Designing A Time Management App For And With Informatics Students

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MInf Project (Part 1) Report

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Abstract

Students in university can sometimes have problems managing their time and they make use of different tools to help them manage their time better. In this report, I describe how I designed a time management app for Informatics students in the University of Edinburgh. To do this, I reviewed the existing literature on time management, especially amongst students, and the resources offered by the University of Edinburgh. I also interviewed students and staff members regarding students' needs and wants in regards to time management and followed the results of these interviews as well as the research to design an app using Figma [61]. I created two iterations of the design, each followed by an evaluation. The final evaluation revealed that some Informatics students would be keen to use the app once developed.

Acknowledgements

I would like to thank all the participants in my studies, in particular participants who agreed to participate in multiple studies.

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Chapter 1

Introduction

1.1 Motivation

When starting university for the first time, one of the biggest issues students usually face is the change from a high school setting to a university setting. University students no longer have a structured class schedule, instead they have to spend most of their time on independent study [1] [11]. Furthermore, transition to university usually means transition into adulthood as well. For most of them this will be the first time they live on their own, and so they have to deal with new responsibilities, such as cooking, laundry, paying bills, and managing their finances. Students are not used to managing their time on their own, so they tend to run into a lot of problems when they find they do not have enough time to do everything they need to do. This can lead to changes in sleep quality and quantity, as well as changes in their levels of stress and overall mood, which can in turn affect their academic performance [2].

The University of Edinburgh is aware of this and students can find workshops on time management and procrastination [3], imparted by the Counseling service [4], and workshops, study support and an exam boot camp, offered by the Institute for Academic Development (IAD) [5]. However, only students who actively partake in these workshops or seek help from these departments are able to reap the benefits of theses resources. Otherwise, students can also seek counseling from the personal tutors.

I have always been very interested in time management, especially when I first arrived at university. I realised I really needed to find a system that would work for my life as a university student, which included living on my own for the first time. University life is a very unique period of your life, and although short, it is very important to be able to manage your time effectively. Personally, I have tried many combinations of apps, looking for something that could cover all the needs of a university student, but I never found anything that would work long term, because I would have to keep track and constantly check different apps, which ended up being counter-productive and making me waste more time. Today I use a blank paper planner together with the bullet journal system [6], which allows me to have everything in one place. However, as a student, I am often on the move, going from lecture to tutorial to the supermarket to the library, and I do not find it convenient to have to get my paper planner out of my bag to check

where the next lecture is or what I need to get from the supermarket.

This is why I think there is a need for an app that is specific for student life management. An app that does not only help students with scheduling their studies and keeping up with their deadlines but also reminding them to do their laundry or to attend their society's events. We hope to design a system that Informatics students at the University of Edinburgh can use long term and that will help them throughout their time at university.

1.2 Research goals

The main goal of this research project is to design a time management app that addresses the time management needs, wants and problems of students in the School of Informatics at the University of Edinburgh.

The goal for this project can be broken down into the following research questions.

1. What is the typical daily schedule of an Informatics student?
   (a) Does it change during the weekend?
   (b) Does it change during the revision period?
2. How do they handle coursework?
3. What kind of issues do they run into?
4. Do they have problems with procrastination?
   (a) What are their main distractions?
5. What kind of methods and/or tools do Informatics students use to:
   (a) managing their studies?
      i. keeping up with their courses?
      ii. meeting deadlines?
      iii. reducing procrastination?
   (b) managing their personal life?
6. What aspects of these methods/tools do they find useful?
7. What features would they like to see in a time management app for Informatics students?
8. How can we design a time management app that suits Informatics students at the University of Edinburgh?
9. How is the usability of the design perceived by Informatics students?
10. What would be the potential impact of the app for students, in terms of:
    (a) managing their studies?

i. keeping up with their courses?

ii. meeting deadlines?

iii. reducing procrastination?

(b) managing their personal life?

This project is part 1 of a 2-part MInf project. In part 2, the goal will be to develop the app and evaluate it with Informatics students to explore the impact this app can have on students.

1.3 Dissertation structure

The dissertation is divided into eight chapters and is structured as follow:

In chapter 2, I review the existing literature on time management and how it relates to university students and their mental health. Moreover, I review the resources offered by the University of Edinburgh and other existing tools for time management.

In chapter 3, I discuss the methodology I used throughout this project, which included collecting the requirements for the proposed system and applying these requirements and design principles to design the app as part of two iterations, each followed by an evaluation.

In chapter 4, I explain the details of the requirements gathering process, including the methodology used for the studies, the participants, and the results obtained from these studies.

In chapter 5, I discuss the process of applying the requirements to create the first iteration of the design, as well as the decisions I made. I also describe the evaluation process of the first iteration of the design.

In chapter 6, I describe how I used the results of the evaluation of the first iteration of design to improve the design.

In chapter 7, I discuss the process of the final evaluation and the results.

In chapter 8, I present my thoughts on how this project turned out, my plans for the second part of the project, and the conclusion to the project and all the research questions.

Chapter 2

Background

2.1 Introduction

Time in university is characterised by an increase in self-regulated learning, and although this kind of learning can give students more freedom to adopt their preferred strategies for studying, this usually leads to a decrease in academic success in their first semesters in university compared to their performance in high school [11].

With today's wide access to the Internet, the lack of a regular structure in university students' lives and the increase in autonomy, relative to that of high school students, can sometimes be seen as negative since students will spend more of their time using leisure media (social media, video-on-demand, etc)[18] [20][19].

For most students, transitioning to university also means no longer living with parental figures, which can lead to decrease in academic performance. In a study of sixty-students, learning dispositions of autonomous students were less negatively affected by the university transition than those of non-autonomous students [1].

To combat all of these factors, students sometimes turn to time management as a way to have better control of how they use their time and to use their time more effectively [16]. Not only that, but good time management habits have been proven to improve students' academic performance and reduce their stress [9][12][13].

2.2 Time management

Time management does not seem to have one set definition. The Cambridge dictionary defines it as "the practice of using the time that you have available in a useful and effective way", whereas in The Oxford dictionary, it is defined as "the ability to use one's time effectively or productively". On the UK National Health Service (NHS) page on time management tips, Emma Donaldson-Feilder, a chartered occupational psychologist, states the following regarding time management: "The aim of good time management is to achieve the lifestyle balance you want."

Throughout the different studies made on this topic, time management has been given a

wide range of definitions, but ultimately I have decided to use the following definition of the term for this dissertation: ”behaviours that aim at achieving an effective use of time while performing certain goal-directed activities”, which was suggested by Claessens *et al.* in their review of time management literature [10]. This type of behaviours include the following:

- time assessment behaviours, which ”aim at self-awareness of one’s time use” [10],
- planning behaviours, which include setting goals, scheduling tasks, prioritising, dividing tasks into subtasks, and grouping tasks [10][9][13], and
- monitoring behaviours, which ”aim at observing one’s use of time while performing activities” [10].

2.3 Time management and health

Time management has not only been proven to help students with improving their academic success [9][10][11][12][13][14], but also to help them deal with their academic stress [9][10][12].

Students experience an increase in stress after starting university, and this kind of stress cannot only deteriorate the mental health of the student, causing, in some cases, anxiety or depression, but it can also affect their physical health and academic performance, and can cause changes in their behaviour [21][22][23]. Some of the stressors during their time in university can include final grades, coursework and examinations [15], which are integral to the current education system and cannot be disposed of to benefit students’ health.

That is why many health officials, health professionals and counselors recommend practicing time management techniques [21][24]. A study from 2000 found that time management behaviours had a great buffering effect on academic stress, even more than leisure satisfaction activities, which is also recommended to alleviate stress [12].

2.4 Recommended time management techniques

The National Health Service (NHS) in the United Kingdom suggests the following techniques for time management [24], usually aimed at professionals doing office jobs:

- Work out your goals: work out what you want to achieve in life, and use these goals to determine how you spend your time (planning behaviour)
- Make a list: to-do lists are a good way to stay organised (planning behaviour)
- Focus on results: Good time management at work means concentrating not on how busy you are, but on results. (time assessment behaviour)
- Have a lunch break: working through your lunch break can be counter-productive
- Prioritise important tasks (planning behaviour)

Despite being aimed at professionals, some of these tips can be applied to any kind of work or situation, such as working on a personal project or studying in university.

Universities, and particularly the University of Edinburgh, also join this effort in encouraging students to use time management in order to reduce stress and improve their results during their time in university. Both the Student Counselling Service [4] and the Institute for Academic Development (IAD) [5] have resources to help students apply time management to their studies and day-to-day lives. The Student Counselling Service offer several workshops every semester focusing on many different topics like time management, procrastination, sleep, stress, mindfulness, and many more [3]. I attended the workshop for time management and the workshop for procrastination, and gathered the material they use on these workshops and the information they offer to students.

The workshop on time management offered by the university's Student Counselling Service include the following suggestions:

- Estimate how much time you spend on day-to-day activities such as academic work, household jobs, sleeping, hobbies, etc. (time assessment behaviour)
- Time bandits: find activities or things you spend too much time on. These can include internal bandits such as unclear objectives, tiredness, perfectionism or lack of self-discipline, and external habits such as interruptions, locating resources, social media, etc. (time assessment behaviour)
- Plan your week and your day in advance (planning behaviours)
- Set goals, prioritise them and plan how you will accomplish them (planning behaviours)

The Institute for Academic Development provides study skills support for teaching, learning and development [5]. Some of the services they offer for undergraduate students are workshops, exam resources, one-to-one meetings, and the Study Hub, which includes online advice and downloadable learning resources, to help develop more effective working and learning strategies [25].

On the topic of time management, the IAD gives a workshop on time management techniques for students every semester and advises using similar techniques and tips in the Study Hub [25]. The following are tips suggested in both the workshop and the Study Hub.

- Make a list of everything you need to do (planning behaviour).
- Find your time sponges (same as previously mentioned time bandits) (time assessment behaviour).
- Planning and prioritising (planning behaviour). Recommendation: use the Eisenhower matrix to prioritise [27].
- Plan your week (planning behaviour).
- Use the timer method, also referred to as Pomodoro Technique [28], to improve your focus on a task (planning behaviour)

- Self-assess your time (time assessment behaviour).

2.5 Procrastination

Procrastination consists of ”the intentional delay of an intended course of action, in spite of an awareness of negative outcomes” [31] [36]. Procrastination affects as many as 20% of adults [35], but it is estimated that the rate of problematic academic procrastination among undergraduates students falls at around 70% [36][31].

Nowadays, procrastination is often blamed on the Internet, social media or video games, but procrastination is not something new, and although the tools that make procrastination easier might have evolved, the reasons for procrastination in students seem to have not changed. A study conducted at the University of Vermont found fear of failure and aversiveness of the task to be the most prominent factors for procrastination among students [33].

Often, time management and procrastination are connected since often procrastination can be the result of the aforementioned ”time bandits”, and many time management techniques aim at reducing procrastination in order to use time more effectively. In a study from 1993, it was found that students who got into the habit of setting goals and prioritising (planning behaviours) reported a greater percent of planned academic work actually accomplished [29].

The University of Edinburgh’s Student Counselling Service [4] offers a workshop on procrastination and how to combat it. The workshop suggests the following techniques to reduce procrastination:

- Estimate how much time you spend on day-to-day activities such as academic work, household jobs, sleeping, hobbies, etc. (time assessment behaviour)
- Ask yourself what it feels like to put things off
- Set goals, prioritise them and plan how you will accomplish them (planning behaviours)
- Plan your week and your day in advance (planning behaviours)

Most of these suggestions are the same as the suggestions form the time management workshop.

2.6 Existing time management tools

In this section I will be reviewing existing apps that can be used for time management. I will limit my discussion to mobile apps, as I think that students benefit more from mobile version of apps than they benefit from the desktop version since they are usually on the move, going to different lectures and tutorials.

2.6.1 Microsoft Outlook [37]

Microsoft Outlook is an app that combines email and calendar for an Outlook account. Students in the University of Edinburgh also use it, as seen in section 4.7.

The calendar in the app is very similar to other calendar apps, it lets users add events to their own calendar. The events can be colour-coded. It lets the user set reminders for the event, as well as location, contacts, description amongst other things. Users can also share events with contacts as well as add events to their contacts' calendar. This app is especially advantageous to University of Edinburgh students, since their class schedule and exam dates are automatically added to their Outlook calendars, so it saves them set-up time.

2.6.2 Google Calendar [38]

Google Calendar is a calendar app that is often used by students, as seen in section 4.7. This is a standard calendar app that lets the user add their own events to their calendar, similar to Outlook Calendar. However, it also lets users add reminders and goals to the calendar. Reminders are similar to events but more simple. You are only allowed to select a date and time, and the user has the option to set the reminder to be repeated. When adding goals, it shows the user several suggestions for goals and it helps the user schedule time for that goal on their calendar. The user is able to have different calendars in the app and link multiple Gmail accounts.

2.6.3 MyStudyLife [39]

This app, unlike Google Calendar and Microsoft Outlook, is targeted for students. Its main four features are Calendar, Tasks, Exams and Schedule. In Calendar, the user can view their lectures, tutorials and other university contact hours. In Tasks, the user can have university-related tasks, which are limited to three options: assignment, reminder and revision. In Exams, the user can add their exams, including date, time, duration and course. In Schedule, the user can add their lectures, tutorials, and other contact hours, which will be used to populate the user's calendar.

This app, although targeted for students, is inflexible and very limited to only university-related events and tasks. As seen in section 4.7, some students use this app, although in conjunction with other methods and/or tools.

2.6.4 Trello [40]

Trello is a collaboration tool that organizes your projects into boards. In one glance, Trello shows the user three boards: what's being worked on, who's working on what, and where something is in a process. Each project has those basic three boards, but users are able to add more boards if necessary. Users can add tasks to any boards and easily move tasks between boards by dragging them. Users can assign a label, a due date, a description, and more, to a task. Trello is also unique in that is more than a tool to manage your tasks and progress, but it is also targeted at teams looking to collaborate on a project.

2.6.5 Todoist [41]

Todoist is a very popular task management app. Users are able to add tasks an assign them subtasks, a label, a priority level, a due date, amongst other things. Users can also create different tasks lists to group tasks by topic or project. Todoist has three default tasks lists: Inbox, Today, and Next 7 Day. The Today and Next 7 Days lists show tasks that are due on that day and the next 7 days, respectively. However, some of the features in Todoist are not available for free, for example, to add a label, a reminder or a comment to your task, you need to update to a premium subscription.

2.6.6 Microsoft To Do [42]

Microsoft To Do is another popular task management app. It is similar to Todoist, in the sense that users can add tasks with subtasks, due dates and more. However, To Do is completely free and all features are available to everyone. To Do does not offer labels, but users can still group together tasks by using tasks list. It also does not have priorities, but users can mark a task as important. Furthermore, To Do has a list called ”Today”, where users can add the tasks they want to accomplish today, no matter when the due date is. The app also gives the user ideas about what tasks they might want to do today, like tasks that have been overdue or will be due soon, or tasks marked as important.

2.7 Methodologies for involving users in software development

For apps that are created to help users, especially apps that aim to help users on a personal level, such as time management, I think it is important to involve the potential users in the process of developing the app. As the person working on creating this software, you want your app to be as useful as possible, and for that you need to learn about other people’s experiences and opinions, since without their input you are only creating an app for yourself. That is why I sought to involve users throughout the whole process of designing this app, and researched the methodologies to do so.

2.7.1 User-centered Design (UCD) [43]

User-Centered Design (UCD) is an iterative design process in which designers focus on the users and their needs in each phase of the design process [43]. Coined by Donald A. Norman in 1986, this design process is based upon an explicit understanding of users, tasks, and environments, and addresses the whole user experience. The international standard 9241-210 provides requirements and recommendations for user-centered design principles [44]. This process includes: identifying the primary users of the product, specifying requirements and product goals, creating a design solution to cover the requirements and goals, and evaluating the resulting product. After the evaluation, an iterative process begins, where designs are changed to cover any flaws or new requirements uncovered during the previous evaluation, and this new iteration of the design is evaluated again [45].

2.7.2 Participatory Design (PD) [46]

Participatory design is a design approach that brings the user into the design process [46]. Users can be kept involved in different stages of the design process by using interviews during the requirements gathering process, workshops during the design process, where they get to decide what they want and how they want it, and constant consultation with users during the implementation. Unlike with UCD, where users are consulted throughout the design process, with PD, users are allowed to actually make decisions on how design will look like. This can lead to products well suited to users needs.

2.8 Data collection methods

2.8.1 Types of data [47]

- Quantitative data is data that can take a numerical form, and thus can be easily analysed and compared [47].
- Qualitative data is data that cannot take numerical form [47], such as data resulting from an interview.

2.8.2 Interviews [48]

An interview consist of a researcher asking a series of questions to the participant in order to gather data about a certain topic [48]. Interviews can fall under the following three categories: structured, semi-structured or unstructured.

2.8.2.1 Structured interviews [48]

In structured interviews, the interviewer asks the interviewees a series of pre-established questions which allow only a limited number of response categories [48]. The interviewer should deviate from these questions as little as possible. All interviewees are asked the same questions and in the same order. Thus, analysing the findings is very straightforward and the interview could be easily replicated.

2.8.2.2 Unstructured interviews [48]

The unstructured interview consists of the researcher only asking an initial planned question and then only unplanned follow-on questions [48]. The unstructured interview process shapes to the individual situation and context. These kind of interviews are especially useful when the researcher does not yet have enough knowledge on the topic. Unstructured interviews are very rich in data, but are very difficult to replicate and to analyse.

2.8.2.3 Semi-structured interviews [48]

The semi-structured interview involves a set of prepared questions, but can also include unplanned follow-on questions whenever the researcher deems it necessary [48]. This

method is the most popular, thanks to its flexibility and the ability to dig deeper.

2.8.3 Focus group [48]

Interviews can also take place in a group setting called focus group [48]. The primary advantages of this method are the time saved by interviewing several participants at the same time and the convenience. There is also less bias introduced by the researcher since they take a more passive role in the conversation. However, the researcher has an important role of mediating the conversation and trying to get everyone sharing their opinion, while trying to stop other participants from taking over the discussion. Some downsides to this method might be, that when discussing more personal matters, some participants might feel discouraged from sharing or be biased by other participants.

2.8.4 Questionnaire [49]

A questionnaire consists of a series of questions that the participant answers in order to collect data [49]. Questionnaires can be web-based or on paper. Questions can be long form, where the participant provides an answer to a questions with their own words, multiple-choice, where a series of pre-planned responses are provided and the participant can choose one or more responses, or both, when participant do not feel like the set responses apply and are allowed to add their own response. This type of data collection method usually provides data that is very easy to analyse. However, researchers are not allowed to ask for clarification or further explanation, when researchers do not understand of the responses or want to know more about it.

2.8.5 Note taking

This method consists of taking notes of participants responses or behaviours, as well as the context of the study, which might affect how the participant reacts. This can be helpful, since audio or video recording might not be able to capture every detail of a study or the participant's reactions.

2.8.6 Audio recording

This consists of recording the participants responses during the study. Using audio recording allows the researcher to revisit the responses of the participant verbatim, without having to rely on good note taking, since the person taking the notes can always miss something that was said or note it incorrectly.

2.9 Data analysing methods and tools

2.9.1 Thematic analysis (Qualitative Data Analysis) [50]

Thematic analysis is a type of qualitative analysis and it focuses on examining patterns of data [50]. It consists of assigning items of analytic interest in the data a theme. Themes can be created as the data is analysed, and so to ensure a thorough analysis,

the data should be analysed more than once to ensure all existing themes have been discovered.

A top down thematic analysis approach consists of assigning predened themes from your research questions, to parts of your data [60]. A bottom up thematic analysis approach consists of clustering parts of your data with common points together into themes and then try to cluster those themes [60].

2.9.2 NVivo [51]

NVivo is a software to facilitate qualitative data analysis [51]. It helps the researcher manage the data, as well as organise the data into different themes (or nodes). It can also be used to analyse pictures, audio, video, etc.

2.9.3 Quantitative Data Analysis [52]

Quantitative data analysis is the interpretation of quantitative data, which involves the use of data to create summary statistics and draw conclusions from them [52]. This can include using the mean average or medium from a series of results from different participant to establish an overall result.

2.10 Design principles

During the design phase, I will be trying to uphold Nielsen's 10 Heuristics, developed by Jakob Nielsen in 1995 [53]. The 10 Heuristics are the following:

1. **"Visibility of system status"**: The user should be able to know what the status of the system is, when appropriate.
2. **"Match between system and the real world"**: The user should be able to clearly understand the systems language without any extra knowledge.
3. **"User control and freedom"**: Users should be able to go back to a previous state, at all times.
4. **"Consistency and standards"**: The system should use the presentation for things that do or mean the same thing, throughout the system.
5. **"Error prevention"**: Design the system so the user can easily avoid committing an error.
6. **"Recognition rather than recall"**: Make instructions and options always visible, do not rely on the user's memory.
7. **"Flexibility and efficiency of use"**: Users should be able to customise how to complete different actions.
8. **"Aesthetic and minimalist design"**: Only relevant information should be presented to the user.

9. **”Help users recognize, diagnose, and recover from errors”**: Users should be able to understand errors and how to fix them, without any extra knowledge.
10. **”Help and documentation”**: Users should be able to find help and instructions on how to use the system and every aspect of it, in a language that they understand.

2.11 Usability

There exists several definitions of usability. The ISO defines usability as ”The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.” [54]. Jakob Nielsen defines usability as ”a quality attribute that assesses how easy user interfaces are to use” [55].

2.12 Usability evaluation methods

2.12.1 Think Aloud

A think aloud is a method where the participant is given a set of tasks to perform in the system to be evaluated [56]. The participant should perform this tasks while saying out loud what they are doing and why, and the researcher should not intervene or talk while the participant is completing the tasks, the researcher is only able to comment once the tasks have been completed.

2.12.2 Stakeholder Walkthrough

This evaluation method brings project stakeholders and representative end users together in the same room to evaluate the system through a task-base scenario [57]. It provides a forum in which to identify and consider usability problems early in the prototyping process. Participants are used to complete a task and, afterwards, discuss amongst themselves the system, the task and any issues they might have run into.

2.12.3 Cooperative Evaluation

This is a more relaxed variation of Think Aloud where the participant is encouraged to ask questions and to criticise the system [58]. The evaluator can make clarifications if the participant encounters any problems or ask questions regarding the decisions of the participant when using the system.

2.12.4 System Usability Scale

The System Usability Scale is a simple, ten-item questionnaire that can provide a global view of subjective assessments of usability [59]. It includes statements that

will provoke agreement or disagreement in the participants. Items where there is ambiguity are not good discriminators of attitude, so such statements where avoided when creating this scale.

To analyse the data from the SUS questionnaires, researchers can follow the procedure laid out by John Brooke in his 1986 paper, where he first described the SUS [59]: sum the contributions of each item and multiply them by 2.5. The contribution of items with uneven number positions is the score position minus 1. The contribution of items with even number positions is 5 minus the score position.

To attribute this score a meaning, I followed the acceptability scale established by Aaron Bangor, *et al.*[69] and the grading scale [70] (see table 2.1 for the acceptability rating scale and table 2.2 for the grading scale).

Acceptability ranges	Mean SUS score
Not acceptable	below 50
Marginal	50 - 70
Acceptable	above 70

Table 2.1: SUS Acceptability Rating Scale (taken from [69])

Grade	Mean SUS score
F	below 60
D	60 - 69
C	70 - 79
B	80 - 89
A	90 - 100

Table 2.2: SUS Grading Scale (taken from [70])

Chapter 3

Methodology

This chapter presents the methodology used in each step of this project, including how I approached every step of the project and the methods and tools I used to carry out my plans.

3.1 Development stages

In the following sections, I describe the different phases I went through to complete this project. In figure 3.1, you can observe an overview of these phases and how the results of one phase led to the next one.

For this project I decided to use User-Centered Design (UCD) [Background - 2.7.1] to guide the design process. The reason for choosing UCD instead of Participatory Design (PD) [Background - 2.7.2] was the time limitations. Using PD, this project would have taken more time to finish than I had available as I would have had to ask participants to be more involved in the design of the app, acting as designers of the group. Not only would this have taken more time, but it would have been more difficult to get people to be participants, since it would mean they would have to give away more of their time. However, by using UCD, it allowed me to get a clear picture of what the potential users needed from such a system, without having to ask participants to get that involved in the process.

3.1.1 Requirements gathering

During this phase, my aim was to answer Research Questions 1 through 7: how students manage their time and tasks, both academic and general, what kind of issues they stumble upon and how they deal with them in terms of the methods or tools they use, focusing on students studying Informatics at the University of Edinburgh. I also aimed to learn about the kind of features they would like to have in a time management app. This, together with the research presented in chapter 2, helped me establish the target users' needs, and consequently the requirements for the system.

To do this I conducted 15 semi-structured interviews [48][Background - 2.8.2.3] with

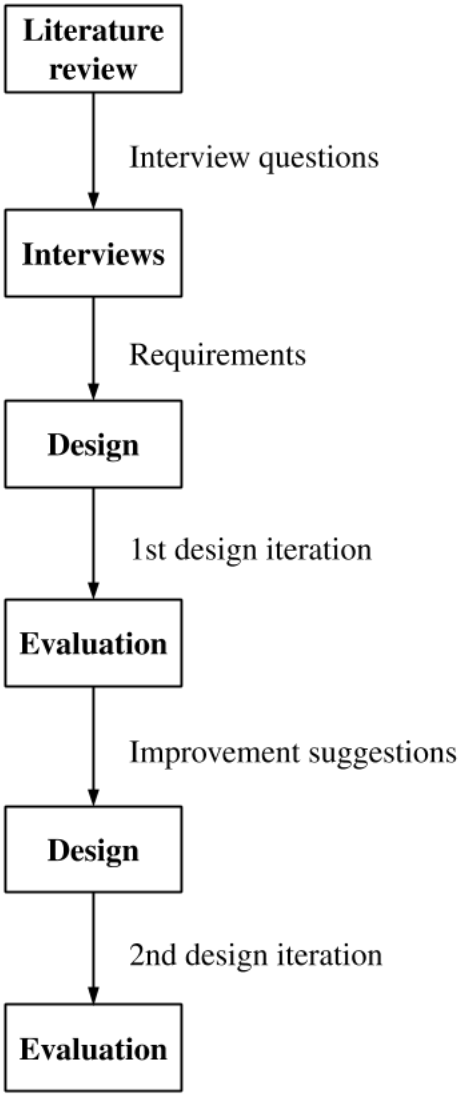

Figure 3.1: Phases of the project

students ranging from 2nd to 4th- year using questions inspired by the research. I decided to conduct semi-structured interviews [48] [Background - 2.8.2.3], together with note taking [Background - 2.8.5] and audio recording [Background - 2.8.6], as I already had an idea of what kind of information I needed for the project and I would later need to compare results between participants, but I also wanted them to be able to elaborate on any point they thought was important, so as to get the most accurate information possible. I considered to conduct a focus group [48] [Background - 2.8.3] study instead of interviews since it would save time and it would be more convenient, but I quickly discarded the idea as I thought the questions were of a somewhat personal nature and I did not want participants to feel embarrassed or to be influenced by the responses of other participants.

