Master Thesis U.S.E.

Utrecht University

Stop procrastinating on your master thesis: an intervention based on the theory of planned behavior[1]

Abstract: Academic procrastination among master students writing their thesis is concerningly high. Possible negative effects of procrastination are anxiety, depression, physical health issues and degrading academic outcomes. This study researched the effect of a behavioral intervention based on the theory of planned behavior on procrastination among economic master students writing their master thesis at the University of Utrecht. Following a quasi-experimental research approach using a pre-test and post-test non-equivalent control group design of 2x2, 23 participants were included in an experiment. Although the power of the results is low, the results showed that using a nudging technique based on the TPB had positive effects on participants who received them compared to those who did not. The results of this study provide an inspiration for future research.

Author:	**Supervisor:**
Babel Essink	Dr. J.C.L. (Jason) Gawke
Student number: 4080424	**Co-reader:**
b.essink@students.uu.nl	Dr. T.H. (Timo) van Balen

Table of content

List of tables

List of figures

1. Introduction

Whether it is putting off exercising till tomorrow or writing your thesis in the last weeks before the deadline, everybody procrastinates sometimes. Not surprisingly, the group that procrastinates the most are students. It has long been established that the majority (around 80 - 95%) of students procrastinate (Steel, 2017). Most see it as just a discomfort, having to rush at the last moment to meet a deadline, but sometimes procrastination can also result in other issues. Procrastination can lead to depression, anxiety, and even physical health problems (Sirois, 2015). Next to that procrastination can result in lower grades for assignments and lower quality of work (Tice & Baumeister, 1997). Overall, procrastination is a self-defeating habit that is portrayed by short-term benefits and usually followed by long-term costs. It goes without saying that methods to decrease procrastination amongst students are being explored. One of those methods is using the theory of planned behavior (TPB).

The TPB predicts the intention to perform a certain type of behavior, such as procrastination, by using measures of attitude, subjective norm, and perceived behavioral control (Ajzen, 1991). Literature about using the TPB to predict procrastination is not always in line with each other. In a study by Lin (2017) it was found that when people have higher measures of the TPB, they procrastinate less. In contrast, Webb and Sheeran (2006) found that the relationship between the intention to procrastinate less and the level of procrastination is low. One implication could be that people have strong intentions not to procrastinate but do not act upon them (Steel, 2007). Various studies have been done using aspects of the TPB to influence procrastination, but a viable intervention to decrease procrastination using the TPB has yet to be found (Zacks & Hen, 2018).

An effective way to influence people's behavior with an intervention is basing the intervention on the theory of nudging. The latter was first defined by Thaler and Sunstein (2008) and uses changes in the choice-architecture to influence people to make a certain kind of decision or behave in a certain way. Prior literature has shown promising effects in the field of education. By means of example, research by Castell and Meyer (2020) found that text reminders cause students to earn higher credits. Weijers et al. (2020) even defined a nudging matrix depicting what type of nudges would work best for different educational goals. However, in terms of academic procrastination or combining the TPB with the theory of nudging, no research has been conducted to date and thus forms a challenge to be addressed.

In order to address formerly named challenge, this research aims to answer the following research question:

"What are the effects of a behavioral intervention based on the theory of planned behavior on procrastination among students in the first phase of writing their master thesis?"

To obtain an answer to above research question this study can be structured into three phases. The first phase involved conducting an extensive literature research to design nudges based on the TPB. From the literature on nudging, it was found that a transparent type 2 nudge, further explained in the literature review, would fit this research best (Weijers et al. 2020). Since attitude, subjective norm, and perceived behavioral control influence intention which on its turn influences behavior, a way had to be found to incorporate those components into a behavioral intervention. Since literature is scarce about combining the TPB with nudging in education the taxonomy of behavior change techniques was used in combination with other literature pin-pointing the measures of the TPB in education (e.g., Abraham & Michie, 2008; Carnegie, 2019; Becker, 2020).

The second phase consisted of an experiment amongst economic master students from the University of Utrecht. The measurements and nudges took place in the first phase of writing the thesis. An experiment bridges the gap between literature and practice and gives an opportunity to apply results locally (Joyce & Cartwright, 2019). The experiment tested the nudges designed in phase 1 using a quasi-experimental design, explained in more detail in the methodology (section 4) of this paper (Oldham, 1994).

In the third and final phase the results were statistically analyzed using SPSS (version 28). SPSS was chosen as it is the most widely used statistical program to analyze human behavior data (Choueiry, 2021). After that the results were critically discussed in light of the literature. Subsequently everything for this paper was combined, revised, and finalized.

This research found that using a nudging technique based on the TPB has a positive effect on students who received it compared to those who did not. For the students who did not receive the nudges procrastination rose between the pre-test and post-test. While those who received the nudges stayed the same in level of procrastination. Furthermore, a connection between the

results and the TPB could not be detected which makes the reason why those nudges worked unclear. While these findings could contribute to research, they should be seen in light of limitations such as a small sample size. This prevents this research from having ample power to have conclusive results.

The contributions of this research are two-fold. First, using the TPB for a behavioral intervention trying to influence procrastination is new. This research could prove as a base for future research to build upon with this new angle. The research shows that nudging techniques can be devised that could have an influence on procrastination. Second, the results of this study could prove to be useful for educators to reduce procrastination for students writing their master thesis. This will reduce the negative effects procrastination has such as mental problems and lower quality of work.

The remainder of this paper begins with a literature review regarding the theory of nudging, the TPB, academic procrastination and research of these topics in education. The literature review will be followed with the development of hypotheses. Subsequently, the methodology of the paper is explained and motivated. In what follows the results are analyzed. The paper ends with a discussion and conclusion where the results will be discussed in light with literature, limitations are named, implications and contributions are highlighted, and conclusions are made answering the research question.

2. Literature review

2.1. Theory of nudging

The concept of nudging was first defined by Thaler and Sunstein (2008, page 356) as *"any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives."* The theory is an important aspect of behavioral economics and is often used as a base for behavioral change interventions. The nudging theory combines the concepts from psychology and sociology with economics. An example of a nudge is eating dinner from a smaller plate to reduce the intake of calories or placing your work-out outfit next to your alarm clock. Nudging is proved to be an effective way to make people do what they want to do or prevent people from doing things that are not as productive/legal/etc. (Sunstein, 2014).

2.1.1. Nudging in education

According to the dual process theory (Thaler & Sunstain, 2008) there are two cognitive systems which process information. System 1 (automatic) evolves around effortless, uncontrolled, unmeasured, associative, and unconscious thinking. System 2 (reflective) evolves around effortful, controlled, reasonable, measured, self-aware, and deliberate thinking. Automatic system responses can influence reflective system responses such as comparing two sorts of beer but choosing the Dutch one because you heard Dutch music in the store (North et al., 1999). Next to the dual process theory research by Hansen & Jespersen (2013) differentiates nudging in being transparent or non-transparent. Transparent nudges are clear to the operator as something that influences their behavior. Non-transparent nudges are the opposite, and the operator does not know that they are being nudged. By means of example, figure 1 shows a nudging matrix containing type 1, type 2, transparent and non-transparent nudging techniques.
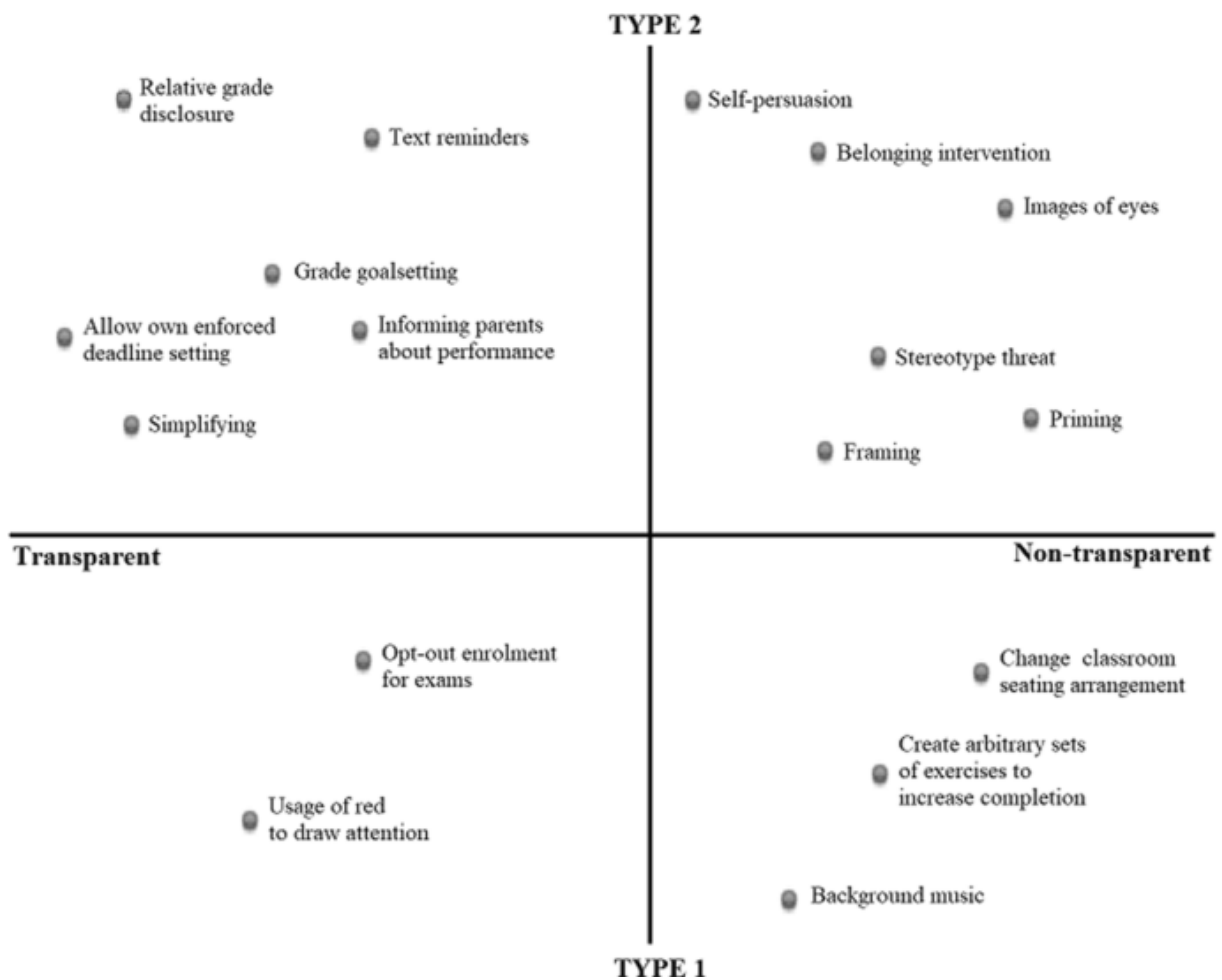
Figure 1: Nudging matrix (Weijers et al., 2020)

Small nudges in an individuals' situation can make use of the irrationality of the automatic cognitive system to positively influence them in a predictable way without making unsustainable exertions. Therefore, nudging could be used as a motivation booster for students writing a master thesis or educators coaching these students. However, while the nudging theory has been researched in other fields such as e.g., health, there is still a lot to discover within the field of education (Weijers et al., 2020).

Prior literature shows that education is a promising field to use the nudging theory as it leads to improvement of educational outcomes and behavior (Damgaard & Nielsen, 2018). Some of the more recent literature shows different takes on how nudging can be used in education. For example, research by Clark et al. (2016) determined that setting task-specific goals for courses lead to more university students taking practice exams. Further evidence by Castleman and Meyer (2020) found that students who got a text reminder earned more course credits during their first semester. Especially students who performed poorer prior to the experiment. Research by Bandiera et al. (2015) showed that feedback has a positive effect on grades.

