

Faculty of Interaction Design

Bachelor's Thesis

**From Intention to Action: Harnessing
Implementation Intentions to Guide the Design of
Digital Interventions for Academic Procrastination**

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Abstract

Procrastination, characterized by the intentional delay of tasks despite knowing the negative consequences, is a prevalent issue among university students, significantly affecting their academic performance and well-being. Implementation intentions, introduced by Peter Gollwitzer, offer a promising self-regulatory strategy by creating specific "if-then" plans to bridge the gap between intentions and actions. Despite the availability of many tools aimed at helping students combat procrastination, there is a notable gap in tools that utilize implementation intentions. This study aims to explore how students can effectively use implementation intentions to manage procrastination and develop design guidelines for digital tools that support this method.

Methodology: Through a qualitative study involving a week-long diary and semi-structured interviews with six university students, this research explores how digital tools can support the formation and tracking of Implementation Intentions. The study uncovers the processes students employ to create and adapt if-then plans, their interaction with these plans, and the consequent impact on their procrastination habits.

Results: Results suggest that implementation intentions, through specific "if-then" plans, effectively help students manage procrastination by addressing emotional and situational triggers. Key findings highlight the superior effectiveness of behavior-based plans over task-based plans in reducing procrastination. The importance of self-reflection and awareness in formulating these plans was emphasized. The study also found that reminders and positive motivational messages helped maintain engagement with the method.

These insights led to the development of design guidelines for digital tools aimed at supporting students in overcoming procrastination and enhancing their academic performance.

I Table of Contents

1. Introduction.....	3
2. Implementation intentions and their impact on procrastination.....	4
3. Relevant works.....	5
4. Methodology.....	8
4.1. Study design.....	8
4.2. Participants.....	10
4.3. Data collection.....	10
4.4. Data analysis.....	11
5. Results.....	11
5.1. The process of formulating and interacting with if-then plans.....	12
5.2. Strengths and weaknesses of the application process.....	15
5.3. Enhancing the engagement and effectiveness of the if-then strategy.....	18
5.4. Results design recommendations.....	21
6. Discussion.....	25
7. Final design guidelines.....	28
8. Conclusions.....	30
9. Limitations.....	30
References.....	32
II Appendix.....	37

1. Introduction

Procrastination is a widespread behavior defined across many disciplines not merely as the act of delaying a task, but rather, it involves the intentional postponement of action despite the awareness that such a delay will negatively impact task performance or the individual's feelings about the task or themselves (Milgram et al., 1998; Steel, 2007; Pychyl, 2013).

It is particularly prevalent among university students, with estimates indicating that 80%–95% of college students procrastinate (Steel, 2007). Furthermore, Pychyl et al. (2000) highlighted that procrastination typically occupies over one-third of students' daily activities. This behavior significantly impacts their academic performance and overall well-being, leading to lower grades, increased stress, and reduced self-confidence (Klassen et al., 2008; Balkis, 2013).

Mood-repair theory explains procrastination as an emotion regulation strategy. People procrastinate to relieve negative emotions associated with aversive tasks, mistakenly believing that avoidance will alleviate these feelings. As a result, they focus mainly on immediate emotional relief as opposed to the long-term consequences of delaying (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013).

Psychologist Peter Gollwitzer introduced the concept of *implementation intentions*, a strategy designed to address self-regulatory issues and bridge the gap between intentions and actions. Although not initially created to combat procrastination, implementation intentions have been found to be effective in reducing procrastination by linking specific situational cues to clear, actionable plans, thereby automating the initiation of goal-directed behaviors and simplifying decision-making processes (Wieber & Gollwitzer, 2010; Sommer & Haug, 2012; Balkis, 2013; Van Eerde, 2000; Pychyl, 2013).

Despite the availability of numerous digital tools designed to help students manage procrastination through task prioritization and time management, there is a notable absence of digital tools that leverage implementation intentions to help students manage and overcome procrastination.

The research aims to answer the question: How can digital solutions be designed to effectively support the formation and tracking of implementation intentions to help students combat academic procrastination?

This study aims to fill this gap by exploring the process of implementing the technique of implementation intentions. By introducing a framework based on this method to a group of students struggling with academic procrastination, the study will capture firsthand accounts of their experiences, highlighting both the strengths and weaknesses of the approach.

The results will be utilized to formulate guidelines for the development of future tools utilizing the implementation intention method tailored to address the specific needs of students dealing with procrastination.

2. Implementation intentions and their impact on procrastination

'Implementation intention' is a self-regulatory strategy developed by Peter M. Gollwitzer in 1993 designed to bridge the gap between intention and action and help individuals overcome self-regulatory issues such as procrastination by providing a structured action plan.

These plans, formulated in an if-then format: "If situation Y is encountered, then I will initiate behavior Z in order to reach goal X!" and link specific situational cues (the "if" component) to predetermined responses (the "then" component), thus automating the initiation of goal-directed behaviors (Wieber & Gollwitzer, 2010).

Research has demonstrated the effectiveness of implementation intentions in reducing procrastination across various contexts. For example, by detailing when, where, and how one intends to initiate an action, individuals can overcome initial reluctance to act, enhancing the likelihood of following through with their intentions and ultimately curbing procrastination. (Wieber & Gollwitzer, 2010; Balkis, 2013; Van Eerde, 2000).

Furthermore, by creating automatic responses to specific situations, individuals reduce the cognitive load associated with decision-making at the moment, making it easier to start and complete tasks. This strategy is particularly effective because it addresses the specific triggers that lead to procrastination, enabling individuals to act promptly when those triggers arise. (Wieber & Gollwitzer, 2010; Balkis, 2013; Van Eerde, 2000; Sommer & Haug, 2012).

Further supporting this, Balkis (2013) emphasized that implementation intentions help individuals solidify their plans for action in specific situations, enhancing the mental association between triggers and actions. This strong mental association makes it easier for individuals to automatically initiate the intended response when faced with the specific situation, helping them overcome behavioral inactivity that often leads to procrastination.

Pychyl (2013) noted that implementation intentions go beyond mere commitment and motivation. They address the specific actions one will take in response to potential distractions or obstacles. By forming if-then plans that anticipate distractions and provide pre-decisions on how to act when these distractions arise, individuals can better navigate challenges that may lead to procrastination. This proactive planning results in better task performance and reduced procrastination than those who do not utilize such strategies (Pychyl, 2013).

This strategy addresses some of the core triggers of procrastination by planning how to respond to distractions, situations, and opportunities for task initiation. Next, we will examine the existing tools designed to support students in combating procrastination and explore how implementation intentions have been utilized in technology so far and how to potentially use them in future designs.