I also conducted unstructured interviews [48][Background - 2.8.2.2], together with note taking [Background - 2.8.5] and audio recording [Background - 2.8.6], with two staff members: an experienced personal tutor at the School of Informatics and an academic developer for taught students from the Institute for Academic Development (IAD). I decided to interview these two staff members since they both deal with students on a daily basis and have had experience advising students on how to manage their time. I decided to use unstructured interviews with both academic staff members in order for the participants to be able to share their knowledge without the constraints of a set of established questions.

I analysed the results from the interviews using thematic analysis [50][Background - 2.9.1] and a combination of top down and bottom up approaches using NVivo 11 [51][Background - 2.9.2]. When analysing, I started by creating themes for each of my interview questions, and as I noticed common data, I created new themes. Using this method allowed me to cover all the information shared by the participants, so that no point went unnoticed.

3.1.2 Design and Evaluation of First Iteration

During this phase I used the previously obtained requirements to answer Research Questions 8 and 9: how can we design a time management app for our target users that covers all of the requirements and how is the first iteration of the design perceived by potential users in terms of usability.

First, I made a hand-drawn sketch of my proposed design, which was then reviewed by my supervisor. This was helpful as it allowed me to show my ideas to my supervisor in a way that was easily editable and it allowed us to agree on a design that covered all the requirements. After reviewing the proposed changes, I used Figma [61] to create a low-fidelity prototype of my paper design. I decided to use Figma because I had previous experience using this software and it allowed the users evaluating the design to interact with the system.

To evaluate the first iteration of the design, I decided to conduct a study that consisted of a Think Aloud [56][Background - 2.12.1], a questionnaire [49][Background - 2.8.4] and the System Usability Scale [59][Background - 2.12.4], together with note taking [Background - 2.8.5] and audio recording [Background - 2.8.6], and had six

Informatics students participate in it individually. Ideally, I would have liked to have more participants, however, I did not have enough time to run the study with more participants.

I chose to conduct a Think Aloud to get a better idea of where users could get stuck or have difficulty interacting with the system. This kind of study also helped me detect flaws that should be improved in the second iteration of the design.

I analysed the results from the interviews using thematic analysis [50][Background - 2.9.1] and a combination of top down and bottom up approaches using NVivo 11 [51][Background - 2.9.2], similar to the previous phase.

3.1.3 Design of Second Iteration

During this phase, I used the results of the previous evaluation to construct a list of necessary changes and new requirements in order to improve the overall design and usability of the low-fidelity prototype, as well as adding any features that were not detected or overlooked during the requirements gathering phase (Section 3.1.1).

3.1.4 Final Evaluation

During this phase, my aim was to evaluate the final design in depth, and answer the Research Questions 9 and 10. To evaluate the second iteration of the design, I conducted a Stakeholder Walkthrough [57][Background - 2.12.2] with five Informatics students, which also included a questionnaire [49][Background - 2.8.4] and the System Usability Scale [59][Background - 2.12.4] at the end of the session, together with note taking [Background - 2.8.5] and audio recording [Background - 2.8.6]. My goal was to conduct at least two Stakeholder Walkthrough sessions with at least six students per session, but due to the Coronavirus pandemic [62] and sudden unavailability of some participants, I was not able to reach this goal.

Instead, I produced an online questionnaire [49][Background - 2.8.4], which covered Research Questions 9 and 10. To cover Research Question 9, I used the System Usability Scale (SUS) [59][Background - 2.12.4], which allowed me to get a good idea of how the usability of the system was perceived by the participants. I added other questions about the requirements I obtained from the interviews, to discern if the right requirements had been chosen or if they needed to be changed. Lastly, I asked what the potential impact of this system would be among Informatics students, in terms of productivity and health, in order to cover Research Question 10. This questionnaire was completed by 12 participants, all Informatics students at the University of Edinburgh, since they are the target users.

Furthermore, I conducted a Think Aloud study [56][Background - 2.12.1], which also included a short questionnaire [49][Background - 2.8.4] at the end of the session, together with note taking [Background - 2.8.5] and audio recording [Background - 2.8.6], with two Human-Computer Interaction (HCI) experts, to get a better idea of how the design could be improved in terms of usability (RQ9). I also conducted a Cooperative evaluation study [58][Background - 2.12.3], together with a short questionnaire

[49][Background - 2.8.4] about what could be missing in the design and the potential impact on students (RQ10), note taking [Background - 2.8.5] and audio recording [Background - 2.8.6], with the two staff members that were previously interviewed during the Requirements Gathering phase (section 4). I thought a Cooperative Evaluation study would be more appropriate in this case since these two staff members are not potential end-users, and I was just interested in them getting to know the app so they could give their opinion on how they thought this app could potentially impact students.

I analysed the results from the interviews using thematic analysis [50][Background - 2.9.1] and a combination of top down and bottom up approaches using NVivo 11 [51][Background - 2.9.2]. When analysing, I started by creating themes for each of main features of the app, such as Calendar and Time Tracker, and as I noticed common data, I created new themes. Using this method allowed me to cover all the information shared by the participants, so that no point went unnoticed.

Chapter 4

Requirements gathering

In this chapter, I present the process of the requirements gathering phase. To obtain the necessary requirements, I decided to conduct a study consisting of interviews [Background - 2.8.2] with Informatics students as well as some staff members who work supporting students during their time in university. These studies were approved by the University of Edinburgh School of Informatics, with RT 2019/83871. The method is fully described in Methodology - 3.1.1.

4.1 Aims

The goal during this phase was to learn more about how Informatics students, in particular, manage their time, inside and outside of the university, what tools or methods they find useful to manage their time, what kind of issues they run into, and what kid of features they would like to have in a time management app. I aimed to cover the Research Questions 1 through 7:

1. What is the typical daily schedule of an Informatics student?
    (a) Does it change during the weekend?
    (b) Does it change during the revision period?
2. How do they handle coursework?
3. What kind of issues do they run into?
4. Do they have problems with procrastination?
    (a) What are their main distractions?
    (b) How do they deal with procrastination?
5. What kind of methods and/or tools do Informatics students use to:
    (a) managing their studies?
        i. keeping up with their courses?

ii. meeting deadlines?

iii. reducing procrastination?

(b) managing their personal life?

6. What aspects of these methods/tools do they find useful?
7. What features would they like to see in a time management app for Informatics students?

4.2 Participants

I met with 15 Informatics students in total: nine 4thyear students, three 3rdyear students and three 2ndyear students (see table 4.1). I chose to have Informatics students from the University of Edinburgh participate in the study because the most appropriate way of establishing their needs is by discussing these with them, as part as the UCD process. I decided to interview a greater amount of 4thyear students since I considered that they would have more experience with time management at university and they would have a better sense of what methods work for them. For that same reason, I decided to only interview students in 2ndear or above. I would have liked to interview more students, however, it took a long time to find 15 students to participate in the study as well as an appropriate time for each participant. It also took a long time to analyse the collected data, so due to time constraints I was not able to have more students participate in the study.

Moreover, I recruited two members of staff: an experienced personal tutor and an academic developer for taught students at the Institute for Academic Development (IAD) [5] (see table 4.1). I chose these participants because they both have experience working with students to help them during their time in university as well as help them with time management issues. I contacted other departments in the University of Edinburgh to invite them to participate in the study, such as the Counseling service [4] and the Disability service [63], but both declined the invitation.

4.3 Data collection methods

I conducted semi-structured interviews [48][Background - 2.8.2.3] with student participants. I decided to conduct semi-structured interviews [48][Background - 2.8.2.3] as I already had an idea of what kind of information I needed for the project and I would later need to compare results between participants,but I also wanted them to be able to elaborate on any point they thought was important,so as to get the most accurate information possible.

I conducted unstructured interviews [48][Background - 2.8.2.2] with the staff members who participated in the study. I did not have a prepared set of questions for these interviews. I decided to use unstructured interviews [48][Background - 2.8.2.2] with both academic staff members in order for the participants to be able to share their knowledge without the constraints of a set of established questions.

Participant		Participant	
s1	4th-year student	s10	4th-year student
s2	4th-year student	s11	2nd-year student
s3	4th-year student	s12	4th-year student
s4	4th-year student	s13	4th-year student
s5	4th-year student	s14	3rdyear student
s6	3rd-year student	s15	2nd-year student
s7	2nd-year student	as1	Academic staff - personal tutor
s8	3rd-year student	ss1	Student support staff -
s9	4th-year student		academic developer from IAD

Table 4.1: List of participants

Throughout all interviews, I used audio recording [Background - 2.8.5] to collect the data, as well as note taking [Background - 2.8.5].

4.4 Materials

I composed a Participant Information Sheet for students (see Appendix B) and another for staff (see Appendix C). This document gives the potential participants the necessary understanding for the motivation and procedures of the study and sources of information to answer any further questions. This includes: information about the researchers and the study, the impact of participation, such as risks and benefits, and information about data protection.

I composed a consent form (see Appendix A), which was used to obtain the consent from the participant. In this form, the participant was asked to confirm to have had access to the participant information sheet, to have understood the purpose of the study, and that their participation was voluntary. They were also asked to approve (or not) of being audio recorded and have their anonymised data be used in academic publications and in future ethically approved research. Finally, they were asked to confirm agreement to take part in the study.

I had a prepared set of questions (see Appendix D) for the semi-structured interviews [48][Background - 2.8.2.3] with students. I designed the questions so that the interviews would not take more than 30 minutes each. This helped to get all the relevant information and to focus on the topic at hand, instead of going off topic.

The interview questions aimed to cover Research Questions 1 through 7: how Informatics students manage their time and their work, what tools or methods they find useful to manage their time and what kind of issues they run into, amongst other things.

4.5 Procedure

When the potential participants were being contacted by email, they were sent the Participant Information Sheet (PIS) (see Appendix B), so they could review all the information before agreeing to meet for an interview.

4.5.1 The study with students

On the day of the interview, I would ask the participant to meet with me in an empty room in a building of the University of Edinburgh School of Informatics, and once there I would hand them a printed copy of the participant information sheet and consent form. They would fill in the consent form and we would both sign it. I would let them know that I was about to start recording and ask if they would like to ask or add anything before the recording started. I would ask them the questions from my prepared list of questions, following up on any details I thought were interesting or relevant. Once all the questions were over, I would stop the recording and ask them if they had any questions or comments. Lastly, I would thank them for their participation.

4.5.2 The study with the staff

On the day of the interview, I would ask the participant to meet with me in their office, and I would hand them a printed copy of the participant information sheet and consent form. They would fill in the consent form and we would both sign it. I would let them know that I was about to start recording and ask if they would like to ask or add anything before the recording started. To start the interview, I would ask them about their role in the University. Because they were aware of the aim of the study, they would direct their answers towards time management. If they said anything worth chasing of if I had any questions about what they were talking about, I would follow up with another question. Once the interview was over, I would stop the recording and ask them if they had any questions or comments. Lastly, I would thank them for their time and say goodbye to them.

4.6 Analysis

After the sessions, I transcribed every recording from the interviews and analysed these transcriptions together with the notes taken during the sessions, with NVivo 11 [51][Background - 2.9.2] using thematic analysis [50][Background - 2.9.1] and a combination of top-down and bottom-up coding. When analysing, I started by creating themes for each of my interview questions (see Appendix D), and as I noticed common data, I created new themes and sub-themes. Once I was done analysing all the interviews, I went through the transcriptions again checking that the theme selected for each point was still the correct one. Using this method allowed me to cover all the information shared by the participants, so that no point went unnoticed. My full list of nodes can be seen in Appendix E.

4.7 Results

4.7.1 Daily schedule

This section aims to answer Research Question 1: what does the daily schedule of an Informatics student look like, and does it change during the weekend or during the revision period.

All the students had very different schedules: some had part-time jobs (6/15), most took part in activities or societies (9/15), and one of them had lectures at a different campus (1/15). However, there were certain aspects in their schedule that held some similarities.

Most of the interviewed students (9/15) came to campus most days, even if they did not have any contact hours, to do independent study. During the weekend, the schedule stayed almost the same for most students (8/15), although some of them would take advantage of not having contact hours to take some time to do chores and/or sleep longer (5/15), and one of them took advantage of it by studying more (1/15). During revision weeks, their schedule again does not change that much (8/15). Two of them (2/15) said they would schedule their revision more strictly, and two other students (2/15) mentioned that, if the dates allowed it, they would dedicate the last few days before an exam to that subject.

When asked if they planned their time, almost all students (12/15) said they did. These students mentioned they used the following tools to do so: Trello (2/15) [Background - 2.6.4], Outlook Calendar (3/15) [Background - 2.6.1], Google Calendar (4/15) [Background - 2.6.2], paper calendar/planner (4/15), Notes app (2/15).

In order to manage to follow this plan they set for themselves, three of the students (3/15) said it was important to be flexible and add buffers to your plan. One of the participants (1/15) said that prioritising tasks was very helpful for them and another one of the students (1/15) said that motivation was very important.

"I'll treat myself or do something I enjoy after I finish all of it, so it is rewarding." - s5

4.7.2 Challenges faced by students

This section covers Research Questions 2 through 4: issues faced by students, such as dealing with coursework deadlines and procrastination.

After analysing the results I found that one of the main issues students face (10/15 students) while studying in university is dealing with an unstructured schedule. Most of their time is spent on independent study, but their schedule often ends up being driven by coursework, as these are usually the only deadlines they have throughout the teaching period. This causes students to neglect other responsibilities, such as attending lectures or tutorials (7/15 students). Some students will even sacrifice their sleep in order to keep working on coursework (3/15 students). As a result of this, when the revision period arrives, they are unprepared for exams and feel the pressure to catch up in a few days, as mentioned by the experienced personal tutor (1/2 staff).

"Some students neglect their courses because they spend most of their time on coursework, and towards the end of the semester, they get stressed because they need to catch up." - as1

Both staff members interviewed (2/2 staff) expressed concern about how all of this can end up affecting students' mental health. They explained that students do not only feel the pressure to perform well on coursework and exams, but they also need to keep a healthy lifestyle -healthy eating, exercise, enough sleep- while maintaining a social life. This can leave them feeling very overwhelmed.

"It's very common for students to feel overwhelmed and anxious with the amount of work they are expected to get through, which I think is achievable if you're organized and make good use of your time." - ss1

According to the personal tutor (1/2 staff), this can lead to students thinking that the best immediate solution is to neglect what they think is non-essential, like spending time cooking a healthy meal, exercising or getting enough sleep. This behaviour can be significantly harmful to the mental health of the student.

"Something that is very important too is students' health. Studies can get quite intense, students can get stressed and can be working late at night, not getting enough sleep, not getting exercise, not eating properly. We see a lot of stress, mental health problems in students, and there's a question there of whether good time management can help with reducing that." - as1

Moreover, one issue that affects everyone, not only students, is procrastination. All students interviewed (15/15) stated that they procrastinated, most of them by spending time on social media or the Internet in general (12/15 students). Some students outside of Informatics will completely turn off all of their devices or disable their Internet connection [19]. However, Informatics students cannot resort to this method, as they often need Internet access and some type of device to complete their work, which can potentially increase the time they spend distracted instead of working.

4.7.3 Tools and methods they use and what they like about them

This section aims to answer the Research Questions 5 and 6: what kind of methods and tools students use for time management and what aspects of these tools do they find the most useful.

4.7.3.1 Calendar

Most students (9/15) said they used some kind of calendar, either in app form or on paper, to manage their time. Some students used Outlook calendar (5/15) [37][Background - 2.6.1] because their contact hours are uploaded and updated automatically, which makes it easier for them to stay on top of their university schedules. Some students (4/15) used Google Calendar [38][Background - 2.6.2], although two of those students (2/15) used it in combination with other tools. One of those students (1/15) used Google Calendar together with MyStudyLife [39][Background - 2.6.3], as MyS-

tudyLife is very academically focused and they did not feel like they could use MyStudyLife for everyday events and chores.

"The reason I use Google Calendar is because when I plan my weekly schedule it is not just academia, I also meet with friends and do other things. I can set other events and reminders. Google Calendar is more useful to plan my whole life, unlike MyStudyLife which is only useful during term time and for academic purposes." - s1

Two of the students (2/15) mentioned that what they like about calendar apps is to be able to visualise your schedule quickly and clearly.

"I like that they show me exactly what I am doing at each period of the day, it is really clear."

4.7.3.2 To-do lists

Most students (10/15) stated that they write to-do lists, in one way or another. Some of them (5/15) used a combination of apps and physical tools, e.g. Trello [Background - 2.6.4] and paper, or paper planner and Notes app. Some of those students (4/15) stated they would write different to-do lists for tasks for the day and tasks to be completed throughout the week. Three students (3/15) declared they used the default notes app in their phone for daily tasks, as this helped them write and check their to-dos quicker. One of them (1/15) revealed that they only used to-do lists for their job. Another student (1/15) declared that they only did to-do lists for tasks that had to be completed in a short amount of time since they would forget to check the list if the tasks spanned over a longer period of time.

Some students (5/15) said that they do not write to-do lists, citing different reasons: three of them (3/15) stated that they remembered the tasks in their heads, and one of them (1/15) said that they had tried writing to-do lists but gave up because they would forget to check the list or forget what they wrote. Another student (1/15) declared that they wished they would write them, as they thought that would make them more productive.

In order to complete tasks, two of the students (2/15) mentioned that they check their lists often and move tasks around -to another day or week- if necessary. Over half of them (8/15) mentioned they liked to prioritise their tasks, to know which tasks they should complete next. A few of them (2/15) said they used colour-coding to prioritise, and another student (1/15) mentioned that they would sometime use the Eisenhower matrix [27]. Some of them (4/15) declared they liked to break down bigger tasks into smaller steps, and two students (2/15) mentioned they liked to group tasks together by subject or if they are similar.

A few students mentioned some features they find useful in the tools they currently use:

- Tasks with deadlines (2/15 students): Two students said they like to add deadlines to tasks, as this helps them accomplish these tasks.

  "I quite like doing to-do lists with dates on them. If I do not have a clear dead-

line, it sometimes creates the feeling that I can just do it whenever, but if there's a deadline I quite like to beat the deadline." - s3

- Ticking off completed tasks (2/15 students): Two students mentioned they liked being able to tick off tasks when they complete them, as it gives them a sense of achievement.

  "Once a task is completed, I can tick it off, and that is actually quite motivating" - s12

4.7.3.3 Physical tools

Two of the students (2/15) mentioned they used physical calendars to write important dates in, like deadlines, but both of them used apps as well. Two other students (2/15) said they used a physical planner to manage their time. One of them (1/15) used a paper planner together with the Bullet Journal system [6], which they said they liked because of its flexibility.

"I can be creative with it, I can design the pages. I can also just add a list wherever, there is no template to complete, I can put whatever I want. I also like that I can change sizes of stuff, like days, for example, for when there are days when I have to get more stuff done." - s15

4.7.3.4 Other

- Two students (2/15) brought up alarms, as they used them to remind them of things they need to do, or just to wake up in the morning.
- One of the students (1/15) mentioned that they used a Gantt Chart [64] for their coursework deadlines.
- One student (1/15) said they had a big to-do list with all the things they needed to do throughout the semester, with dates next to each task. They said they used it when they were behind and needed to catch up.
- One of the students (1/15) claimed they used no methods or tools for time management.

4.7.4 Features they would like to see in this app

This sections aims to answer the Research Question 7: what kind of features would Informatics students like to have in a time management app.

4.7.4.1 Calendar

In section 4.7.3, we saw that over half of students (9/15) used some kind of calendar app and that a few (4/15) used a calendar in physical form. This is supported by both staff members (2/2) and the literature (see section 2.4). A couple of students (2/15) as well as the personal tutor (1/2) expressed an interest in having assignment deadlines uploaded to the calendar in the app automatically and easily visible to users. The way

deadlines could be made easily visible to students is by showing these deadlines in the form of a Gantt chart [64] -suggested by one student (1/15)-, which could potentially help students have a better idea of how they should distribute their work and what assignments will overlap. Both of these features could make it easier for users to set up the app and use it on a daily basis.

"Ideally, at the start of the semester you know when the start and due date for coursework are, and you can try to plan accordingly." - as1

Some students mentioned some features that calendar apps usually include, that they find useful and would like to be included in an app like this one, such as reminders and notifications before an event (6/15 students and 1/2 staff members), colour-coding (7/15 students), recurring events (2/15 students), different layout options -month, week, 3 days, day- (2/15 students), and being able to add other email accounts in order to combine all calendar events into the same calendar (1/15 students), since students sometimes have separate emails -student, staff, personal-, and when they get invitations to different meetings and events, and it is all in different calendars or apps.

4.7.4.2 To-do lists

In section 4.7.3.2, we saw that two thirds (10/15) of interviewed students used to-do lists in different ways. Some students mentioned several things they would like to have as part of a to-do list feature:

- Prioritisation (10/15 students and 1/2 staff): The academic developer stated that prioritisation is one of the most important strategies for time management. This is also supported by research (see section 2.4). The user should be able to assign certain tasks as important. Tasks will then be able to be listed in order of importance.
- Grouping (2/15 students): A few students mentioned they liked grouping tasks by course, theme, or activity. Such a feature would allow the student to keep their tasks organised and it would be easier for them to find what they need to do.
- Task progress (2/15 students): Two students brought up the task progress bar included in MyStudyLife [Background - 2.6.3], they both thought it would be a good idea to include in a time management app.

  "I think it's an easier way to view how far you are in something. Especially when you have a lot to do or a big coursework, it's nice to see you've made progress." - s1

- Adding tasks quickly (2/15 students): Two students said that it would be important to be able to add tasks quickly, so that they do not forget what they need to do. This could be done by allowing the user to add a task by simply choosing its title and no other details.

  "When I'm writing down my to-do list, I'm not thinking about it, I just remember something I need to do, so I need to be able to add it super quick and simple." -

s12

4.7.4.3 Tasks on calendar

Almost half of the students (7/15 students) mentioned they would like to have the calendar and to-do lists combined, by being able to link tasks or task lists to certain calendar events, or even add a task to your schedule. A couple of them (2/15 students) suggested the app could ask the user through a notification if the tasks were completed, after the event had finished. I believe this way the user can keep better track of their task list and their tasks, as 3 out of 15 students said they did not use to-do lists often because they forgot to check them.

"You could potentially link an event to what you actually you're planning to do during that time period." - s3

"What I am missing from Google Calendar [38] is to add a to-do list to a specific event." - s10

"I think an app that combines a calendar with a to-do list would be really useful." - s14

"If time periods were linked to tasks, giving the option to complete a task after the event, having the phone ask you: "Did you manage to complete this task?", that might be quite useful. That helps to maintain and update your to-dos, rather than doing what most people do of leaving the lists for days and forget about it." - s3

4.7.4.4 Tracking time

A few students as well as both interviewed staff members (3/15 students and 2/2 staff) said they thought it would be useful to have the app track the amount of time students spend on every study session or working on a coursework. Students suggested this as a method to control how much time they spend working on a specific coursework, or how much time they spend procrastinating.

"I think it would be useful to see how much time I set out for work and how much I actually spend doing the work." - s14

The personal tutor suggested that this information could be fed back to course organisers. This way they would be able to know if the coursework is too easy, in order to correct it for future years, or if students are spending more time than estimated on a certain assignment, they would able to change the deadline or the coursework specification.

"If such an app detects that students are spending a huge amount of time on given coursework, perhaps that information could be fed back to the course organizers while coursework is still going on, so that they are aware that students are spending way more time than they budgeted." - as1

The academic developer, on the other side, proposed that every activity should be tracked since knowing how long students take on any daily activity, such as walking to campus or cooking dinner, would help them schedule their time better.

"The app could record how long it takes them to do things, like basic things they have to do over and over, so that in the future they can allocate the right mount of time to do something like that." - ss1

4.7.4.5 Help distribute work

A few students (3/15) and the personal tutor (1/2) thought it would be useful to have the app suggest times in their schedule when the student could be working on an assignment. This would help the students schedule their work better and more evenly throughout the time that they have available before the deadline, instead of cramming all the work during the last few days before the deadline, which 7 out of 15 students said they sometimes do. The app would use the student's schedule on their calendar and the estimated number of hours the student is supposed to be working on an assignment to automatically assign time blocks for this work.

"You know how they give you an estimate of hours you need to spend of a coursework? The app could automatically suggest when you should be working on the coursework. If the calendar could find where you have free time, it could suggest the timings." - s10

4.7.4.6 Reward system/Achievements

Three out of the 15 students (3/15 students) interviewed as well as the academic developer from the IAD expressed an interest in having a reward system implemented into the app. This could hopefully encourage students to use the app, and in turn to schedule their time on a regular basis. This system would reward students for simple things at the beginning such as connecting their university account with the app in order to get the schedule information, or for using the app consistently and efficiently, e.g. using the app 5 days in a row or ticking off all the tasks scheduled for today. This system could also be used to encourage students to spend more time studying, e.g. a reward for studying 80 hours this week.

4.7.4.7 Other

Some other suggestions offered by participants are provided below:

- Easy to use and set up (7/15 students)
- Everything in one place (3/15 students): Three students said they would really like to have everything in one place, referring to everything in their life -like tasks and events- but also referring to the important information on their courses, like dates and schedule.

  "Course organisers do not use just one place to post all course information, which is unfair to us, because instead of looking at one place we have to search for it in different places." - s1

- Monitor how much time users spend on coursework and notify them if they are behind schedule (1/2 staff)

"Tell the app: this week I am spending 2 hours on this and 2 hours on that, so half-way through the week the app can say if you're behind on something and if today you should put some more time into that." - as1

- Life management (1/15 students and 1/2 staff): The personal tutor as well as one of the students pointed out that users should be able to use the app to manage their studies as well as the rest of their lives.

  "An app ideally should be holistic, not only helping them with their studies but also helping them with the rest of their lives as well. [...] This app is life management, as much as study management." - as1

- Feedback (1/2 staff): The personal tutor interviewed mentioned it could be useful to have user feedback sent to the people maintaining the app, on how it is performing and how well it is perceived.

4.8 Requirements

In tables 4.2 and 4.3, I have gathered a list of requirements extracted from the results of my studies. I have assigned each requirement a level of priority, which helps distinguish which requirements should be included in the design.