However, research has also revealed that generating a nudge might be difficult. Coaching-based interventions do not have a significant impact on academic outcomes, according to Oreopoulos and Petronijevic (2019). Students saw that more work was required to accomplish the project due to the coaching, but instead of studying more, they decreased their expectations. There was no meaningful consequence from instructing students to create a weekly calendar and providing them with reminders. While the amount of time spent studying increased, there was no influence on the student's grade (Oreopoulos et al., 2018).

2.2. Theory of planned behavior

The TPB is a psychology concept that connects beliefs to actions. According to the theory, an individual's behavioral intentions are shaped by three basic components: attitude, subjective norm, and perceived behavioral control. Together they influence intention, which influences behavior (Ajzen, 1991). See Figure 2 for a visual depiction of how the components of TPB influence each other.
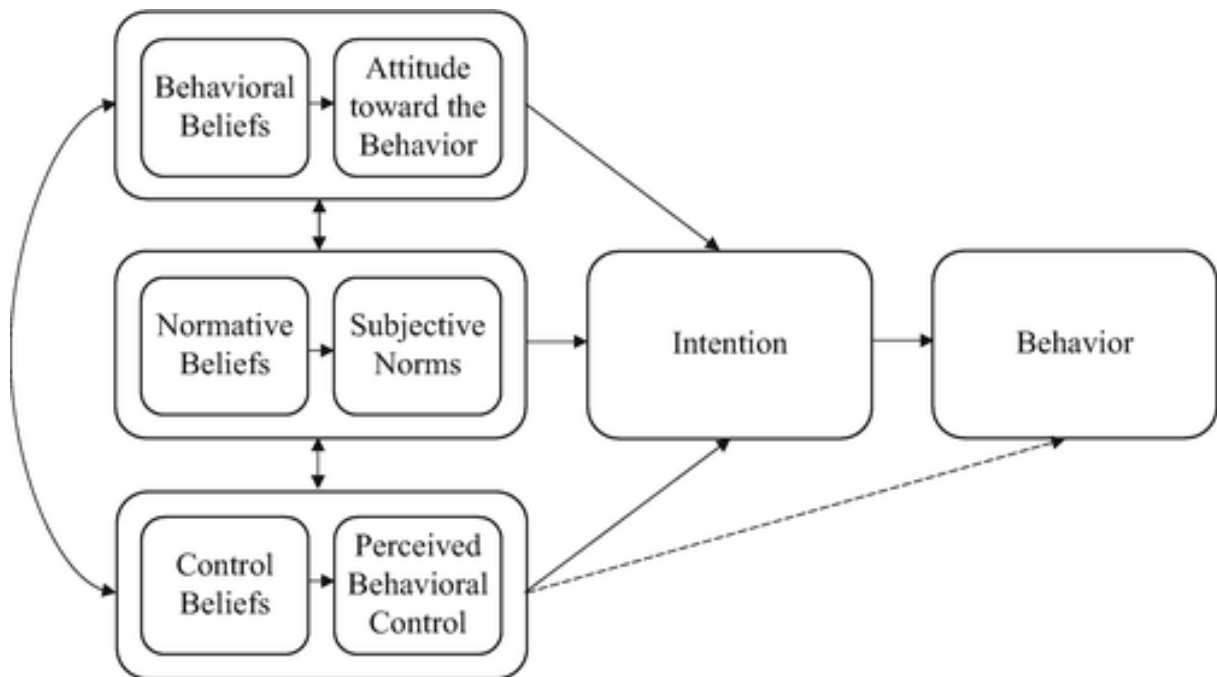
Figure 2: Theory of planned behavior (Ajzen, 2020)

Behavior from intention

Intention is a direct predictor of behavior. The stronger the intention to perform the behavior the more likely that the behavior will be performed. However, a multitude of factors can influence the actual action upon the intentions of an individual. Attitude, subjective norm, and perceived behavioral control next to actual behavioral control all have an influence over if intention turns into behavior (Ajzen, 2020). Intention can change over time according to various internal and external factors such as changing beliefs or changing jobs (Joseph & Wong, 1985).

Attitude

The degree to which a person has a favorable or unfavorable opinion or appraisal of the action in issue is referred to as attitude toward the behavior (Ajzen, 1991). Attitude is influenced by behavioral beliefs which can have a negative or positive impact on attitude. A behavioral belief is the person's subjective belief that the actions preformed will prove a certain outcome or an experience (Ajzen, 2020). For example, if a person believes that studying (the behavior) will contribute to good grades (the outcome) but takes a lot of time (the experience).

Subjective norm

The perceived social pressure to perform or refrain from a behavior is known as the subjective norm (Ajzen, 1991). Both injunctive and descriptive normative beliefs contribute to the subjective norm. Injunctive normative beliefs are depicted by the expectation that others (e.g., friends, family, colleagues, etc.) have about the behavior of a person. Descriptive normative beliefs are depicted by how important others are behaving (Ajzen, 2020).

<u>Perceived behavioral control</u>

The concept of perceived behavioral control grew out of the concept of the theory of self-efficacy and is concerned with the individual's impression of his or her own ability to accomplish a specific behavior (Ajzen, 1991). Bandura (1997) defined self-efficacy as *"a person's particular set of beliefs that determine how well one can execute a plan of action in prospective situations."*. Perceived behavioral control is believed to be based on accessible control beliefs. These control factors could for example be skills, availability of resources, availability of time, etc. Perceived behavioral control moderates the effects attitude and subjective norm have on the intention. Next to that actual behavioral control has an influence on the behavior. This is that a person acts upon his intents that he can perform a certain behavior because he has control over it (Ajzen, 2020).

2.2.1. Theory of planned behavior and behavior changes (Nudging)

The TPB is a helpful framework to create behavioral change interventions and is being used more often as theory for experiments. However, studies confirming the effect of using the TPB are limited to specific domains. So far, TPB-based behavioral experiments can be classified into 8 domains, of which one is interventions in work and school behavior (Steinmetz et al., 2016). However, none of the studies targeted procrastination.

2.2.2. Theory of planned behavior and research in education

Research about all the components of the TPB in combination with education is mostly about predicting intention amongst students. For example, in research by Dewberry & Jackson (2018) it was discovered that the components of the TPB explained over 50% of the intention of students to drop out of university. In research by Sutter & Paulson (2016) it was discovered that the TPB predicted the graduation intention of undergraduates. Both of these research papers, and others like it, suggest using the TPB not only as a way to predict intention but also

as a theory to build interventions upon to influence intention and behavior of students. However, no research could be found which explored the effectiveness of this theory.

2.3. Academic procrastination

Academic procrastination is a behavioral concept in which students put off working on their studies with the risk of failing prescribed assignments (Rusbandi & Usman, 2020). Academic procrastination is closely related to decisional procrastination, which is characterized as a delay in reaching a decision. This type of procrastination consists of a cognitive barrier to delaying the start of an assignment when faced with stressful events (Kristanto & Abraham, 2016). Decisional procrastination, according to Mann et al. (1997), is a type of avoidance associated with serious conflict, loss of hope for a better solution, no time target, and is also related to high stress. When faced with many options, people who suffer from decisional procrastination take longer to make decisions (Ferrari & Dovidio, 2000).

Over 70% of undergraduate students engage in this type of behavior on a regular basis (Klingsieck et al., 2013). Furthermore, when it comes to delaying written assignments, graduate students indulge in this behavior 3.5 times more than undergraduate students (Onwuegbuzie, 2000). Most people who procrastinate see this behavior as a source of discomfort leading to depression and anxiety and would prefer to minimize it (Steel, 2007). Procrastination could even result in serious physical health issues, such as hypertension (Sirois, 2015). Multiple studies have found a negative correlation between procrastination and academic performance. In research by Michinov et al. (2011) it was found that students with a tendency for procrastination would be less active in the discussion groups, and their performance would suffer as a result. Cerezo et al. (2016) observed that procrastination is, to a great extent, negatively related to student accomplishment. Furthermore, chronic procrastinators frequently underestimated the time required to finish the work, and insufficient time was allotted to complete the task, resulting in failure for a lot of students (Díaz-Morales et al., 2008). Since academic procrastination can have long-term effects on lives of students it should be addressed (Kim & Seo, 2015).

When addressing academic procrastination, the effects during a set time period should be considered. Research by Zhu et al. (2018) depicted that the how longer the deadline is away, the more a person procrastinates at the start of the period set for completing the task. This is

referred to as the "deadline-effect" and could be explained by the tendency of persons to postpone tasks till the latest moment.

2.4. Procrastination and the theory of planned behavior

Previous research has found a link between students' study procrastination and all the TPB aspects. TPB has also been used to investigate study habits in general. TPB, for example, was found to account for more than half of the variance in the amount of time spent studying in research by Leone et al. (1999). In research by Lin (2017) it was found that participants were less likely to procrastinate when they had a good attitude, felt more behavioral control, had a stronger subjective norm, and had a better behavioral intention to complete the task. However, contradicting literature has stated the effect intention (not to procrastinate) has on procrastination can be low (Webb & Sheeran, 2006). According to research by Ariely & Wertenbroch (2002) most people have strong intentions not to procrastinate. However, they do not act on it, or act biased upon it (Steel, 2007).

Attitude

The degree to which an individual has a favorable or unfavorable opinion or appraisal of the action in issue is referred to as *attitude toward the behavior* (Ajzen, 1991). A positive attitude has a positive effect on goal intentions (Sommer & Haug, 2012) and study intention in general (Leone et al., 1999). A direct link between attitude and procrastination has not been found but as mentioned in the research by Lin (2017), a student is less likely to procrastinate when they have a good attitude.

Subjective norms

Prior literature has not clearly linked the impact of social norms to procrastination. There is literature linking social norms to intention to study like research by Leone et al. (1999) and research by (Sommer & Haug, 2012). However, when employed in a TPB situation, subjective norm is often a poor predictor (Armitage & Conner, 2001). One could argue that the dimension of subjective norms plays a part in procrastination as students generally try to be in line with other students.

<u>Perceived behavioral control</u>

As the concept of perceived behavioral control grew out of the theory of self-efficacy they are closely linked together. Therefore, it is relevant that according to Bandura (1997) self-efficacy is one of the most crucial aspects in learning (Bandura, 1997). It is troublesome that research by Sarirah and Shaq (2019) found that students' procrastination, when preparing to write their thesis, is higher when their academic self-efficacy is low.

Despite former research and the broad academic knowledge on TPB, a viable intervention to decrease procrastination has yet to be found. There is a great need to research methods that work on decreasing procrastination, not only for academic purposes but also in light of the effects academic procrastination has (Zacks & Hen, 2018).

3. Hypotheses

To develop hypotheses gaps in the literature were found that needed to be addressed. In this section the hypotheses will be explained and substantiated in line with previous literature.

Following the research by Lin (2017) this research first examined if the components of the TPB are negatively related to procrastination. The hypothesis to investigate students' attitude towards working on the thesis (attitude), subjective norm towards working on the thesis (subjective norm) and perceived behavioral control towards working on the thesis (perceived behavioral control) related to the level of procrastination (procrastination) is as follows:

H1: Students' attitude, subjective norm and perceived behavioral control are negatively related to procrastination.

According to theory it can be expected that all the components of the TPB at baseline jointly are a good indicator of intention and that intention is a good measure for the behavior on procrastination (Ajzen, 1991; Lin, 2017). However, contradicting literature was found that states that about the relationship between intention and procrastination could be very small and thus it is possible that no effect is found (Ariely & Wertenbroch, 2002; Steel, 2007; Webb & Sheeran, 2006).