3. Relevant works

Digital Tools Designed to Address Procrastination

Various digital tools have been developed to combat academic procrastination by enhancing productivity, improving focus, and minimizing distractions. McGarvie (2024) highlights that task management apps like Todoist, Trello, and Asana boost

productivity through features that assist with prioritizing tasks, setting deadlines, and tracking progress. Research indicates that these apps enhance organizational skills and productivity (Shama et al., 2024). Building on this, Guimarães and Lazaro (2018) found that well-designed task management apps can significantly improve productivity and organizational skills among procrastinating students. Additionally, incorporating gamification elements, such as rewards and personalization options, can further enhance focus, engagement, and motivation. This suggests that future designs could benefit from integrating gamification, which has been shown to help students manage their tasks more effectively and boost their organizational skills and productivity (Martín-García & Pérez Marín, 2020).

Time-tracking apps such as Toggl and RescueTime aid in making informed decisions about time management by monitoring how time is spent (McGarvie, 2024).

Research consistently shows that time-tracking apps can significantly improve time management skills by providing detailed feedback on time usage (Pammer-Schindler & Bratic, 2013; Tabuenca, 2015). The use of mobile learning analytics to track and monitor time devoted to learning has been found to positively impact self-regulated learning and time management skills (Tabuenca, 2015).

Other apps are designed to enhance focus by reducing distractions. Minimalist writing apps like Writemonkey and Werdsmith provide a distraction-free writing environment (McGarvie, 2024). More aggressive approaches include apps like StayFocusd, Freedom, or Cold Turkey, which limit access to distracting websites and apps during study sessions (McGarvie, 2024). A field experiment by Marotta and Acquisti (2017) focused on the impact of online distractions and the ability to curtail them using the "Freedom" application. The study found that individuals in the exogenous treatment group, where access to distracting websites was externally limited, experienced increased productivity, completing more tasks and earning more money compared to the control group. This supports the notion that limiting access to distracting websites can significantly enhance focus and productivity.

Furthermore, apps employing the Pomodoro Technique, such as Focus Booster and TomatoTimer, promote sustained concentration by structuring study time into focused intervals followed by short breaks (Cirillo, 2019; McGarvie, 2024).

While these tools address common procrastination issues such as poor focus, avoidance of tasks, and inadequate time management, they do not tackle the underlying emotional factors identified by mood repair theory as core causes of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013). Mindfulness apps like Headspace, Calm, or Insight Timer, which Pychyl suggests can increase awareness of procrastination triggers and foster healthier coping mechanisms (Pychyl & Flett, 2012; McGarvie, 2024), may help address these emotional aspects. However, these apps are not specifically designed for academic procrastination, highlighting a gap in tools that can tackle both the behavioral and emotional roots of procrastination. This gap presents an opportunity for implementation intentions to play a crucial role in developing solutions that address the negative emotions driving procrastination.

Digital Tools Utilizing Implementation Intentions

Implementation intentions, also known as "if-then" plans, serve as a powerful self-regulation strategy in app design, facilitating behavior change and habit formation (Gollwitzer, 2006; Wicaksono et al., 2019). The study by Dogangün et al. (2017) demonstrates this by showcasing the DayActivizer app, which uses user data to personalize physical activity recommendations. This app employs "if-then" plans to promote habit formation by providing action steps tailored to individual routines and preferences, thereby enhancing user engagement. Similarly, Kardes (2005) found that implementation intentions can significantly influence consumer behavior and increase product consumption. This is achieved through advertising strategies that encourage consumers to plan when and how they will use a product and by involving them in creating their own implementation intentions. Additionally, Pinder et al. (2016) show how digital tools benefit from implementation intentions by linking contextual cues with specific goal-related behaviors, using smartphones' context-aware capabilities to automate and enhance behavior change.

These findings underscore the utility of implementation intentions in digital design, proving particularly useful in enhancing engagement, personalization, and behavior change. This approach could be transformative in designing apps to combat

academic procrastination, using "if-then" plans to integrate study habits seamlessly into students' daily routines, potentially leading to significant improvements in academic productivity and focus.

4. Methodology

The study seeks to gain a deeper understanding of the process of implementing the technique, along with its strengths and weaknesses, to guide the development of a digital tool designed to combat academic procrastination using Implementation Intentions.

It investigates how university students can best use this strategy to tackle procrastination by introducing the implementation intention framework and capturing firsthand accounts of students' implementation processes and experiences through a week-long diary study followed by semi-structured interviews.

This section outlines the research methods employed, participant recruitment strategies, data collection techniques, ethical considerations, and the approaches used for data analysis.

4.1. Study design

The experimental setup unfolded in three phases: an initial meeting, a diary study, and post-study interviews. The study primarily focuses on qualitative data from a diary study complemented by semi-structured interviews.

Initial participant meeting

Before the diary study, an initial participation meeting was conducted online via Google Meet, designed to introduce the participants to the Implementation Intentions method, gather preliminary demographic data, and address any initial queries.

Participants were introduced to the concept of implementation intentions, a method that leverages specific situations (cues) to trigger pre-planned behaviors aimed at reaching personal goals, and, in this case, combating academic procrastination. They became familiar with the structure of forming these intentions: 'If situation Y is

encountered, then I will initiate behavior Z to achieve goal X.' and were provided with examples showing how this framework can be used for scheduling tasks, dealing with distractions, and handling emotions to ensure the participant's understanding of the method (Appendix A).

The participants were not given any specific instructions on how to implement the method beyond its foundational principles and were encouraged to adapt the strategy in ways that best suited their individual needs.

Diary study

During the week-long diary study, participants were instructed to set 'if-then' goals with the main goal being mitigating their academic procrastination habits. They were given the freedom to choose how, when, and how often they would create these 'if-then' goals.

Participants were asked to document their goals and the methods used for recording them as well as reflect daily on the effectiveness of their plans, noting any distractions or emotions that influenced procrastination and assessing their motivational factors. They were required to send these reflections at least once a day, focusing on their 'if-then' goals, the thought processes behind forming them, any adjustments made along the way, any challenges they have encountered, and their impact on academic productivity.

A day before the diary-study started the participants received a message with all the detailed instructions and reminders of the implementation intention format and examples discussed in the initial participation meeting. On the fourth day of the study, a motivational message was sent to encourage continued participation (Appendix A).

Semi-structured interviews

After the diary study, semi-structured interviews were conducted to gain deeper insights into each participant's experience. The interview questions were organized around two main themes.