The following are the requisites for the three different levels of priority:

- High: A requirement will be prioritised as high if it is supported by research or supported by at least five participants. A requirement will also be prioritised as high if it is common of time management apps. There might be features which were not mentioned by many students because they take for granted that they will be included in the app, due to being common features in existing apps.
- Medium: A requirement will be prioritised as medium if it is supported by at least two participants.
- Low: A requirement will be prioritised as low if it is supported by at least one participant.

When creating the design, I will aim to add all high requirements and some medium requirements that I deemed necessary. I will also add a few low requirements if I think they are a good idea and would like to test them out during the evaluation.

4.9 Coverage of requirements by Existing tools

I will only include apps that have a mobile version available and are free, the apps that were discussed in the background - section 2.6. I will be focusing solely on the features offered on the mobile apps, and not on the desktop versions of these apps.

In table 4.4, I show what existing tools have the features that I gathered from my studies. I have included only the requirements marked as high or medium from tables 4.2 and 4.3. From the table, it is clear to see that none of the reviewed tools include

all of the features extracted from the study. However, we can also see that some of the features are present in most of the apps, which could mean that these kind of features are important for users of these kind of apps. Some tools, like MyStudyLife, are aimed at students and present a combination of calendar and to-do lists, but lack the capability of covering things outside of academia.

4.10 Summary

In this chapter, I described the studies I conducted in order to gather the requirements for the app. I discussed what methods I used and what kind of participants took part in the studies. I also discussed the results I extracted by analysing the data provided by the studies, and summarised it into a list of requirements for the app. Lastly, I examined some of the most popular time management apps, which are further described in the background (see section 2.6).

#	Requirement	Priority	Reason For Priority
1	Calendar system	High	Supported by 13/15 students, 2/2 staff members and research (see section 2.4).
2	Have contact hours automatically uploaded	High	Supported by 5/15 students. It would make the calendar easier to set up.
3	Have assignment deadlines automatically uploaded	Medium	Supported by 2/15 students and 1/2 staff members. It would make it easier to set up.
4	Use a Gantt Chart [64] to display assignment deadlines	Low	Supported by 1/15 students.
5	Reminders and notifications for events	High	Supported by 6/15 students and 1/2 staff members.
6	Colour-coding	High	Supported by 7/15 students.
7	Recurring events	High	Useful for events that repeat, like lectures, and very common in calendar apps. Supported by 2/15 students.
8	Different calendar viewing options (month, week, 3-days, day)	High	Supported by 2/15 students and very common in calendar apps.
9	Synchronise calendars from other accounts	Low	Supported by 1/15 students.
10	To-do lists	High	Supported by 10/15 students and by research (see section 2.4).
11	Add deadlines to tasks	High	Supported by 2/15 students. Useful for students to stay on top of their tasks and very common in to-do apps.
12	Tick off tasks to mark them as completed	High	Supported by 2/15 students. Included in all task management apps, very basic feature.
13	Prioritise tasks	High	Supported by 10/15 students, 1/2 staff members and research (see section 2.4).
14	Group tasks	High	Supported by 2/15 students and research (see section 2.4).
15	Task progress bar	Medium	Supported by 2/15 students.
16	Quickly adding tasks	Medium	Supported by 2/15 students.
17	Have tasks linked to calendar events	High	Supported by 7/15 students.
18	Ask the user after the event if the tasks were completed	Medium	Supported by 2/15 students.
19	Tracking time	High	Supported by 3/15 students, 2/2 staff member and research (self-assessment behaviour - see sections 2.2 and 2.4).
20	Feedback time tracking information to course organisers	Low	Mentioned by 1/2 staff.
21	Help distribute work	Medium	Supported by 3/15 students and 1/2 staff members

Table 4.2: List of requirements

#	Requirement	Priority	Reason For Priority
22	Reward System	Medium	Supported by 3/15 students and 1/2 staff members.
23	Easy to use and set-up	High	Supported by 7/15 students.
24	Have everything in one place	Medium	Supported by 3/15 students.
25	Monitor how much time the user spends on something and notify if behind schedule	Low	Supported by 1/2 staff members
26	Life management	Medium	Supported by 1/15 students and 1/2 staff members.
27	Feedback	Low	Supported by 1/2 staff members

Table 4.3: List of requirements (cont.)

Requirement	Outlook	G.Calendar	MyStudyLife	Trello	Todoist	To Do
1. Calendar	X	X	X			
2. Contact hours uploaded	X					
5. Reminders	X	X				X
6. Colour-coding	X	X	X	X	X	
7. Recurring events	X	X	X			
10. To-dos			X	X	X	X
11. Deadlines			X	X	X	X
12. Tick off tasks					X	X
13. Prioritising			X	X	X	X
14. Grouping				X	X	X
17. Tasks linked to calendar						
19. Time tracking						
21. Help distribute work						
22. Reward system						

Table 4.4: List of available features by existing tools

Chapter 5

First iteration of the design

In this chapter, I will discuss the different decisions I took to create the first iteration of the design and I will present the evaluation study I conducted to evaluate the first iteration of the design. You can find all the screens of the first iteration here.

During the evaluation, I aimed to answer research questions 8 and 9: how we can design a time management app for students and how do students perceive the usability of the app. The evaluation study was ethically approved by the University of Edinburgh School of Informatics with RT 2019/49519. The methodology of the first evaluation is described in Methodology - 3.1.2.

5.1 Design decisions

With this first iteration of the design, I aimed to cover all requirements from the table 4.2 with a priority level of high, and some with medium priority.

5.1.1 Colours and font

For this design I decided to only use the font Montserrat, as I thought it is clear enough for everyone to be able to read.

For the main colours I chose to use a combination of the colours seen in figure 5.1. For the font, instead of using black on white (or vice versa), I chose instead a dark grey (#444444). A research study found that ”the striking effects of contrast polarity suggest that it may not be advisable to read black text on white background.” [65].

5.1.2 Dashboard

The dashboard or home screen displays the events and tasks you have for today and you can see it in figure 5.2.

On the top bar, you can find the date and the Menu icon, which will take you to the menu screen. On the bottom, you can find quick access bar which will allow you to navigate to other parts of the app quicker. In this case, we have (from left to right), the

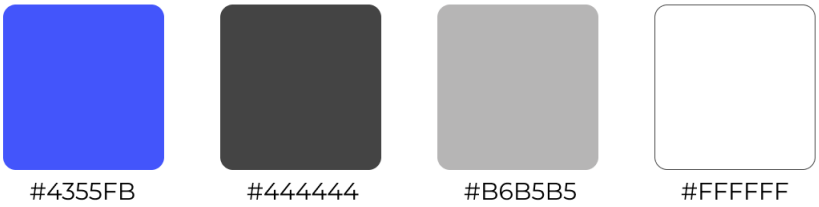

Figure 5.1: Colours used in the design

Tasks icon, which takes you to the Tasks screen, the Home icon, which takes you back to the current screen, when you're in another screen, and the Calendar icon, which takes you to the Calendar screen. The quick-access bar and the Menu icon are both used throughout the app. Both of these elements are very common in other well-established apps. Outlook [Background - 2.6.1] includes both elements and all other apps I described in the Background chapter (see section 2.6) include the Menu icon.

The top-half of the screen shows the events from the calendar that are occurring today under "Upcoming". Each event card shows the time when the events starts, the duration, the title and the group that events belong to (e.g. Computer Security, Software Testing). Each card uses different colours, each colour representing a different group (e.g. orange is assigned to Software Testing), in order to better differentiate events. This part of the screen can be scrolled vertically, which I decided to add in order to be able to see the rest of the events, in case they do not all fit in that section of the app.

The bottom-half of the screen shows the tasks that were assigned for today under "Today's tasks". Each task card shows the title, the group and other details such as how many days until the deadline (if a deadlines is set), or when the reminder will be (if a reminder is set). Each card is also colour-coded following the same colours as with the event cards. Lastly, each event card includes a checkbox that you can check once the task has been completed. This part of the screen can be scrolled horizontally. I decided to have horizontal scroll instead of vertical scroll in this section because it creates a sense of separation and distinction from the other section which display the events.

5.1.3 Menu

The menu screen includes buttons to reach other parts of the app, as seen in figure 5.3. As you can see from the menu, these screens cover requirements 1, 10, 19 and 22.

Each button includes not only an icon, but also the name of the screen it will take you to, following one of the ten heuristics, "recognition rather than recall" (see section 2.10).

5.1.4 Calendar

When you click on the Calendar button, either from the menu or the quick-access bar, the Calendar screen opens, as seen in figure 5.4. This screen shows you all the events

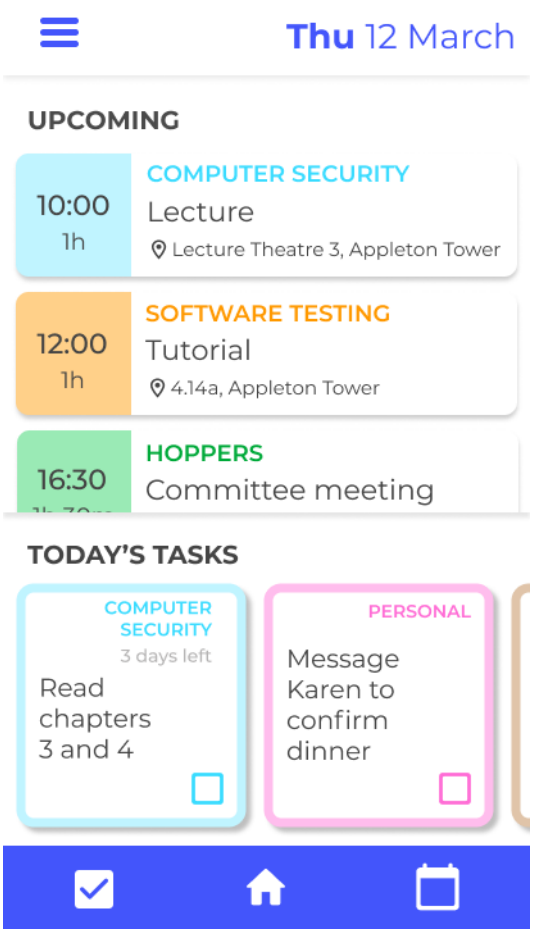

Figure 5.2: Dashboard screen

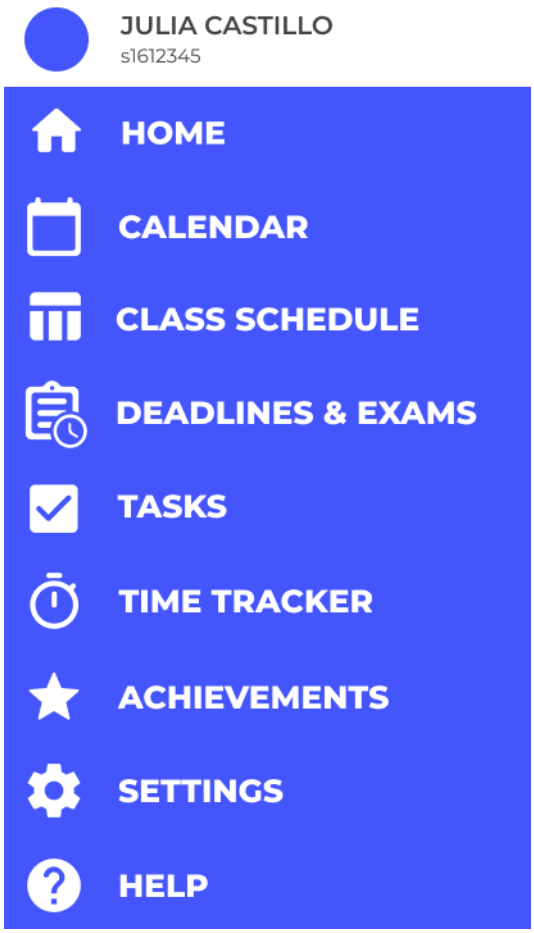

Figure 5.3: Menu screen

you have in your calendar, with the same format for the event cards as in the dashboard screen. This covers requirements 1 and 6.

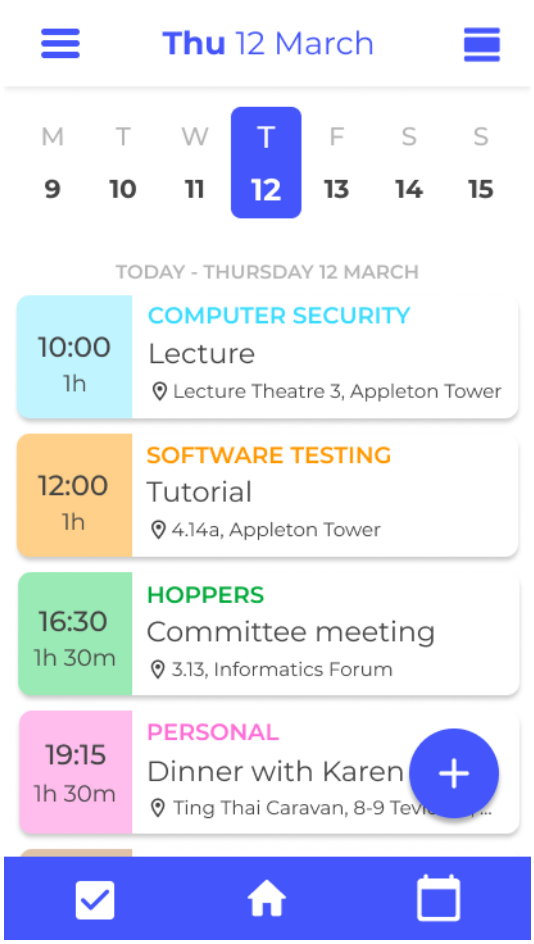

Figure 5.4: Calendar screen

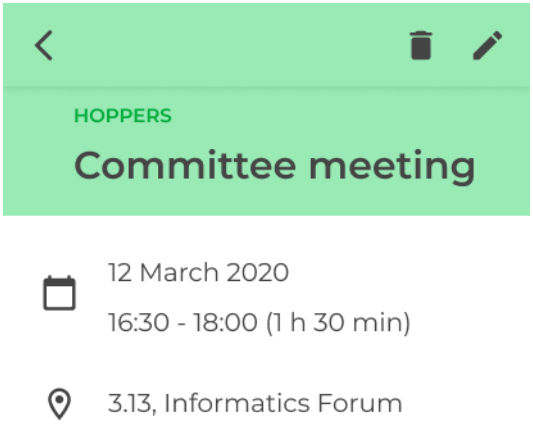

Figure 5.5: Event screen

On the top bar you can see the menu icon as before, the date, and another icon, which when pressed, will show you different layouts for the calendar, which would cover requirement 8. Underneath the top bar are the days of the current week. This part can be scrolled horizontally to reveal more days, which is something Outlook includes [Background - 2.6.1]. You can select one of these days to see the events for that day.

This screen also includes a blue floating button in the bottom-right part of the screen with a ”+” on it. This button will allow you to add an event. These kind of buttons (round floating buttons on the bottom-right of the screen) are very common in mobile apps, so I decided to use this format throughout the app to add elements, in this case it adds an event.

When you select an event, a screen like the one seen in figure 5.5 opens. This screen shows the information of the event selected. On the top bar, you can see an edit button (pencil icon), a delete button (dustbin icon) and a back button (arrow icon), following one of the ten heuristics: ”user control and freedom” (see section 2.10).

When you select the blue floating button in the Calendar screen or the edit button, another screen will open. If you clicked the edit button, the screen will be populated with the information from that event, as seen in figure 5.6. If you clicked on the blue

button, the screen would be the same, except it would not be populated, as you would be creating a new event from scratch.

In figure 5.7, you can see the same screen with numbers assigned to each element:

1. Close button: it takes you back without saving any changes.
2. Save button: it saves the changes made to the existing event or it saves the new event.
3. Title of the event
4. Event group to which the event belongs to. If you click on the arrow, a drop-down menu will all the groups will appear and you will be able to select one of them.
5. Date and time of the event
6. Location of the event
7. Add tasks to the event: By clicking here you will be able to select from your pre-existing tasks (see section 5.1.5) to add to your event, thus covering requirement 17.
8. Repeat event: It lets you select if the event should be repeated and how often. This covers requirement 7.
9. Reminder: It allows to set up a reminder before the event. This covers requirement 5.
10. Notes: It lets you add any comments or notes to the event. This was not one of the requirements, but it is something that most calendar apps include, and I think it can be useful, so I decided to add it and check this in the evaluation.
11. People: It lets you invite people to event. Like the previous item, this was not one of the requirements, but it is something that most calendar apps include. This can be helpful to students when planning an event to work on a group project or when organising a group event.
12. Delete button: This button lets you delete the event.

5.1.5 Tasks

When you click on the Tasks button from the quick-access bar or from the menu, the screen seen in figure 5.8 will open. This screen shows a list of the tasks assigned for today.

In the top bar, you can find the menu icon, the name of the current task list, the Sort icon, and the More options icon. When clicking on the sort button, a drop-down menu will appear with different options on how to sort the tasks, for example by deadline, by priority, by name, etc. This kind of option is included in some to-do apps, such as Todoist [Background - 2.6.5].

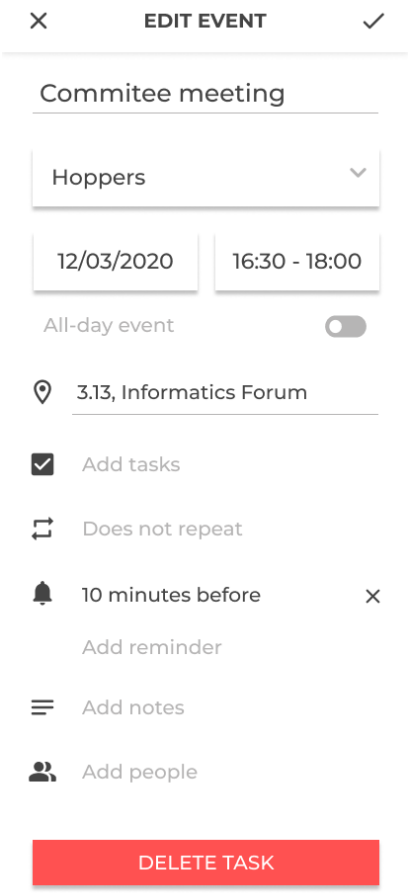

Figure 5.6: Screen to edit an event

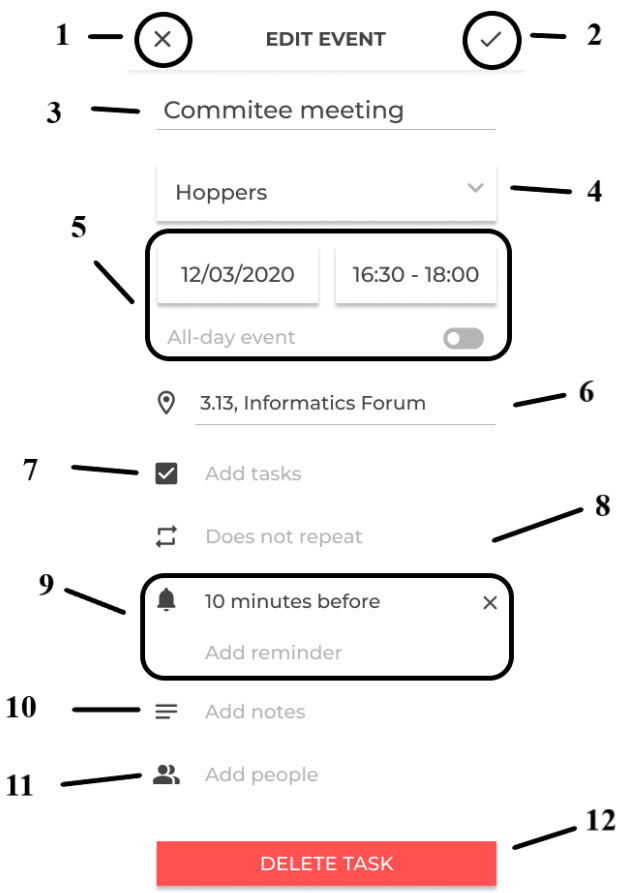

Figure 5.7: Screen to edit an event with numbers assigned to each element

Every task has a checkbox on the left that you can select once you complete that task to tick it off, which covers requirement 12.

When clicking on the menu button from the Task screen, the menu seen in figure 5.9 will appear. This version of the menu still lets you choose one of the other features of the app (on the left), but it also shows you the different tasks lists available. In the bottom, there is a button to create a new list.

I decided to have a different menu for the Tasks screen since I had to show the different task lists in a way that can be easy accessible, so I chose to do it this way and test it during the evaluation.

In the Tasks screen, there is also a blue floating button, similar to the one in the Calendar screen. By pressing this button or by pressing one of the tasks, you will be redirected to the screen shown in 5.10.

In figure 5.11, you can see the same screen with numbers assigned to each element:

1. Back button: It allows you to go back to the previous screen without saving any changes.

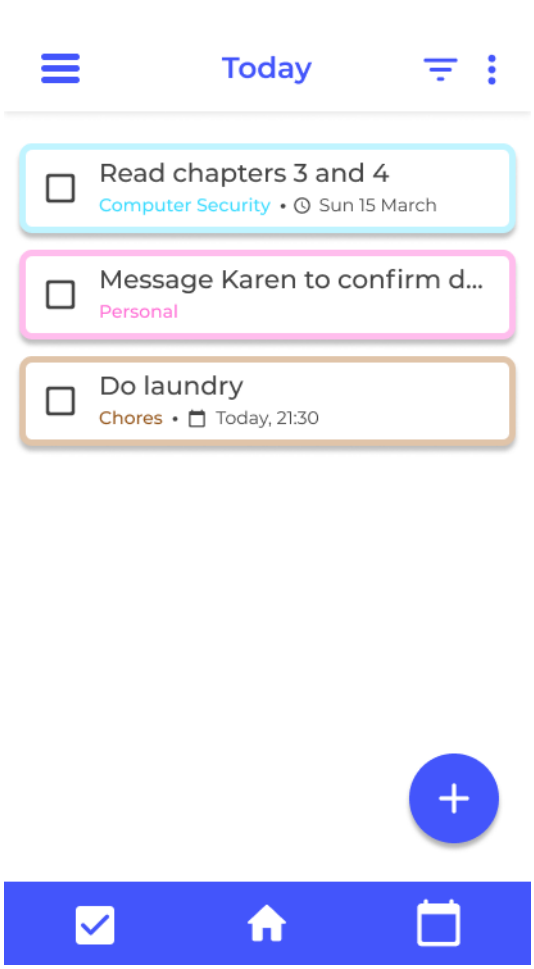

Figure 5.8: Tasks screen

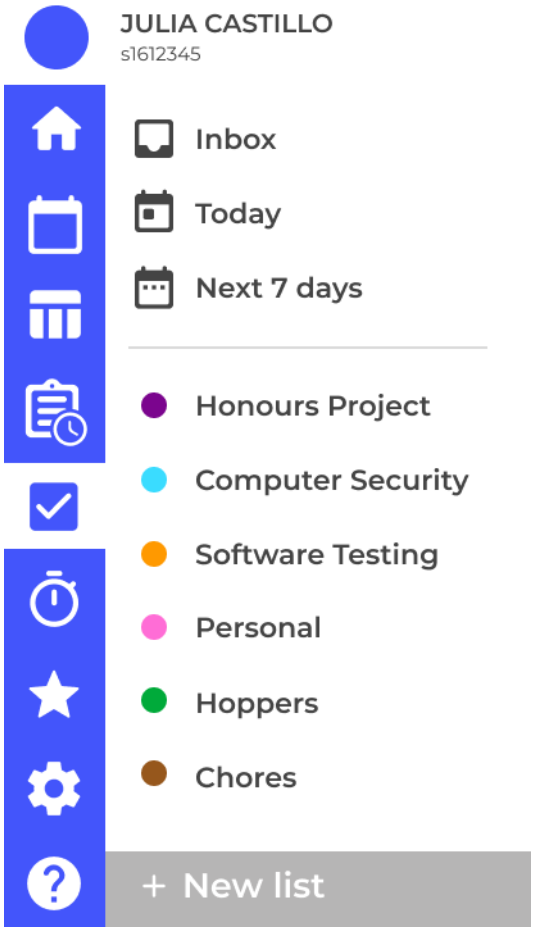

Figure 5.9: Menu screen accessed from the Tasks screen

2. Save button: It saves the changes made and goes back to the previous screen.
3. Title of the task
4. Subtasks: You can add subtasks to the task, and tick them off. Being able to have subtasks was supported by the research (see section 2.4).
5. Task list: You can assign the task to one of the task lists. This covers requirement 14.
6. Add to Today button: This allows you to add the task to your list of tasks to do today. I think this can be useful, as once you have selected the tasks you want to do today, you are able to focus on those ones, without seeing all the other tasks you need to complete.
7. Reminder: Similar to the reminders for events. This covers requirement 5.
8. Add deadline: It lets you set a deadline for this task. This means the task should be completed before this deadline. This covers requirement 11.
9. Add to calendar: It lets you add this task to the calendar. You can add this task

simply as it is to the calendar or you can add this task to an event. This covers requirement 17.

10. Set a priority: It lets you set a priority level. This covers requirement 13.
11. Repeat: Similar to the option in events.
12. Notes: Similar to notes for events.
13. Delete button: This button lets you delete the task.