Furthermore, it is expected that students who received nudges aimed on boosting the components of the TPB will score higher after receiving them than students who do not. Combining the theory of nudging with the TPB is a new angle for education. Since previous research has been successful in developing nudges that influence students, and other previous research successful in rising the components of the TPB, it is expected that combing the two theories has a positive effect (Weijers et al., 2020; Steinmetz et al., 2016). The hypothesis that was formulated is as follows:

H2: Students who received nudges aimed at boosting students' attitude, subjective norm and perceived behavioral control will score significantly higher on the components of the theory of planned behavior than to those who did not receive nudges.

Since attitude, subjective norm and perceived behavioral control is linked to intention, it can be expected that the intention of students who receive nudges based upon those components will score higher after receiving those nudges (Ajzen, 1991). The hypothesis was formed in light of research by Joseph and Wong (1985) who found that intent can change over time. Therefore, if no effect is found for H2 it is still important to look at intention. The hypothesis that was formulated is as follows:

H2a. Students who received nudges aimed at boosting student's attitude, subjective norm and perceived behavioral control will score significantly higher on intent compared to those who did not receive nudges.

Since the TPB can be linked to procrastination and nudging can positively influence students, it is expected that students who receive nudges based on the components of the TPB will score lower for procrastination after receiving those nudges than students who do not (Lin, 2017; Weijers et al., 2020). The hypothesis that was formulated is as follows:

H3: Students who received nudges aimed at boosting students' attitude, subjective norm and perceived behavioral control will score significantly lower on procrastination on the post-test compared to those who did not receive nudges.

Subsequently, research by Zhu et al. (2018) showed that the deadline effect could cause students to procrastinate more when a deadline is not in direct sight. Therefore, it could be argued that students who receive nudges based on components of the TPB will procrastinate less or the same after the intervention compared to the pre-intervention. The hypothesis that was formulated is as follows:

H3a: Students' who received nudges aimed at boosting students' attitude, subjective norm and perceived behavioral control will score significantly lower, or the same on procrastination on the post-test compared to their pre-test.

To test the deadline effect for the students who did not receive nudges another hypothesis was formulated (Zhu et al., 2018). It is expected that the procrastination level of students who did not receive nudges will increase between the pre-test and the post-test. The hypothesis that was formulated is therefore as follows:

H3b. Students' who did not receive nudges aimed at boosting students' attitude, subjective norm and perceived behavioral control will score significantly higher on procrastination on their post-test compared to their pre-test.

The next section will explain the methods used to answer the above hypotheses.

4. Methodology

In order to explore the possibilities of the theory of nudging in combination with the TPB to lower procrastination while working on a master thesis, a 3-fold experiment was carried out. The first part consisted of a survey measuring the initial components of the TPB and procrastination. The second part was the experiment conducted with a between-subjects design (Charness et al., 2012) consisting of emails with or without nudges based on the TPB. The final part consisted of a second survey where the current components of the TPB and procrastination were measured.

4.1. Methods

The approach within this research is broadly similar to research by Kothe et al. (2012). This experiment was a quasi-experimental research using a pre-test and post-test non-equivalent control group design of 2x2. While careful measures (e.g., like conducting the experiment on economic master students) were taken to ensure that the treatment and the control group are as similar as possible, the experiment could not control for all possible key factors. Hence, this experiment follows a quasi-experimental design (Oldham, 1994). A pre-test and post-test were used to measure the effect of the intervention. By using a pre-test one can determine if the treatment and control group are the same on baseline measures. Using the post-test, the potential amount of change can be measured (Dimitrov & Rumrill, 2003). Adopting a non-equivalent control group design of 2x2, or a between-subjects design the validity of results can be ensured. For this design the participants are split into a treatment group and a control group. This ensures that each subject is only exposed to one treatment. In a within-subject design the results could have been biased because of the learning effect, decreasing the validity of the experiment (Charness et al., 2012).

4.2. Experimental design

For this thesis a specific population sample was taken as this group simultaneously had to write their economic master thesis at the same university, decreasing the chance of sampling bias. The requirements were therefore that they were an economic master student at the University of Utrecht, doing a one-year master course, and in the process of writing their master thesis.

The literature has shown that receiving a nudge in form of a notification can have a positive effect on academic outcomes (Castleman & Meyer, 2020). Therefore, the initial plan would have been to have two treatment groups and one control group to control for this effect. The treatment groups would get emails, one group with nudges the other without. And the control group would not receive any emails. However, due to the few participants participating in the experiment only two groups were chosen: a treatment group and a control group (see Table 1: Between-subjects design).

Group	Description
Treatment group: Nudges	Participants received emails with nudges based on attitude, subjective norm and perceived behavioral control.
Control group: No nudges	Participants received emails without nudges.

Table 1: Between-subjects design

4.2.1. Designing nudges

According to Blumenstein et al. (2019), designing a nudge that moves students is almost an art form. There should be careful consideration of what to convey and when. Following the nudging protocol devised by Brown et al. (2022) there are four steps when designing a nudge for students. Step 1 is to devise what you want to nudge, for this experiment that will be attitude, subjective norm, and perceived behavioral control. Step 2 is to plan when to nudge the students, for this experiment this was at the start of the week for two weeks during the first phase of writing a master thesis. Step 3 is to identify who to nudge, for this experiment this were economic master students at the University of Utrecht in process of writing their master thesis. Step 4 is to plan the wording and style of communication, for this experiment the nudges were devised to 'sound' happy and give informal tips supported by a good lay-out.

To boost student's attitude, subjective norm and perceived behavioral control using the theory of nudging research by Weijers et al. (2018) gave a starting point in deciding what type of nudges would fit best. According to their research transparent type 2 nudges suited this experiment best as they aim to change behavioral change by engaging the reflective system, causing students to reflect on their behavior. See Figure 3 for a visualization of the nudging emails.

4.2.1.1. Combining nudges with the TPB

The TPB is rarely used as a way of intervention. It is mainly used as a measure to predict behavioral intention (Hardeman et al., 2002). Therefore, the nudges were designed using the taxonomy of behavior change techniques (Abraham & Michie, 2008). These techniques are derived, among other theories, from the TPB and fits the scope of this experiment. See Table 2 for an overview of the techniques used, the definitions, and the text used in the emails.

The techniques were combined with research suiting each of the techniques:

Attitude

To increase attitude convincing arguments must be made to change someone's believes. It was chosen to use the behavior change techniques "provide information on consequences" and "Provide general information on behavior – health link". For the first technique research was used from Bolkin (1998) stating that working for a set time a day the efficiency and quality of the work written will improve. For the second technique the research by Carnegie (2019) was used. The research states that productivity will be higher if a person starts with a productive task at the start of the day.

Subjective norm

To increase subjective norm people should come in contact with socials norms. It was chosen to use the behavior change techniques "plan social support/social change" and "Provide opportunities for social comparison". For the first technique research by Botha (2021) was used about co-operative learning. Working together in a group can enhance the productivity and consistently of writing. For the second technique research by Stanbury (2010) was used to design the text. Most people are reluctant to ask for help but people's willingness to help is higher than they often think.

Perceived behavioral control

To increase Perceived behavioral control a person needs to believe they can do the task set out for them. It was chosen to use the behavior change techniques "arguments to bolster self-efficiency" and "provide instruction". For the first technique research by Becker (2020) was used that states that the best way to start writing is to just start. Next to that research by Verplanken (2006) states that a habit will be built even if the task is performed only five minutes per day. For the second technique research by Allison (2015) was used. According to that paper task management increases productivity.

Component of TPB	Behavior change technique	Definition	Text used in the emails
Attitude	Provide information on consequences	Informing about the benefits of action or the costs of inaction.	*Work on your thesis each day.* Try to work on your thesis for at least 15 to 30 minutes a day. Research shows that this will greatly improve the efficiency and quality of your work.
	Provide general information on behavior– health link	Informing about the correlation between health and behavior.	*The first hour of the day determines your productivity.* If you start your day doing something that you have to achieve, you'll stay more productive throughout the day. So don't start your day scrolling Instagram but think about what you want to do for your thesis.
Subjective norm	Plan social support/ social change	Prompting knowledge how others could help. Include tips for 'buddy' systems.	*Get a little help from others!* Do you want to work consistently on your thesis? Why not make a thesis group app to motivate each other to work on it. And, you can organize study sessions together with your group to create a valuable working environment.
	Provide opportunities for social comparison	Provide information so social comparison can occur	*People's willingness to help is higher than you think.* Most students in your class are also in the process of writing their thesis. Are you struggling with getting enough data or interviews? Or a bit low on motivation? Don't be afraid to ask if your peers can help you out.
Perceived behavioral control	Arguments to bolster self efficacy	Assuring the participant that they can successfully perform the behavior.	*But how do I start?* The best way to start is… to just start! Set a daily alarm to remind yourself to work on it. Even if you only work on it for 5 minutes you will build a habit. This way you will reach the 30 minutes in no time!
	Provide instruction	Informing the participant how they could perform the behavior by providing tips.	*Keep track of your plans.* One of the methods you can use to work consistently on your thesis is using task management. For example, with the free apps Todoist or Any.do. You can set deadlines for your writing, and it will remind you of it. Give it a try!

Table 2: Overview of the designed nudges

4.2.2. Designing "no-nudges"

For the control group text had to be designed that were not nudging towards increasing the components of the TPB (no-nudge). To make the no-nudges as similar as possible to the nudges the no-nudge emails looked similar to the nudge emails. However, the headings and the texts were different. The headings implied that with three tips you would feel better to start or continue writing your thesis. The text had motivational tips that would not directly help with writing a thesis. Because of ethics the text could not be disadvantageous for the participants. For a visualization of the no-nudge emails see Figure 4.

Tips to start writing your thesis

Work on your thesis each day

Try to work on your thesis for 15 to 30 minutes each day. Research shows that this will greatly improve the efficiency and quality of your work.

Get a little help from others!

Do you want to work consistently on your thesis? Why not make a thesis group app to motivate each other to work on it.
And, you can organize study sessions together with your group to create a valuable working environment!

But how do I start?

The best way to start is... to just start! Set a daily alarm to remind yourself to work on it. Even if you only work on it for 5 minutes you will build a habit. This way you will reach the 30 minutes in no time!

Good luck!

If you have any questions feel free to contact me: b.essink@students.uu.nl

Tips to continue writing your thesis

The first hour of the day determines your productivity

If you start your day doing something that you have to achieve, you'll stay more productive throughout the day. So don't start your day scrolling Instagram but think about what you want to do for your thesis.

People's willingness to help is higher than you think

Most students in your class are also in the progress of writing their thesis. Are you struggling with getting enough data or interviews? Or a bit low in motivation? Don't be afraid to ask if your peers can help you out.

Keep track of your plans

One of the methods you can use to work consistently on your thesis is using task management. For example with the free apps Todoist or Any.do. You can set deadlines for your writing and it will remind you of it. Give it a try!

Good luck!

If you have any questions feel free to contact me: b.essink@students.uu.nl

Figure 3: Nudging emails 1 (left) and 2 (right)

3 Tips to feel better to start writing your thesis

Drink enough water

Drinking water is good for your concentration. Try to drink at least 1.5 liters of water a day. If you are not such a big water drinker you can try tea or lemonade.

Go outside

Try to go outside for 30 minutes each day to revitalize yourself. You can take a walk around the block, do a workout or simply sit in the sun and look at the people walking by.

Get social

Try to get in contact with some of your friends and do something fun, call family members you haven't spoken to in a while to tell them how you are doing, or gather some courage and connect with new people either online or offline.

Good luck!