The first focused on the creation and application of 'if-then' plans, exploring how participants developed and implemented these strategies, their effectiveness, the tools used for management, and any challenges they faced. This part aimed to clarify and expand upon the diary entries, providing a richer context to the quantitative data.

The second theme collected additional feedback, considering potential app features that could enhance the implementation intentions technique, changes in participants' motivation levels, and ideas for increasing the strategy's engagement and effectiveness. This part aimed to gather further insights from the participants after they tried out the method, focusing on the design-related aspects of the potential development of a digital tool based on the method (Appendix B).

4.2. Participants

A total of six international students enrolled at a university in Berlin who all struggle with procrastination participated in the study, which included a week-long diary study and semi-structured interviews lasting 25-30 minutes each. Participants were selected using convenience sampling due to the study's intensive engagement requirements. To ensure a diverse range of perspectives, quota sampling principles were applied to achieve a balance across genders and various backgrounds.

Recruitment was conducted through the university's Slack channels, followed by individual screening calls via Google Meet to confirm each participant's eligibility and commitment. During these calls, participants received detailed explanations about the study's structure, what was expected of them, and the ethical considerations involved.

Participants were also informed of their rights concerning the confidentiality of their data and their freedom to withdraw from the study at any time without any penalty and ensure anonymity in any resulting research outputs.

4.3. Data collection

Data collection for the study utilized a blend of digital platforms and remote communication tools to facilitate both the diary study and the interviews. For the documentation and communication during the diary study, participants chose digital

platforms such as WhatsApp, Telegram, and Google Sheets based on their preference to maximize comfort and consistency in daily reporting. They were instructed to document their daily 'If-Then' plans and reflections, noting any changes in their goal-setting strategies and the reasons behind these adjustments.

The interviews and the initial participation meetings were conducted using Google Meet. Each session was recorded with the participant's consent, and the audio was transcribed using automated tools. The transcriptions were then manually corrected to ensure accuracy and comprehensiveness. Throughout this process, careful measures were taken to maintain participant anonymity by removing all personal identifiers from the final transcripts.

4.4. Data analysis

The data collected was analyzed in two groups, the first was the diary study documentation alongside the first part of the interviews. The first part of the semi-structured interviews is invaluable to understanding the diary study documentation and, therefore grouping them provided a complete data set. The second part was the second half of the semi-structured interviews, which had a stronger focus on design and feature-related data.

Both data sets were analyzed using the same process separately. The analysis began with thematic coding of the diary entries and interview transcripts in Google Sheets to identify common themes and patterns. The quotes and their related codes were then transferred to Miro where an affinity diagram was created to organize these themes and facilitate a deeper visual analysis.

5. Results

This chapter presents the findings from the qualitative analysis of diary studies and semi-structured interviews, focusing on users' experiences with the implementation intentions technique to tackle academic procrastination through if-then plans.

The findings are organized into three main themes: The Process of Formulating and Interacting with If-Then Plans, Strengths and Weaknesses of the Application Process,

and Digital Support Features for Implementation Intentions followed by a section of the results related to design recommendations. These themes emerged from the thematic coding of diary entries and interview transcripts, further refined using an affinity diagram. Each theme is supported by direct quotes from participants, differentiated by "I" for interviews and "D" for diary entries, followed by participant identifiers ranging from 1 to 6.

The selected themes directly address the research questions, highlighting barriers to implementing if-then plans, exploring how digital solutions can support this method, and providing a comprehensive understanding of the challenges and opportunities in using implementation intentions to combat academic procrastination.

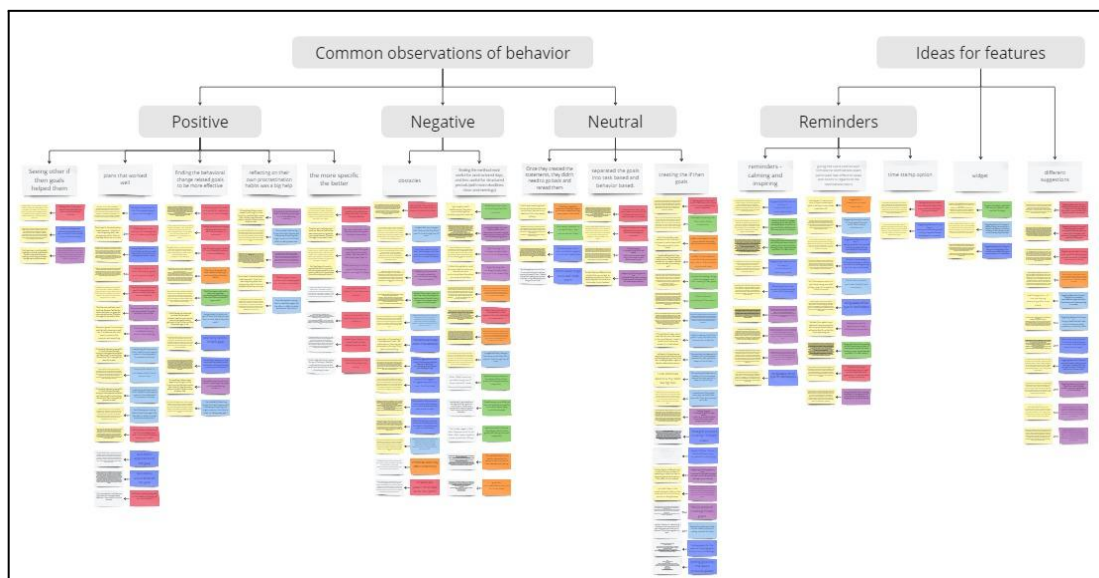


Figure 1: affinity diagram with diary study and semi-structured interview data clustered.

5.1. The process of formulating and interacting with if-then plans

This theme explores how participants applied and adapted the implementation intentions technique. It explores the development of if-then plans, including the frequency and circumstances that prompted participants to modify or create new plans. Additionally, it examines the methods used for documenting these plans and their subsequent interactions.

Context

Before beginning the diary study, participants were introduced to the basic if-then format: "If situation Y is encountered, then I will initiate behavior Z to achieve goal X." Although three examples were provided to illustrate this framework's application to tasks such as scheduling, managing distractions, and handling emotions, participants were encouraged to apply the if-then format in any way they found useful. They were instructed to integrate these plans into their daily routines throughout the week.

Plan creation process

Participants instinctively organized their if-then plans into behavior/situation-based and task-based categories. This categorization was a common theme as they detailed their process for developing these plans. For example, one participant observed, *"two different kinds of paths that you can take. So depending on what your task, or depending what the situation is, that's what I kind of realized."* (I6). Despite minimal guidance on plan creation, all participants followed a consistent sequence of steps, with minor variations between the task and behavior-based approaches.