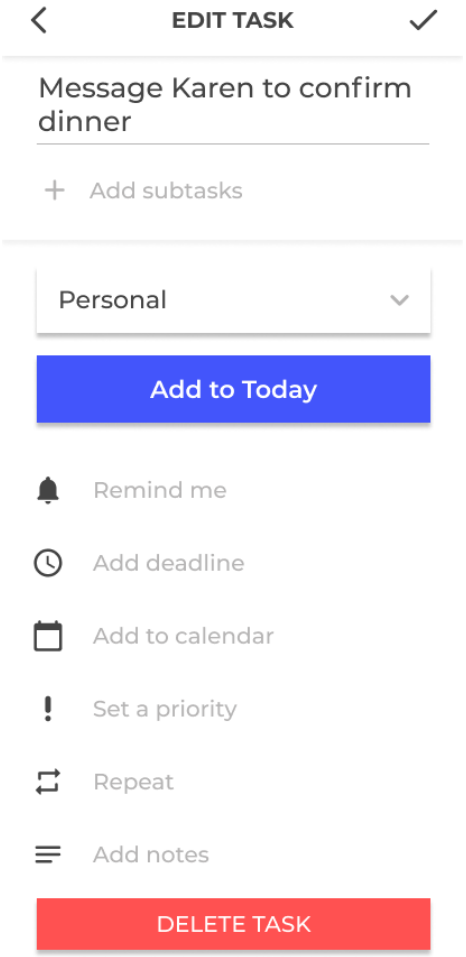

Figure 5.10: Screen to edit a task

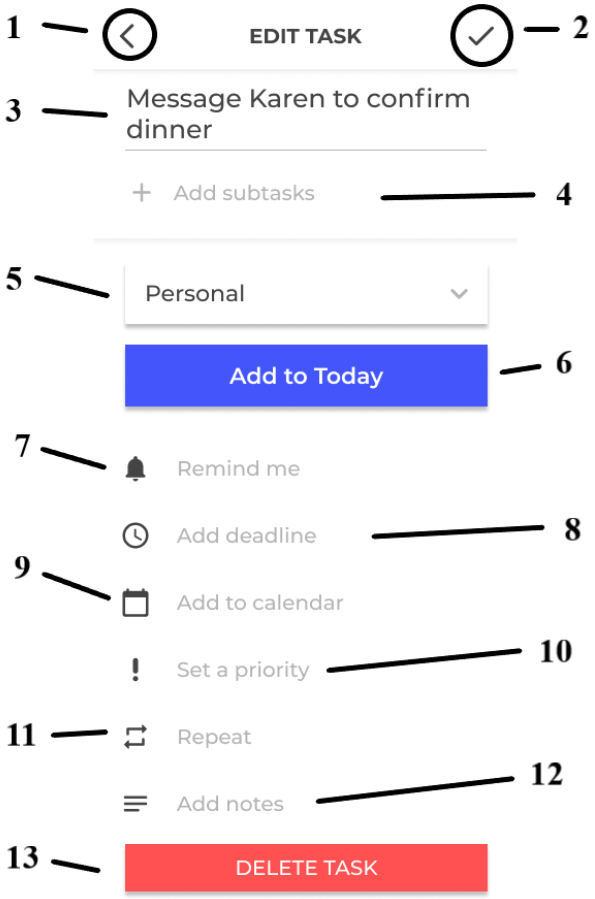

Figure 5.11: Screen to edit an event with numbers assigned to each event

5.1.6 Time Tracker

When you click on the Time Tracker button from the menu, it directs you to the screen shown in figure 5.12. This covers requirement 19.

In the top-half of the screen, there is only one button, which is similar to the blue floating buttons in other screen, but larger and in a different position of the screen. By pressing this button, you can create a new tracker. You can also select one of the existing trackers from the bottom-half of the screen, if you are continuing something you started in the past.

For example, this morning you dedicated one hour and 28 minutes to working on the Computer Security Coursework. Now you want to continue working on that coursework, so you select the tracker and the screen changes to what is shown in figure 5.13. From there, you can click on the big play button to start the timer. To stop using this tracker and change to another one, you would click on the red stop button, which would take you back to the screen shown in figure 5.12.

I decided to add a Take a break button, so that you can select how long you want the break to be, and once that time has passed, the app can notify you.

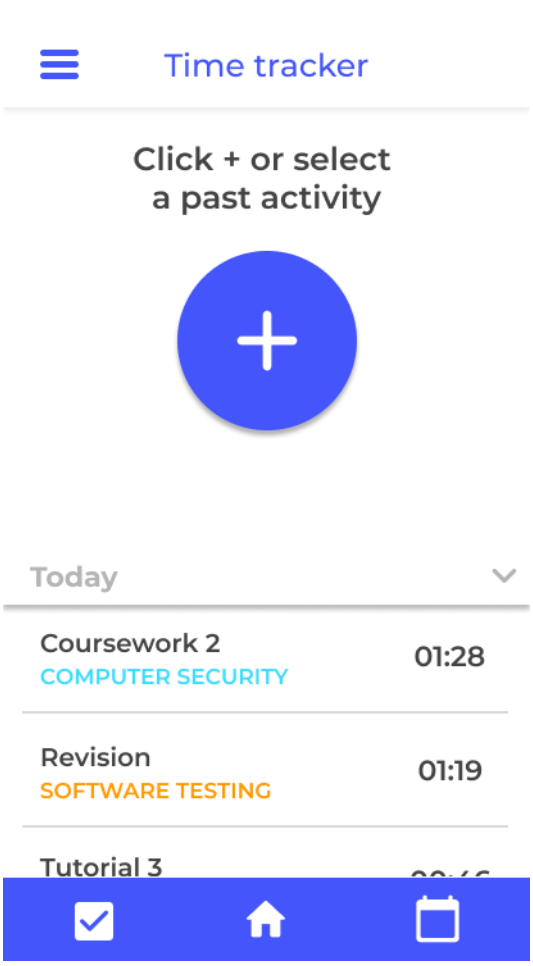

Figure 5.12: Time tracker screen

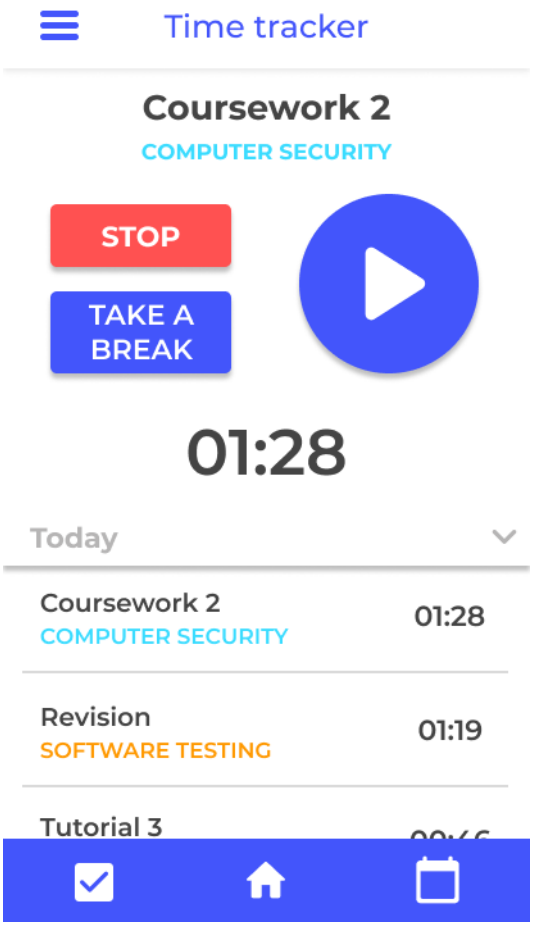

Figure 5.13: Time tracker screen, when tracking an activity

5.1.7 Not included in this iteration

As you can see in the Menu screen (see figure 5.3), I decided to add to the design a calendar, tasks, a time tracker, and achievements, which are requirements 1, 10, 19, and 22, respectively (see table 4.2 for all requirements). I also decided to add a class schedule and a section for deadlines and exams. The class schedule was not one of the requirements, but I decided to add it since I thought it might be a good idea for students to be able to quickly see their weekly schedule and wanted to test the idea during the evaluation. The section for deadlines and exams was added for a similar reason, because I thought it would be useful for students to be able to see these quickly, but it would also be a way towards covering requirement 4, which consisted in using a Gantt Chart or something similar to show coursework deadlines in a clear way to see how they overlap.

However, I did not create screens for the class schedule, deadlines and exams, and achievements. The reason for this is because I first wanted to evaluate the basic elements of the design: the colours, the font, the choice of buttons and icons and their positioning, as well as the navigation. Another reason was that I wanted to test the idea of having these in the app before I started designing the screens.

5.2 First evaluation

5.2.1 Aims

The aim of this study is to evaluate the first iteration of the design as presented in section 5.1 and to cover research questions 8 and 9 for the first iteration: how we can design an app that suits Informatics students (i.e. what changes should be made to the design to better suit Informatics students) and how the usability of the app is perceived by them. This study will also cover RQ7 in order to refine or to add to the list of requirements in chapter 4 (see table 4.2).

5.2.2 Participants

The study had six participants who all were Informatics students: four 4thyear students and two 3rdyear students (see table 5.1). I chose to only have Informatics students as my participants as they are the potential end-users of the app. I decided to interview a greater amount of 4thyear students since I considered that they would have more experience with time management at university and they would have a better sense of what methods work for them. I would have liked to have more participants, but this phase of the project coincided with the Innovative Learning week, where students have a week without any lectures or tutorials, so many students I contacted were away. Eleven students were contacted by email or Facebook, and recruiting message was posted on a Facebook group for Informatics students, but only six students were available to participate.

Participant	
s1	4thyear student
s2	4thyear student
s3	4thyear student
s4	4thyear student
s5	3rdyear student
s6	3rdyear student

Table 5.1: List of participants of the first evaluation

5.2.3 Data Collection Methods

I decided to use a combination of the Think Aloud method [56][Background - 2.12.1], the System Usability Scale [59][Background - 2.12.4] and a questionnaire [49][Background - 2.8.4]. I decided to use the Think Aloud method, as I thought this would be the best way to find faults in the design that not even the participants would notice. I decided to add the questionnaire and the SUS after the Think Aloud in order to be able to get more information about the honest opinion of the participants on how they perceive the current design and how it could be improved.

Throughout each session, I used audio recording [Background - 2.8.6] as well as note taking [Background - 2.8.5] to collect the data. If participants did not agree to be audio recorded, I was open to only taking notes.

5.2.4 Materials

I composed a Participant Information Sheet for the participants (see Appendix F). This document gives the potential participants the necessary understanding for the motivation and procedures of the study and sources of information to answer any further questions. This includes: information about the researchers and the study, the impact of participation, such as risks and benefits, and information about data protection.

I used the same consent form as in the previous study (see section 4.4 and Appendix A), which was used to obtain the consent from the participant. In this form, the participant was asked to confirm to have had access to the participant information sheet, to have understood the purpose of the study, and that their participation was voluntary. They were also asked to approve (or not) of being audio recorded and have their anonymised data be used in academic publications and in future ethically approved research. Finally, they were asked to confirm agreement to take part in the study.

I composed a script to explain to the participant what they need to do during a Think Aloud session (see Appendix G). This script also includes the three tasks the participant had to complete as part of the Think Aloud. I also composed a series of questions to ask the participant after the Think Aloud (see Appendix H) together with the SUS questionnaire, which aimed to learn about their opinion on the different elements of the design.

The three tasks used during the Think Aloud session (see Appendix G) were composed

to cover the basic functionality of the first iteration of the app: Calendar, Tasks and Time Tracker. They were very simple tasks, as in this first evaluation I was more interested in the participants getting familiar with the app and learning their opinion on the basic elements of the app.

5.2.5 Procedure

When the potential participants were being contacted, they were sent the Participant Information Sheet (PIS) (see Appendix F), so they could review all the information before agreeing to meet for the study.

After they agreed to participate, we would agree on a time and date, and I would book a room on campus to conduct the study in.

On the day of the study, I would meet the participant in the booked room and I would hand them the consent form (see Appendix A). After reading, filling in and signing the consent form, I would inform them that I would start recording and start recording.

I would read the script out loud to them and once they understood the instruction I gave them the tasks and access to my personal laptop to complete the tasks on the Figma prototype [61]. While they were completing the tasks, I would observe what they were doing while taking notes. Once they finished the tasks, I would ask them to complete the SUS [Background - 2.12.4], and then I would ask them the questions from my prepared set (see Appendix H). Once all the questions were over, I would stop the recording and ask them if they had any questions or comments. Lastly, I would thank them for their participation.

5.2.6 Analysis

After the sessions, I transcribed every recording from the sessions and analysed these transcriptions together with the notes taken during the sessions, with NVivo 11 [51] using thematic analysis [50][Background - 2.9.1] and a combination of top-down and bottom-up coding. When analysing, I started by creating themes for each of my interview questions (see Appendix H), and as I noticed common data, I created new themes and sub-themes. Once I was done analysing all the data, I went through the transcriptions again checking that the theme selected for each point was still the correct one. Using this method allowed me to cover all the information shared by the participants, so that no point went unnoticed. My full list of themes and subthemes can be seen in Appendix I.

To analyse the data from the SUS [59] [Background - 2.12.4], I used the method and rating scales described in the background chapter (see section 2.12.4.

5.2.7 Results

5.2.7.1 Think Aloud

All participants were able to complete the tasks successfully, although some of them found some difficulties along the way:

- Delete button (see number 12 in figure 5.7 and number 13 in figure 5.11): Most participants (5/6) showed confusion when they tried to save an event or task. After they had finished adding the details to the event/task, they continued down to find the Save button, but instead they found the Delete button. None of them clicked it since once they saw it was red and they read the words, they understood that was not the button they were looking for. Once they realised this they quickly found the button on the top bar and they all understood that the tick icon meant "save". Some of these participants (4/5) suggested the save button and the delete button could swap positions: have the save button as a big button in the bottom of the screen (in a different colour), and have the delete button in the top-right corner.

  "The delete task button seems quite big, and it stands out because it is red as well. And I think my instinct was to go to the bottom of the task to confirm that that was what I wanted to do. I guess that naturally, I would expect the delete button to be on the top and a confirm on the bottom. I think I went to that button because that is where I was going and because of the colour." -s6

- Task icon in the quick-access bar (see figure 5.2): Most of the participants (4/6) clicked on the task icon on the quick-access bar from the dashboard screen when starting task 2 (see Appendix G). However, two of the participants (2/6) did not see or understand the checkbox icon in the bottom bar, and instead went to the menu, and from there they were able to find the Tasks screen. When I asked them about this, once the Think Aloud was over, they both stated that they did not associate a checkbox icon with tasks.

  "I do not think of that icon as a task button, I do not really have an image of what a task is. But once I would start using it, I think I would connect that icon with tasks." - s4

5.2.7.2 What participants liked

- Colour-coordination: Most participants (5/6) expressed how they liked the colours used on the design and they liked how the colours for the different groups stayed consistent throughout the app, which helped differentiate the different tasks and events.

  "I liked the different colour for things, because that always helps me out, I like that is based on the actual activity of the colours." - s1

  "I like that everything is colour-coordinated." - s3

- Everything in one place: Half of participants (3/6) mentioned how they liked that the app combined different things that are otherwise separate. One of them (1/6) also mentioned how this app can also cover not only academia events but everything else too.

  "Having the to-do lists in there is also useful because sometimes I want to get something done at a specific time. So I like the distinction between the two [Calendar and Tasks], and not having separate apps." - s1

"It's really nice. It would be nice to have a system that I can just check because I check the Outlook Calendar [37] for uni stuff and if I have any meetings, and then I will go to my notes to check the to-dos, so I have different apps to do it, so it is nice if it is all in one package." - s2

"This looks like it would be really good for academia as well as things outside the university. I think it reaches the goal of having everything in one place, because I think I would download this app, and I would delete every other calendar, tasks and time tracking apps." - s3

- Time tracker (see figures 5.12 and 5.13): Some of the students (4/6) mentioned that they liked the idea of having a time tracker.

  "It's nice that you can track the time you spend on chores as well. I could use it to keep track of how long I spend doing admin things. It's just writing emails and stuff but it does add up time. In my head I just say it does not count, and then it takes me an hour or more." - s3

- Menu (see figure 5.3): Two participants (2/6) said they liked the menu and having all of the options available there.

  "It's really nice that the navigation drawer menu opens up to more things." - s3

- Easy to use: Half of the participants (3/6) mentioned that they found the design clean and easy to use and navigate. Two of those participants (2/6) mentioned it reminded them of other apps they had used previously, so that made it easier to use.

  "Even if you have never used it before, it is easy to pick up from familiarity from other software." - s5

  "It follows the design from other apps I already use, it was pretty similar to Google Calendar [38] when adding an event. Since it followed these already, I had a sense of what to do to add an event or add a task." - s6

- Quick-access bar: One of the participants (1/6) said they liked the bar as it made easier to reach other parts of the app.

  "I liked the tabs at the bottom, it made it easy to navigate between the screens, it was easy to switch between them." - s6

- One of the participants (1/6) showed interest when seeing the Achievements button in the menu screen.

  "Oh, achievements, that sounds fun. I think it would be useful to make people use the app." - s4

5.2.7.3 What participants disliked

- Delete button: As mentioned before, in section 5.2.7.1, the position of the delete button was confusing to most participants (5/6), and was later mentioned again when asked about what they disliked about the design.

- Crowded menu (see figure 5.3): One of the participants (1/6) mentioned that they thought the menu had too many options and seemed crowded.

5.2.7.4 Navigation

Overall, all participants (6/6) said they found the navigation of the app easy and straightforward. Half of the participants (3/6) mentioned that since the app looked similar to other apps, everything was familiar to them.

"I have used similar apps and so I recognised some elements and icons, and for the last one, when I did not know how to get to the time tracker screen, I just clicked on the menu icon in the corner and everything was there so it was easy to find." - s1

"Everything was spaced out well and familiar, it was quite intuitive." - s5

TASK 1: ADD AN EVENT

All participants (6/6) found that the navigation of the app while completing task 1 was also clear and straightforward. One of the participants (1/6) added that they thought they would be able to add the event from the dashboard, but once they realise they couldn't, they quickly found the right way to do it.

"I thought it was pretty straightforward. Initially, I thought I would be able to add it from the first screen, like a shortcut. I think it would be useful to be able to add them from the dashboard." - s2

"I just went to the calendar, I clicked the giant plus button. It was clear. It reminded me of other calendar apps." - s3

TASK 2: ADD A TASK

All participants (6/6) found the navigation in this task to be straightforward, except for the big delete button, as described in section 5.2.7.1. And, as mentioned before in section 5.2.7.1 as well, two of the participants (2/6) did not use the quick-access bar on the bottom of the screen to reach the Tasks screen, but instead checked the menu.

"It was fine apart from the delete button. I did not go to click it but it did make me do a double-take. Apart from that, everything was pretty straightforward." - s5

TASK 3: ADD A NEW TIME TRACKER

Again, all participants (6/6) found the task easy to complete and the navigation very straightforward. For most of them (4/6) it was the first time using the menu, but they were able to find it easily.

"That's how I found the menu because I did not find anything that looked like that in the bottom bar. The navigation drawer is very clear because everything is labeled and has an icon. I really like how you add a new time tracker." - s3

"That was fine, I just checked the menu because everything is on the menu." - s2

5.2.7.5 Icons

When asked about the icons used on the design, all participants (6/6) said they found them clear. As mentioned before in section 5.2.7.1, two of the participants (2/6) did not connect the checkbox icon to tasks, but they said all other icons were clear to them.

5.2.7.6 Colours

Like it was already mentioned, most participants (5/6) liked that the events and tasks were colour-coordinated throughout the app. Moreover, all participants (6/6) said they liked the colours used and how they were all clearly different from each other, so there was not any confusion.

"I liked the distinction between things with the colours, it was useful to me." - s1

"I really liked the colours. The colour scheme is really nice, they complement each other. And I like that it has different colours for each course and other things. Also, I like that the colours for events and tasks complement each other and that the colour for the menu and bar stands out more." - s6

5.2.7.7 Font

Regarding the font, all participants (6/6) said it was easy to read, even in lighter colours like the light grey seen in section 5.1.1.

"It's readable, and the order of the titles make sense. It looks good, as a person who wears glasses." - s2

"The font is great. The colour is a nice grey. The size is readable." - s3

5.2.7.8 Positioning of buttons

When asked about the the position of the buttons, all participants (6/6) said most buttons were where they expected. Some of the participants (2/6) mentioned the delete button again and another two participants (2/6) mentioned the checkbox icon again, both already described in section 5.2.7.1.

"They were pretty clear. The menu in the top left corner is standard, I like that. I like the bar in the bottom, it just has 3 buttons so it makes it less crowded, so those are the main thing you will use. Also, finding the time tracker was really easy once I clicked the menu, so it was where I expected." - s6

"Everything apart from the delete button made sense to me. The classic top left to open more the menu is always useful. And the two key ones, being the tasks and calendar on the bottom of the screen, it makes sense." - s1

5.2.7.9 What participants would add or remove

When asked about what they would add to the design, participant s5 said that it would be nice if the tasks in the task screen could be pressed and held or slid to the sides to show more options, like Add to Today or Delete.

In regards to the time trackers, participant s3 said ”it might be nice to have a visualization, in form of a pie chart or a bar chart, to see how long you spend on things.”

Participant s6 said that, in the dashboard, the tasks could also be scrolled vertically, like the events, instead of horizontally.

”One other thing, you scroll up and down through events, and then sideways through the tasks. It might be nicer to have the tasks up and down as well, so it is more consistent.” - s6

When asked about what they would remove from the design, both participant s3 and s6 said they would remove certain things from the menu that they did not think was necessary. Participant s3 also said that they found the menu very crowded.

”It’s really nice that the navigation drawer menu opens up to more things, but there are so many things, it is a little overwhelming. Maybe the class schedule is not necessary since you can filter the calendars to select only the course calendars and you can set the calendar to weekly view. I do not think I would use the class schedule.” - s3

Both participant s3 and s5 also mentioned the delete button again.

5.2.7.10 SUS results

The results of the SUS questionnaire can be seen in table 5.2. The score from all participants is above 90, and the mean is 95.83. This score rates the first iteration of the design as acceptable, according to the rating scale in table 2.1, and graded with an A, according to the grading scale in table 2.2.

Participant	SUS score
s1	95
s2	100
s3	92.5
s4	95
s5	97.5
s6	95
Mean	**95.83**

Table 5.2: SUS Results for every participant and the mean

5.2.7.11 New requirements and suggested changes

From this evaluation, I have managed to gather new requirements (requirements 28) that the second iteration of the design should cover. All the requirements are now in tables 5.4 and 5.5. I also gathered some suggested changes to improve the design, seen in table 5.3.

The following are the requisites for the three different levels of priority:

- High: A requirement or suggested change will be prioritised as high if it is supported by research or supported by at least three participants. A requirement

will also be prioritised as high if it is common of time management apps. There might be features which were not mentioned by many students because they take for granted that they will be included in the app, due to being common features in existing apps.

- Medium: A requirement or suggested change will be prioritised as medium if it is supported by at least two participants and/or I think would be useful to add or change.
- Low: A requirement or suggested change will be prioritised as low if it is supported by at least one participant.

#	Suggestion	Priority	Reason For Priority
1	Move Delete button from the screen to edit events and tasks	High	Supported by 5/6 participants.
2	Remove class schedule from menu to make it less crowded	Medium	Supported 2/6 participants.
3	Add option to add tasks or events from the dashboard	Medium	Supported by 1/6 participants, and I think it would be useful for adding things quicker to the app.
4	Add other options when sliding a task to the sides	Low	Supported by 1/6 participants.

Table 5.3: Changes suggested by the participants

However, there are two requirements I decided not include in the requirements list. One of them concerns the two participants who did not realise that the checkbox icon would lead them to the Tasks screen (see section 5.2.7.1). The checkbox is a very common representation of a task or to-do, and this would be something potential users would get familiar with soon after starting to use the app, as expressed by one of the participants:

"I do not think of that icon as a task button, I do not really have an image of what a task is. But once I would start using it, I think I would connect that icon with tasks." - s4

The other requirement I decided not to add was mentioned by one of the participants (1/6) in section 5.2.7.9 about the dashboard screen (see figure 5.2):

"One other thing, you scroll up and down through events, and then sideways through the tasks. It might be nicer to have the tasks up and down as well, so it is more consistent." - s6

However, when first creating the design, I tried doing it the way that the participant suggested, but I quickly discarded it since, like I explained in section 5.1.2, I found that having both sections scroll vertically was confusing as there did not seem to be any distinction between them. This may be error prone, as having two vertical scrolls

in the same screen at close proximity to one another could cause the user to scroll through the other section than intended.

5.3 Summary

In this chapter, I described the kind of decisions I made when designing the first iteration of the design for the time management app, and the kind of elements I added to cover the requirements gathered in chapter 4. I also described the evaluation study I conducted with six students and I presented the results from the study. Lastly, I created a new list of suggested changes and added to the list of requirements from chapter 4 (see table 4.2) to cover the results extracted from the evaluation.

#	Requirement	Priority	Reason For Priority
1	Calendar system	High	Supported by 13/15 students, 2/2 staff members and research (see section 2.4).
2	Have contact hours automatically uploaded	High	Supported by 5/15 students. It will make it easier to set up.
3	Have assignment deadlines automatically uploaded	Medium	Supported by 2/15 students and 1/2 staff members. It would make it easier to set up.
4	Use a Gantt Chart [64] to display assignment deadlines	Low	Supported by 1/15 students.
5	Reminders and notifications for events	High	Supported by 6/15 students and 1/2 staff members.
6	Colour-coding	High	Supported by 7/15 students.
7	Recurring events	High	Useful for events that repeat, like lectures, and very common in calendar apps. Supported by 2/15 students.
8	Different calendar viewing options (month, week, 3-days, day)	High	Supported by 2/15 students and very common in calendar apps.
9	Synchronise calendars from other accounts	Low	Supported by 1/15 students.
10	To-do lists	High	Supported by 10/15 students and by research (see section 2.4).
11	Add deadlines to tasks	High	Supported by 2/15 students. Useful for students to stay on top of their tasks.
12	Tick off tasks to mark them as completed	High	Supported by 2/15 students. Included in all task management apps, very basic feature.
13	Prioritise tasks	High	Supported used by 10/15 students, 1/2 staff members and research (see section 2.4).
14	Group tasks	High	Supported by 2/15 students and research (see section 2.4).
15	Task progress bar	Medium	Supported by 2/15 students.
16	Quickly adding tasks	Medium	Supported by 2/15 students.
17	Have tasks linked to calendar events	High	Supported by 7/15 students.
18	Ask the user after the event if the tasks were completed	Medium	Supported by 2/15 students.
19	Tracking time	High	Supported by 3/15 students, 2/2 staff member and research (self-assessment behaviour - see sections 2.2 and 2.4).
20	Feedback time tracking information to course organisers	Low	Mentioned by 1/2 staff.
21	Help distribute work	Medium	Supported by 3/15 students and 1/2 staff members

Table 5.4: New list of requirements

#	Requirement	Priority	Reason For Priority
22	Reward System	Medium	Supported by 3/15 students and 1/2 staff members.
23	Easy to use and set-up	High	Supported by 7/15 students.
24	Have everything in one place	Medium	Supported by 3/15 students.
25	Monitor how much time the user spends on something and notify if behind schedule	Low	Supported by 1/2 staff members
26	Life management	Medium	Supported by 1/15 students and 1/2 staff members.
27	Feedback	Low	Supported by 1/2 staff members
28	Have visualization of time tracker information	Medium	Supported by 1/6 participants and I think it would be useful to have.

Table 5.5: New list of requirements (cont.)