If you have any questions feel free to contact me: b.essink@students.uu.nl

3 Tips to feel better to continue writing your thesis

Start with a good breakfast

You will have a lot more focus and motivation if you give your body enough energy to start with. If you have trouble eating in the morning prepare something small and eat something bigger half an hour later.

Exercise

Exercise is a vital component of a healthy and happy life. If you exercise regularly you will have more energy to tackle daily chores. Try to increase your heart rate for at least 30 minutes a day.

Don't forget to relax

This period can be pretty exhausting. Next to having to write your thesis, there are a lot of social activities. While the summer is the perfect time to have fun, don't forget to take some time for yourself to recharge.

Good luck!

If you have any questions feel free to contact me: b.essink@students.uu.nl

Figure 4: Non-nudging emails 1 (left) and 2 (right)

4.3. Experimental procedure

The experimental procedure consisted of 3 steps: introduction and preliminary survey, treatment, nudging emails, and pre-experiment survey. The steps are described in more detail in the following sections.

4.3.1. Step 1: Introduction and preliminary survey

The participants were asked to participate via email, which was send out to their student accounts. In this email the experiment was introduced without naming the subject as this could cause information bias. The participants were informed that the experiment consisted of a preliminary survey, emails, and a final survey. They were asked to answer honestly, read the emails and where possible follow the advice given in the emails. Furthermore, a note was given that their answers would be handled anonymously and with strict confidentiality. For each participant € 0,50, - was donated to Giro 555 (for Ukraine). In the email contained a link directing to the first survey.

The first survey consisted of questions about demographics, the measures of the TPB and procrastination. Next to that the participants were asked if they were an economic master student at the University of Utrecht and in the process of writing their master thesis as an extra security measure.

The demographics asked were age, gender, country of origin and master's program. To measure the components of the TPB the questions were based on the questionnaire from Ajzen (2002). Measuring intention, attitude, subjective norm and perceived behavioral control along a 7-point Likert scale. To measure procrastination participants were asked questions based on the questionnaire by Aitken (1982) along a 5-point Likert scale.

Three questions were asked to measure the intention (e.g., "I intend to work for at least 30 minutes each day on my thesis the forthcoming month."). Five questions were asked to measure attitude (e.g., "For me to work for at least 30 minutes each day on my thesis the fortcoming month is: Harmfull – Beneficial."). Five questions were asked to measure subjective norm (e.g., "It is expected of me that I work on my thesis at least 30 minutes each day the forthcoming month."). Four questions were asked to measure perceived behavioral control (e.g., "It is mostly up to me if I work on my thesis for at least 30 minutes each day the forthcoming month."). 12 questions were asked to measure procrastination (e.g., "I delay starting things till the last minute."). After collecting the results from the first survey the

participants were randomly assigned to the treatment or control group using Excel's randomizer. See appendix A.1 for the survey.

4.3.2. Step two: Treatment: nudging emails

In the period of two weeks all the participants received two emails. The treatment group received the nudges depicted in Figure 3 and the control group received the "no-nudges" depicted in Figure 4.

4.3.3. Step three: Pre-experiment survey

Two weeks after the last email the participants were asked through email to fill in the pre-experiment survey. If they did not fill in the survey after the first email, they would receive two more emails to ensure that they would.

The participants first had to fill in the same e-mail address as they had used for the preliminary survey so they could be identified. After that they had to fill in a control question about how many emails they received: 0, 1 or 2.

The components of the TPB were questioned in the same way as the preliminary survey only with the adjustment that they asked about the student's perception about 'this month': the last month of writing their thesis. The questions about procrastination were the same as in the preliminary survey with the adjustment that the participants were asked about 'last month': the month that the experiment took place.

A couple of extra questions were asked about the emails to explore if there were any unforeseen effects of the emails. See appendix A.2 for the survey.

4.4. Power analysis

To find the sample size for the experiment a power analysis was needed. G*Power was conducted using a priori analysis (see appendix B). Effect sizes can be small (f = 20%), medium (f = 50%) or large (f = 70%) (Cohen, 1988). Since there is no existing literature about combining the TPB with the theory of nudging it complicated finding a sufficient effect size. Therefore, the overall effect size of existing literature on nudging was used as a guideline. Next to that research by Kothe et al. (2012) also proved as an example.

In research by Hummel & Maedche (2019) the effect sizes of 317 studies in nudging were analyzed. They found that the effect size between digital and offline nudging did not prove

any significant difference. Furthermore, they categorized nudging effect sizes into categories but none of the categories match education. Therefore, it was chosen to take the median effect size of all nudging studies as a guideline for this experiment, which is f = 21%.

Research by Kothe et al. (2012) investigated if an intervention based on the TPB could influence the intake of fruit and vegetables. Since the aim of their study is mostly similar to this experiment it could prove, next to research by Hummel & Maedche (2019), as a guideline for effect size. The effect size found in the research was f = 20%.

Therefore, this experiment was conducted with a significance level of α = 0.05 with a minimum power of 80% and an effect size of f = 20%. The desired sample size for this study was 128.

5. Results

To answer the research question *"What is the effect of a behavioral intervention based on the theory of planned behavior on procrastination among students in the first phase of writing their master thesis?"* the results will be statistically analyzed using IBM SPSS (version28). This section starts with descriptive statistics after which the hypotheses are tested.

5.1. Descriptive Statistics

In total 28 people participated in the experiment. However, 5 people did not take the pre-experiment survey and were thus excluded from the research (N = 23 (28 – 5)). 12 people were randomly assigned to the treatment group and 11 to the control group respectively. Table 3 provides an illustration of the frequencies of the demographics gender, age, country of origin and master's program.

Variable	Specification	Treatment Group	Control Group	Total
N		12	11	23
Gender	Female	3 (13.04%)	7 (30.43%)	10 (43.48%)
	Male	9 (39.13%)	4 (17.39%)	13 (56.52%)
Age	μ = 24.91	μ = 25.08	μ = 24.73	
	σ = 2.52	σ = 3.00	σ = 2.01	

Country of Origin	Netherlands	6 (26.09%)	4 (17.39%)	10 (43.48%)
	Other	6 (26.09%)	7 (30.43%)	13 (56.52%)
Master's Program	BDE*	11 (47.83%)	9 (39.13%)	20 (86.96%)
	IM**	1 (4.35%)	2 (8.70%)	3 (13.04%)

Table 3: Frequencies demographics

*Business Development & Entrepreneurship
**International management

Using the independent samples t-test for gender, age, country of origin and master's program there was no significant difference found across all conditions (all p's > 0.05, see appendix C, Table 17). Also, for baseline measures of TPB and procrastination no significant difference was found (all p's > 0.05, See appendix C, Table 18). Therefore, it was concluded that the randomization of the groups was successful.

The variables used in this experiment are specified in Table 4. The Likert-scale measurements all range from low to high for their specific variable, 1 being low and 5 or 7 being high. Table Table 5 shows descriptive statistics of all variables divided by treatment & control group.

Variable	*Specification*	*Measurement*
Intent1	Intention to work on the thesis (pre-test).	Likert 1-7
Intent2	Intention to work on the thesis (post-test).	Likert 1-7
Attitude1	Attitude to work on the thesis (pre-test).	Likert 1-7
Attitude2	Attitude to work on the thesis (post-test).	Likert 1-7
SN1	Subjective norm to work on the thesis (pre-test).	Likert 1-7
SN2	Subjective norm to work on the thesis (post-test).	Likert 1-7
PBC1	Perceived behavior control to work on the thesis (pre-test).	Likert 1-7
PBC2	Perceived behavior control to work on the thesis (post-test).	Likert 1-7
P1	Level of procrastination (pre-test).	Likert 1-5
P2	Level of procrastination (post-test).	Likert 1-5

Table 4: Variables and their specifications

Variable	Group	Obs.	Mean	Std. Dev.	min	Max
Intent1	Treatment group	12	5.3611	1.27492	3.67	7.00
	Control group	11	4.9091	2.26613	1.00	7.00
Intent2	Treatment group	12	6.0000	1.41421	3.00	7.00
	Control group	11	6.7273	0.60678	5.50	7.00
Attitude1	Treatment group	12	4.8500	1.40162	2.20	6.80
	Control group	11	5.3455	1.01623	3.20	6.40
Attitude2	Treatment group	12	5.3167	1.11342	3.40	6.80
	Control group	11	5.0545	1.02016	3.80	6.60
SN1	Treatment group	12	4.8667	1.31103	1.60	6.40
	Control group	11	4.4727	1.62548	1.00	6.80
SN2	Treatment group	12	5.0667	1.05256	3.20	6.40
	Control group	11	5.0182	1.22786	3.60	7.00
PBC1	Treatment group	12	5.5417	1.04356	3.00	7.00
	Control group	11	5.0455	2.04884	1.00	7.00
PBC2	Treatment group	12	6.2083	0.68119	5.00	7.00
	Control group	11	6.1818	0.66230	4.75	7.00
P1	Treatment group	12	2.9444	0.68657	1.75	3.92
	Control group	11	2.9015	0.48422	2.17	3.67
P2	Treatment group	12	2.7708	0.56867	1.92	3.58
	Control group	11	3.2348	0.59022	2.17	3.92

Table 5: Descriptive statistics: all variables

5.1.1. Common method variance

Because the same measurement instruments were used during the surveys it is essential to check for common method bias. This was tested by doing a Harman's single factor test. There is no common method bias for this experiment (Sums of squared % of variance < 50%, see Table 6).

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.070	30.696	30.696	3.070	30.696	30.696
2	1.894	18.940	49.636			
3	1.634	16.338	65.974			
4	1.092	10.916	76.891			
5	.969	9.690	86.581			
6	.463	4.629	91.210			
7	.364	3.641	94.851			
8	.254	2.537	97.387			
9	.155	1.553	98.940			
10	.106	1.060	100.000			

Extraction Method: Principal Component Analysis.

Table 6: Harman's single factor test for common method variance

5.2. Testing hypotheses

In this section the hypotheses are analyzed using various tests and robust test to critically assess the data. Only relevant robust tests are carried out for each of the tests. The relevant findings of tests and robust tests will be shown in tables. If a statistically significant result is found it was visualized by means of a graph.

5.2.1. H1: The TPB and procrastination

To test if there is a statistically significant correlation between the components of the TPB on procrastination hypothesis H1 is tested:

H1: *Students' attitude, subjective norm and perceived behavioral control are negatively related to procrastination.*

Fist it is tested if the pre-test is an accurate measure of the TPB. Correlations were run and attitude, subjective norm and perceived behavioral control were correlated with each other (See Table 7Table 8Table 7). A multiple regression was run to predict intention with attitude, subjective norm, and perceived behavioral control. Attitude and subjective norm but not perceived behavioral control were significant predictors of intention (see Table 8). The model proved to be a good fit for the data with a R^2 of 0.719 (F (3, 19) = 16.213, p < 0.05, see

appendix C, Table 19 & Table 20). A second regression was run to determine the effect of intent on procrastination. Intention was not a significant predictor of procrastination (see Table 9). The model did not prove to be a good fit for the data with a R^2 of 0.000 (F (1,21) = 0.129, p > 0.05, see appendix C, Table 21 & Table 22). The TPB as measured in this experiment is not related to procrastination. Therefore, H1 is rejected. Figure 5: Structual equation model of the TPB on procrastination at baselinedepicts a structural equation model of the correlations and effects.

Note: ** p < 0.005; Intention R2 = 0.72; Procrastination R2 = 0

Figure 5: Structual equation model of the TPB on procrastination at baseline

Correlations

		Attitude1	SN1	PBC1
Attitude1	Pearson Correlation	1	.475*	.501*
	Sig. (2–tailed)		.022	.015
	N	23	23	23
SN1	Pearson Correlation	.475*	1	.717**
	Sig. (2–tailed)	.022		<.001
	N	23	23	23
PBC1	Pearson Correlation	.501*	.717**	1
	Sig. (2–tailed)	.015	<.001	
	N	23	23	23

*. Correlation is significant at the 0.05 level (2–tailed).
**. Correlation is significant at the 0.01 level (2–tailed).