Common steps included:

1. Identifying specific procrastination triggers or tasks.
2. Creating actionable if-then plans.
3. Documenting these plans on paper or digitally.
4. Adjusting the plans based on their effectiveness.

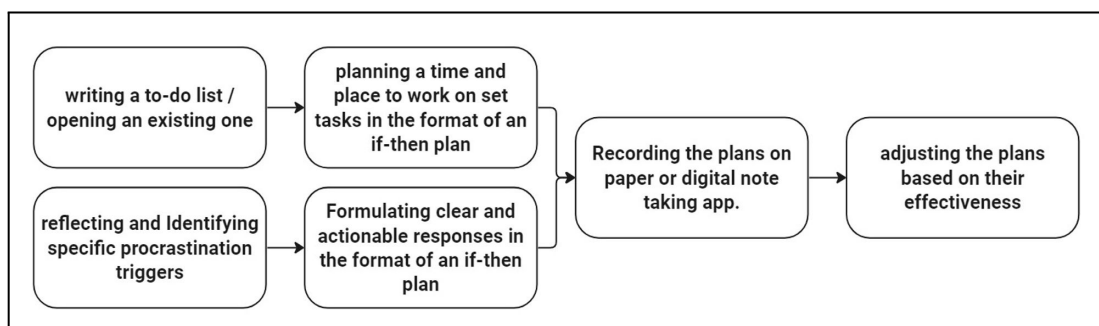


Figure 2: diagram presenting the common process of creating if-then plans.

Behavior-based plan formulation

In behavior-based plan formulation, participants began by identifying procrastination patterns and distractions. For instance, one participant explained, *"I went through my mind and experience and tried to figure out what makes me procrastinate during the process of studying, and then I try to come up with 'if-then's' that I thought would be helpful with me continuing to study"* (I3). as in this example for some participants reflected in their mind and wrote them down directly in the form of if-then plans. However, some participants found it essential to add another step: writing down distractions and feelings before formulating plans.

Task-based plan formulation

For task-based plans, participants started with a to-do list, prioritizing tasks before transforming them into if-then statements: *"I have a list of to-dos, and according to them, I also try and set my goals, e.g., structuring them in a certain way to maybe achieve better results"* (D6).

Most participants encountered no significant issues while forming these plans. Reflecting on this process, one noted, *"Thought process creating 'If-Then' Goals: Looking at the common distractions and feelings that lead to procrastination, it was fairly easy to form the 'if-then' goals"* (D5).

However, some initially found the process challenging but noted improvement over time: *"Since I went with the whole pattern-based approach, I think first it was recognizing what I was doing wrong, which I think takes some time on its own and apart from it. Once you recognize what you're doing wrong, just putting it into the format also takes a bit of time to see what's the most efficient way for it to be applied... but I noticed as the week progressed, it became easier to make if-then statements"* (I1).

Documentation methods

Participants used various methods for documenting their plans, choosing tools that fit their regular routines: *"For myself, I wrote them down on a notebook on a piece of paper, and sometimes I would just transfer those to my to-do list app"* (I1); *"I use*

Obsidian, which is my note-taking tool ... I will keep it in the app because everything else is also there, as I said, and having everything in front of me that I'm making because I might not take this notebook with me to uni" (I4).

Interaction and adjustment of plans

Post-creation, participants engaged with their if-then plans in varying ways. Some revisited their plans sporadically to add new tasks or when new patterns emerged that necessitated the formulation of additional plans: *"So when you start realizing there's a new pattern, then it's nice to create a new if-then goal" (I6).* They also returned to the list to revise or delete any plans that were not effective: *"But then there's, of course, for example, like the first one I wrote. That's not precise enough for me, so I would probably just try and iterate that and be more specific about it" (I6).* Two participants specifically noted that they reviewed their lists at the end of each day to identify ineffective plans, subsequently revising or removing them: *"One day after I created them, I would look at them, and that was helpful to look at them and see what worked and didn't work" (I4).*

Memorability of plans

An interesting observation was that many participants felt the act of creating the plans made them inherently memorable: *"I think I partially memorized them because since you thought about them, it's there in the back of your mind" (I1)* and *"When I would write them. I don't even need to go back to look at them because once I write them, they are in my head kind of I'm very aware of them" (I2).* However, about half of the participants found it beneficial to keep their lists visible as a constant reminder, reinforcing their commitment to the actions described, even though they did not actively review the content regularly: *"Since the goals are in front of me, I'm unconsciously and sometimes consciously aware of them" (D5).*

5.2. Strengths and weaknesses of the application process

This theme explores the participants' experiences as they adapted the implementation intentions technique. It focuses on their feedback about the effectiveness of their if-then plans across different types and situations. This analysis provides essential

data on the strengths and weaknesses of the application process, revealing areas for potential improvement in future applications.

Context

During the diary study, participants documented their experiences with if-then plans, noting both the effectiveness of these plans and the challenges encountered.

Follow-up interviews further explored how these plans influenced their daily academic activities, identifying the types of if-then statements that were particularly useful or less effective.

Effectiveness of behavior change goals

Many participants provided positive feedback on the effectiveness of behavior-related goals. During interviews, when asked about the types of if-then statements they found most helpful, all six participants highlighted behavior change goals as the most effective. For example, one participant noted, *"I think at least when it came to a lot of behavioral changes, I noticed if-then's working more than the ones I would consider productivity tasks" (I1)*. Another participant expressed a similar sentiment: *"I just like the ones that worked for me the time and more of the emotional aspect." (I2)*

Further reflections during interviews and diary entries often highlighted behavior-based plans as particularly beneficial. One participant described a successful strategy: *"If I feel overwhelmed by a large project, then I will break it down into smaller, more manageable tasks and create a checklist to track my progress."* They later reflected, *"Breaking down tasks helped alleviate feelings of overwhelm and provided a clear roadmap for tackling the project step by step. The 'if-then' approach guided me in taking proactive steps to manage my workload effectively." (D1)*

Notably, only one participant mentioned they found task-based plans helpful, particularly when they were specific, including a time and place: *"I noticed what helped was making the tasks more super specific. I noticed that if I made them*

time-based and set in a certain place and exactly just make it as specific as possible, the chances of me doing it were much higher." (I1)

Self-reflection and awareness

When discussing why they believe certain plans were more effective than others, participants emphasized self-reflection and awareness of their habits as crucial: *"So I would say it helps in some aspects to just bring it to the front of my mind that there's a certain path I shouldn't take, like certain patterns I shouldn't follow in certain situations." (I6)* Another mentioned, *"the mindset of foreseeing things that might happen and foreseeing something that might come up I think that is what my takeaway was." (I4)*

