smartphone use. On several occasions he reported to pick up his phone while studying, but as Focus Mode was running he then managed to put it down and continue working until the time was up. P2 did however not seem to benefit as much from dividing assignments and having them organized in the app, but reported to find it helpful. Like P1, in the post-study interview P2 also described to still use the app occasionally even after the diary study.

P3 appeared to not benefit too much from using the app at all. He was generally positive about the concept and design of it, but his overall user experience with the app was tainted due to him disliking smartphones in general. He also appeared to be a quite diligent student and described maintaining structure as a necessity for him to perform well. When given a larger project, he reported to always structure out his work and create a plan before anything else. As he already had established methods which work well for him that provide similar results as the app intends to, he was understandably reluctant about using the app to change his habits as he neither felt a need or a want to change them. Using the app therefore felt more like a chore to him as he found the benefits to not be worth the effort required, and

incorporating the app into his study routine was reported to feel unnatural for him. Although he maintained good structure, he did report to find academic procrastination problematic. Similar to P2, he had problems with impulses and described to often get distracted while studying. Unlike P2, he did not find his smartphone distracting however, and described his computer as the primary source of distractions. He therefore also did not find Focus Mode to benefit him, but described how a similar function for his computer would be vastly more helpful to him.

6.4.6 Summary of findings

To some extent, the app appears to be able to treat different underlying factors of procrastination as evident by the insights provided by participants. They reported having different motivations and appeared to benefit from it in differing ways. One participant reported to experience impulsive smartphone use while studying as highly problematic, he found the app to be very useful as Focus Mode helped him to combat this. Another participant who reported to frequently procrastinate and experienced this as a major problem he faces as a student found the app to benefit him through the organization and structure gained by using the app. He specifically reported to procrastinate at a lesser extent by using the app. Both of these participants also reported to still use the app occasionally after the diary study, assuming this to be true it would indicate that the app can in fact help some individuals reduce academic procrastination effectively enough to be applied in actual contexts of interaction. However, it was also found to be largely useless by another participant who reported seeing no benefits from it regarding his academic procrastination. Although the app was not expected to negate all the different underlying factors that contribute to procrastination, this insights shows that there is room for improvement in order for it to be effective for a broader audience.

7 Discussion

The intention of this master thesis was to explore the following research question:

RQ: How can a digital aid be designed to counteract the negative aspects of academic procrastination?

To address this, a concept for a mobile application was created based on insights gathered from procrastination research. The concept was then refined and finalized through feedback received from participants in a focus group of target users. This combined insight from users and procrastination research was used to design a digital aid, i.e., a mobile application intended to proactively help students reduce their personal procrastination while doing study-related activities. More specifically, the app incorporates certain features which are designed to negate specific underlying factors which promote procrastination tendencies in students. To further explore the research question, the app was tested by users to gain insight about the effectiveness in which it manage to reduce academic procrastination, i.e., whether the design achieves its intended purpose. This insight was gained through a diary study where participants used the app over a three week period while providing insights into their experience through self-reporting.

7.1 Findings in literature

Research into the scientific literature showed that academic procrastination is clearly a prevalent problem. Not only is it detrimental to academic performance as students who engage in the behavior tend to display lower grades, it also has a negative affect on health and general life satisfaction. Although intervention strategies exists which can reduce problematic procrastination with the help of a psychologist, these strategies are not always effective as they require effort and time which leads to many dropping out of treatment before any progress is made. Finding alternative solutions for reducing procrastination, especially in students, would therefore appear to benefit society at large.

The literature also gave insight into the complexity of procrastination as there are a vast amount of different underlying factors which influence the behavior. An ideal method for reducing procrastination through a digital aid would therefore have to be highly personalized in order to direct effective treatment in response to the specific user and situation. Considering the significant amount of different individual and environmental factors that contribute to the occurrence of procrastination, this would however be quite difficult if not impossible to achieve using a single digital aid. An alternative approach would be to either create a highly effective solution for a narrow subset of individuals, e.g., only impulsive procrastinators, or instead create a solution which is broad in scope that can be moderately effective for a wider subset of underlying causes.

Concerning the use of a mobile device as the medium for a digital aid to reduce procrastination has both advantages and disadvantages. The literature showed that smartphones could in part be involved with the apparent growth of procrastination in society in general due to the immediate gratification it provides. Using a smartphone might therefore only exacerbate procrastination tendencies, especially for highly impulsive people. However, as procrastination is susceptible to environmental influences having a portable device can be advantageous. The smartphone in particular as it is widely available and most people have it on their person at all times, and furthermore it includes a number of sensors which could be useful for predicting procrastination, e.g., through machine learning.