Table 7: Correlations attitude, subjective norm and perceived behavior control (pre-test)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	−1.208	.988		−1.223	.236	−3.276	.860
	Attitude1	.748	.208	.515	3.597	.002	.313	1.184
	SN1	.706	.219	.572	3.219	.005	.247	1.165
	PBC1	−.142	.204	−.126	−.699	.493	−.569	.284

a. Dependent Variable: Intent1

Table 8: Multiple regression model: attitude, subjective norm, and perceived behavioral control on intent

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.056	.387		7.898	<.001	2.251	3.860
	Intent1	−.026	.071	−.078	−.359	.723	−.174	.122

a. Dependent Variable: P1

Table 9: Coefficients linear regression model: intent on procrastination

5.2.2. H2: The intervention and the TPB

To test if there is a statistically significant increase on the components of the TPB for the treatment group compared to the control group hypothesis H2 is tested:

H2: *Students who received nudges aimed at boosting students' attitude, subjective norm and perceived behavioral control will score significantly higher on the components of the theory of planned behavior than to those who did not receive nudges.*

Differences between the post-test results of the treatment group and control group were tested using an independent samples t-test. Attitude, subjective norm, and perceived behavioral control are different between the groups (all p's > 0.05, see appendix C, Table 23). Therefore, there is a difference between the treatment and control group, and they have to be analyzed separately.

For the analysis a split-plot ANOVA was run. All the components of the TPB were not statistically significantly different between the control group and the treatment group. This is because the tests of within subjects' effect did not show any significant difference between the means at the different time points (all p's > 0.05, See Table 10, Table 11 & Table 12).

Therefore, H2 is rejected. There is no statistically significant increase on the components of the TPB for the treatment group compared to the control group.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
PREPOSTATTITUDE	Sphericity Assumed	.089	1	.089	.128	.724	.006
	Greenhouse-Geisser	.089	1.000	.089	.128	.724	.006
	Huynh-Feldt	.089	1.000	.089	.128	.724	.006
	Lower-bound	.089	1.000	.089	.128	.724	.006
PREPOSTATTITUDE * Group	Sphericity Assumed	1.647	1	1.647	2.384	.138	.102
	Greenhouse-Geisser	1.647	1.000	1.647	2.384	.138	.102
	Huynh-Feldt	1.647	1.000	1.647	2.384	.138	.102
	Lower-bound	1.647	1.000	1.647	2.384	.138	.102
Error(PREPOSTATTITUDE)	Sphericity Assumed	14.508	21	.691			
	Greenhouse-Geisser	14.508	21.000	.691			
	Huynh-Feldt	14.508	21.000	.691			
	Lower-bound	14.508	21.000	.691			

Table 10: Tests of within-subjects effects: attitude

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
PREPOSTSN	Sphericity Assumed	1.595	1	1.595	1.022	.324	.046
	Greenhouse-Geisser	1.595	1.000	1.595	1.022	.324	.046
	Huynh-Feldt	1.595	1.000	1.595	1.022	.324	.046
	Lower-bound	1.595	1.000	1.595	1.022	.324	.046
PREPOSTSN * Group	Sphericity Assumed	.342	1	.342	.219	.644	.010
	Greenhouse-Geisser	.342	1.000	.342	.219	.644	.010
	Huynh-Feldt	.342	1.000	.342	.219	.644	.010
	Lower-bound	.342	1.000	.342	.219	.644	.010
Error(PREPOSTSN)	Sphericity Assumed	32.764	21	1.560			
	Greenhouse-Geisser	32.764	21.000	1.560			
	Huynh-Feldt	32.764	21.000	1.560			
	Lower-bound	32.764	21.000	1.560			

Table 11: Tests of within-subjects effects: subjective norm

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
PREPOSTPBC	Sphericity Assumed	9.329	1	9.329	6.186	.021
	Greenhouse-Geisser	9.329	1.000	9.329	6.186	.021
	Huynh-Feldt	9.329	1.000	9.329	6.186	.021
	Lower-bound	9.329	1.000	9.329	6.186	.021
PREPOSTPBC * Group	Sphericity Assumed	.633	1	.633	.420	.524
	Greenhouse-Geisser	.633	1.000	.633	.420	.524
	Huynh-Feldt	.633	1.000	.633	.420	.524
	Lower-bound	.633	1.000	.633	.420	.524
Error(PREPOSTPBC)	Sphericity Assumed	31.669	21	1.508		
	Greenhouse-Geisser	31.669	21.000	1.508		
	Huynh-Feldt	31.669	21.000	1.508		
	Lower-bound	31.669	21.000	1.508		

Table 12: Tests of within-subjects effects: perceived behavioral control

To test if there is a statistically significant increase of intent for the treatment group compared to the control group hypothesis H2a is tested:

H2a. *Students who received nudges aimed at boosting student's attitude, subjective norm and perceived behavioral control will score significantly higher on intent compared to those who did not receive nudges.*

Differences between the post-test results of the treatment group and control group were tested using an independent sample t-test. Intent is not different between the groups ($p < 0.05$, see appendix C, Table 23). Therefore, group intent between the treatment and control group can be grouped together, as they are not different from each other.

The combined intervention effects between intent at the pre-test compared to the post-test were compared using a paired sample t-test. Normality had to be tested with a Shapiro-Wilk test. Intent is normally distributed as the p-value is not statistically significant ($p > 0.05$, See Appendix C, Table 24). On average the students had an intent score of 5.1 pre-test and 6.3 post-test. The mean difference is statistically different ($p < 0.05$, see Table 13). Therefore, it can be concluded that the participants intent increased after the intervention. The effect size is $f = 0.56$ (see appendix C, Table 25) which is slightly over a medium effect (Cohen, 1988). H2a is rejected while intent rose there was no difference between the treatment and control group. See Figure 6 for a graph of pre and post intent.

Paired Samples Test

		Paired Differences							Significance	
				Std. Error	95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Mean	Lower	Upper	t	df	One–Sided p	Two–Sided p
Pair 1	Intent1 – Intent2	–1.20290	2.13317	.44480	–2.12535	–.28045	–2.704	22	.006	.013

Table 13: Paired samples t-test: intent
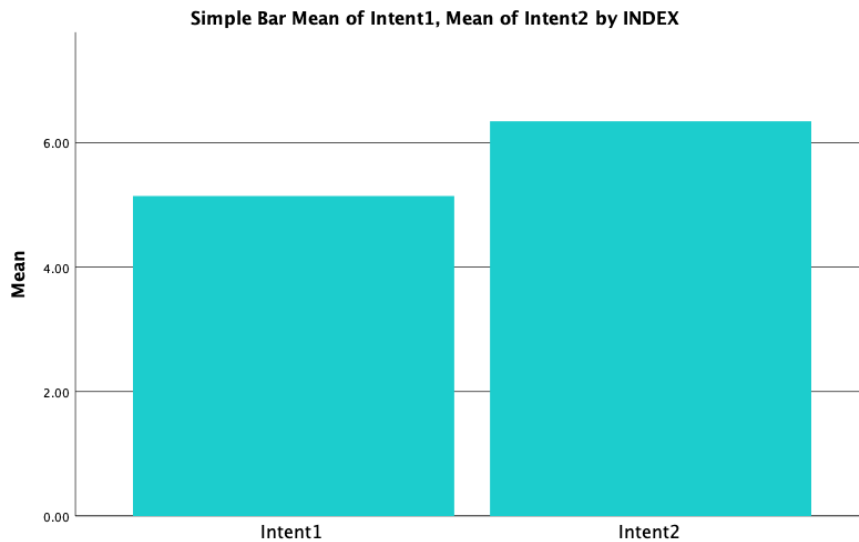
Figure 6: Difference in means (pre- post- intent)

5.2.3. H3: The intervention and procrastination

To test if there is a statistically significant difference of procrastination between the treatment group compared to the control group hypothesis H3 is tested:

H3: *Students who received nudges aimed at boosting students' attitude, subjective norm and perceived behavioral control will score significantly lower on procrastination on the post-test compared to those who did not receive nudges.*

To answer the second hypothesis a split-plot ANOVA was conducted with Group as between-participants factor and procrastination as within-participants factor. In this case there the data should be normally distributed and there should be homogeneity of covariance matrices. Attitude, subjective norm, perceived behavioral control and procrastination are normally distributed as all p-values are statistically insignificant (all p's > 0.05, see appendix C, Table 26). For homogeneity of covariance matrices, a Box's test was used. All p-values for this test were statistically insignificant which means that the correlation between pre-experiment and

post-experiment is the same for both groups (p > 0.05, see appendix C, Table 27). The within-subjects test is statistically significant (F(1,21) = 4.671, p < 0.05, see Table 14).

Tests of Within–Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
PREPOSTPROCRAS	Sphericity Assumed	.073	1	.073	.464	.503	.022	.464	.100
	Greenhouse–Geisser	.073	1.000	.073	.464	.503	.022	.464	.100
	Huynh–Feldt	.073	1.000	.073	.464	.503	.022	.464	.100
	Lower–bound	.073	1.000	.073	.464	.503	.022	.464	.100
PREPOSTPROCRAS * Group	Sphericity Assumed	.737	1	.737	4.671	.042	.182	4.671	.541
	Greenhouse–Geisser	.737	1.000	.737	4.671	.042	.182	4.671	.541
	Huynh–Feldt	.737	1.000	.737	4.671	.042	.182	4.671	.541
	Lower–bound	.737	1.000	.737	4.671	.042	.182	4.671	.541
Error(PREPOSTPROCRAS)	Sphericity Assumed	3.316	21	.158					
	Greenhouse–Geisser	3.316	21.000	.158					
	Huynh–Feldt	3.316	21.000	.158					
	Lower–bound	3.316	21.000	.158					