Chapter 6

Second iteration of the design

In this chapter, I go through each screen in the second iteration of the design discussing the changes and additions I have made, and linking them to the list of suggested changes and requirements discussed in the previous chapter (see tables 5.3 and 5.4). You can find all the screens of the second iteration here.

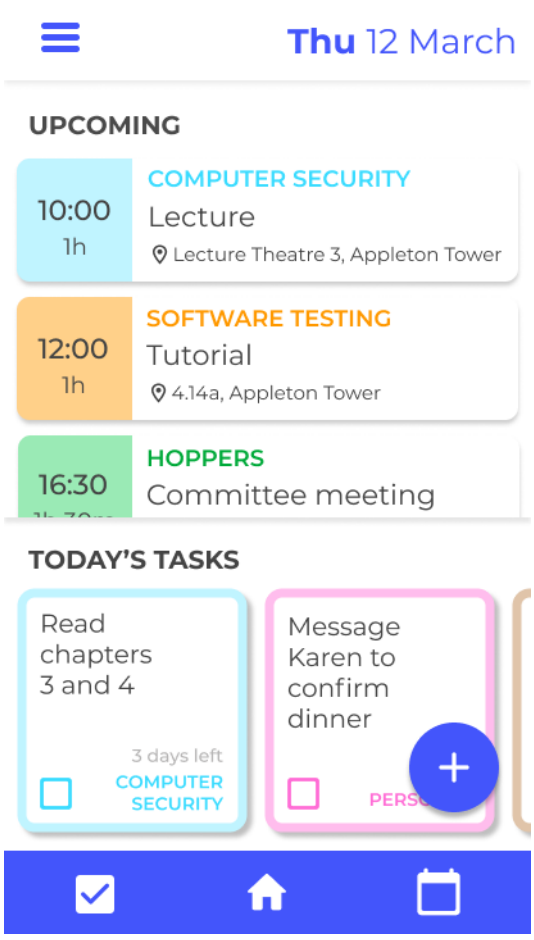

Figure 6.1: Dashboard screen

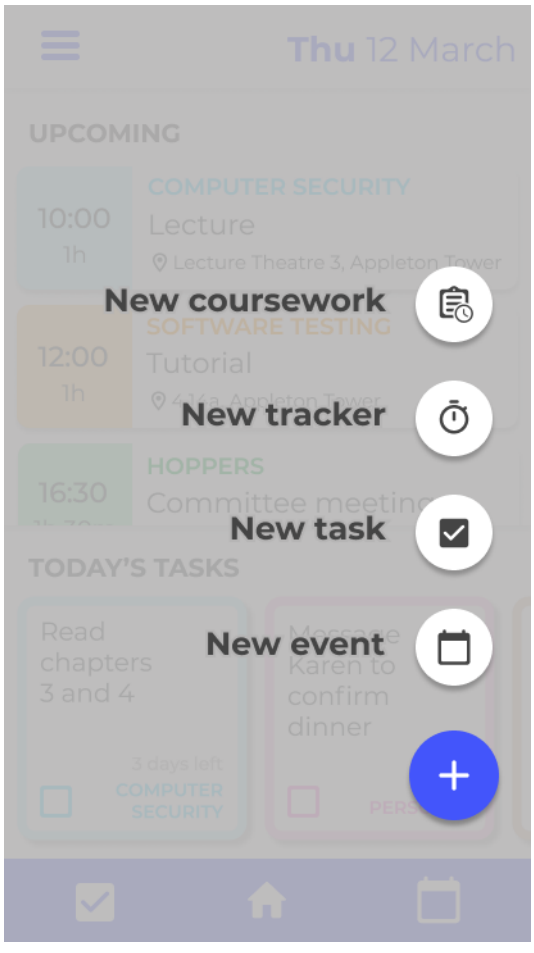

Figure 6.2: Screen to add elements from the Dashboard

6.1 Dashboard

To cover suggested change 3 (see table 5.3), I added the same round blue button there is in the Calendar screen and Tasks screen. By pushing this button (as seen in figure 6.1), a new screen will appear showing the different kind of elements you can add, such as an event, a task, a tracker and a coursework (see figure 6.2).

To accommodate the new button, I changed the position of the checkbox inside the task cards in the dashboard from the bottom-right to the bottom-left. I changed this because when pressing the Add button, the checkbox could have been accidentally pressed, as the checkbox was behind the Add button. This also helps with complying with one of the 10 heuristics, ”consistency and standards” (see section 2.10), since the checkboxes in the Tasks screen are also on the left.

6.2 Menu

To cover suggested change 2 (see table 5.3), I removed the class schedule button and increased the space between the menu items so that the menu looked less crowded (see figure 6.3).

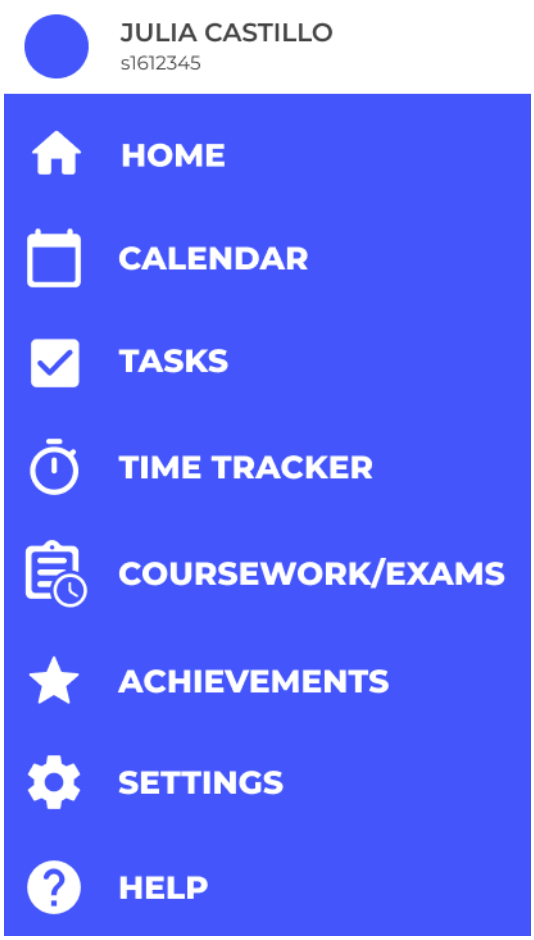

Figure 6.3: Menu screen

Figure 6.4: Achievements screen

6.3 Achievements

To cover requirement 22 (see table 5.5), I created the Achievements screen (see figure 6.4). It includes medals for things such as completing all the tasks in the ”Today” list (”Productive”) or tracking over 5 hours of study or work during today (”Hard worker”). It also include medals to promote a daily use of the app (”Streaks”). The medals that have been achieved are coloured in red and yellow, and the medals which have not been achieved, were greyed out. To read the requirements to achieve a badge, you just need to click on the badge and a new window will appear.

Having a reward system was only supported by 2/15 students and 1/2 staff members interviewed during the Requirements gathering phase (see chapter 4), but adding reward systems and positive reinforcement to apps has been proven to engage users in the regular use of the app on a new level [66].

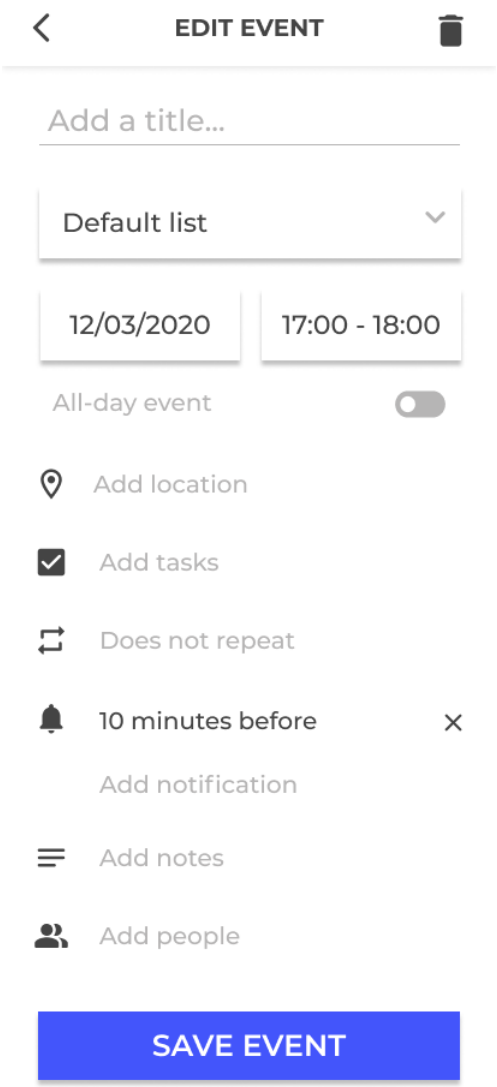

Figure 6.5: Screen to edit an event

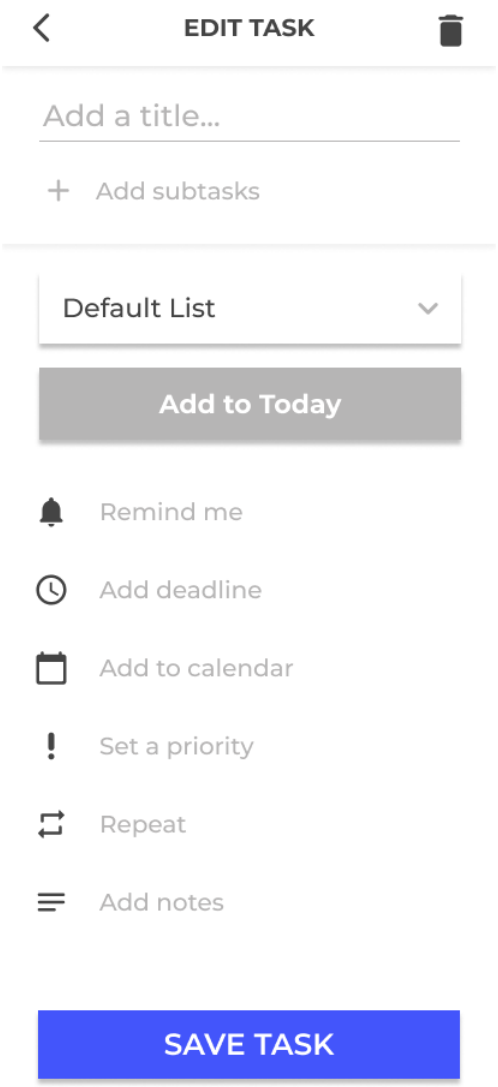

Figure 6.6: Screen to edit a task

6.4 Editing events and tasks

To cover suggested change 1 (see table 5.3), I replaced the Delete button on the bottom with the Save button in both screens used to edit/add events and tasks (see figures 6.5 and 6.6, respectively). I also changed the colour of the button from red to blue, as some of the participants of the evaluation (2/4) associated the colour red with delete, which is what stopped them from pressing that button (see section 5.2.7.1.):

"Sometimes when you're adding something, you have the OK button at the bottom, but the red was obvious and I immediately understood that wouldn't be the OK button because of the red. So when I discarded that, I looked up and saw the other icons." - s4

Instead, I chose blue so the button still stands out amongst the white and greys. For the delete icon, I chose a dustbin icon and moved it to the right-top corner, where the Save icon used to be.

6.5 Time Tracker

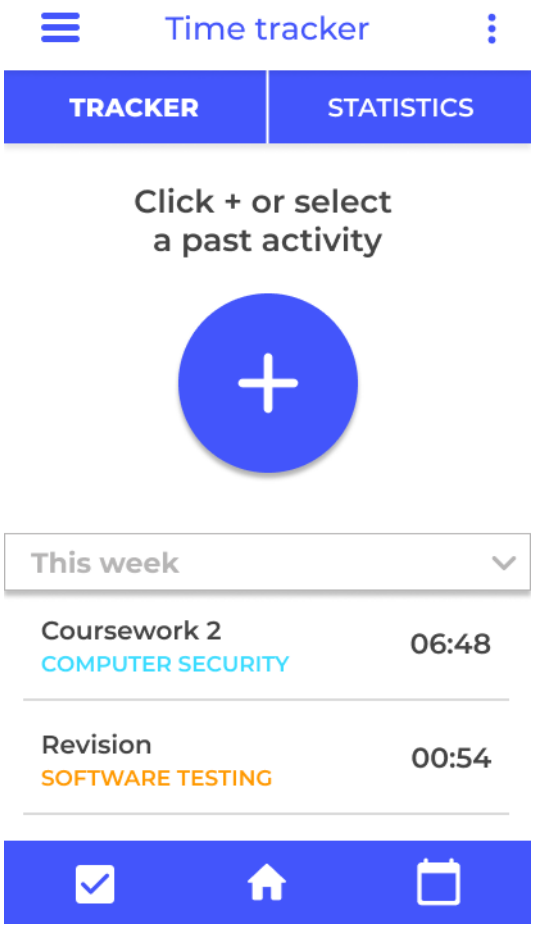

Figure 6.7: Time tracker screen

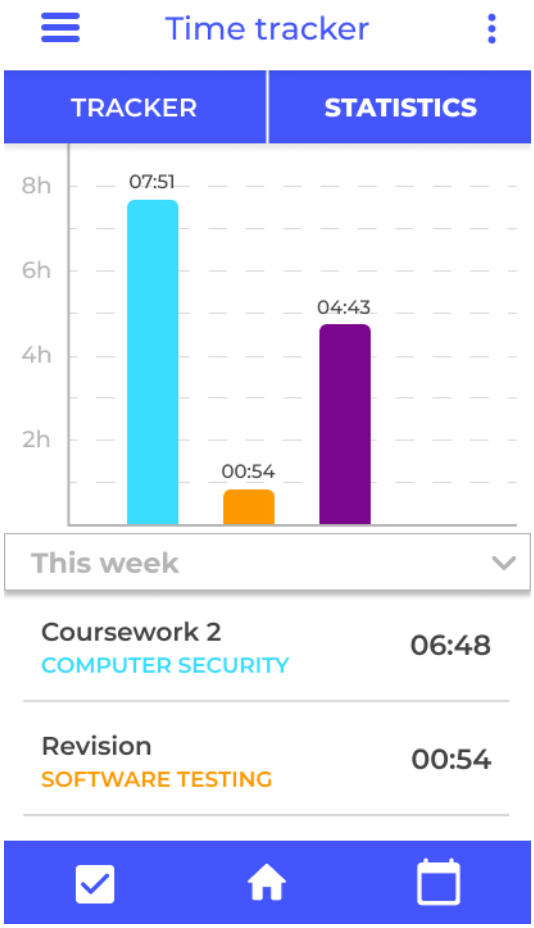

Figure 6.8: Statistics screen

To cover requirement 28 (see table 5.5), I added tabs at the top of the screen of the time

tracker (see figure 6.7), so you can access the Statistics screen (see figure 6.8).

The Statistics screen includes the visualisation of the time trackers that one of the participants (1/6) of the evaluation suggested. For the chart, I chose a bar chart and used the same colours for the different groups as are used throughout the app.

6.6 Coursework and exams

To cover requirement 4, and because I thought it is a good idea for students to be able to see this kind of information clearly and not mixed with other information, I created two new screens to show the different coursework deadlines (figure 6.9) and exams (figure 6.10).

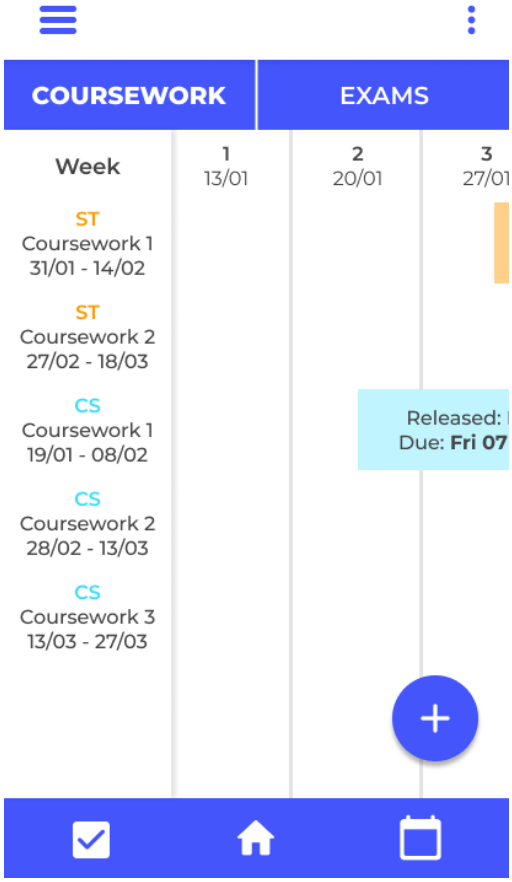

Figure 6.9: Coursework screen

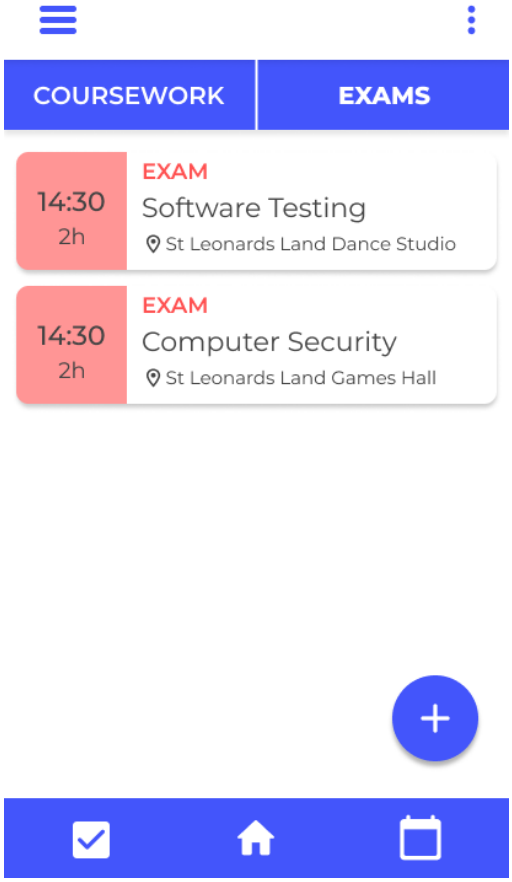

Figure 6.10: Exams screen

For the Exams screen, I used the same format of event card used in the Calendar screen and the Dashboard (see figures 6.1 and 5.4, respectively), which complies with one of the 10 heuristics, ”consistency and standards” (see section 2.10).

For the Coursework screen, I created a Gantt chart [64] (as suggested in requirement 4) that covers all 11 weeks of the semester in the University of Edinburgh [67]. Since the Gantt chart is too wide to fit in the screen, I made it so that the Gantt chart can be scrolled horizontally to be able to view it entirely, but the column on the left that

includes the courses of the coursework stays in the same position (see figure 6.11 for the complete Gantt chart).

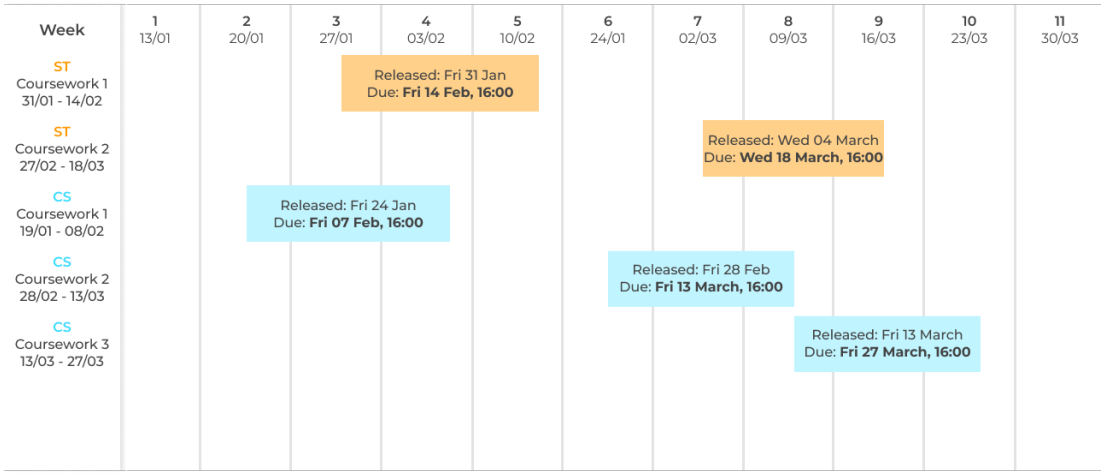

Figure 6.11: Complete Gantt chart (Coursework screen)

Both screens also include the Add button, which is used throughout the app, which also complies with one of the 10 heuristics, ”consistency and standards” (see section 2.10).

If you click on the Add button from the Exams screen, a screen similar to the Edit event screen opens up to add a new exam date (see figure 6.5).

If you click on the Add button from the Coursework screen, a screen like the one in figure 6.12 appears. In this screen you can specify the title of the coursework, the course, the release date as well as the due date and due time. These will then be used to populate the Gantt chart [64]. Under ”How many hours do you want to work on it?”, you can select how many hours you want to work on this coursework per day, per week or per fortnight. This will be used to help you keep your working on track. If you select the ”Do you want notifications to keep you on track?” option, the app, when implemented, will send you notifications telling to dedicate more time to this coursework if, for example, you have selected you want to work on this coursework 15 hours per week, and by Friday you have only worked on it for 5 hours that week. This covers requirement 25 (see table 5.5 for all requirements). Under ”When do you want to work on it?”, you can either select existing events from the calendar, to let the app know that you will be working on the coursework on times. Otherwise, you can select ”Suggest times” and the app will suggest times (within your working hours, which can be changed in Settings) on the days that you select, for you to work on the coursework. This covers requirement 21 (see table 5.4 for all requirements).

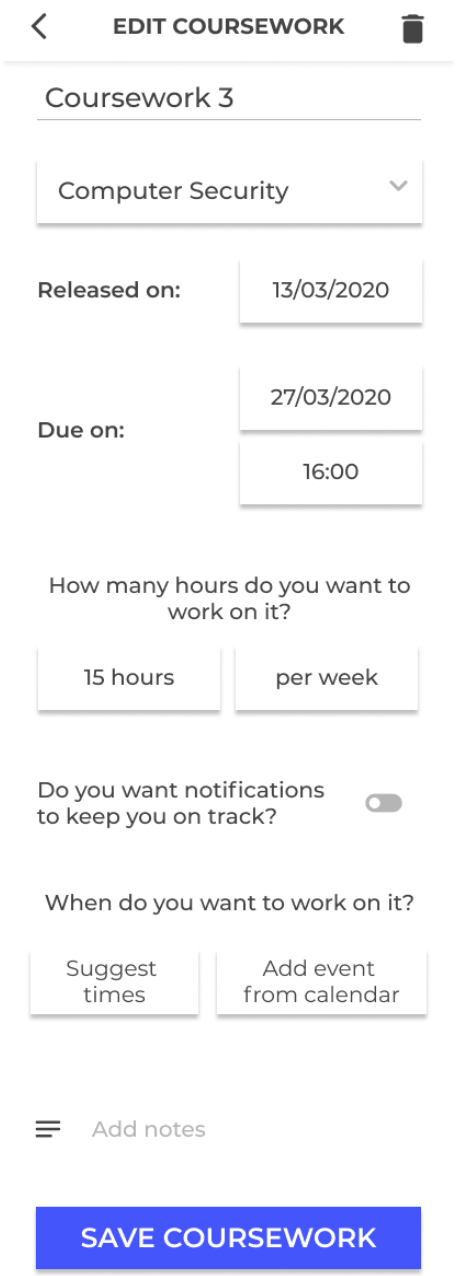

Figure 6.12: Screen to edit/add a coursework deadline

6.7 What requirements were not covered

Some of the requirements were not able to be added to the design since Figma, the tool used to create this design, has certain limitations. Figma [61] is an online tool to design user interfaces, which means there is no actual functionality or code behind the UI created. Because of this, I was not able to cover all requirements which involve notifications, such as requirement 18, or having data automatically uploaded, such as requirements 2 and 3. Overall the following requirements were not covered in this iterations (see table 5.4 for all requirements): 2, 3, 9, 15, 16, 18, 20, 27, and suggested

change 4.

6.8 Summary

In this chapter, I described the changes I made to the design to cover the new requirements extracted from the results of the first evaluation.

Chapter 7

Final Evaluation

In this chapter, I evaluate the second iteration of the design of the app by conducting a series of studies with students, HCI experts and staff members and analyse the results to find out what should be changed or added to the design to improve it. The evaluation studies were ethically approved by the University of Edinburgh School of Informatics with RT 2019/49519. The methodology of the final evaluation is described in Methodology - 3.1.4.

7.1 Aims

The aim of this study is to evaluate the second iteration of the design as presented in chapter 6 and to cover research questions 8, 9, and 10:

10. How can we design a time management app that suits Informatics students at the University of Edinburgh?

11. How is the usability of the design perceived by Informatics students?

12. What would be the potential impact of the app for students, in terms of:

    (a) managing their studies?

        i. keeping up with their courses?

        ii. meeting deadlines?

        iii. reducing procrastination?

    (b) managing their personal life?

        i. completing chores?

        ii. being on top of their health?

        iii. maintaining a social life?

7.2 Participants

For this evaluation, I had 21 participants in total (see table 7.1. 17 of those participants being Informatics students at the University of Edinburgh. I decided to have mostly students participate in my studies since students are the potential end users of this app. To recruit students, I sent an email to an Informatics students mailing list. I also posted a recruiting message on a Informatics student Facebook group and emailed participants of previous studies.

I had two HCI experts participate in the study as well, in order to get a more in-depth evaluation in terms of usability and find ways to improve the general usability of the app. Both HCI experts were contacted directly through email.

Lastly, I contacted the two staff members I interviewed during the Requirements gathering phase (chapter 4) through email and they both agreed to meet with me to evaluate the design.

I again contacted other departments in the University of Edinburgh to invite them to participate in the study, such as the Counseling service [4] and the Disability service [63], but both declined the invitation.

Participant		Participant	
s1	Student - Stakeholder Walkthrough	s12	Student - Questionnaire
s2	Student - Stakeholder Walkthrough	s13	Student - Questionnaire
s3	Student - Stakeholder Walkthrough	s14	Student - Questionnaire
s4	Student - Stakeholder Walkthrough	s15	Student - Questionnaire
s5	Student - Stakeholder Walkthrough	s16	Student - Questionnaire
s6	Student - Questionnaire	s17	Student - Questionnaire
s7	Student - Questionnaire	ex1	HCI expert
s8	Student - Questionnaire	ex2	HCI expert
s9	Student - Questionnaire	as1	Academic staff - personal tutor
s10	Student - Questionnaire	ss1	Student support staff - academic developer from IAD
s11	Student - Questionnaire		

Table 7.1: List of participants of the final evaluation

7.3 Data Collection Methods

I conducted a Stakeholder Walkthrough session [57][Background - 2.12.2] with 5 students, which also included a short questionnaire (see questions 7 and 8 in Appendix P) and SUS [59][Background - 2.12.4] at the end of the session. My goal was to conduct at least two Stakeholder Walkthrough sessions, with at least 6 students per session, but due to the Coronavirus pandemic [62] and sudden unavailability of some participants, I was not able to reach this goal.