7.2 Findings in diary study

The diary study where users tested the app in real conditions over a longer period of time gave valuable insight and shed some light on the research question. Insights did in fact indicate that the app can be helpful for some individuals to reduce their academic procrastination. Of the three participants in the study, two reported seeing great benefits from it, and one found it to not benefit him at all. Interestingly enough, the two participants who found it beneficial did so in quite different ways. One of them reported the app to reduce his procrastination by improving his structure and organization. In particular, he found breaking up assignments into smaller tasks to be especially beneficial and experienced feeling less overwhelmed as a result. On several occasions he also described how he managed to complete tasks sooner than usual due to them being broken down into manageable pieces, and also because the deadlines

created in the app pushed him to complete them. The other participant who reported the app to be useful did so because of Focus Mode, a feature that will temporarily silence notifications and block users from accessing other apps for a predetermined amount of time. He described how impulsive smartphone use was a major problem for him while studying, and found the app to be very helpful in combating this through the use of Focus Mode. These two participants who found the app useful also reported to still use it occasionally after the diary study ended. This supports the notion of it being effective enough for some individuals to be applied in real circumstances.

Insights from participants indicate that the app can effectively counteract two underlying factors of procrastination, lack of structure and impulsiveness associated with smartphone-related distractions. To some extent, the app therefore appears to be adaptable and helpful in reducing procrastination as caused by some different underlying factors. However, it is also apparent that it can not be effective for all individuals. One participant who reported to experience academic procrastination problematic found the app to not be helpful in this regard at all. He further explained that he experience distractions on his computer to mostly be the source of his procrastination, and described smartphone-related distractions as not being problematic for him while studying. He also disliked using his smartphone and generally avoided using apps, this impacted his overall experience using the app negatively as he was reluctant about incorporating his smartphone as a part of his study routine.

7.3 Limitations

All studies will have some limitations, including this one. The current covid-19 pandemic did create some minor limitations surrounding user testing as all information gathered from participants had to be done online, except the focus group conducted early in the project. A greater limitation was the fact that this project was entirely done alone, and I set too high requirements for the development of the app. Learning android app development and then having to design and program the app by myself turned out to be way more difficult and time-consuming than expected, and resulted in a majority of the time spent working on this thesis going into development of the app. Ideally I would have involved users more during the development and then iterated based on their feedback, however time constraints made this difficult.

As data collected through the diary study is self-reported, meaning the participants provided insights by themselves without external interference, this also created some limitations regarding the reliability of the data. Self-reported data is inherently biased which means there is a deviation between what is actually true and what is being reported by the participant. In case of the diary study, the data collected from participants appears to show a bias towards positive experiences as the majority of insights skewed in this direction with less focus on the negatives. Although participants were instructed to report about their experience with the app in its current state, and that they should include any negative experiences they might have as a result of it being incomplete, it is highly likely that the participants were unknowingly biased in their perception of the app due to knowing they were testing an unfinished product. Furthermore, all participants were recruited based on personal connections, and there is a possibility of this having an influence in their responses.

Additionally, as with all qualitative data analysis, the diary study findings will naturally be affected by my interpretation of the data. Although I intended to be unbiased, and believe I was, all qualitative analyses will be impacted by the researcher. Ideally, several people should have analyzed the findings to minimize the potential of bias in the analysis.

I also acknowledge the limited reproducibility of the process in this project. It was intended to be explained in more detail on the basis of using an RtD approach, however with the time available I did not manage to describe the process extensively enough as originally planned. Furthermore I also would have liked to present the app better, but I hope installing the app on a physical device will demonstrate its design and functionality.

7.4 Future work

To improve the app by continuing the development of it, there are several functionalities that did not get implemented due to time constraints. A statistics page, a dedicated page to gain an overview of assignments and their associated tasks, receiving notifications about upcoming deadlines, a method of assigning task prioritization, and overall polish is lacking in the current version.