Challenges with external factors

Participants also discussed challenges in adhering to their 'if-then' plans, particularly when external factors like unpredictable schedules interfered. Four participants noted issues related to not being in control of their time due to other obligations or unexpected changes:

One participant explained, *"The main problem was that there's not so much free time right now because there's a lot of meetings and everything." (I6)* They added that the method would be more effective with more self-managed time: *"I feel like utilizing these things. For example, last semester, I was still studying medicine. There, I had one semester where I was just supposed to study, and I had one class. So I had a lot of free time, and I feel like this implementation method would work way better if you have more time that you need to manage yourself." (I6)*

Another participant mentioned, *"I didn't know how to use them when situations got out of hand." (I2)* They continued, discussing the challenge of adapting the plans to sudden schedule changes: *"I want to sit down, I actually want to get things done, then such a big thing that takes three to four hours per day happens. How am I supposed to tackle that? What about how it implicated the if statements for the other days? ...basically when it just feels like it's not fixable anymore. And you just need to throw it away and start over." (I2)*

Overwhelming procrastination

Another issue brought up is that In cases of strong procrastination, participants noted that sometimes their reluctance overwhelmed their motivation: *"Times I was just too tired or like still my procrastination was bigger than my motivation to do something for university"* (16). Another participant reflected on the internal struggle: *"I think that a part of my brain tries to find a way around them. It's like a rule that you have set yourself, and then that part of your brain that wants to relax or doesn't want to face the future. You could say I want to procrastinate and just want to feel good. I think that part of the brain is trying actively. Okay, how can I avoid this? Right. I think that's kind of like a lot of mental or willpower is needed."* (15)

5.3. Enhancing the engagement and effectiveness of the if-then strategy

This theme explores how to enhance the if-then strategy based on participants' desired features for an app, preferences for reminders, responses to check-in messages, and suggestions for improvements. The analysis identifies commonalities and patterns that can inform the development of a more effective and engaging approach to implementation intentions.

Context

The findings for this theme were derived from the second part of the semi-structured interviews conducted with participants. This portion of the interviews aimed to gather insights after participants had experienced implementing the method for a week. The focus was on enhancing engagement and effectiveness of the implementation intentions technique. Participants were asked several vital questions: What features did they consider essential for an app based on the technique? How does the app remind or encourage them without being intrusive? What were their feelings about receiving a halfway check-in message? What could be added to the strategy to make it more engaging or effective?

Importance of reminders

Participants underscored the importance of reminders to consistently integrate the if-then strategy into their routines to boost engagement: *"So if there was an option for me to keep being reminded of them, even if it's repetitive, I think it's a must" (I4)*. Although all participants recognized the need for reminders, concerns about their potential intrusiveness were also mentioned. One participant noted, *"It could lead someone not to use it at all or uninstall it, but then I think that's also maybe an important factor that is annoying. If it's not harming your productivity, if you're working, you focus, and then you get reminded of something, but if it's reminding you in a good way and annoying you in a good way, I think that's important."* (I5)

A recurring solution for effective reminders was the need for them to be customizable and not intrusive, allowing participants to control the timing and frequency: *"Reminders need to be controllable. I need to be able to delete/mute them when I want to."* (I2). Another participant pointed out that while reminders are crucial, they might not always be appropriate, referring to scenarios where reminders could inadvertently increase procrastination: *"You sometimes need a reminder, but also sometimes a reminder, like, for example, you know when. You were a kid, and your mom, as you or you were about to do the dishes or clean your room. And then your mom comes, and it's like, here, you should clean your room or do the dishes. And then you're like, well, now I don't want to do it anymore."* (I6)

Positive and motivational messages

The integration of positive, motivational messages was viewed positively by participants, keeping them encouraged without directly reminding them of tasks: *"For example, I'm using this app. I'm not using it actively, but it's sending me throughout the days between specific times notifications of sentences, And there are some quotes that are kind of inspiring, you could say" (I5)*. This approach helped alleviate the guilt often associated with procrastination, as one participant explained: *"It had these notifications, just positive notes that were really nice to see during the day, and they were not necessarily about the task....Any kind of positive sentence, I will get a notification, and if I remember that, it would immediately make me smile."* (I3)

Non-intrusive check-in messages

As a part of the diary study, participants received a "check-in message" with two purposes: to ensure people kept engaging and documenting during the study and the second was to test the response to this type of "motivational reminder."

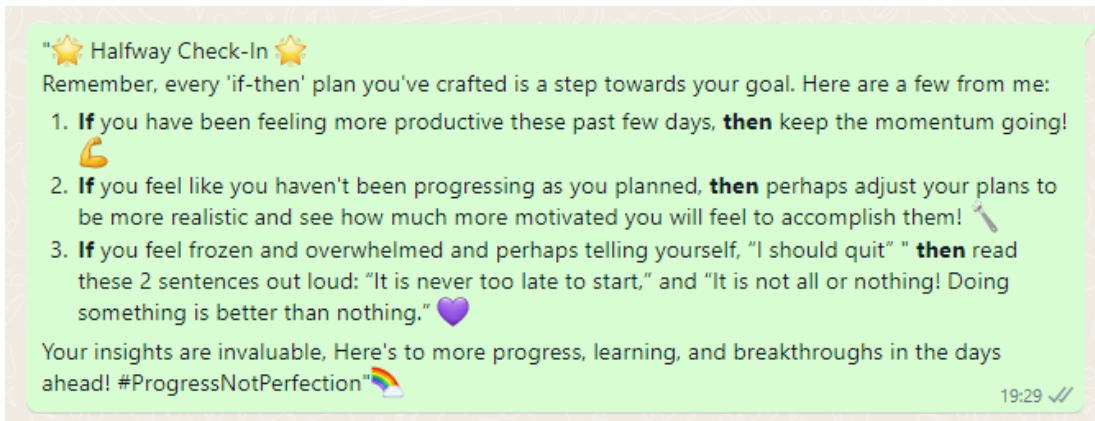


Figure 3: an image of the "check-in message" sent to the participants during the diary study.