In order to increase the amount of participants, I instead created a online questionnaire [49][Background - 2.8.4] on Microsoft Forms [68], which included the same tasks that the Stakeholder Walkthrough participants had to complete (see Appendix O) as well as the same questions (see Appendix P) and the SUS [59][Background - 2.12.4]. This questionnaire was useful since students who were interested in the project but were unable to participate in the Stakeholder Walkthrough, due to unavailability or, later, due to the pandemic, were still able to participate in the studies. In total, 12 students completed the questionnaire.

Furthermore, I used the Think Aloud method [56][Background - 2.12.1], as well as a short questionnaire (see questions 1 through 7 in Appendix P), with two Human-Computer Interaction (HCI) experts, to get a better idea of how the design could be improved in terms of usability.

Lastly, I conducted a study with the two staff members that were previously interviewed during the Requirements Gathering phase (section 4). During each session, I let the participant explore the prototype freely and ask any questions they may had, and once they had finished I would ask them a few questions about what could be missing in the design and the potential impact on students (see questions 3, 4 and 8 in in Appendix P). I thought this would be more appropriate in this case since these two staff members are not potential end-users, and I was just interested in them getting to know the app so they could give their opinion on how they thought this app could potentially impact students.

In all studies, except the study involving the online questionnaire, I used note taking [Background - 2.8.5] and audio recording [Background - 2.8.6] to collect data.

7.4 Materials

I composed four different Participant Information Sheets: one for the face-to-face study with students(Appendix J), one for the study involving the online questionnaire (Appendix L), one for study with HCI experts (Appendix M), and one for study with staff members (Appendix N). This document gives the potential participants the necessary understanding for the motivation and procedures of the study and sources of information to answer any further questions. This includes: information about the researchers and the study, the impact of participation, such as risks and benefits, and information about data protection.

I used the same consent form (see Appendix A) I used for the previous studies, which

was used to obtain the consent from the participant. In this form, the participant was asked to confirm to have had access to the participant information sheet, to have understood the purpose of the study, and that their participation was voluntary. They were also asked to approve (or not) of being audio recorded and have their anonymised data be used in academic publications and in future ethically approved research. Finally, they were asked to confirm agreement to take part in the study. For the online questionnaire participants, I created another consent form similar to the previous consent form, except in this one the participant is not asked to give consent to be audio recorded (see Appendix K).

I created five tasks that were used for the Stakeholder Walkthrough, the questionnaire, and the Think Aloud (see Appendix O). These tasks cover most of the functionality offered by the second iteration of the design (see chapter 6), such as adding a task with subtasks and adding it to the calendar, adding a new coursework, checking the Statistics screen, adding new events with tasks, using a time tracker, earning a badge and deleting tasks and events.

I also produced a list of questions that were used in all fours studies in different degrees (see Appendix P). Questionnaire participants had to answer all questions, whereas Stakeholder Walkthrough participants only had to answer questions 7 and 8, and instead where asked to comment after every task. HCI experts were asked questions 1-7, and staff member were only asked questions 3, 4 and 8.

7.5 Procedure

When the potential participants were being contacted, they were sent the Participant Information Sheet (PIS) by email (see Appendices J, L, M, N), so they could review all the information before agreeing to participate in the study.

7.5.1 Face-to-face study with students

On the day of the session, I met with the participants in a room in a building that belongs to the University of Edinburgh School of Informatics. I asked them to fill in and sign the consent form (see Appendix A). Once they had filled in the consent form, I sent them the link for the prototype and the questions by email, so they could access them from their own laptops, and explained how the session was going to work and what they had to do. Once they understood, I started audio recording and asked them to begin completing the first task individually. After they all had finished the first task, I asked each one of them to describe what they did and then opened the floor to discussions about any difficulties they may have had, suggestions or comments about the task. Once the discussion was over, I asked them to move to the next task and again discussed the task after everyone had completed it. We did so with most tasks. Unfortunately, we quickly ran out of time, and we had to leave the room soon, so I asked them to skip the last task, and instead complete the online questionnaire which contained the SUS and questions 7 and 8 from Appendix P. Once they were done, I stopped the recording and thanked them for their participation.

7.5.2 Online study with students

Once the participant agreed to take part in the study, I sent them the consent form (Appendix K), the links to the prototype and the questionnaire, and the instructions on how to complete the questionnaire, all by email. In the instructions I asked them to first complete the consent form and send it back to me and then proceed with the questionnaire, which included the tasks they had to complete using the prototype.

7.5.3 Study with HCI experts

I met one of the participants in person, but, due to the pandemic, I had to conduct the other session through Skype [72]. However, the procedure for both sessions was similar. I asked the participants to fill in the consent form (and send it back to me, in the case of the online session), and once they did I started audio recording. I asked them to complete the five tasks (see Appendix O) while talking aloud. After the tasks had been completed, I asked them questions 1 through 7 in Appendix P. Once I had asked all questions, I stopped the recording and thanked them for participating.

7.5.4 Study with staff members

Similarly to the study with HCI experts, I had to conduct one of two sessions through Skype [72]. I asked the participants to fill in the consent form, and once they did I started audio recording. I allowed the participants to explore the app freely and to ask any questions they had. Once they had finished, I would ask them questions 3, 4, and 8 in Appendix P. Once I had asked all questions, I stopped the recording and thanked them for participating.

7.6 Analysis

After the sessions, I transcribed every recording from the sessions and analysed these transcriptions together with the notes taken during the sessions, with NVivo 11 [51] using thematic analysis [Background - 2.9.1] and a combination of top-down and bottom-up coding. When analysing, I started by creating themes for each of the sections in the design, such as calendar, tasks, time tracker, and so on, and as I noticed common data, I created new themes and sub-themes. Once I was done analysing all the data, I went through the transcriptions again checking that the theme selected for each point was still the correct one. Using this method allowed me to cover all the information shared by the participants, so that no point went unnoticed. My full list of themes and subthemes can be seen in Appendix Q.

For these studies, I decided to start the analysis of the data by creating themes for each of the sections in the design, instead of creating themes for each of the questions, like I did during the previous studies. Since I conducted four different types of studies with different methods and different materials, I thought it would be better to separate the data by the different screens in the design.

To analyse the data from the SUS [59] [Background - 2.12.4], I used the method and rating scales described in the background chapter (see section 2.12.4.

7.7 Results

The following sections (sections 7.7.1 to 7.7.7) cover the Research Question 8: how we can design a time management app for Informatics students.

7.7.1 General

Many participants had positive comments to say about the app in general.

"Being a Figma prototype, there are limitations in presenting the interaction, but even so, it is easy to interact with. The interface is pleasant and it is effective because, if I were a student, it would cover whatever I would like to do, like personal things but it would still be related to my occupation as a student. It's a nice app and I would like to see it finished, and I think for students it would be nice to have it." - ex2

"I am really impressed, and I can see how it is more than what's already out there. The Outlook Calendar [37] can do some of the stuff that you're showing, but the additional functionalities is what makes it really interesting." - ss1

"I think all that you have there are good ideas to have. It's doing some useful things." - as1

"This would be an app that I would work with every day." - s14

Some participants (2/17 students and 1/2 HCI experts) said they found the app to be easy to use.

"I like the interface, it is user-friendly and easy to use" - ex2

Some participants (3/17 students, 1/2 HCI experts and 1/2 staff members) said they liked the colours used in the app and how the different colours for events and tasks stayed consistent.

"I liked that there were different colours for the different events and that they stayed consistent throughout the app" - ex1

Furthermore, two students (2/17 students) suggested to have the option of customising the colours.

Some participants, including both HCI experts (1/17 students and 2/2 HCI experts) stated that the app should show confirmation windows after creating or deleting things such as events, tasks or coursework.

Some students (6/17) said they liked that the app combined several feature, which are usually in separate apps.

"Overall it has everything I need in one place, and it feels well integrated. Has a lot of features that I want and wish I could use right now." - s10

However, a few students (2/17) stated that they thought the app had too many features, and they wouldn't use some of them.

"There were some extra features that I would not use but made the app more complicated than need be." - s12

Some students (2/17 students) also suggested that the app could be more helpful if certain elements could be shared with other users, such as being able to share a shopping list with your flatmate, which gets updated when one of the users ticks off one of the elements in the list (1/17) or share your calendar with other users to find a time when everyone is free (1/17).

"It would be awesome to have a feature to share events, tasks, and other features between multiple devices with other users (e.g. invite friends to group study sessions, fill in a shopping list together with someone, etc.)" - s9

Two of the participants (1/17 students and 1/2 HCI experts) also stated that the font could be made smaller.

"The font size should be improved, making it smaller. you could also just add a system to adjust the size." - s14

Some other suggestions were:

- Course overview (1/2 HCI experts): they said it would be nice to have an overview of your courses.

  "It would be cool if you could search for a course and it would give you an overview of that course: like how much time you spent on time, what tasks do you have, lectures and other things" - ex1

- Suggestions from the app on when to work (1/2 staff members): they suggested that the app could notify the user when they have weeks that are less busy so that they can get some work done.

- Study timer: one of the students (1/17 students) stated that they would like it if the app included some system to partition your time into chunks and include breaks in between, to not overwork. When I saw this, I thought of the study timer technique which is supported by research (see section 2.4).

7.7.2 Dashboard and menu

Two of the students (2/17) said they thought the dashboard looked too cluttered, and one of those students (1/17) suggested to make the font smaller in order to make the screen look less cluttered. Additionally, one of the HCI experts (1/2) said the font in the menu should also be smaller and the words should not all be in upper-case.

Furthermore, one of the students (1/17) suggested to add the option of selecting events and tasks directly from the dashboard in order to edit or delete them, so that the user does not need to go to the Calendar or Tasks screen to do so.

7.7.3 Calendar

When editing or creating an event, some of the participants (2/17 students and 1/2 HCI experts) did not see at first that the screen could be scrolled vertically to show more options. The two students (2/17) suggested that there should be some sort of visual cue to make this clear.

"When all the elements of creating a new event (or in this case coursework) do not fit on the screen, you need some sort of indicator that it is possible to scroll down. Whether it would be a semitransparent scroll bar on the side, or an only half-visible tab/button/text on the bottom, or something else, this is necessary, as otherwise it is not obvious that scrolling down is an option." - s9

A few participants (1/17 students and 1/2 staff members) said they liked that the user can add tasks to an event or to the calendar.

"It's cool that you can assign tasks to specific study sessions so you know what you're working on!" - s10

"You can add tasks to an event or to the calendar? That's really nice." - ss1

Some of the participants (2/17 students and 1/2 staff members) suggested that it would be useful to be able to add new tasks, when the user is linking tasks to an event. In the current design, the user can only add existing tasks to the event.

"Maybe it would be useful to create new tasks from this screen directly." - as1

One of the students (1/17) said that they would like to see when events end, instead of seeing the duration of the event.

"The duration rather than end time on things. I'd like to know just by looking at it when I am free rather than doing (admittedly very basic) Maths." - s15

One of the students (1/17) asked if it would be possible to sync other calendars in the app, which was one of the original requirements (see table 4.2), which I decided not to include as of yet since only one students had mentioned it during the Requirements Gathering phase (see section 4).

7.7.4 Tasks

One of the HCI experts (1/2) stated that it would be useful to have the app suggest tasks to complete today, i.e. add to the Today task list. The app could suggest tasks with highest priority, tasks with the closest deadlines, and tasks that you were not able to complete the day before. etc. Microsoft To Do [42] [Background - 2.6.6] includes a similar feature. One of the students (1/17) also said that the app could send notifications at the end of the day updating the user of the tasks they had to finish today and did not complete.

"Maybe it could have a notification feature that updates you if you are near the end of your day and just want to see what else you need to do." - s12

In the current design, there is a special tasks menu that can only be accessed from the Tasks screen (see figure 5.9), however two of the students (2/17) did not like that the menu from tasks changes.

Regarding the Edit Tasks screen, one of the students (1/17) pointed out that there was no delete icon for the subtasks when editing a task.

One of the students (1/17) mentioned Google Keep [71] and how it can auto-complete words while you are writing, and said that it was something they would like to see in this app as well. The same student added that Google Keep also lets them share a shopping list with someone.

"Creating a shopping list in Google Keep is nice, because it suggests common things to auto-complete with as you type, as well as things from your previous history of what you had written in this list before. I can share the shopping list with my girlfriend, so we can both add things to the same place and whenever one of us goes shopping, that person can tick off what they bought." - s9

7.7.5 Time tracker

A few participants (2/17 students and 1/2 staff members) suggested that it could be useful to start a time tracker directly from an event, if you want to track that event specifically.

"It won't automatically track if I have an event on the calendar? This might be something people might want." - as1

Two participants (1/2 HCI expert and 1/2 staff members) pointed out that the tabs to choose between the Time Tracker screen and the Statistics screen were too similar, and it was not clear which one was selected. The staff member (1/2) suggested to change the colour of the selected tab to white.

"You could change the tabs, so the one that is selected is maybe in white so it continues with the rest of the screen, this will give you a better idea of in which tab you're on." - as1

A few students (2/17) also pointed out that the user could forget to stop the time tracker after they stop working, or maybe the user has worked on a course and they forgot to start the time tracker, so there should be some mechanism to avoid this.

"The user might forget to click start and then stop. I am worried that what if I forget to stop the tracker, maybe I remember 6 hours later. " - s3

Some other suggestions were:

- Filter and group trackers (1/17 students): One of the students suggested that one should be able to filter and group the past trackers to be able to find them quicker.
- Make big '+' (plus) button smaller (2/17 students): a couple students thought the button was taking too much space on the screen.

- Start tracker without having to add the label (1/17 students): currently, to start a time tracker you need to specify what the tracker is for, however, one of the students said the tracker should be able to start without having to specify the label, and maybe the user can set the label later.

Overall, the time tracker feature received some nice comments from a few participants (3/17 students, 1/2 HCI experts and 1/2 staff members).

"The time tracker and achievements are a really good combination to help improve motivations." - s6

"It showcased a nice feature that I haven't got when using Google Calendar [38], by tracking time spent on different categories for you." - s9

"I loved to be able to track time and the suggestion of time about when to work on something." - s8

The Statistics screen also received good comments as well as some suggestions to improve it.

- Include legends or labels to the axis in the chart (1/17 students and 1/2 HCI experts)

  "This is nice, maybe it would be good to have legends on the bar chart." - ex1

  "For statistics, the bar chart only has colours to show the amount of time - I think it would be clearer if you could add the labels or abbreviations too?" - s10

- Display how much time is split between courses (1/17 students)

  "Really like the stats! Also is there a way to display how much time you are splitting between your courses. I try keep track of this so I do not go too much into one subject." - s15

7.7.6 Coursework and Exams

The Coursework screen and the "Suggest times" feature received some good feedback (3/17 students and 1/2 staff members).

"I loved [...] the suggestion of time about when to work on something.I loved it, gosh, I wish I had this already!" - s8

"I think it was nice that it will automatically add it to my calendar, the times that I am going to study." - s3

Regarding the Gantt Chart, which was one of the original requirements (see table 4.2), there were mixed opinions about it. One of the HCI experts (1/2) said one of the things she liked most about the design was the chart, but it could be extended for coursework that falls out of the usual semester weeks.

"I liked the chart for the coursework, that was very nice. Although, what about coursework that ends in April or May? You could just add en entire calendar." - ex1

However, one of the students (1/17) said they found the chart confusing.

"The resulting calendar is quite confusing at first to me. I think the visualization could be severely improved." - s7

Some of the participants had some ideas to improve this feature:

- Help managing revision (1/17 students)

  "Just like the time suggest for coursework, a similar function for the exam (include those small tests) to help manage the necessary revision should be useful, too." - s6

- Suggestions from the app on when to work (1/2 staff members)

  "You could make the app be more proactive in terms of putting all the deadlines and lectures at the start of the semesters, and maybe it could encourage you to start coursework early, or maybe if there are many deadlines close together in the future the app could suggest the user schedule sometime now to work on that coursework rather than waiting." - as1

- Renaming the feature (1/17 students)

  "When it is not term time I would still like to use the app - so maybe renaming it to be 'New project', with an option to say it is coursework? Since I like to try and do projects over the summer in a similar way to coursework and try to set deadlines for myself." - s15

7.7.7 Achievements

Several participants (5/17 students, 1/2 HCI experts and 1/2 staff members) expressed interest in the rewards feature of the app.

"I like the idea of gamification of one's own schedule. It could be a good way to help people maintain discipline. I know because I struggle with discipline, and I love games." - s7

"I love it, no suggestions on improving it." - s8

"Nice to have achievements so that there's a feeling of accomplishment/motivation to study (and continue using the app)." - s10

Some participants (2/17 students and 1/2 staff members) suggested that the screen could show a progress bar for each achievement.

"I would like to see progress bars or some kind of other indicator next to the badges, maybe showing me them in order of how close I am to getting them. Listing them out with progress bars next to them would also eliminate the need to click on a badge to see progress for it - less clicks to navigate = easier and simpler UI." - s9

"I think the achievements for me wouldn't necessarily be black and white. It would be things like: I spent 30% of the time I planned to spend on that coursework. So achievements could be how well you kept to your schedule, not like "yes, you kept to your schedule" or "no, you did not", but more like getting an intermediate measure, like 60% of the time you're keeping to your schedule. In this case, to be able to see

how your productivity improves, especially with the help of the app, would be very rewarding." - as1

One of the students (1/17) pointed out that the greyed out badges that is supposed to represent badges that have not been achieved, look like a silver badges.

One thing I found weird was when you went to the achievements, the greyed out badges look like a silver badge. - s5

7.7.8 Potential impact

This section covers Research Question 10 about how this app could potentially impact students. Students were asked to rate the app from 1 (very unhelpful) to 5 (very helpful) and the staff members were asked to comment on how helpful the app could be for students, both in terms of 4 different aspects: keeping up with courses, meeting deadlines, reducing procrastination and managing personal life.

Participant	Keeping up with courses	Meeting deadlines	Reducing procr.	Managing pers. life
s1	4	4	2	3
s2	4	5	3	3
s3	4	5	3	4
s4	5	5	5	4
s5	4	4	4	2
s6	4	4	5	5
s7	3	5	4	4
s8	5	3	5	5
s9	5	5	3	4
s10	5	5	5	5
s11	3	4	5	4
s12	4	5	4	3
s13	5	5	5	5
s14	4	4	5	3
s15	5	5	4	5
s16	4	3	4	3
s17	4	4	3	4
Mean	**4.24**	**4.41**	**4.06**	**3.88**
Median	**4**	**5**	**4**	**4**

Table 7.2: Ratings given by students on how helpful the app could be to them

7.7.8.1 Keeping up with courses

As seen in the second column of table 7.2, most students (15/17) thought the app could be "somewhat helpful" (4) or "very helpful" (5) with helping them keep up with their courses, and two (2/17) students thought the app would be "neither helpful nor unhelpful" (3) at helping them. When asked about this, the staff members that took part in the studies said the following:

"I do think that by committing to that app and using it properly I'm sure students will be more organized. Just being able to see what they need to do by when, basically visualizing their schedule, and if they stick to their schedule it could be very helpful and I think it will make them more effective. I think it's a really useful tool. You also have this tool which can help them reflect on how much time they spend on something, the time tracker." - ss1

"I think it could help. I think people often don't have time discipline so having an app that can help with that, and help with keeping track of things, would be very useful." - as1

7.7.8.2 Meeting deadlines

As seen in table 7.2, this aspect is the highest rated out of the four, with a mean of 4.41 and a median of 5. Most students (9/17) thought the app could be "very helpful" (5) and some students (6/17) thought it would be "somewhat helpful" (4), but two (2/17) students thought the app would be "neither helpful nor unhelpful" at helping them meet deadlines, different students from the ones that rated the app with a 3 in the previous section.

"I think it would be helpful, but they need to commit to putting the data into the app so that it can help them manage their time. It could help them because it has a visual representation of what they need to do and by when, and just help them be more organized. It could potentially reduce a bit of anxiety as well, just by having a clearer idea of what they need to do, they will be more likely to meet their deadlines and not feel so anxious." - ss1

"Specifically, the fact that you see deadlines, the amount of work you budgeted, the fact that is giving you notifications of upcoming events, certainly should be helpful." - as1

7.7.8.3 Reducing procrastination

Most students (12/17) rated the app with a 4 or 5 in terms of reducing procrastination, although there were some students (4/17) who thought the app would be "neither helpful or unhelpful" (3) and one student (1/17) who thought this app would be "somewhat unhelpful" (2), as seen on table 7.2. Overall, it has a mean of 4.06 and a median of 4.

"If you plan to work on something for two hours and tell the app, and you then spend half an hour on social media then you realize how much time you have waste, so I think this could help with avoiding distractions and procrastination." - ss1

"Being able to see what you got to do and by when should help people realize when crunches might be approaching, so as long as they check the app regularly to see what the calendar looks like for the upcoming week or next few weeks seems like it ought to help." - as1

7.7.8.4 Managing personal life

This aspect is the lowest rated out of the four, with a mean of 3.88, but still a median of 4. Even though most students (11/17) rated the app as helpful (4 or 5) on this aspect (six students rated it with a 4 and five students with a 5), five students (5/17) rated it as ”neither helpful or unhelpful” (3) and another student (1/17) rated it as ”somewhat unhelpful”(2), as seen on table 7.2. This could be because some students do not make use of an app to manage their personal life, and they would only make use of tools like this to manage their time at university. The staff members had the following to say:

”Yes, the fact that you can put social stuff in your calendar as well, and just a reminder that you need to get to the shop. Because when you’re very focused on the work, you might forget to take care of yourself which is also a priority.” - ss1

”I think it could be useful, in terms of keeping track of laundry, shopping for groceries. If you have not done laundry in two weeks maybe it can remind you when you have free time.” - as1

7.7.9 SUS results

Participant	SUS score
s1	52.5
s2	67.5
s3	90
s4	90
s5	50
s6	80
s7	50
s8	95
s9	52.5
s10	80
s11	57.5
s12	62.5
s13	100
s14	90
s15	100
s16	87.5
s17	80
Mean	**75.59**
Median	**80**

Table 7.3: SUS results from the final evaluation

This section aims to answer RQ9: how this app is perceived by students in terms of usability. The results of the SUS questionnaire can be seen in table 7.3. The score from over half of the participants is above 80, seven participants rated it below that, in the range between 50 and 70. The mean is 75.59 and the median is 80. This score rates

the second iteration of the design as acceptable, according to the rating scale in table 2.1, and graded with a C, according to the grading scale in table 2.2.

Although still in the acceptable range, these results are lower than the ones from the previous evaluation (see table 5.2). This could be due to the greater amount of participants, some of which not interested in a tool like this, or the increase in complexity of the design, which can be sometimes emphasised by the limitations of Figma [61].

7.7.10 New requirements and suggested changes

From this evaluation, I have managed to gather new requirements (requirement 28-47) that the second iteration of the design should cover. All the requirements are now in tables 7.5 and 7.6. I also gathered some suggested changes to improve the design, seen in table 7.4.

The following are the requisites for the three different levels of priority:

- High: A requirement will be prioritised as high if it is supported by research, supported by at least five participants and/or supported by both HCI experts.
- Medium: A requirement will be prioritised as medium if it is supported by at least two participants and/or supported by one HCI expert.
- Low: supported by at least one participant.

7.8 Summary

In this chapter, I described the kind of evaluation I conducted for the second iteration of the design and I discussed the results from the evaluation, including the results from the SUS. The results were overall positive. Some participants stated they liked some of the features or the app in general, and the SUS results graded the design of the app as acceptable. Furthermore, most students thought the app could help them during their time in university, in one way or another. I got many suggestions to improve the design that I will hopefully be able to apply to the design in the future.

#	Suggestion	Priority	Reason For Priority
1	Move Delete button from the screen to edit events and tasks	High	Supported by 5/6 participants.
2	Remove class schedule from menu to make it less crowded	Medium	Supported 2/6 participants.
3	Add option to add tasks or events from the dashboard	Medium	Supported by 1/6 participants, and I think it would be useful for adding things quicker to the app.
4	Add other options when sliding a task to the sides	Low	Supported by 1/6 participants.
5	Font should be smaller	Medium	Supported by 1/17 students and 1/2 HCI experts.
6	Make scrolling more visible	Medium	Supported by 2/17 students and 1/2 HCI experts.
7	Create new tasks when linking tasks to event	Medium	Supported by 2/17 students and 1/2 staff members.
8	Show the time when the event ends	Low	Supported by 1/17 students.
9	Menu should not change	Medium	Supported by 2/17 students.
10	Add delete icon to subtasks	Low	Supported by 1/17 students.
11	Change colour of selected tab to white	Medium	Supported by 1/2 staff members and 1/2 HCI experts.
12	Make start tracker button smaller	Medium	Supported by 2/17 students.
13	Include legend in bar chart	Medium	Supported by 1/17 students and 1/2 HCI experts.
14	Extending the Gantt chart [64]	Medium	Supported by 1/2 HCI experts.
15	Renaming the feature of Coursework	Low	Supported by 1/17 students.
16	Change designs of incomplete badges	Low	Supported by 1/17 students.