a. Computed using alpha = .05

Table 14: Tests of within-subjects effects: procrastination

Therefore, H2 is accepted. Procrastination is significantly lower for the treatment group than for the control group. The effect size is calculated using partial eta squared as this is the most commonly used effect size calculation for split-plot ANOVA's. The within subject between procrastination and group yielded an effect size of 0.182, which is a large effect size (Richardson, 2011, see Table 14). Figure 7: Split-plot for pre-test procrastination and post-test procrastinationshows a split-plot graph of pre-post procrastination for the groups.
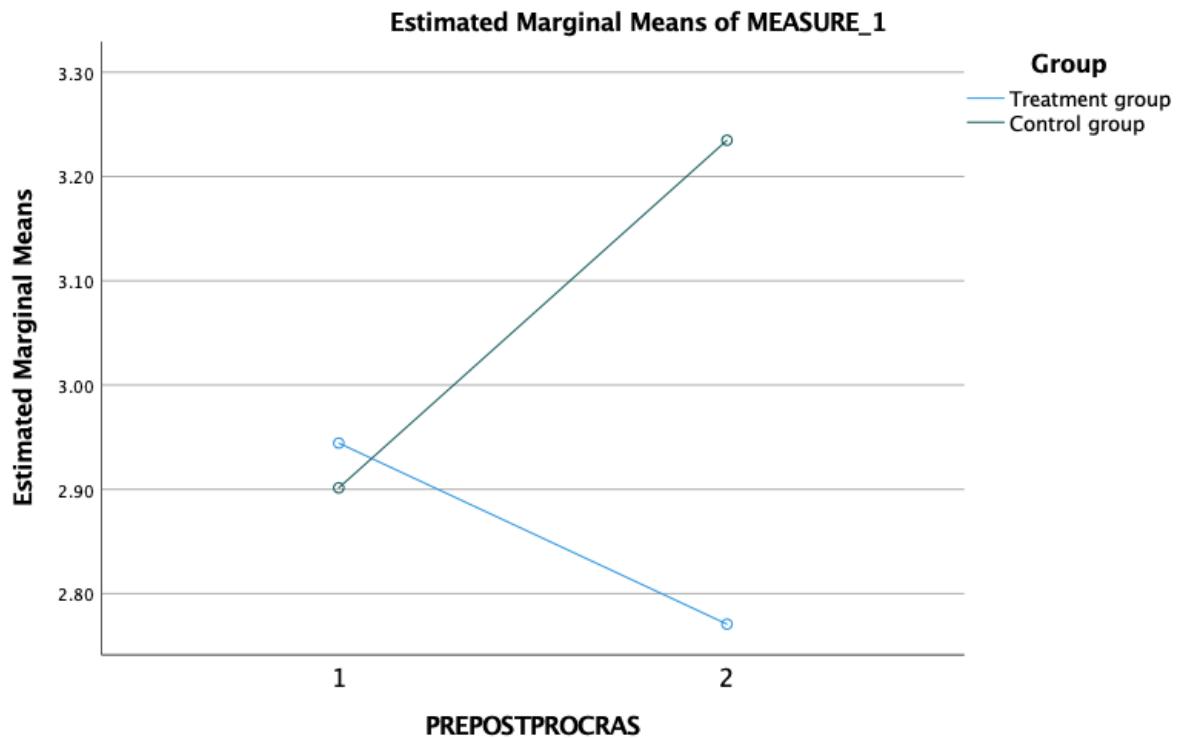
Figure 7: Split-plot for pre-test procrastination and post-test procrastination

To test if there is a statistically significant difference of procrastination between the pre-test and the post-test of the treatment group hypothesis H3a is tested:

H3a: *Students' who received nudges aimed at boosting students' attitude, subjective norm and perceived behavioral control will score significantly lower, or the same on procrastination on the post-test compared to their pre-test.*

While there is a significant difference between the treatment and control group in difference of procrastination, there could be no significant effect on the difference between the pre-test and the post-test of the treatment group. Running an independent samples t-test the data shows that there is difference between the groups for procrastination as the p-value is insignificant (p > 0.5, see appendix C, Table 23). New variables were created sorting the procrastination measures of the treatment group into "pre-test procrastination treatment group" = P1G1 and "post-test procrastination treatment group" = P2G1.
To compare if there was a significant difference between the two measurements for the treatment group a paired t-test was carried out. The mean difference between the pre-test and post-test for the treatment group procrastination is not significant (p > 0.05, see Table 15).

Therefore, H3a is accepted. The students in the treatment group scored the same on procrastination in their post-test compared to their pre-test.

Paired Samples Test

	Paired Differences							Significance	
			Std. Error Mean	95% Confidence Interval of the Difference					
	Mean	Std. Deviation		Lower	Upper	t	df	One–Sided p	Two–Sided p
Pair 1 P1G1 – P2G1	.17361	.62205	.17957	–.22162	.56884	.967	11	.177	.354

Table 15: Paired samples t-test (pre-post procrastination treatment group)

To test if there is a statistically significant difference of procrastination between the pre-test and the post-test of the control group hypothesis H3b is tested:

H3.b. *Students' who did not receive nudges aimed at boosting students' attitude, subjective norm and perceived behavioral control will score significantly higher on procrastination on their post-test compared to their pre-test.*

Because for H3a. it was already concluded that the groups are different for their procrastination measures new variables can be computed for the control group. New variables were created sorting the procrastination measures of the control group into "pre-test procrastination control group" = P1G2 and "post-test procrastination control group" = P2G1.

To compare if there was a significant difference between the two measurements for the treatment group a paired t-test was carried out. Normality had to be tested with a Shapiro-Wilk test. Procrastination for the control group is normally distributed ($p > 0.05$, see appendix C, Table 29). On average the control group had a procrastination score of 2.9 pre-test and 3.23 post-test. The mean difference between the pre-test and post-test for the treatment group procrastination is significant ($p < 0.05$, see Table 16). This means that the control group scored higher in procrastination for their post-test compared to their pre-test. H3b is therefore accepted. The effect size is $f = 0.49$ (See appendix C, Table 30) which is slightly under a medium effect (Cohen, 1988). See Figure 8 for a graph of mean differences between the measures.

Paired Samples Test

| | | Paired Differences | | | | | | | Significance | |
| | | | | Std. Error | 95% Confidence Interval of the Difference | | | | | |
		Mean	Std. Deviation	Mean	Lower	Upper	t	df	One-Sided p	Two-Sided p
Pair 1	P1G2 – P2G2	−.33333	.48734	.14694	−.66073	−.00593	−2.269	10	.023	.047

Table 16: Paired samples t-test: procrastination control group
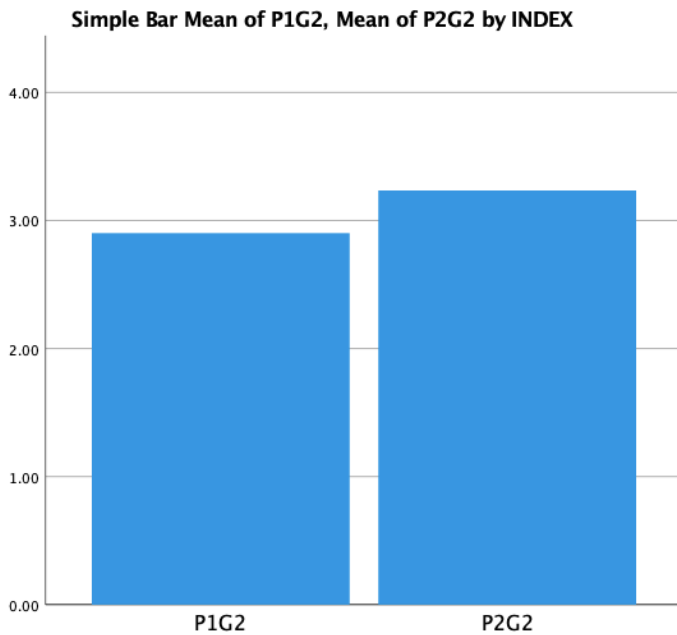
Figure 8: Difference in means (pre-post procrastination control group)

6. Discussion

While behavioral interventions using the TPB are increasing and proving to be effective, none of the studies has applied such an intervention to decrease procrastination (Steinmetz et al., 2016). Even though higher scores for the components of TPB can be linked to less procrastination (Lin, 2017). Therefore, the aim of this study was to investigate the use of nudges based on the theory of planned behavior to influence the level of procrastination for students in the first phase of writing their thesis. First, the experiment examined if there was a link between the TPB and procrastination. Second, the experiment examined if the intervention had a different effect on the TPB between control and treatment group. Third, the experiment examined if the intervention had an effect on procrastination.

The link between TPB and procrastination

According to the theory of planned behavior, attitude, subjective norm, and perceived behavioral control are a good indicator of intention (Ajzen, 1991). In this study it was found that while attitude and subjective norm had a significant effect on intention, perceived behavioral control did not. However overall, the model proved to be a good fit for the data. Attitude, subjective norm, and perceived behavioral control were a good indicator for predicting the intention to work for at least 15 to 30 minutes a day on the master thesis. Contradicting to previous research the results did not find a link between intention and the level of procrastination (Lin, 2017). However, this could be explained by other previous research about the overall effect of behavioral intentions on procrastination. Overall, most people have strong intentions to not procrastinate, but do not act or act biased upon it. Therefore, the effect size of intention on procrastination can be low (Ariely & Wertenbroch, 2002; Steel, 2007; Webb & Sheeran, 2006). Additionally, in research by Lin (2017) students were measured who did not have hard deadlines or tasks set before them. Without clear constraints students have more space for autonomy and initiative. Therefore, it could be that this research measured a different kind of procrastination than Lin's and it could prove an explanation why no connection between the TPB and procrastination was found. For potential future research it could be interesting to measure the effect of the TPB has on different kinds of academic procrastination.

The effect of the intervention on the TPB

Behavioral changes in this experiment were designed using the taxonomy of behavior change techniques (Abraham & Michie, 2008). While those techniques proved successful in previous research regarding health-related intentions such as research by Kothe et al. (2012), it did however not have a different effect on the components of the TPB between the treatment group and the control group. This could have a multitude of different reasons. First, the sample size of this study does not have the statistical power to expose an effect. This could mean that with further research with a bigger sample size an effect could be found. Second, it could be that the techniques do not work on study related attitude, subjective norm, and perceived behavioral control. Third, the theory upon which the techniques were designed could prove ineffective. And lastly, the duration of the experiment was relatively short. If measured along the whole period of writing the thesis and providing participants with more nudging emails, it could prove an effect. However, this is not supported by literature as research by Kothe et al. (2012) found that the frequency of sending emails does not matter for the effect on the components of the TPB.

This research did find an overall increase of intent for all the participants. While it has long been established by previous research that intention can change over time (Joseph & Wong, 1985), no research could be found if intent rises for students when they are nearing a deadline. Due to the limitation that this study had a small sample size and therefore could not have a control group that did not receive nudges, the effect found could be due to two reasons. First, it could be that there is a general effect that intention changes while a deadline is closer. Second it could be that sending an email to students is a sufficient nudge that increases the intent to study. The second reason would be in line with literature on behavioral changes based on the TPB. It would be interesting for future research to explore the intention to study over time and to see if nudging can significantly increase intention to study.

The effect of the intervention on the TPB

Combining the theory of nudging and the TPB did cause a significant difference between the level of procrastination between the treatment group and the control group. The treatment group procrastinated less than the control group. This is an interesting observation because the results also showed that the nudging-emails did not significantly increase the components of the TPB for the treatment group. Also, while intention rose overall, there was no difference in intention between the treatment and control group. There are multiple reasons why this experiment did find an effect between the two groups. First, the results of this experiment were derived from a very small sample group. This could mean that with a bigger sample group different effects could be found. Second, it could mean that the nudges based on the TPB were successful on changing behavior. But since the effect size of intention on procrastination is low according to research by Webb & Sheeran (2006) the effect was not detected. Finally, it could mean that the nudges based on the TPB were successful but not because they were targeted on the components of TPB. For this reason, it is not clear what could have caused the medium effect the nudges had. A possibility could be that the students who received the nudges procrastinated less than the students who did not because the text inspired them to work on the thesis directly. Overall, these results pose an interesting opportunity for future research.

According to research there is a dead-line effect which causes procrastination to increase during the start of the period given to complete a task (Zhu et al., 2018). The results found were in line with the literature. The control group scored significantly higher on the post-test

compared to their pre-test, which indicated that their level of procrastination rose. Additionally, the procrastination for the treatment group did not change. This interesting effect could be due to the same reasons mentioned in the former paragraph.

6.1. Limitations

Even though the results from this experiment show interesting insights for future research, the results must be seen in light of six limitations.

First and one of the most important limitations to this study was the small sample size. The priori analysis depicted a sample size of 128 participants. However, this study had a sample size of 23 participants. There are a few possible reasons why the sample size was not big enough. For example, it was difficult to connect with all the economic master students from the University of Utrecht as mailing had to go through coordinators, which mostly did not send the message through. Also, the period of writing a thesis is a stressful period. A lot of students could not feel up to participating in an experiment. Altogether, this means that this study was too low powered and that a type II error may have occurred: hypothesizes were falsely accepted or rejected. Future studies should make sure that they have an ample sample size. This could for example be achieved by broadening the target group to all master students in the Netherlands writing their thesis, controlling for applicable control measurements.