Future work that is not based on continuing development of the app should ideally be more personalized in intervention strategies to reduce procrastination more effectively depending

on the user and situation. I can definitely see the potential of machine learning being a useful method of predicting the occurrence of the behavior, future research should explore this further as a major weakness in the app presented in this thesis is the fact that it does not attempt to predict the behavior or direct treatment towards specific underlying factors based on the user. Besides machine learning, future work should have a greater focus on minimizing distractions besides smartphone-related ones, ideally it should be a combined solution that works both on mobile and computer. The possibility of minimizing distractions on a network-level should also be explored as this could be used to limit access for unproductive activities associated with any device connected to a home-network, e.g., phones, computers, TV and gaming consoles.

7.5 Recommendations and considerations when designing to reduce procrastination

To respond to the research question and contribute knowledge for future researchers in the field, this section will present a set of recommendations and considerations when designing to reduce procrastination. This list is based on insights gained through research and development of this project, and will cover the most important aspects to take into consideration, particularly relating to academic procrastination.

Proactive vs reactive: As procrastination is often considered a coping-mechanism to avoid unwanted emotions such as stress, anxiety, boredom, etc. it is in itself a reaction to manage a situation. Interventions should therefore ideally take action before the behavior occurs, i.e., a proactive approach. As procrastination continues, the harder it will be to treat as the underlying conditions that first caused it will only exacerbate. For example, when a student is faced with a large project deemed to difficult and therefore avoids it, this feeling of hopelessness will only keep increasing until the deadline becomes too short to avoid. Although proactive interventions are preferable, reactive approaches can work if action is taken immediately. This can be seen in Focus Mode as it uses both proactive and reactive strategies to reduce engaging in impulsive behavior. Notifications are silenced as the proactive approach, and additionally users will be blocked from accessing other apps if this is attempted. The latter is an reactive approach as no action is taken until procrastination is about to be engaged in.

Gamification: Several facets of procrastination indicate that gamification can be a useful design-tool for preventing the behavior. Lack of motivation is a major predictor for procrastination. By incorporating game-elements into a design and rewarding positive behavior, motivation can increase and therefore result in minimizing procrastination. Research also indicate that procrastinators tend have a lower ability to delay gratification and prefer immediate rewards. This can be related to academic procrastination as the effort put into studying is not rewarded until much later. Using gamification, for example by rewarding students with points while studying, they can feel like their efforts are noticed and therefore worth doing. Ideally, these rewards should be given immediately. This can be seen incorporated into both Hold and Forest (see section 2.6). In forest, users can visualize their time spent staying productive in a virtual garden as each time a productivity session is completed the user will be rewarded with a new tree planted in their virtual garden (see subsection 2.6.1).

Positive reinforcement vs negative reinforcement: Related to the concept of gamification, positive enforcement should be utilized when designing to reduce procrastination. Encourage users by giving them incentives and reward them for good behavior. As procrastination is often used as an escape to avoid negative stimuli by engaging in activities which provide immediate positive stimuli, e.g., watching TV instead of studying, positive reinforcement can be used to condition users over time that not engaging in procrastination will be associated with feeling good. Negative reinforcement should however be used with caution as it can have the opposite effect and might only further increase the likelihood of engaging in procrastination. Consider an application which audibly nagged whenever a user postponed doing an intended task, instead of doing this tasks to stop the nagging it might be easier to just distance yourself from the environment to avoid it entirely. This would then only serve as another hurdle to overcome in order to stop procrastinating.

Reducing temptations/distractions: Tempting activities that can interfere with starting or progressing an intended activity should be reduced as much as possible, especially for impulsive individuals. This can be done by removing temptations from the environment or make them less desirable, or alternatively move the user into another environment without distractions. A practical example would be to remove distractions from your work-environment to prevent the desire to engage with them, e.g., putting your phone out of sight or into another room. From a designers perspective, this might require some creative solutions to incorporate as it is not always easy change environmental factors surrounding

the user. Some good examples can be seen in the app Hold. Besides rewarding users for not using other apps thereby reducing the desire to engage with smartphone-related temptations, the app also used to require that users were connected to an educational WiFi¹¹. This effectively meant that users had to be physically located in their place of study, i.e., an environment with few temptations.