Table 7.4: Changes suggested by the participants

#	Requirement	Priority	Reason For Priority
1	Calendar system	High	Supported by 13/15 students, 2/2 staff members and research (see section 2.4).
2	Have contact hours automatically uploaded	High	Supported by 5/15 students. It will make it easier to set up.
3	Have assignment deadlines automatically uploaded	Medium	Supported by 2/15 students and 1/2 staff members. It would make it easier to set up.
4	Use a Gantt Chart [64] to display assignment deadlines	Low	Supported by 1/15 students.
5	Reminders and notifications for events	High	Supported by 6/15 students and 1/2 staff members.
6	Colour-coding	High	Supported by 7/15 students.
7	Recurring events	Medium	Useful for events that repeat, like lectures, and very common in calendar apps. Supported by 2/15 students.
8	Different calendar viewing options (month, week, 3-days, day)	Medium	Supported by 2/15 students and very common in calendar apps.
9	Synchronise calendars from other accounts	Medium	Supported by 1/15 students and 1/17 students.
10	To-do lists	High	Supported by 10/15 students and by research (see section 2.4).
11	Add deadlines to tasks	High	Supported by 2/15 students. Useful for students to stay on top of their tasks.
12	Tick off tasks to mark them as completed	High	Supported by 2/15 students. Included in all task management apps, very basic feature.
13	Prioritise tasks	High	Supported used by 10/15 students, 1/2 staff members and research (see section 2.4).
14	Group tasks	High	Supported by 2/15 students and research (see section 2.4).
15	Task progress bar	Low	Supported by 2/15 students.
16	Quickly adding tasks	Medium	Supported by 2/15 students.
17	Have tasks linked to calendar events	High	Supported by 7/15 students.
18	Ask the user after the event if the tasks were completed	Low	Supported by 2/15 students.
19	Tracking time	High	Supported by 3/15 students, 2/2 staff member and research (self-assessment behaviour - see sections 2.2 and 2.4).
20	Feedback time tracking information to course organisers	Low	Mentioned by 1/2 staff.
21	Help distribute work	Medium	Supported by 3/15 students and 1/2 staff members
22	Reward System	Medium	Supported by 3/15 students and 1/2 staff members.
23	Easy to use and set-up	High	Supported by 7/15 students.

Table 7.5: New list of requirements

#	Requirement	Priority	Reason For Priority
24	Have everything in one place	Medium	Supported by 3/15 students.
25	Monitor how much time the user spends on something and notify if behind schedule	Low	Supported by 1/2 staff members
26	Life management	Medium	Supported by 1/15 students and 1/2 staff members.
27	Feedback	Low	Supported by 1/2 staff members
28	Have visualization of time tracker information	Low	Supported by 1/6 participants.
29	Customisable colours	Low	Supported by 2/17 students.
30	Confirmation windows after creating or deleting an element	High	Supported by 1/17 students, 2/2 HCI experts and would cover one of Nielson's heuristics, "error prevention" [Background - 2.10].
31	Users should be able to share tasks and events with other users	Low	Supported by 2/17 students.
32	Course overview	Medium	Supported by 1/2 HCI expert.
33	Suggestions of the app on when to work	Low	Supported by 1/2 staff members.
34	Study timer	High	Supported by 1/17 students and research (see section 2.4).
35	Edit/delete events or tasks from dashboard	Low	Supported by 1/17 students.
36	Help choosing today's tasks	Medium	Supported by 1/2 HCI experts.
37	Notifications about tasks left to complete	Low	Supported by 1/17 students.
38	Word auto-complete	Low	Supported by 1/17 students.
39	Have multiple collaborators in one task	Low	Supported by 1/17 students.
40	Start time tracker from event	Medium	Supported by 2/17 students and 1/2 staff members.
41	Send notifications to help the user not forget to stop the time tracker	Medium	Supported by 2/17 students.
42	Filter and group trackers	Low	Supported by 1/17 students.
43	Start time tracker without specifying label	Low	Supported by 1/17 students.
44	Display how much time is split between courses	Low	Supported by 1/17 students.
45	Help managing revision	Low	Supported by 1/17 students.
46	Suggestions from the app on when to work	Low	Supported by 1/2 staff members.
47	Progress bar for achievements	Medium	Supported by 2/17 students and 1/2 staff members.

Table 7.6: New list of requirements (cont.)

Chapter 8

Discussion, future work and conclusions

8.1 Discussion

Overall, I was satisfied with the methodologies I used throughout this project, for data collecting as well as data analysing. Even though the requirements gathering studies took a long time to conduct, I gathered a lot of useful information by conducting interviews **??** [Background - 2.8.2] that I do not think I would have managed to gather otherwise. I had some issues with the last studies due to the Coronavirus pandemic [62] and having to conduct the rest of the studies online, but I would never have predicted a situation like this and I still managed to gather useful information from the participants by using the online questionnaire [49] or using Skype [72], even if it took longer than expected.

I was also satisfied with Figma [61] as a tool to design the interface of the app. Although Figma has limitations, I had some previous experience using Figma and by using it during this project it allowed me to get to know the tool better, which will help me in other projects in the future. Figma has many useful features that I would have not discovered if it were not for this project and knowing these features allowed me to create a better and more detailed design than I expected.

8.1.1 Limitations

One of the main issues I discovered when conducting all the studies (for requirements gathering and evaluation) is that everyone has very different ways of managing their time, so at times, I would get contrasting statements from participants, which sometimes made it difficult to please everyone. Some participants, especially students, were very excited at the idea of having an app that combines multiple things, as some of them stated that they used more than one app to manage their time and this can sometimes be counterproductive. However, some students did not seem interested in the idea of an app like this, and stated that they would prefer a simpler app, like Google Calendar[38] [Background - 2.6.2]. However, an app like Google Calendar already

exists, and my aim with this project is to fill a gap, so that students can have an option that covers more of their needs. I think a possible solution for this would be to allow users to select the features they want to use when setting up the app, so that the app can be more customised to what every user wants. It is worth noting that there were also some students who simply did not use any time management tools or techniques. In this case, they are not potential end users of this app, at least at the time being, while they may become potential users later in their studies, as they become more difficult to manage.

Another issue was finding participants for the studies. When sending emails to a large student mailing list, I received very few responses, and I would sometimes have to email potential participants one by one or ask them in person in order to be able to get enough participants. When contacting staff members, I could only email whole departments and most of the time they would turn down my request and would try to point me to other departments, which I had already contacted. Additionally, once a participant agreed to take part in the study with the online questionnaire [49] [Background - 2.8.4], I would respond to them and let them know that I would send them the material shortly, as when I started to look for participants for the study with the online questionnaire, I was still working on the questions for the questionnaire. Once I had finished preparing the questions, I would send them the instructions and the necessary links, but they would never get back to me, and I had to remind most participants multiple times to complete it. This was one of the caveats of conducting a study online. Since participants could take the online questionnaire at any time, it was easier for them to postpone it. If I were to do similar studies again, I would start contacting potential participants very early for studies that would involve meeting with the participant in person, but, if the study was online, I would only look for participants once the material for the study was ready, and I would send it to them as soon as they agreed to participate.

During the evaluations, Figma [61] confused a lot of participants, even when I explained that it had many limitations and that what they were evaluating was only a prototype, and they should only comment on the design. I also explained beforehand that some things would be already filled in, since Figma does not allow text entry while you are seeing the prototype. Even so, they would comment on not being able to change titles or not being able to click on some buttons that were not part of the task. If I were to use Figma again to evaluate a design, I would try to do a demonstration first with a prototype of another app to show participants all the limitations of Figma in a more visual way.

Another issue during evaluations was that some participants would sometimes misunderstand some of the tasks, or the wording of the task would lead them somewhere else. In the future, I would try to have another person try out the tasks before I use them during my studies, to make sure they are as clear as possible.

8.2 Future work

As this is only part one of an MInf project, I will have the chance to continue working on this project in part two. My aim for part two of this project is to develop the app as well as include most of the requirements or suggestions that were not addressed during this process (see tables 7.4, 7.5, and 7.6) or requirements that were not covered because they required a back-end solution, like the requirement to upload students' contact hours automatically to the calendar (see requirement 2 in table 7.5). The following sections describe the aspects of the project as well as some of the requirements I will be focusing on during the second part of the project.

8.2.1 Research the best tools and approaches to develop the app

Before I start developing the app, I will research the different technologies and tools there are to do so, and what way would work better with my goals. If I chose to only focus in developing an Android app, I could choose to use Android Studio [73], or if instead I choose to create a hybrid app, I could use Reach Native [74] or Angular [75]. These are some examples of the tools I could use in the future, but I will not know what tool would fit my project until I research all the available tools for app developing.

8.2.2 Secure data storage

For an app like this one, users should be able to store their personal data without having to worry about security issues. One of my main concerns during the second part of this project will be finding a way of storing the users' data securely and in a way that if they ever loose or damage their devices, the data will not be lost.

8.2.3 Authentication

One of the requirements gathered during this project was having the user's learning hours automatically uploaded to the app (see requirement 2 in table 7.5). In order to do this, I could integrate it with the University's login system and get this information from their accounts, without exposing any other information. I will have to research how to accomplish this, but this would not only give the app information that would make it easier for the user to set it up, but it would also make it easier for students to remember their login information.

8.2.4 Working with course organisers

Another requirement was to also have the assignment deadlines automatically uploaded and updated in the app (see requirement 3 in table 7.5). This would not only require the app to have access to the user's university account, but it would also require to be able to access the coursework information. Currently, course organisers use different platforms to communicate and share information and material with students. Some of them use Blackboard Learn [76], Piazza [**?**] or a course website. To solve this, I could create a simple platform that is easy to use to input this kind of information,

which will then update the information on the user's devices. This would mean having to convince course organisers to use this, which might be difficult. Another option would be to let the users themselves upload or update this information, which it then could be confirmed by another student or instructor of that course.

8.2.5 Customisation

As I mentioned in section 8.1.1, a few students said the app had too many features and some students might not use every feature the app offers. A way to deal with this without taking from the experience of other users, could be to make it possible for users to select which features will show on the app in their devices, and which will not show (potentially when they first open the app, and later changeable from their account). This could potentially make the app more customisable and tailored to the needs of each user.

8.2.6 Study timer

Using the study timer method is one of the time management techniques that is recommended for students (see section 2.4). This technique consists of spending a limited amount of time working or studying and taking a short breaks in between. However, it was never mentioned during the studies of the requirements gathering phase (section 4), which made me decide to not add it to the design at first. In the last evaluation, however, one of the participants mentioned it (see requirement 34 in table 7.6), and so I think it would be a good idea to add it to the app. Since some students already think the app has a lot of features, the study timer could be integrated with the Time Tracker, as they are fairly similar concepts. The difference between the two is that a time tracker only keeps track of how much time you spend on a certain activity, which can help the user decide if they are spending too much or not enough time on certain activities, whereas a study timer can help the user limit the amount of time they spend doing something, by letting them know when the time is over through a notification, and encourage them to take breaks.

8.3 Conclusions

During this project, I designed and evaluated a time management app for Informatics students. I began by doing some research on the topics of time management and procrastination, and specifically involving students, which led me to interview students, as well as some staff members, to specify what kind of time management features would students be interested in and to gather requirements for the design. Based on the requirements, I designed two iterations of the design for the app, each one evaluated by students. During the first evaluation I aimed at evaluating the basic aspects of the app, and for the second evaluation, I added more features, some which are not common in time management apps, to evaluate these features as well as the features in the context of the app. During the second evaluation, I also conducted studies with staff members and HCI experts, as well as students. The overall response to the app was positive and many students showed interest in using it once it is ready.

During the studies I aimed to answer the Research Questions established at the beginning of the project (see section 1.2). In the following sections, I will summarise the answers to these questions.

8.3.1 RQ1: What is the typical daily schedule of an Informatics student?

The answer to this question is described in section 4.7.1. Students have different kinds of schedule, depending on what other responsibilities they have in their lives, besides university. Most students go to campus on a daily basis, and their schedule does not seem to change much during the weekend or during revision weeks. Some students said they used the extra time during the weekend to do chores or sleep longer. Students also mentioned they would use the extra time during revision weeks to study more and prepare for the exams.

8.3.2 RQ2: How do they handle coursework?

The answer to this question is described in section 4.7.2. In order to be able to dedicate more time to coursework, students will neglect some of their responsibilities, such as lectures and tutorials, and will even sacrifice their sleep.

8.3.3 RQ3: What kind of issues do they run into?

The answer to this question is described in section 4.7.2. According to staff members, some of the issues students face during their time in university, are: dealing with an unstructured schedule and taking care of their mental health, which can be affected by the pressure to perform well in university as well as dealing with other responsibilities, such as jobs, societies and taking care of themselves.

8.3.4 RQ4: Do they have problems with procrastination?

The answer to this question is described in section 4.7.2. Procrastination seems to be widespread amongst students. All students interviewed stated they procrastinated, most of them by spending time on social media or on the Internet in general.

8.3.5 RQ5: What kind of methods and/or tools do Informatics students use?

The answer to this question is described in section 4.7.3. Students like to use calendar apps, such as Google Calendar [38], Microsoft Outlook [37] and MyStudyLife [39]. They also like to use to-do lists, either on apps, such as Trello [**?**] or any notes app on their phone, or on paper. Some of them also use physical tools such as planners and paper calendars.

8.3.6 RQ6: What aspects of these methods/tools do they find useful? and RQ7: What features would they like to see in a time management app for Informatics students?

The answers to these questions are described in section 4.7.3 and 4.7.4, respectively, as well as in the results of both evaluations (see section 5.2.7 and 7.7). For a summary of these features, see tables 7.4, 7.5, and 7.6.

8.3.7 RQ8: How can we design a time management app that suits Informatics students at the University of Edinburgh?

The answer to this question is described in the results of both evaluations (see section 5.2.7 and 7.7). In order to design a time management app for Informatics students, one should follow the suggestions they offered during both evaluations, summarised in tables 7.4, 7.5, and 7.6.

8.3.8 RQ9: How is the usability of the design perceived by Informatics students?

The answer to this question is described in sections 5.2.7.10 and 7.7.9. The usability of the design was rated better during the first evaluation of the design than during the second evaluation. This could be due to the increase in participants as well as complexity of the design during the second evaluation. Overall, the design was rated as acceptable in both evaluations, according to the Acceptability rating scale described in section 2.12.4 (see table 2.1 for the full scale).

8.3.9 RQ10: What would be the potential impact of the app for students?

The answer to this question is described in section 7.7.8. Overall, students rated the app as ”Somewhat helpful”(4) (mean: 4.24, median: 4) in terms of helping them keeping up with their studies, as ”Somewhat helpful”(4) and ”Very helpful”(5) (mean: 4.41, median: 5) in terms of helping them meet deadlines, as ”Somewhat helpful”(4) (mean: 4.06, median: 4) in terms of helping them reduce procrastination, and as ”Somewhat helpful”(4) (mean: 3.88, median: 4) in terms of helping them manage their personal life.

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Appendices

Appendix A

Consent Form

Participant number:_____

Participant Consent Form

Project title:	Designing a Time Management App for and with Informatics students
Principal investigator (PI):	Cristina Alexandru
Researcher:	Julia Castillo Trujillo
PI contact details:	calexan4@staffmail.ed.ac.uk

Please tick yes or no for each of these statements.

		Yes	No
1.	I confirm that I have read and understood the Participant Information Sheet for the above study, that I have had the opportunity to ask questions, and that any questions I had were answered to my satisfaction.		
2.	I understand that my participation is voluntary, and that I can withdraw at any time without giving a reason. Withdrawing will not affect any of my rights.		
3.	I agree to being audio recorded.		
4.	I consent to my anonymised data being used in academic publications and presentations.		
5.	I understand that my anonymised data can be stored for a minimum of two years		
6.	I allow my data to be used in future ethically approved research.		
7.	I agree to take part in this study.		

Name of person giving consent	Date dd/mm/yy	Signature

Name of person taking consent	Date dd/mm/yy	Signature

THE UNIVERSITY of EDINBURGH informatics

Appendix B

Participant Information Sheet - Students (Requirements Gathering phase)

Participant Information Sheet

Project title:	Designing a Time Management app for and with Informatics students
Principal investigator:	Cristina Alexandru
Researcher collecting data:	Julia Castillo Trujillo
Funder (if applicable):	No

This study was certified according to the Informatics Research Ethics Process, RT number 2019/83871.Please take time to read the following information carefully. You should keep this page for your records.

Who are the researchers?

The researchers of the study are Julia Castillo Trujillo who is an undergraduate student in the University of Edinburgh School of Informatics and Cristina Alexandru who is her supervisor.

What is the purpose of the study?

This study is part of an undergraduate project, which aims to design a time management app that will address Informatics students' need for better managing their time at university. The purpose of this study is to define the biggest issues students have when managing their time, and what techniques and tools they use to help them better manage their time. The study also aims to learn how an app could help and what features they would find useful in such an app.

Why have I been asked to take part?

The aim of this project is to design an app to help Informatics students at the University of Edinburgh. As potential end users for such an app, you can help us design something which will address your needs and, ultimately, help you with your studies and your life at university.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, without giving a reason. Your rights will not be affected. If you wish to withdraw, contact the PI. We will stop using your data in any publications or presentations submitted after you have withdrawn consent. However, we will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

We will ask you some questions in the form of an interview to collect data on the problems you may have run into and the strategies and tools that you have used (or have considered using) to manage your time in university, and what your schedule looks like during term time and exam time. The interview shouldn't last longer than 30min and it will be audio-recorded with your consent.

Are there any risks associated with taking part?

There are no significant risks associated with participation and it will not affect your studies in any way.

Are there any benefits associated with taking part?

The app is to be used by students of the School of Informatics like you, so by participating in this study you'll have the chance to influence the design of the app and include features to address your needs.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data may be archived for a minimum of 2 years.

Data protection and confidentiality.

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a

unique participant number rather than by name. Your data will only be viewed by the researcher/research team: Julia Castillo Trujillo and Cristina Alexandru.

All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, and all paper records will be stored in a locked filing cabinet in the PI's office. Your consent information will be kept separately from your responses in order to minimise risk.

What are my data protection rights?

The University of Edinburgh is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance to the Data Protection Law. You also have other rights including rights of correction, erasure and objection. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk. Questions, comments and requests about your personal data can also be sent to Julia at s165774@sms.ed.ac.uk.

Who can I contact?

If you have any further questions about the study, please contact the principal investigator, Cristina (calexan4@staffmail.ed.ac.uk). If you wish to make a complaint about the study, please contact inf-ethics@inf.ed.ac.uk. When you contact us, please provide the study title and detail the nature of your complaint.

Updated information.

If the research project changes in any way, an updated Participant Information Sheet will be sent by email to you by Julia.

Alternative formats.

To request this document in an alternative format, such as large print or on coloured paper, please contact Julia (s1651774@sms.ed.ac.uk).

General information.

For general information about how we use your data, go to: edin.ac/privacy-research

Appendix C

Participant Information Sheet - Staff (Requirements Gathering phase)

Participant Information Sheet

Project title:	Designing a Time Management app for and with Informatics students
Principal investigator:	Cristina Alexandru
Researcher collecting data:	Julia Castillo Trujillo
Funder (if applicable):	No

This study was certified according to the Informatics Research Ethics Process, RT number 2019/83871. Please take time to read the following information carefully. You should keep this page for your records.

Who are the researchers?

The researchers of the study are Julia Castillo Trujillo who is an undergraduate student in the University of Edinburgh School of Informatics and Cristina Alexandru who is her supervisor.

What is the purpose of the study?

This study is part of my Undergraduate project, which aims to design a time management app that will address Informatics students' need for better managing their time at university. The purpose of this study is to define the biggest issues students have when managing their time, and what techniques and tools they use to help them better manage their time. The study also aims to learn how an app could help and what features they would find useful in such an app.

Why have I been asked to take part?

The aim of this project is to design an app to help Informatics students at the University of Edinburgh. As an academic member of staff and/or personal tutor, you might have had some insight into how students manage their time throughout the years and could help us ascertain the main problems that students run into when

managing their time during their studies, and what kind of tools and techniques they have used.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, without giving a reason. Your rights will not be affected. If you wish to withdraw, contact the PI. We will stop using your data in any publications or presentations submitted after you have withdrawn consent. However, we will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

We will ask you some questions in the form of an interview to collect data on the problems you may have seen students run into and the strategies and tools that you may have seen students use. The interview shouldn't last longer than 30min and it will be audio-recorded with your consent.

Are there any risks associated with taking part?

There are no significant risks associated with participation. Your job and promotion will not be affected by participation in this study.

Are there any benefits associated with taking part?

The app is to be used by students of the School of Informatics to help them improve their time management skills, which may help them to reduce stress and do better in their studies.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data may be archived for a minimum of 2 years.

Data protection and confidentiality

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a unique participant number rather than by name. Your data will only be viewed by the researcher/research team: Julia Castillo Trujillo and Cristina Alexandru.
All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, and all paper records will be stored in a locked filing cabinet in the PI's office. Your consent information will be kept separately from your responses in order to minimise risk.

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Appendix D

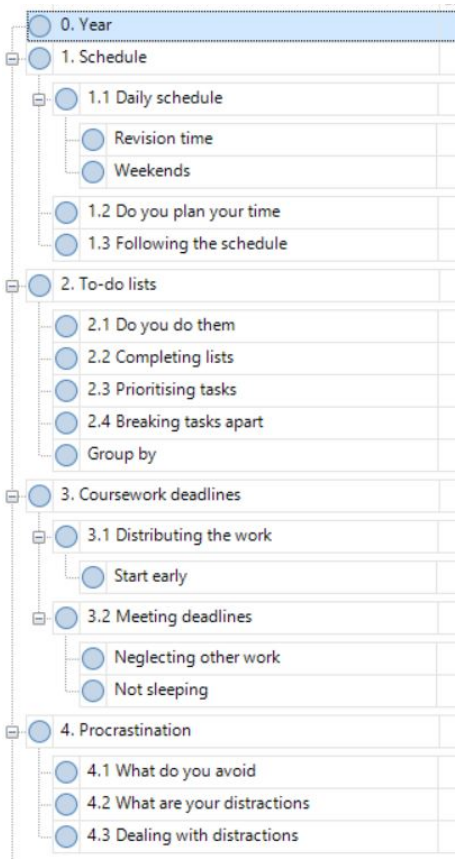
Interview questions

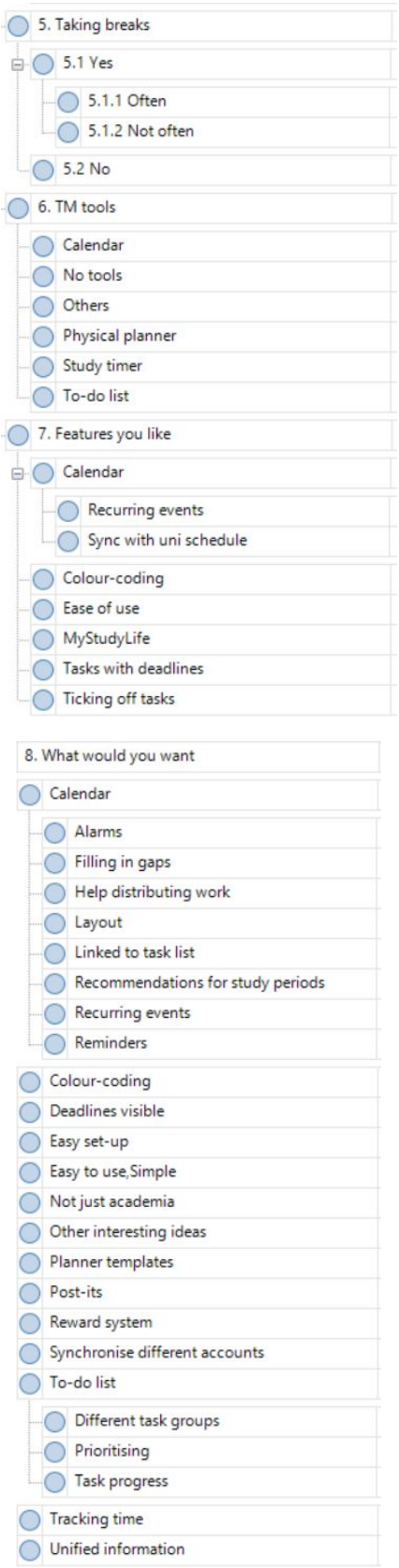
1. What year are you in?
2. What does your daily schedule look like?
   (a) What is the difference between weekdays and weekends?
   (b) What about between term time and revision time?
3. Do you plan your time in any way?
4. If you plan to do something in a certain day and time, how do you manage to follow this plan?
5. Do you write (or have you ever written) to-do lists?
   (a) Do you write them daily, weekly, monthly?
   (b) Do you complete your to-do lists?
   (c) Do you prioritise your tasks?
   (d) Do you break bigger tasks into smaller ones?
6. How do you usually handle coursework deadlines?
   (a) Do you start early and work regularly, or do you cram most of the work in the last few days before the deadline?
   (b) How do you ensure you meet deadlines?
7. Do you procrastinate?
   (a) What do you do when you procrastinate?
   (b) How do you deal with procrastination?
8. Is there anything you unintentionally spend too much time on, consequently neglecting other tasks?
9. Do you take breaks while studying?

10. Do you use any tools or methods to manage your time better or to be more productive?
11. What features do you like the most about these tools/methods?
12. What kind of features would you like to see in a time management app made for Informatics students?

Appendix E

Themes for Requirements Gathering data analysis




5. Taking breaks
5.1 Yes
5.1.1 Often
5.1.2 Not often
5.2 No
6. TM tools
Calendar
No tools
Others
Physical planner
Study timer
To-do list
7. Features you like
Calendar
Recurring events
Sync with uni schedule
Colour-coding
Ease of use
MyStudyLife
Tasks with deadlines
Ticking off tasks
8. What would you want
Calendar
Alarms
Filling in gaps
Help distributing work
Layout
Linked to task list
Recommendations for study periods
Recurring events
Reminders
Colour-coding
Deadlines visible
Easy set-up
Easy to use,Simple
Not just academia
Other interesting ideas
Planner templates
Post-its
Reward system
Synchronise different accounts
To-do list
Different task groups
Prioritising
Task progress
Tracking time
Unified information

Appendix F

Participant Information Sheet (First evaluation)

Participant Information Sheet

Project title:	Designing a Time Management app for and with Informatics students
Principal investigator:	Cristina Alexandru
Researcher collecting data:	Julia Castillo Trujillo
Funder (if applicable):	No

This study was certified according to the Informatics Research Ethics Process, RT number 2019/49519.Please take time to read the following information carefully. You should keep this page for your records.

Who are the researchers?

The researchers of the study are Julia Castillo Trujillo who is an undergraduate student in the University of Edinburgh School of Informatics and Cristina Alexandru who is her supervisor.

What is the purpose of the study?

This study is part of an undergraduate project, which aims to design a time management app that will address Informatics students' need for better managing their time at university. The purpose of this study is to evaluate the design of the first iteration of a low-fidelity prototype, in order to gather feedback and suggestions on its usability.

Why have I been asked to take part?

The aim of this project is to design an app to help Informatics students at the University of Edinburgh. As a potential end user for such an app, you can help us design something which will address your needs and, ultimately, help you with your studies and your life at university.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, without giving a reason. Your rights will not be affected. If you wish to

withdraw, contact the PI. We will stop using your data in any publications or presentations submitted after you have withdrawn consent. However, we will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

We will ask you to perform some tasks on the prototype, while also speaking aloud. After you are done, we will ask you to fill in a short survey regarding the general usability of the design, and we will ask you some questions regarding any comments you have made or any difficulties you may have encountered while making use of the prototype, or to ask for clarification regarding your replies in the survey. This process shouldn't last longer than 40min and it will be audio-recorded with your consent.