When asked about their feelings upon receiving this message, four participants expressed positive sentiments such as affirmation and support. One participant shared their connection with the content of the message: *"I think most relevant to that notification was just that your insights are valuable. Also, your hashtag 'progress not perfection' I think I like that one. I remember the hashtag progress, not imperfection."* (I3) Another acknowledged mixed feelings: *"I was already feeling bad that I wasn't, like, updating enough...But at the same time, it was very nice to get a reminder that was written non-judgmentally. Yeah, it's kind of a mix of guilt-tripping, and also, it is nice."* (I6)

Visibility of if-then plans

A significant aspect discussed was keeping the if-then plans visible without users needing to actively search for them, enhancing spontaneous engagement. Suggestions included implementing a widget similar to those used by apps like Duolingo: *"I think a widget would be fine because I have this Duolingo widget on my phone that shows you your streak, which is zero at the moment, but It's simple and nice."* (I3) This approach was supported by others who favored visibility across

devices: *"Maybe a widget on my laptop and phone and all of that that is connected. And then I can quickly call it in and a companion there not and different app that they have to open."* (I4)

Linking plans to timely reminders

Participants also valued the option to link some of their if-then plans to time-based reminders, enhancing the timeliness and relevance of notifications: *"I think the most important feature would be having time-based ones, right? Because a lot of things for me were time-based. So you got notifications, and you can set up when do I want to see that specific if-then goal"* (I5). This feature seamlessly integrates if-then plans with daily schedules, promoting consistent engagement.

5.4. Results design recommendations

In this section, we present design recommendations derived from the findings presented in the three themes above. Each recommendation is supported by either one or a combination of a few of the findings and an explanation of the reasoning behind them: recommendations on how to best facilitate the process of the users in forming and interacting with the if-then plans, recommendations that help preserve and enrich the positive aspects and help to overcome the obstacles the participants found in using the method, and finally, recommendations to enhance engagement and effectiveness of the method.

Focus on creating useful habits and modifying problematic behaviors

Findings show that participants instinctively organized their if-then plans into task-based and behavior/situation-based categories. However, while some found both tasks helpful, all six participants found behavior change plans more effective for dealing with emotions, situations, and distractions related to procrastination. Participants emphasized self-reflection and awareness of habits during plan formulation as key takeaways from the study.

Recommendation: The design's primary focus should be helping users create useful habits and address problematic ones by highlighting the importance of self-reflection in plan formulation and facilitating introspection. This approach will address

procrastination from a perspective beyond time management, helping users understand their procrastination habits, tendencies, and triggers to create effective plans.

Support flexibility to formulate all types of plans

As mentioned in the recommendation above, the Participants instinctively organized their if-then plans into task-based and behavior/situation-based categories, which helped them address different aspects of procrastination. And although they found the behavior-based plans more effective, some also found the task-based plans useful.

Recommendation: Ensure the solution accommodates all types of cues and actions while users formulate if-then plans and allow users to categorize their plans accordingly. This flexibility accommodates all procrastination triggers and aligns with users' natural tendencies, enhancing plan effectiveness.

Streamlined plan creation process

Participants followed a consistent sequence of steps in plan creation, including identifying triggers, creating actionable plans, documenting them, and adjusting them as needed.

Recommendation: Include a clear and intuitive interface that guides users through these four steps, reducing cognitive load and facilitating quick plan creation: 1) Identifying specific procrastination triggers or tasks, 2) Creating actionable if-then plans, 3) Documenting these plans in this format: "If situation Y is encountered, then I will initiate behavior Z to achieve goal X.", 4) Adjusting the plans based on their effectiveness. Simplifying the plan creation process encourages more consistent and effective tool use.

Periodic plan reviews and adjustments

Addressing the fourth step from the last recommendation, participants found value in periodically reviewing and adjusting their plans based on effectiveness.

Recommendation: Implement dynamic interaction features that prompt users to regularly assess and revise their plans and AI-driven suggestions for plan modifications based on user feedback and success rates. Regular reviews ensure continuous improvement and adaptation of plans to changing needs, maintaining relevance and effectiveness and addressing user feedback that static plans quickly become obsolete or less effective.

Cross-device synchronization

Participants used different tools to document their plans, some of which were changing tools along the way to ensure accessibility at all times. They valued having their plans accessible across different devices.

Recommendation: Ensure synchronization of if-then plans across multiple devices (e.g., phone, tablet, laptop). Cross-device synchronization supports varied usage patterns and promotes continuous engagement with the tool, eliminating barriers to accessing plans and facilitating consistent engagement regardless of the user's chosen device or location.

Easy integration with other tools

Participants mentioned the need to collaborate with their other organizational tools during plan formulation, such as to-do list apps and calendars.

Recommendation: Create a plug-in that allows users to use this method within and in collaboration with all other organizational tools they already use. This recommendation can help users overcome the barrier of changing organizational habits and foster extra help in implementing this method, leading to more consistent tool use.

Visible and interactive widgets for easy access

Participants suggested having a widget on their phones and desktops to be constantly aware of and "reminded" to follow the plans without intrusive notifications. This solution addresses the need for easily accessible if-then plans without frequently opening the app.

Recommendation: Include widgets for desktops and mobile devices that keep if-then plans visible and easily accessible. Design interactive widgets and dashboards that display relevant if-then plans and allow quick interactions without needing to open the app. Visible widgets enhance spontaneous engagement, reduce the effort required to access plans and promote consistent use. Additionally, it creates a tool that fosters engagement with the method without over-engagement with the app, which could lead to procrastination.

Positive and motivational messages

Participants mentioned that reminders are crucial but might not always be appropriate, as they could inadvertently increase procrastination. They noted that they are highly aware of their tasks and that reminders could lead to guilt, furthering procrastination. Positive and motivational messages were seen as beneficial and encouraging without adding pressure.

Recommendation: Integrate periodic, non-intrusive motivational messages that encourage users and reduce feelings of guilt associated with procrastination without mentioning their tasks or specific plans. These messages should foster emotional support, aiming to engage users with the method and the tool.

Customizable and controllable notifications

Participants were divided on the need for reminders and notifications, with some stressing the importance of controlling the timing and frequency of notifications to avoid intrusiveness and the option to turn them off altogether.

Recommendation: Allow users to set, adjust, and turn off notification frequencies according to personal and situational needs. Customizable reminders accommodate diverse user schedules and preferences, reducing annoyance and increasing the effectiveness of the reminder system.

Linking plans to time-based reminders

Participants found time-based plans more effective, with one participant documenting their plans in a tool that allowed them to set time-based reminders, increasing their plans' success.

Recommendation: Offer features that allow users to link if-then plans to specific timed reminders, enhancing their engagement and success rates. This feature should be optional, not mandatory. Time-based reminders ensure timely and relevant notifications, making them more effective in encouraging plan adherence.

Support for unpredictable schedules

Participants found the method beneficial for unstructured periods where they had control over their schedule. However, those with less freedom over their schedule struggled to adhere to plans when faced with unpredictable schedules, last-minute changes, and external obligations.