The second limitation is a result of the first limitation. Because of the small sample size, it was not possible to create a second control group. Ideally, this experiment would have had a third group which received no emails. Using a second control group could explore the measures of TPB and procrastination when students do not receive any nudging at all. In this research it could be a possibility that the no-nudging emails had an effect on the control group that could not be measured. Especially for procrastination future studies should add a second control group so they could measure, and control, for the deadline effect.

The third limitation is that the experiment relied on self-reported measures of the TPB and procrastination. Self-reported measures could lead to various biases. For example, the participants may have over or underrated their intentions or responded to social desirability (Paulhus, 1984). A solution for future research could be that the data is gathered objectively using peer-based reports.

The fourth limitation is that the experiment took place for a short time during the first phase of writing a master thesis. The reason for this is that the data needed to be analyzed before the same deadline as the participants. Therefore, not the entire period could be used to test the designed nudges which could potentially generate different results. Furthermore, it would also be interesting to test if there is an effect on grades for the thesis. It is proposed for future research that the experiment is carried out throughout the whole period of thesis writing.

The fifth limitation is the potential biased view of the participants. Because the participants are economic master students, they have knowledge about the theory of nudging and the TPB. This might influence their answers. For future research it is advised to use either objective data collection or broaden the target group and possibly controlling for education.

The sixth limitation is the Hawthorne effect (Sedgwick & Greenwood, 2015). It could be possible that the participants gave biased answers because they knew they participated in an experiment. Furthermore, they have to give their email address as a mean to identify them. This could have had the effect that they did not answer honestly because the answers were not anonymous to the researcher. Future research should make sure to ensure the anonymity of the participants. Another advice is to incorporate the experiment into daily life so the participants do not know they are partaking in an experiment.

6.2. Implications and contributions

In light of the limitations mentioned above the implications this study might not have been unequivocal. However, there are a couple of possible implications and contributions this research has that could prove interesting.

This research contributes a new angle to the theory for researchers to explore options in. While literature does suggest combining the TPB with the theory of nudging to influence procrastination, the combination has not been used in prior research. Accordingly, this research paved the first step for investigating possible effects before a potential larger, longer, and more expensive research is carried out.

Supposing the results found in this research were not subjective to the limitations the possible practical implications are intriguing. If nudging emails based on the TPB help to decrease

procrastination it could prove an easy solution with many benefits. Sending out emails throughout the thesis writing process could be a worthwhile addition to workshops offered, feedback-moments and intermediate deadlines. Furthermore, it could prove beneficiary to the health of the students as procrastination causes depression, anxiety, or even serious physical health issues (Steel, 2007; Sirois, 2015).

7. Conclusion

The research question aimed to answer in this research was: *"What are the effects of a behavioral intervention based on the theory of planned behavior on procrastination among students in the first phase of writing their master thesis?"*

Previous research demonstrates that procrastination amongst students writing their master thesis is a serious issue to be addressed. Procrastination can lead to depression, anxiety, or physical health issues. Moreover, procrastination also influences the quality and result of the thesis. Using a behavioral intervention based on the theory of planned behavior this quasi-experimental research found that the students who received TPB based nudges procrastinated less than the ones that did not. The findings should be seen in context of a few limitations, including a small sample size and the inability to do research throughout the process of writing a thesis.

Nevertheless, this research could be considered as a first step toward pursuing a new scientific and practical angle, as well as a starting point for future research exploring the use of nudges based on the TPB to influence procrastination.

References

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology*, *27*(3), 379–387. https://doi.org/10.1037/0278-6133.27.3.379

Aitken, I. (1982). A Personality Profile of the College Student Procrastinator (Doctoral Dissertation). *Dissertation Abstracts International.*

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-t

Ajzen, I. (2002). Constructing a TPB questionnaire: Conceptual and methodological considerations. *Citeseer*. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.601.956&rep=rep1&type=pdf

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, *2*(4), 314–324. https://doi.org/10.1002/hbe2.195

Allison, L. (2015). three important lessons for productivity: task management and how to be your own project manager. *European Political Science*, *14*(2), 149–161. https://doi.org/10.1057/eps.2015.1

Ariely, D., & Wertenbroch, K. (2002). Procrastination, Deadlines, and Performance: Self-Control by Precommitment. *Psychological Science*, *13*(3), 219–224. https://doi.org/10.1111/1467-9280.00441

Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40*(4), 471–499. https://doi.org/10.1348/014466601164939

Bandiera, O., Larcinese, V., & Rasul, I. (2015). Blissful ignorance? A natural experiment on the effect of feedback on students' performance. *Labour Economics*, *34*, 13–25. https://doi.org/10.1016/j.labeco.2015.02.002

Bandura, A. (1997). Self-efficacy: the exercise of control. *Choice Reviews Online*, *35*(03), 35–1826. https://doi.org/10.5860/choice.35-1826

Becker, H. S. (2020). *Writing for Social Scientists, Third Edition: How to Start and Finish Your Thesis, Book, or Article (Chicago Guides to Writing, Editing, and Publishing)* (Third ed.). University of Chicago Press.

Blumenstein, M., Liu, D. Y. T., & D, R. (2019). *Learning Analytics in the Classroom: Translating Learning Analytics Research for Teachers Data-informed nudges for student engagement and success.* [E-book]. Routledge.

Bolker, J. (1998). *Writing Your Dissertation in Fifteen Minutes a Day: A Guide to Starting, Revising, and Finishing Your Doctoral Thesis* (1st ed.). Owl Books.

Botha, W. (2021). Cooperative Learning: Building Cooperative skills and attitudes in Learners. *Academia Letters*. https://doi.org/10.20935/al2843

Brown, A., Lawrence, J., Basson, M., Axelsen, M., Redmond, P., Turner, J., Maloney, S., & Galligan, L. (2022). The creation of a nudging protocol to support online student engagement in higher education. *Active Learning in Higher Education*, 146978742110390. https://doi.org/10.1177/14697874211039077

Carnegie, D. (2019). *Learn How to Increase Productivity for Procrastinators*. Sheba Blake Publishing.

Castleman, B. L., & Meyer, K. E. (2020). Can Text Message Nudges Improve Academic Outcomes in College? Evidence from a West Virginia Initiative. *The Review of Higher Education*, *43*(4), 1125–1165. https://doi.org/10.1353/rhe.2020.0015

Cerezo, R., Sánchez-Santillán, M., Paule-Ruiz, M. P., & Núñez, J. C. (2016). Students' LMS
interaction patterns and their relationship with achievement: A case study in higher
education. *Computers & Education*, *96*, 42–54.
https://doi.org/10.1016/j.compedu.2016.02.006

Charness, G., Gneezy, U., & Kuhn, M. A. (2012). Experimental methods: Between-subject
and within-subject design. *Journal of Economic Behavior & Organization*, *81*(1), 1–8.
https://doi.org/10.1016/j.jebo.2011.08.009

Choueiry, G. (2021). *Statistical Software Popularity in 40,582 Research Papers*.
Www.Quantifyinghealth.Com. https://quantifyinghealth.com/statistical-software-
popularity-in-research/

Clark, D., Gill, D., Prowse, V. L., & Rush, M. (2016). Using Goals to Motivate College
Students: Theory and Evidence from Field Experiments. *SSRN Electronic Journal*.
https://doi.org/10.2139/ssrn.2856767

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences. *Routledge*.

Damgaard, M. T., & Nielsen, H. S. (2018). Nudging in education. *Economics of Education
Review*, *64*, 313–342. https://doi.org/10.1016/j.econedurev.2018.03.008

Dewberry, C., & Jackson, D. J. (2018). An application of the theory of planned behavior to
student retention. *Journal of Vocational Behavior*, *107*, 100–110.
https://doi.org/10.1016/j.jvb.2018.03.005

Díaz-Morales, J. F., Ferrari, J. R., & Cohen, J. R. (2008). Indecision and Avoidant
Procrastination: The Role of Morningness—Eveningness and Time Perspective in
Chronic Delay Lifestyles. *The Journal of General Psychology*, *135*(3), 228–240.
https://doi.org/10.3200/genp.135.3.228-240

Dimitrov, D. M., & Rumrill, P. D. (2003). Pretest-posttest designs and measurement of
change. *Work*, *20*(2), 159–165.

Ferrari, J. R., & Dovidio, J. F. (2000). Examining Behavioral Processes in Indecision: Decisional Procrastination and Decision-Making Style. *Journal of Research in Personality*, *34*(1), 127–137. https://doi.org/10.1006/jrpe.1999.2247

Hardeman, W., Johnston, M., Johnston, D., Bonetti, D., Wareham, N., & Kinmonth, A. L. (2002). Application of the Theory of Planned Behaviour in Behaviour Change Interventions: A Systematic Review. *Psychology & Health*, *17*(2), 123–158. https://doi.org/10.1080/08870440290013644a

Hummel, D., & Maedche, A. (2019). How effective is nudging? A quantitative review on the effect sizes and limits of empirical nudging studies. *Journal of Behavioral and Experimental Economics*, *80*, 47–58. https://doi.org/10.1016/j.socec.2019.03.005

Joseph, A. C., & Wong, J. K. (1985). The Effects of Time and Situational Variables on Intention-Behavior Consistency. *Advances in Consumer Research*, *12*, 374–377.

Joyce, K. E., & Cartwright, N. (2019). Bridging the Gap Between Research and Practice: Predicting What Will Work Locally. *American Educational Research Journal*, *57*(3), 1045–1082. https://doi.org/10.3102/0002831219866687

Kim, K. R., & Seo, E. H. (2015). The relationship between procrastination and academic performance: A meta-analysis. *Personality and Individual Differences*, *82*, 26–33. https://doi.org/10.1016/j.paid.2015.02.038

Klingsieck, K. B., Grund, A., Schmid, S., & Fries, S. (2013). Why Students Procrastinate: A Qualitative Approach. *Journal of College Student Development*, *54*(4), 397–412. https://doi.org/10.1353/csd.2013.0060

Kothe, E., Mullan, B., & Butow, P. (2012). Promoting fruit and vegetable consumption. Testing an intervention based on the theory of planned behaviour. *Appetite*, *58*(3), 997–1004. https://doi.org/10.1016/j.appet.2012.02.012

Kristanto, J., & Abraham, J. (2016). "Decisional Procrastination: The Role of Courage, Media Multitasking and Planning Fallacy ". *European Proceedings of Social & Behavioural Sciences*. https://doi.org/10.15405/epsbs.2016.11.69

Leone, L., Perugini, M., & Ercolani, A. P. (1999). A comparison of three models of attitude-behavior relationships in the studying behavior domain. *European Journal of Social Psychology*, *29*(2–3), 161–189.

Lin, L. (2017). Integratin the theory of planned behavior and implementation intention to overcome procrastination. *Acta Psychologica Sinica*, *49*(7), 953. https://doi.org/10.3724/sp.j.1041.2017.00953

Mann, L., Burnett, P., Radford, M., & Ford, S. (1997). The Melbourne decision making questionnaire: an instrument for measuring patterns for coping with decisional conflict. *Journal of Behavioral Decision Making*, *10*(1), 1–19.

Michinov, N., Brunot, S., le Bohec, O., Juhel, J., & Delaval, M. (2011). Procrastination, participation, and performance in online learning environments. *Computers & Education*, *56*(1), 243–252. https://doi.org/10.1016/j.compedu.2010.07.025

Oldham, J. (1994). Experimental and quasi -experimental research designs. *Nurse Researcher*, *1*(4), 26–36. https://doi.org/10.7748/nr.1.4.26.s4

Onwuegbuzie, A. J. (2000). Academic procrastinators and perfectionistic tendencies among graduate students. *Journal of Social Behavior & Personality*, *15*(5), 103–109.