Reducing task aversiveness: A major factor in procrastination is the aversiveness of a task. The more unpleasant a task is perceived to be, the more likely it will be avoided. Although there are many different task characteristics that can influence its aversiveness, difficulty and interest are indicated to be the most common ones. If tasks are too difficult people might avoid them due to the stress or frustration they associate with it, but tasks that are too easy can also become aversive as they are experienced as boring. Furthermore, lack of interest for a task will result in having no motivation for completing it. This can happen if the rewards associated with it are not worth the effort required, or if the task is simply not perceived as interesting to do, e.g., washing dishes. Task aversiveness is especially important to consider when designing to prevent academic procrastination. Assignments, larger ones in particular, can be designed less aversive by improving organization and creating a plan of action. When the work required for an assignment is clearly laid out it is less likely to be delayed as the uncertainty regarding where to start is removed from the equation. An example can be seen in the app presented in this thesis as users are required to divide their assignments into multiple smaller tasks, thus reducing the aversiveness of the assignment by having smaller tasks to strive and organizing the work required.

The aspect of time: Related to task aversiveness is the aspect of time. An unpleasant task is more likely to be avoided if the associated rewards are in the distant future. As mentioned, procrastinating individuals tend to find it difficult to delay gratification. This does not necessarily mean that they lack an intention to pursue future goals, instead procrastinators seem to struggle with acting on their intentions when outcomes are distant. When designing to reduce procrastination, particularly in students, it is therefore recommended to reduce the time between and its outcome. One suggestion is to incorporate short-term goals into the design, for example by setting frequent deadlines or establish milestones. Furthermore, users need an incentive to accomplish these goals in order for the design to be effective, gamification-elements should therefore be taken into consideration.

¹¹ It seems like Hold removed the requirement of being connected to an educational WiFi as points can now be gained wherever you are. This might be the result of schools being shut down during Covid, but this is only speculation.

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Appendix A Information and consent letter

Vil du delta i forskningsprosjektet

”Redusere prokrastinering gjennom design: Et digitalt hjelpemiddel for studenter”?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å designe og utvikle en mobil-app som kan hjelpe studenter i å redusere prokrastinering av eget skolearbeid. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Prokrastinering kan defineres som å utsette noe man har bestemt seg for å gjøre, selv om man vet at utsettelsen vil medføre negative konsekvenser. Det er et svært utbredt fenomen, spesielt blant studenter. Formålet med prosjektet er å lage en mobil-app som skal fungere som et hjelpemiddel studenter kan ta i bruk for å redusere egen prokrastinering. Prosjektet inngår som masteroppgaven min i Medie- og interaksjonsdesign ved Universitetet i Bergen.

Hvem er ansvarlig for forskningsprosjektet?

Forskningsprosjektet skrives av meg, Mats Åsbu Jacobsen, i samarbeid med Universitetet i Bergen ved Truls André Pedersen.

Hvorfor får du spørsmål om å delta?

Du får spørsmål om å delta fordi du er student i høyere utdanning. Hvor mye eller lite du tilsynelatende prokrastinerer har ikke vært en faktor i hvorfor du har blitt spurt om å delta.

Hva innebærer det for deg å delta?

Som deltaker vil du få tilgang til en prototype av appen som installeres på din egen mobil. Over en periode på tre uker skal du bruke appen som du vil når det passer deg. Det er ingen krav til hvordan eller hvor mye du skal bruke appen, men du må regelmessig dokumentere dine erfaringer slik at jeg får samlet informasjon som kan brukes for å evaluere appen (dette kalles en dagbok undersøkelse).

Hvis du velger å delta i prosjektet, innebærer det at du bruker appen i praksis i tre uker og fyller ut et spørreskjema minst tre ganger i uken. Det vil ta deg ca. 5 minutter å fylle ut spørreskjemaet for hver gang. Spørreskjemaet inneholder spørsmål angående din bruk og opplevelse av appen. Dine svar registreres elektronisk gjennom et web-basert spørreskjema.

Etter testperioden er gjennomført vil du også bli bedt om å delta i et kort personlig intervju med meg, Mats Åsbu Jacobsen. Intervjuet vil basere seg på svarene du har oppgitt i spørreskjema både for å oppsummere dine tanker rundt bruk av appen, og for å oppfølge eventuelle utsagn jeg vil du skal utdype eller oppklare.

Du og dine svar oppgitt gjennom spørreskjema og intervju vil behandles konfidensielt. Resultatene fra undersøkelsen vil kun bli brukt for å evaluere appen i sammenheng med min masteroppgave, ingen enkeltpersoner vil kunne gjenkjennes i den ferdige oppgaven.