Recommendation: The tool should include features allowing dynamic re-prioritization and flexible goal setting to accommodate changing schedules. While the method may be more beneficial for users with more control over their schedules, fostering the ability to help with changing schedules can better support all users.

The recommendations above emphasize the need for flexibility, ease of use, and emotional support in designing a digital tool to help facilitate and enhance the experience and effectiveness of the "implementation intention method" to help students combat academic procrastination. They provide actionable guidelines that foster better habit formation and address procrastination more holistically.

6. Discussion

Our results show that the most impactful aspect of using the Implementation Intentions method for students dealing with academic procrastination is identifying emotional and situational triggers and creating plans for addressing them in the form of "if-then" plans. Our results are supported by the literature that highlights the added benefits of identifying and anticipating distractions that may lead to procrastination and planning how to address these emotional and situational triggers in advance (Pychyl, 2013; Sommer & Haug, 2012)

Our findings suggest that some form of reminder is necessary for students to adhere to the method. Reminders have been proven beneficial in changing behavior and promoting goal attainment in five studies across various contexts, such as increasing savings, meeting loan payments, donating to charity, going to the gym, and adhering to medical treatment (Huck & Rasul, 2010; Karlan et al., 2016; Cadena & Schoar, 2011; Altmann & Traxler, 2014; Vervloet et al., 2012). Literature suggests that reminders change behavior by briefly shifting attention toward a particular goal, making it more prominent, and reducing the transaction costs associated with the action compared to the benefits (Gravert, 2022).

However, we found that when students are in a state of procrastination, they are already acutely aware of the tasks they are avoiding, which may suggest that some reminders may intensify feelings of guilt and lead to further procrastination. "Ironical processes of mental control," a study supporting this insight, discusses how an individual's attempt to avoid a task or a certain feeling will inevitably lead to uncontrollable thoughts about the task or feeling they are trying to avoid (Wegner, 1994). Nevertheless, as mentioned in the literature review, this avoidance is merely a temporary solution, and only by working on the task at hand will these negative feelings go away (Sirois & Pychyl, 2013). Therefore, these reminders must be carefully timed and designed to encourage adherence without exacerbating negative emotions or behaviors, which can lead to guilt and heightened procrastination. Instead, reminders should provide an easy action to give users an "easy way out" of their current avoidance state.

Our findings show that students dealing with procrastination react well and benefit from positive motivational messages as they encourage without adding pressure. This insight suggests that motivational messages can help students maintain engagement with the method by reducing procrastination-related stress by addressing its emotional and psychological aspects. Therefore, we recommend integrating periodic, non-intrusive motivational messages that encourage users and reduce feelings of guilt associated with procrastination.

Most of the literature on procrastination discusses the benefits of promoting positive thinking in reducing procrastination-related stress. There is not much research on the

effects of sending positive messages that have no call to action; however, research on the topic of notifications notes the difficulty and nuance of designing positive notifications; according to Czerwinski et al. (2016), when trying to encourage positive health behaviors, notifications should reflect users' emotional states and receptive times.

Our findings show that students find that visible widgets enhance spontaneous engagement and promote consistent use of applications. This insight may indicate that making their plans visually present can act as "passive visual reminders" and be a beneficial substitute for periodic intrusive notifications, fostering engagement with the method without over-engagement with the app, which could lead to procrastination. Therefore, we suggest designing an interactive widget for desktops and mobile devices that keeps if-then plans visible and easily accessible. The literature broadly supports this insight, reinforcing the benefits of widgets as they enhance the user experience by providing quick access to critical functionalities and information directly from the home screen, which saves time and effort. They improve user engagement and interactivity by being visually appealing and interactive, and they increase app visibility by serving as constant reminders on the home screen. (Syaifudin et al., 2020; Weiss, 2007)

Our findings suggest that the method mainly benefits students with less structured routines and more control over their schedules by helping them create the needed structure. In contrast, students with highly structured routines and less freedom struggle to adhere to plans due to unpredictable changes and a lack of free time caused by external obligations. Literature reinforces that often, Students engaged in university studies have high levels of freedom and low structure; the results demonstrated that environmental factors have a negligible impact on low-procrastinating students, whereas unstructured environments are referred to as "procrastination friendly," fostering even stronger procrastination tendencies, which emphasizes these students need to self-regulate (Svartdal et al., 2020). This may suggest that since the method of implementation intention is a self-regulation method, it may be less beneficial in situations where fewer self-regulatory skills are needed. To help foster extra support in these situations, we suggest designing

features that allow dynamic re-prioritization and flexible goal setting to accommodate changing schedules.

7. Final design guidelines

This section provides a list of design recommendations to enhance the effectiveness of digital tools using the "implementation intentions" technique to combat academic procrastination. Based on insights from qualitative studies, the recommendations focus on fostering useful habits, supporting flexibility in plan formulation, and providing emotional support. The goal is to create a user-friendly, adaptable, and supportive tool that effectively addresses procrastination by helping users understand and manage their procrastination habits and triggers.

1. Focus on creating useful habits and modifying problematic behaviors

The design's primary focus should be helping users create useful habits and address problematic ones by highlighting the importance of self-reflection in plan formulation and facilitating introspection.

2. Support flexibility to formulate all types of plans

Ensure the solution accommodates all types of cues and actions while users formulate if-then plans and allow users to categorize their plans accordingly.

3. Streamlined plan creation process

Include a clear and intuitive interface that guides users through these four steps, reducing cognitive load and facilitating quick plan creation: 1)

Identifying specific procrastination triggers or tasks, 2) Creating actionable if-then plans, 3) Documenting these plans in this format: "If situation Y is encountered, then I will initiate behavior Z to achieve goal X.", 4) Adjusting the plans based on their effectiveness.

4. Periodic plan reviews and adjustments

Implement dynamic interaction features that prompt users to regularly assess and revise their plans and AI-driven suggestions for plan modifications based on user feedback and success rates.

5. Cross-device synchronization

Ensure synchronization of if-then plans across multiple devices (e.g., phone, tablet, laptop).

6. Easy integration with other tools

Create a plug-in that allows users to use this method within and in collaboration with other organizational tools users may already use.

7. Visible and interactive widgets for easy access

Include widgets for desktops and mobile devices that keep if-then plans visible and easily accessible. Design interactive widgets and dashboards that display relevant if-then plans and allow quick interactions without needing to open the app.

8. Positive and motivational messages

Integrate periodic, non-intrusive motivational messages that encourage users and reduce feelings of guilt associated with procrastination without mentioning their tasks or specific plans. These messages should foster emotional support, aiming to engage users with the method and the tool.