Are there any risks associated with taking part?

There are no significant risks associated with participation and it will not affect your studies in any way.

Are there any benefits associated with taking part?

The app is to be used by students of the School of Informatics like you, so by participating in this study you'll have the chance to influence the design of the app.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data will be archived for a minimum of 2 years.

Data protection and confidentiality.

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a

unique participant number rather than by name. Your data will only be viewed by the researcher/research team: Julia Castillo Trujillo and Cristina Alexandru.

All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, and all paper records will be stored in a locked filing cabinet in the PI's office. Your consent information will be kept separately from your responses in order to minimise risk.

What are my data protection rights?

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Who can I contact?

If you have any further questions about the study, please contact the principal investigator, Cristina (calexan4@staffmail.ed.ac.uk). If you wish to make a complaint about the study, please contact inf-ethics@inf.ed.ac.uk. When you contact us, please provide the study title and detail the nature of your complaint.

Updated information.

If the research project changes in any way, an updated Participant Information Sheet will be sent by email to you by Julia.

Alternative formats.

To request this document in an alternative format, such as large print or on coloured paper, please contact Julia (s1651774@sms.ed.ac.uk).

General information.

For general information about how we use your data, go to: edin.ac/privacy-research

Appendix G

Think Aloud script for first evaluation

Hello my name is Julia.

Today we will be using a prototype of a time mangement app fro students to do typical tasks like creating an event or a task. Your participation today is purely voluntary, you may stop at any time. The purpose of this exercise is identify issues with the design of this prototype. Please remember we are testing the app, we are not testing you.

Talk aloud training

In this observation, we are interested in what you think about as you perform the tasks we are asking you to do. In order to do this, I am going to ask you to talk aloud as you work on the task. What I mean by "talk aloud" is that I want you to tell me everything you are thinking from the first time you see the statement of the task till you finish the task. I would like you to talk aloud constantly from the time I give you the task till you have completed it. I do not want you to try and plan out what you say or try to explain to me what you are saying. Just act as if you were alone, speaking to yourself. It is most important that you keep talking. If you are silent for a long period of time, I will ask you to talk.

Do you understand what I want you to do? Good.

Now we will begin with some practice problems. First, I will demonstrate by thinking aloud while I solve a simple problem: "How many windows are there in my mother's house?"

[Demonstrate thinking aloud.]

Now it is your turn. Please think aloud as you describe how you would make a cup of tea at home. [Let them finish] Good.

Now, those problems were solved all in our heads. However, when you are working on the computer you will also be looking for things, and seeing things that catch your attention. These things that you are searching for and things that you see are as important for our observation as thoughts you are thinking from memory. So please verbalize these too. As you are doing the tasks, I won't be able to answer any questions. But if you do have questions, go ahead and ask them anyway so I can learn more about what kinds of questions the app brings up. I will answer any questions after the session. Also, if you forget to talk aloud, I'll say, "please keep talking." Do you have any questions about the talk aloud? Now I have some tasks printed out for you. I am going to go over them with you and see if you have any questions before we start.

[Hand them the task.] Here is the task you will be working on. Why don't you read it aloud just so you can get comfortable with speaking your thoughts?

Do you have any questions about the task?

You may begin.

Task 1: create an event

Go to the Calendar screen in the app and add an event called “Committee meeting” under the Hoppers calendar for the 12th of March from 16:30 to 18:00. Once the event is added, make sure the details are correct by clicking on it.

Task 2: create a task

Find the “Today” tasks screen and check if a task to “Message Karen to confirm dinner” is there. If it’s not there, add it under the “Personal” list of tasks, and mark this task as something you want to complete today.

Task 3: add an activity to the time tracker

Find the time tracker screen, stop tracking the already set activity and add a new activity to track revision time for Computer Security.

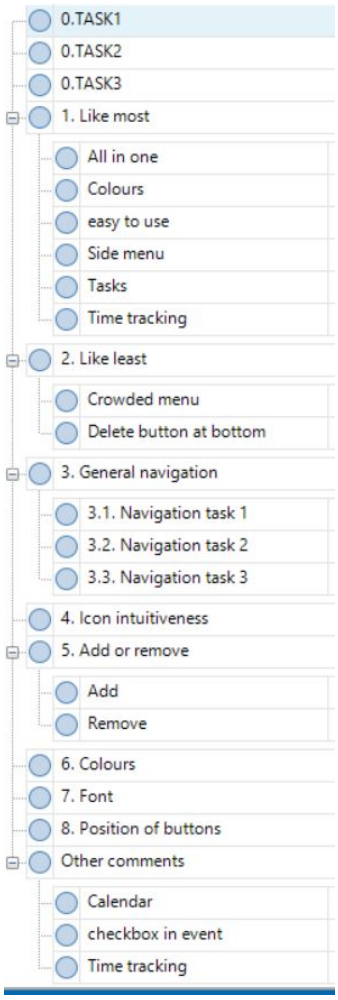
Appendix H

Questions for the first evaluation

1. What did you like most about the design?
2. What did you like the least?
3. How clear did you find the navigation during the first task?
4. How clear did you find the navigation during the second task?
5. How clear did you find the navigation during the third task?
6. How would you rate the intuitiveness of the icons?
7. What did you think of the colours used on the design?
8. What did you think of the font used, as well as the size and colours of the font?
9. How would you rate the positioning of the buttons?
10. What would you add or remove from the design?

Appendix I

Themes for the analysis of the results of the first evaluation



Appendix J

Participant Information Sheet - Stakeholder Walkthrough (Final evaluation)

Participant Information Sheet

Project title:	Designing a Time Management app for and with Informatics students
Principal investigator:	Cristina Alexandru
Researcher collecting data:	Julia Castillo Trujillo
Funder (if applicable):	No

This study was certified according to the Informatics Research Ethics Process, RT number 2019/49519.Please take time to read the following information carefully. You should keep this page for your records.

Who are the researchers?

The researchers of the study are Julia Castillo Trujillo who is an undergraduate student in the University of Edinburgh School of Informatics and Cristina Alexandru who is her supervisor.

What is the purpose of the study?

This study is part of an undergraduate project, which aims to design a time management app that will address Informatics students' need for better managing their time at university. The purpose of this study is to evaluate the design of the second iteration of a low-fidelity prototype, in order to gather feedback and suggestions regarding the usability of the app, but also on its potential impact for you and your peers.

Why have I been asked to take part?

The aim of this project is to design an app to help Informatics students at the University of Edinburgh. As a potential end user for such an app, you can help us improve our design to create something which will address your needs and, ultimately, help you with your studies and your life at university.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, without giving a reason. Your rights will not be affected. If you wish to withdraw, contact the PI. We will stop using your data in any publications or presentations submitted after you have withdrawn consent. However, we will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

We will send you the link to the prototype and a questionnaire on Office 365 Forms. You will be asked to perform a certain amount of tasks stated on the questionnaire. Once you are done, you will be asked to complete the rest of the questions in the questionnaire regarding the general usability of the design, any difficulties you may have encountered while making use of the prototype, your opinion on the prototype, and the potential impact of this system. This process shouldn't last longer than 20min.

Are there any risks associated with taking part?

There are no significant risks associated with participation and it will not affect your studies in any way.

Are there any benefits associated with taking part?

The app is to be used by students of the School of Informatics like you, so by participating in this study you'll have the chance to influence the design of the app.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data will be archived for a minimum of 2 years.

Data protection and confidentiality.

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a unique participant number rather than by name. Your data will only be viewed by the researcher/research team: Julia Castillo Trujillo and Cristina Alexandru.

All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, and all paper records will be stored in a locked filing cabinet in the PI's office. Your consent information will be kept separately from your responses in order to minimise risk.

What are my data protection rights?

The University of Edinburgh is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance to the Data Protection Law. You also have other rights including rights of correction, erasure and objection. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk. Questions, comments and requests about your personal data can also be sent to Julia at s165774@sms.ed.ac.uk.

Who can I contact?

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Updated information.

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General information.

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Appendix K

Consent form for questionnaire participants

Participant number:_____

Participant Consent Form

Project title:	Designing a Time Management App for and with Informatics students
Principal investigator (PI):	Cristina Alexandru
Researcher:	Julia Castillo Trujillo
PI contact details:	calexan4@staffmail.ed.ac.uk

Please tick yes or no for each of these statements.

		Yes	No
1.	I confirm that I have read and understood the Participant Information Sheet for the above study, that I have had the opportunity to ask questions, and that any questions I had were answered to my satisfaction.		
2.	I understand that my participation is voluntary, and that I can withdraw at any time without giving a reason. Withdrawing will not affect any of my rights.		
3.	I consent to my anonymised data being used in academic publications and presentations.		
4.	I understand that my anonymised data can be stored for a minimum of two years		
5.	I allow my data to be used in future ethically approved research.		
6.	I agree to take part in this study.		

Name of person giving consent	Date dd/mm/yy	Signature

Name of person taking consent	Date dd/mm/yy	Signature

THE UNIVERSITY of EDINBURGH informatics

Appendix L

Participant Information Sheet - Questionnaire (Final evaluation)

Participant Information Sheet

Project title:	Designing a Time Management app for and with Informatics students
Principal investigator:	Cristina Alexandru
Researcher collecting data:	Julia Castillo Trujillo
Funder (if applicable):	No

This study was certified according to the Informatics Research Ethics Process, RT number 2019/49519.Please take time to read the following information carefully. You should keep this page for your records.

Who are the researchers?

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What is the purpose of the study?

This study is part of an undergraduate project, which aims to design a time management app that will address Informatics students' need for better managing their time at university. The purpose of this study is to evaluate the design of the second iteration of a low-fidelity prototype, in order to gather feedback and suggestions regarding the usability of the app, but also on its potential impact for you and your peers.

Why have I been asked to take part?

The aim of this project is to design an app to help Informatics students at the University of Edinburgh. As a potential end user for such an app, you can help us improve our design to create something which will address your needs and, ultimately, help you with your studies and your life at university.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, without giving a reason. Your rights will not be affected. If you wish to withdraw, contact the PI. We will stop using your data in any publications or presentations submitted after you have withdrawn consent. However, we will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

This will be conducted in a group. We will ask you to perform some tasks on the prototype and write down every decision you're making and any problems you run into on a piece of paper. After every participant is done, we will ask that all of you verbalize your written responses and discuss potential usability problems. After that, we will ask you to fill in a short survey regarding the general usability of the design and the potential impact of the system, and we will ask you some questions regarding any difficulties you may have encountered while making use of the prototype and your opinion on the prototype. This process shouldn't last longer than one hour and it will be audio-recorded with your consent.

Are there any risks associated with taking part?

There are no significant risks associated with participation and it will not affect your studies in any way.

Are there any benefits associated with taking part?

The app is to be used by students of the School of Informatics like you, so by participating in this study you'll have the chance to influence the design of the app.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data will be archived for a minimum of 2 years.

Data protection and confidentiality.

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General information.

For general information about how we use your data, go to: edin.ac/privacy-research

Appendix M

Participant Information Sheet - Think Aloud with HCI experts (Final evaluation)

Participant Information Sheet

Project title:	Designing a Time Management app for and with Informatics students
Principal investigator:	Cristina Alexandru
Researcher collecting data:	Julia Castillo Trujillo
Funder (if applicable):	No

This study was certified according to the Informatics Research Ethics Process, RT number 2019/49519. Please take time to read the following information carefully. You should keep this page for your records.

Who are the researchers?

The researchers of the study are Julia Castillo Trujillo who is an undergraduate student in the University of Edinburgh School of Informatics and Cristina Alexandru who is her supervisor.

What is the purpose of the study?

This study is part of an undergraduate project, which aims to design a time management app that will address Informatics students' need for better managing their time at university. The purpose of this study is to evaluate the design of the second iteration of a low-fidelity prototype, in order to learn what the biggest faults are and how the design could be improved. This study also aims to learn about the usability of this design.

Why have I been asked to take part?

The aim of this project is to design an app to help Informatics students at the University of Edinburgh. As an HCI expert and a member of staff and/or personal tutor, you might have had some insight into how students manage their time throughout the years and could help us know how useful this app could be with such a design, as well as flag any usability problems on the prototype.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, without giving a reason. Your rights will not be affected. If you wish to withdraw, contact the PI. We will stop using your data in any publications or presentations submitted after you have withdrawn consent. However, we will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

We will ask you to complete a few tasks on the prototype, while talking aloud about your experience with it. After you are done, we will ask you some questions about the usability and potential impact of the app, as well as regarding any comments you have made or any difficulties you may have encountered while making use of the app. This process shouldn't last longer than 20min and it will be audio-recorded with your consent.

Are there any risks associated with taking part?

There are no significant risks associated with participation. Your job and professional progression will not be affected by participation in this study.

Are there any benefits associated with taking part?

The app is to be used by students of the School of Informatics to help them improve their time management skills, which may help them to reduce stress and do better in their studies.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data will be archived for a minimum of 2 years.

Data protection and confidentiality

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a unique participant number rather than by name. Your data will only be viewed by the researcher/research team: Julia Castillo Trujillo and Cristina Alexandru.
All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, and all paper records will be stored in a locked filing cabinet in the PI's office. Your consent information will be kept separately from your responses in order to minimise risk.

What are my data protection rights?

The University of Edinburgh is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance to the Data Protection Law. You also have other rights including rights of correction, erasure and objection. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk. Questions, comments and requests about your personal data can also be sent to Julia at s165774@sms.ed.ac.uk.

Who can I contact?

If you have any further questions about the study, please contact the principal investigator, Cristina (calexan4@staffmail.ed.ac.uk). If you wish to make a complaint about the study, please contact inf-ethics@inf.ed.ac.uk. When you contact us, please provide the study title and detail the nature of your complaint.

Updated information.

If the research project changes in any way, an updated Participant Information Sheet will be sent by email to you by Julia.

Alternative formats.

To request this document in an alternative format, such as large print or on coloured paper, please contact Julia (s1651774@sms.ed.ac.uk).

General information.

For general information about how we use your data, go to: edin.ac/privacy-research

Appendix N

Participant Information Sheet - Cooperative Evaluation with staff members (Final evaluation)

Participant Information Sheet

Project title:	Designing a Time Management app for and with Informatics students
Principal investigator:	Cristina Alexandru
Researcher collecting data:	Julia Castillo Trujillo
Funder (if applicable):	No

This study was certified according to the Informatics Research Ethics Process, RT number 2019/49519. Please take time to read the following information carefully. You should keep this page for your records.

Who are the researchers?

The researchers of the study are Julia Castillo Trujillo who is an undergraduate student in the University of Edinburgh School of Informatics and Cristina Alexandru who is her supervisor.

What is the purpose of the study?

This study is part of an undergraduate project, which aims to design a time management app that will address Informatics students' need for better managing their time at university. The purpose of this study is to evaluate the design of the second iteration of a low-fidelity prototype, in order to learn what the biggest faults are and how the design could be improved. This study also aims to learn about the usability of this design.

Why have I been asked to take part?

The aim of this project is to design an app to help Informatics students at the University of Edinburgh. As a member of staff and/or personal tutor, you might have had some insight into how students manage their time throughout the years and could help us know how useful this app could be with such a design.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, without giving a reason. Your rights will not be affected. If you wish to withdraw, contact the PI. We will stop using your data in any publications or presentations submitted after you have withdrawn consent. However, we will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

We will let you use the app freely for a few minutes, while talking aloud about your experience with it. After you are done, we will ask you some questions about the usability and potential impact of the app, as well as regarding any comments you have made or any difficulties you may have encountered while making use of the app. This process shouldn't last longer than 30min and it will be audio-recorded with your consent.

Are there any risks associated with taking part?

There are no significant risks associated with participation. Your job and professional progression will not be affected by participation in this study.

Are there any benefits associated with taking part?

The app is to be used by students of the School of Informatics to help them improve their time management skills, which may help them to reduce stress and do better in their studies.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data will be archived for a minimum of 2 years.

Data protection and confidentiality

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a unique participant number rather than by name. Your data will only be viewed by the researcher/research team: Julia Castillo Trujillo and Cristina Alexandru.
All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, and all paper records will be stored in a locked filing cabinet in the PI's office. Your consent information will be kept separately from your responses in order to minimise risk.

What are my data protection rights?

The University of Edinburgh is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance to the Data Protection Law. You also have other rights including rights of correction, erasure and objection. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk. Questions, comments and requests about your personal data can also be sent to Julia at s165774@sms.ed.ac.uk.

Who can I contact?

If you have any further questions about the study, please contact the principal investigator, Cristina (calexan4@staffmail.ed.ac.uk). If you wish to make a complaint about the study, please contact inf-ethics@inf.ed.ac.uk. When you contact us, please provide the study title and detail the nature of your complaint.

Updated information.

If the research project changes in any way, an updated Participant Information Sheet will be sent by email to you by Julia.

Alternative formats.

To request this document in an alternative format, such as large print or on coloured paper, please contact Julia (s1651774@sms.ed.ac.uk).

General information.

For general information about how we use your data, go to: edin.ac/privacy-research

Appendix O

Tasks for second evaluation

Task 1:

https://www.figma.com/proto/vIXswebCDGt370Ydx7GXye/Task-1?node-id=2%3A0&viewport=406%2C476%2C0.1284082531929016&scaling=min-zoom

You need to go to the supermarket to buy bananas, bread, and potatoes on Sunday:

1) Add a task to the Chores list.
2) Add the things you need to buy as subtasks.
3) Add a reminder for Sunday, the 15th at 6.50 pm.
4) Add this task to your calendar for Sunday, the 15th at 7 pm.

Task 2:

https://www.figma.com/proto/BxHDdVIfuCtZjQq5UT9RRW/Task-2?node-id=1%3A352&viewport=540%2C700%2C0.23481307923793793&scaling=min-zoom

The new Computer Security coursework has just been released and you want the app to help you work on it for 12 hours every week until the due date:

1) Add this coursework to the app.
2) Set a deadline for it for the 27th of March.
3) Tell the app that you would like to work on it for 12 hours every week.
4) Ask the app to notify you if you're not working on it enough.
5) Ask the app to suggest times to work on the coursework for the next 7 days.

Task 3:

https://www.figma.com/proto/6wd5k3tUkvCvV3S7fcaAOT/Task-3?node-id=1%3A287&viewport=-452%2C-824%2C0.604271411895752&scaling=min-zoom

You are planning your day for tomorrow and see that you have a 5-hour gap on your schedule, so you want to dedicate that time to catch up on your most neglected course this week:

1) Check the time tracker to see how you have been spending your time this week and look for the course that you have spent less time on.
2) Add a new event to work on this course
3) Set the event for tomorrow, the 13th between 14:30 and 19:30.
4) Add all 3 tasks related to this course to the event.

Task 4:

https://www.figma.com/proto/yLg8KhNf3iqrSsXXW39KaG/Task-4?node-id=1%3A287&viewport=517%2C348%2C0.228357195854187&scaling=min-zoom

You're very close to achieving the "Consistent study" badge for this week. Check what else you need to do to complete all requirements, and then do it.

Task 5:

https://www.figma.com/proto/YcUWIxzEg6qWCgqGcumMmW/Task-5?node-id=1%3A287&viewport=29%2C256%2C0.5&scaling=min-zoom

There has been a change to the syllabus of the Software Testing course and you no longer need to read those chapters that you were planning to read tomorrow between 14:30 and 19:40. Delete the tasks and the event.

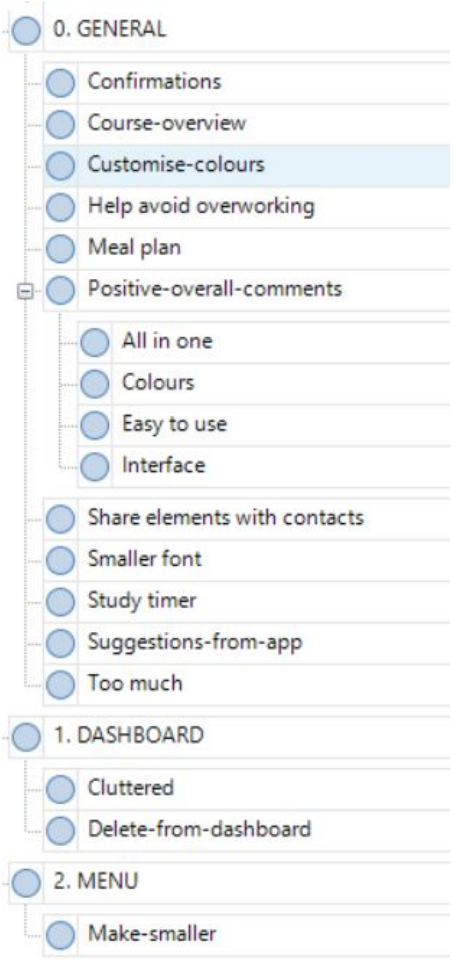
Appendix P

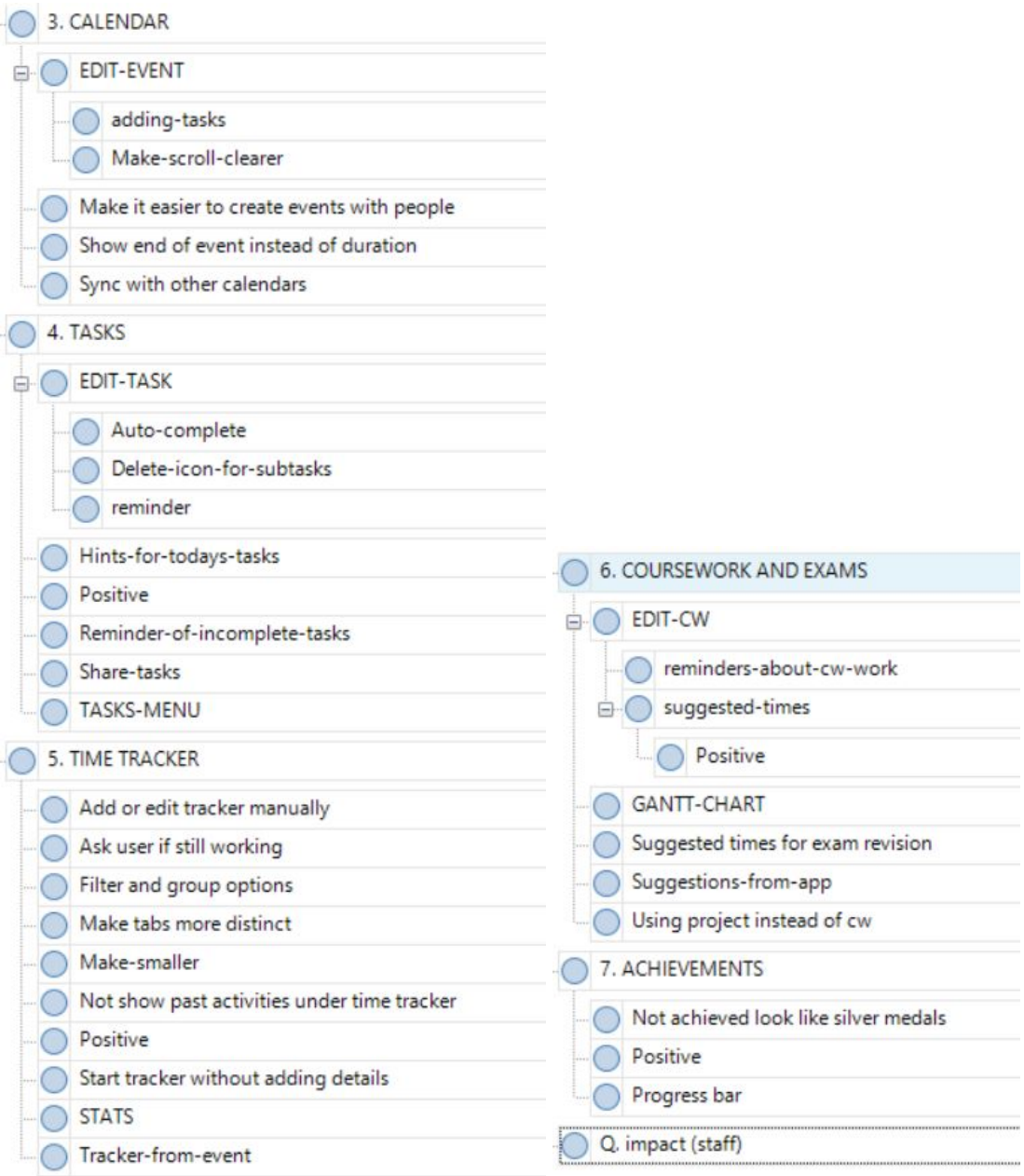
Questions for the questionnaire in the final evaluation

1. What did you like most about the prototype?
2. What did you like the least?
3. In your opinion is there anything missing from the design?
4. Do you have additional suggestions?
5. In your opinion, what is the difference between an event and a task in general?
6. Were you able to understand the difference between an event, a task, and an activity (time tracker) on this app?
7. Please rate the following from 1 (very low0 to 5 (very high):
   (a) Navigation (how well the pages are linked so that you can do things effectively, clarity/intuitiveness of buttons and icons to keep you on right path)
   (b) Presentation (how engaging and intuitive the design is, e.g. in terms of layout, fonts, colours, buttons/icons, charts used)
   (c) Interaction (clarity and match with expectations of the way you interact)
   (d) Content (how easy it is to understand and help make decisions)
8. If you were to use this app every day, how much would you envisage it would impact you in terms of (please rate from 1 (very unhelpful) to 5 (very helpful):
   (a) Keeping up with your courses
   (b) Meeting deadlines
   (c) Reducing procrastination
   (d) Managing your personal life

Appendix Q

Themes for the analysis of the final evaluation data




3. CALENDAR
EDIT-EVENT
adding-tasks
Make-scroll-clearer
Make it easier to create events with people
Show end of event instead of duration
Sync with other calendars
4. TASKS
EDIT-TASK
Auto-complete
Delete-icon-for-subtasks
reminder
Hints-for-todays-tasks
Positive
Reminder-of-incomplete-tasks
Share-tasks
TASKS-MENU
5. TIME TRACKER
Add or edit tracker manually
Ask user if still working
Filter and group options
Make tabs more distinct
Make-smaller
Not show past activities under time tracker
Positive
Start tracker without adding details
STATS
Tracker-from-event
6. COURSEWORK AND EXAMS
EDIT-CW
reminders-about-cw-work
suggested-times
Positive
GANTT-CHART
Suggested times for exam revision
Suggestions-from-app
Using project instead of cw
7. ACHIEVEMENTS
Not achieved look like silver medals
Positive
Progress bar
Q. impact (staff)