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

- Informasjonen som samles vil kun være tilgjengelig for meg, Mats Åsbu Jacobsen, og veileder Truls André Pedersen
- Informasjon du oppgir vil kun brukes for å evaluere appen og vil ikke publiseres på en identifiserbar måte. Eventuell publisering av resultater vil skje i anonymisert form uten direkte sitat (eksempel bruk: “flere deltakere mente at [...]”)
- Navnet og kontaktopplysningene dine vil jeg erstatte med en kode som lagres på egen navneliste adskilt fra øvrige data, noe som gjør at eventuelle uvedkommende ikke vil kunne koble dataene dine med identiteten din
- Svar du oppgir gjennom spørreskjema vil krypteres, så om dataene skulle komme på avveie vil det være uleselig uten krypteringsnøkkel

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?

Prosjektet skal etter planen avsluttes 1. Juni 2021. Ved prosjektslutt vil personopplysninger anonymiseres slik at data som oppbevares videre ikke har noen tilknytning til deg.

Dine rettigheter

Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?

Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Universitetet i Bergen har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?

Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

- Universitetet i Bergen ved Mats Åsbu Jacobsen, epost matsaaj@gmail.com eller telefon 99 35 71 37. Eventuelt kan du ta kontakt med veileder Truls André Pedersen, epost Truls.Pedersen@uib.no
- Vårt personvernombud: Janecke Helene Veim, på epost personvernombud@uib.no.
- NSD – Norsk senter for forskningsdata AS, på epost (personverntjenester@nsd.no) eller telefon: 55 58 21 17.

Med vennlig hilsen

Mats Åsbu Jacobsen
(Masterstudent)

Truls André Pedersen
(Veileder)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet “Redusere prokrastinering gjennom design: Et digitalt hjelpemiddel for studenter”, og har fått anledning til å stille spørsmål. Jeg samtykker til:

- å delta i dagbok undersøkelse
- å delta i spørreskjema
- å delta i personlig intervju

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, ca. 01.06.21

(Signert av prosjektdeltaker, dato)

Appendix B Diary study questionnaire

Dagbok undersøkelse journal

Takk for at du vil bidra til studien! Her er noen punkter som kan hjelpe deg å fylle ut journalen.

- Journalen skal fylles ut minst tre ganger i uken (f.eks. mandag, onsdag, fredag), men gjerne også mer (f.eks. etter at noe med appen gjorde et spesielt inntrykk på deg, eller på slutten av dagen etter å ha brukt appen).
- Det spiller ingen rolle hvor mye du skriver, men prøv å skriv litt på hvert punkt for hver gang. Tilbakemeldingen din er svært viktig for meg, så ikke vær redd for å skrive for mye!
- Ikke tenk på rettskriving eller språk.
- Husk at dette er din journal som skal representere dine tanker, erfaringer og følelser. Jeg er interessert i hvordan du opplever bruk av mobil-appen, ikke hva du tror jeg eller andre ønsker å høre. Skriv ned det du tenker selv om du ikke tror det er relevant!
- Har du noen spørsmål kan du kontakte meg, Mats Åsbu Jacobsen på e-post matsaaj@gmail.com eller telefon 99357137.

Skriv inn initialene dine her:

[tekstboks]

Dersom du har lagt til en oppgave i appen siden forrige journal utfylling:

Var det tydelig hvordan og hvorfor du skulle dele oppgaven i mindre deler?

Hva synes du om hvordan det fungerte?

[valgfri tekstboks]

Hvordan har du brukt appen siden forrige journal-utfylling? (gå gjerne i detalj og skriv om spesifikke funksjoner du brukte)

[tekstboks]

Beskriv hendelser ved bruk appen som gjorde særlig inntrykk på deg, og hva du følte eller tenkte om disse hendelsene (var det noe du likte eller mislikte?)

[tekstboks]

Oppnådde du det du ønsket ved å bruke appen?

[tekstboks]

Er det noe annet du vil tilføye?

[valgfri tekstboks]

Appendix C How to download and install the app

The app can only be installed on android smartphone devices. In order to do so open the following link on your mobile device:

<https://drive.google.com/file/d/1EXA7u3MaP6AZGJEDe7SuBKQQ7u0nTPMr/view?usp=sharing>

or alternatively:

<http://bit.ly/procrastination-app> – Short url that will redirect to google drive

Then click download and open the file on your device to install it. You will most likely encounter a message stating that your phone lacks privileges to install apps from unknown sources. This is a security measure that will be displayed before installing any unpublished apps in order for the user to be critical about unknown sources. In this case it is completely safe to allow as the app will not do any harm to your phone. After allowing unknown sources the app will then be installed.