9. Customizable and controllable notifications

Allow users to set, adjust, and turn off notification frequencies according to personal and situational needs.

10. Designing reminders to ensure goal adherence

Reminders must be carefully timed and designed to encourage adherence without exacerbating negative emotions or behaviors and should provide an easy action to give users an "easy way out" of their current avoidance state.

11. Linking plans to time-based reminders

Offer features that allow users to link if-then plans to specific timed reminders, enhancing their engagement and success rates. This feature should be optional, not mandatory.

12. Support for unpredictable schedules

The tool should include features allowing dynamic re-prioritization and flexible goal setting to accommodate changing schedules.

8. Conclusions

The review of existing literature shows a notable absence of digital tools that specifically address procrastination through the strategy of implementation intentions. Most current tools focus on task prioritization, time management, and reducing distractions but fail to integrate self-regulatory strategies that directly tackle the emotional and situational triggers of procrastination.

By conducting a diary study where students applied the implementation intentions method, this research found that identifying and planning for emotional and situational triggers significantly helped manage procrastination. Creating specific "if-then" plans to address these triggers was highly effective, with students reporting that behavior-based plans were particularly impactful in managing emotions and distractions. Additionally, students appreciated reminders and positive motivational messages, which helped maintain their engagement with the method. As a result, the study proposes design guidelines based on these conclusions to develop digital tools that effectively support students in overcoming procrastination.

In summary, this thesis lays the groundwork for the future development of digital tools using implementation intentions to help students overcome procrastination, enhancing their academic performance and well-being. Continuous user feedback and iterative design will be vital in refining these tools to meet evolving student needs.

9. Limitations

This study has several limitations that need to be acknowledged. Firstly, the small sample standing of six participants, although valuable for in-depth qualitative analysis, may not sufficiently represent the broader university student population. This restricts the generalizability of the findings, which could influence the

development parameters of the digital tool designed to combat academic procrastination.

Secondly, the duration of the study, limited to one week, may restrict insights into how students might adapt to and find the method helpful over a longer period. The potential for sustained motivation and habit formation, key elements for the digital tool's effectiveness, remains unexamined.

Lastly, the broad instructions provided to participants were intended to explore diverse personal adaptations of the method; however, this could also mean that the creativity and variety of implementations were constrained by the participants' initial understanding and personal initiative. While this approach helped identify individual preferences and strategies, it might have also limited the exploration of more structured or innovative adaptations that could be more generally effective.

To overcome these limitations, future studies should consider employing a larger, more diverse sample and extending the duration to capture longitudinal effects. Additionally, exploring structured implementation frameworks might offer new insights into optimizing the method for digital adaptation.

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II Appendix

Appendix A: Diary study guidelines.....	37
Appendix B: Interview questions.....	39

Appendix A: Diary study guidelines

Welcome to our study on overcoming academic procrastination!

Starting tomorrow, you'll embark on a reflective and proactive journey, applying the "implementation intention" method to your daily academic routines. This is an opportunity to explore new strategies, learn more about your work habits, and perhaps discover effective ways to enhance your productivity and reduce procrastination.

Setting your 'if-then' goals:

- Plan Ahead or Day-by-Day: You have the flexibility to set your 'if-then' goals at the beginning of the week for the entire week and iterate as needed, or you may choose to set new goals each day.
- Distractions & Feelings: Be mindful of potential distractions and feelings that lead to procrastination, and prepare a plan for them.
- Remember your WHY: remind yourself what your goal is, why you chose to join this study, and what your motivation is. This can be helpful in formulating your 'If-Then' goals.

Reflect & share:

Your daily reflections are crucial. Share Through WhatsApp, either as text or voice messages. Your journey, insights, and adaptations are key to understanding and improving this method for combating academic procrastination.

On my end, the more you document, the better! You may include screenshots or pictures of your goal lists, and you can send reflections or documentation as many times a day as you'd like. However, to make it as simple and as least time-consuming as possible, send at least once at the end of each day and focus on these bullet points:

- Document your 'if-then' goals and the thought process behind forming them.
- Note the tools you use for writing and saving your goals (e.g., pen and paper, to-do list apps, Google Calendar).

- If you change your goal-setting method during the week, document the new process and why you made the change.
- Reflect on how these plans work for you daily. Feel free to jot down any adjustments, how you felt, or any challenges you encountered.

Support:

If you have any questions or need a bit of encouragement, don't hesitate to reach out. We're in this together, and your input is invaluable.

This week is about exploration, learning, and adaptation. The goal isn't perfection but progress and understanding how to make the 'implementation intention' method work for you. Looking forward to your reflections!

If-then format:

To refresh your memory about the implementation intention method, here is the format and the example we have gone over in the initial meeting:

"If situation Y is encountered, then I will initiate behavior Z in order to reach goal X!"

Example 1: If it is 5 pm on Monday then I will sit at my desk and read these 2 articles. (The “If” specifies an external cue, and the “Then” is a task related to the end goal.)

Example 2: If I am studying and a friend calls and offers to meet up then I will remind myself how relieved I will feel if I get more done and keep studying. (The “If” specifies an external cue that threatens to send goal striving off track, and the “Then” is an action to stabilize goal striving.)

Example 3: If I don't feel like studying and start telling myself I will do it tomorrow then I will get myself up and study for at least 20 min before I decide if I postpone studying or not. (The “If” specifies an internal cue and the “Then” specifies an actionable response.)

Appendix B: Interview questions

1. Can you describe how you formulated your 'if-then' plans during the study? What specific steps did you follow?
2. How did the 'if-then' plans influence your daily academic activities?
3. Were there types of if-then statements you found more useful? And why?
4. Were there types of if-then statements did you found less useful? and why?
5. When did you find yourself looking at the “if-then” statements? Or writing new ones?
6. What were the main challenges or barriers you faced while trying to follow your 'if-then' plans?
7. Were there any particular moments or situations where the 'if-then' strategy did not work as expected? Can you elaborate on those instances?
8. What tools or methods did you find most helpful for recording and remembering your 'if-then' plans? (e.g., apps, pen and paper, reminders)
9. Did you switch tools or methods during the study? If so, why?
10. If an app were developed based on the 'implementation intentions' technique, what features would you consider essential?
11. How could an app effectively remind or encourage you to stick to your 'if-then' plans without becoming annoying or intrusive?
12. How did you feel when receiving the halfway check-in message?
13. How did your motivation levels change throughout the study when using the 'if-then' strategy?
14. In a perfect world, What could be added to the 'if-then' strategy to make it more engaging or effective for you personally?