Oreopoulos, P., Patterson, R., Petronijevic, U., & Pope, N. (2018). When Studying and Nudging Don't Go as Planned: Unsuccessful Attempts to Help Traditional and Online College Students. *National Bureau of Economic Research*. https://doi.org/10.3386/w25036

Oreopoulos, P., & Petronijevic, U. (2019). The Remarkable Unresponsiveness of College

    Students to Nudging and What We Can Learn from it. *SSRN Electronic Journal*.

    https://doi.org/10.2139/ssrn.3427597

Paulhus, D. L. (1984). Two-component models of socially desirable responding. *Journal of*

    Personality and Social Psychology, *46*(3), 598–609. https://doi.org/10.1037/0022-

    3514.46.3.598

Richardson, J. T. (2011). Eta squared and partial eta squared as measures of effect size in

    educational research. *Educational Research Review*, *6*(2), 135–147.

    https://doi.org/10.1016/j.edurev.2010.12.001

Rusbandi, N., & Usman, O. (2020). Effect of Self Effication, Locus of Control, and

    Emotional Intelligence on Procrastination. *SSRN Electronic Journal*.

    https://doi.org/10.2139/ssrn.3646005

Sedgwick, P., & Greenwood, N. (2015). Understanding the Hawthorne effect. *BMJ*, h4672.

    https://doi.org/10.1136/bmj.h4672

Sharirah, T., & Shag, S. H. (2019). Academic self-efficacy as a predictor toward decisional

    procrastination among college students preparing a thesis in Indonesia. *Journal of*

    Advanced Research in Social Sciences and Humanities, *4*(1).

    https://doi.org/10.26500/jarssh-04-2019-0104

Sirois, F. M. (2015). Is procrastination a vulnerability factor for hypertension and

    cardiovascular disease? Testing an extension of the procrastination–health model.

    Journal of Behavioral Medicine, *38*(3), 578–589. https://doi.org/10.1007/s10865-015-

    9629-2

Sommer, L., & Haug, M. (2012). What Influences Implementation Intentions in an Academic

    Learning Context – The roles of Goal Intentions, Procrastination, and Experience.

    International Journal of Higher Education, *1*(1). https://doi.org/10.5430/ijhe.v1n1p32

Stanbury, D. (2010). The kindness of strangers. *Education + Training*, *52*(2), 100–116.

    https://doi.org/10.1108/00400911011027707

Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of

    quintessential self-regulatory failure. *Psychological Bulletin*, *133*(1), 65–94.

    https://doi.org/10.1037/0033-2909.133.1.65

Steinmetz, H., Knappstein, M., Ajzen, I., Schmidt, P., & Kabst, R. (2016). How Effective are

    Behavior Change Interventions Based on the Theory of Planned Behavior? *Zeitschrift*

    Für Psychologie, *224*(3), 216–233. https://doi.org/10.1027/2151-2604/a000255

Sunstein, C. R. (2014). Nudging: A Very Short Guide. *SSRN Electronic Journal*.

    https://doi.org/10.2139/ssrn.2499658

Sutter, N., & Paulson, S. (2016). Predicting College Students' Intention to Graduate: a Test of

    the Theory of Planned Behavior. *College Student Journal*, 409–421.

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving Decisions About Health, Wealth,*

    and Happiness. Yale University Press.

Tice, D. M., & Baumeister, R. F. (1997). Longitudinal Study of Procrastination, Performance,

    Stress, and Health: The Costs and Benefits of Dawdling. *Psychological Science*, *8*(6),

    454–458. https://doi.org/10.1111/j.1467-9280.1997.tb00460.x

Verplanken, B. (2006). Beyond frequency: Habit as mental construct. *British Journal of*

    Social Psychology, *45*(3), 639–656. https://doi.org/10.1348/014466605x49122

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior

    change? A meta-analysis of the experimental evidence. *Psychological Bulletin*,

    132(2), 249–268. https://doi.org/10.1037/0033-2909.132.2.249

Weijers, R. J., de Koning, B. B., & Paas, F. (2020). Nudging in education: from theory

    towards guidelines for successful implementation. *European Journal of Psychology of*

    Education, *36*(3), 883–902. https://doi.org/10.1007/s10212-020-00495-0

Zacks, S., & Hen, M. (2018). Academic interventions for academic procrastination: A review of the literature. *Journal of Prevention & Intervention in the Community*, *46*(2), 117–130. https://doi.org/10.1080/10852352.2016.1198154

Zhu, M., Bagchi, R., & Hock, S. J. (2018). The Mere Deadline Effect: Why More Time Might Sabotage Goal Pursuit. *Journal of Consumer Research*, *45*(5), 1068–1084. https://doi.org/10.1093/jcr/ucy030

Appendix A: pre and post-test survey's

A.1 Pre-test text + survey

\<TEXT>

Hi,

My name is Babel Essink and I'm doing research for my master thesis just like you. I aim to find a way to deal with procrastination during the process of writing a master thesis.

You are invited to take part in this study and with doing so you will not only help me, but also the people from/in Ukraine. I will donate € 0,50 to Giro555 for each participant who takes part in this experiment. Also, feel free to contact me if I can help with your research!

The study will run from April 18 to May 16 and will include a preliminary survey, three e-mails, and a final survey. Each survey should take no more than 6 minutes to complete. The e-mails may possibly include small assignments that will take very little of your time. It is expected that you answer the questions honestly, read the e-mails (so check your e-mail), and do the small assignments if needed.

Your answers will be anonymously used in my master thesis and will be handled with strict confidentiality.

As I am doing quantitative research it is important to gather as much participants as possible. Therefore, it would be a great help if you take part!

Click here to start the first survey: https://www.supersurvey.com/QLL2XVPGC (Also on phone)

Thank you in advance for your participation,

Babel Essink
b.essink@students.uu.nl

Supervisor: Jason Gawke (j.c.l.gawke@uu.nl)

<SURVEY>

Questions:

For each of the questions that follow in this questionnaire, please circle whichever number you feel is most appropriate for you. There are no right or wrong answers. Please respond to all of the items. Use your first impression and do not spend too much time on individual items in responding.

- What is your age? (open)

- What is your gender? (open)

- What is your country of origin? (open)

- What is your master's program? (open)

- Are you an economic master student at the University of Utrecht? (yes/no)

- Do you have to write a master thesis in the 4th period? (yes/no)

- What is the e-mail you would like to use for this study?

- Please fill in the following statements (Likert 1,7 Definitely false – Definitely true)

    o I intend to work for at least 30 minutes each day on my thesis the forthcoming month
    o I will try to work for at least 30 minutes each day on my thesis in the forthcoming month
    o I plan to work for at least 30 minutes each day on my thesis in the forthcoming month

- For me to work on my thesis for at least 30 minutes each day in the forthcoming month is (Attitude, Likert 1,7):
    o Harmful (1) – Beneficial (7)
    o Unpleasant (1) – Pleasant (7)
    o Bad (1) – Good (7)
    o Worthless (1) – Valuable (7)
    o Unenjoyable (1) – Enjoyable (7)

- Please fill in the following statements. 1 = not at all true 7 = exactly true (Subjective norm, Likert 1,7)
    o Most of the people who are important to me think that I should work on my thesis for at least 30 minutes each day in the forthcoming month.
    o It is expected of me that I work on my thesis at least 30 minutes each day in the forthcoming month

- o The people in my life whose opinion I value would approve of me working on my thesis at least 30 minutes each day
  - o Most fellow students who are important to me work on their thesis for at least 30 minutes each day
  - o Many fellow students like me work on their thesis for at least 30 minutes each day

- Please fill in the following statements 1 = not at all true 7 = exactly true (Perceived behavioral control, Likert 1,7)
  - o For me to work on my thesis at least 30 minutes each day for the forthcoming month is possible
  - o If I wanted to I could work on my thesis for at least 30 minutes each day for the forthcoming month
  - o I believe that I have enough control to work on my thesis for at least 30 minutes each day the forthcoming month
  - o It is mostly up to me if I work on my thesis for at least 30 minutes each day the forthcoming month

- Last questions! (Procrastination, Likert 1,5 False – True)
  - o I delay starting things until the last minute.
  - o I keep my assignments up to date by doing my work regularly from day to day.
  - o If there were a workshop offered that would help me learn not to put off starting my work, I would go.
  - o I delay starting things so long I don't get them done by the deadline.
  - o I am often frantically rushing to meet deadlines.
  - o It often takes me a long time to get started on something.
  - o I don't delay when I know I really need to get the job done.
  - o If I had an important project to do, I'd get started on it as quickly as possible.
  - o When I have a test scheduled soon, I often find myself working on other jobs when a deadline is near.
  - o I often finish my work before it is due.
  - o I generally arrive on time to class.
  - o I overestimate the amount of work I can do in a given amount of time.

A.2 Post-test text + survey

<TEXT>

Dear participant,

Thank you for participating in my experiment! The only thing that is left for you to do is to fill in the last survey:

https://survey.uu.nl/jfe/form/SV_3rtEsbRwXw2gDtA

Please do it as soon as possible. It will take 5 to 10 minutes to complete.

I wish you all the best and good luck with the finalization of your thesis.

With kind regards,

Babel Essink

<SURVEY>

Questions:

- What is your email? (please use the same email you used for the experiment) (open)

- How many emails have you received? 0, 1, 2

- Please fill in the following statements (Likert 1,7 Definitely false – Definitely true)

    o I have worked for at least 15 to 30 minutes on my thesis each day the last month
    o I feel like I should have worked more on my thesis in the last month
    o I intend to work more on my thesis this month
    o I will try to work more on my thesis this month
    o I plan to work more on my thesis this month

- Please fill in the following statements (Please note that this is about last month) (Procrastination, Likert 1,5 False – True)
    o I delayed starting things until the last-minute last month
    o I kept my assignments up to date by doing my work regularly from day to day
    o There was a workshop offered that would help me learn not to put off starting my work, I went
    o I delayed starting things so long I didn't get them done by the deadline.
    o I was often frantically rushing to meet deadlines.
    o It often took me a long time to get started on something.
    o I didn't delay when I knew I really needed to get the job done.
    o If I had an important project to do, I'd get started on it as quickly as possible.
    o When I had a deadline scheduled soon, I often found myself working on other jobs when the deadline got near.
    o I often finished my work before it was due.
    o I generally arrived on time to class.
    o I overestimated the amount of work I could do in a given amount of time.

- For me to work on my thesis this month will be (Attitude, Likert 1,7)
    o Harmful (1) – Beneficial (7)
    o Unpleasant (1) – Pleasant (7)
    o Bad (1) – Good (7)
    o Worthless (1) – Valuable (7)
    o Unenjoyable (1) – Enjoyable (7)

- Please fill in the following statements. 1 = not at all true 7 = exactly true (Subjective norm, Likert 1,7)
    o Most of the people who are important to me think that I should work more on my thesis in this month.
    o It is expected of me that I work more on my thesis in this month.

- o The people in my life whose opinion I value would approve of me working more on my thesis.
  - o Most fellow students who are important to me work more on their thesis.
  - o Many fellow students like me work more on their thesis.

- Please fill in the following statements 1 = not at all true 7 = exactly true (Perceived behavioral control, Likert 1,7)
  - o For me to work more on my thesis for this month is possible.
  - o If I wanted to I could work more on my thesis for this month.
  - o I believe that I have enough control to work more on my thesis this month.
  - o It is mostly up to me if I work more on my thesis this month.

- Last questions! (extras, Likert 1,5 definitely false – definitely true)
  - o I read the emails
  - o I enjoyed the emails
  - o I followed the advice in the emails
  - o The emails gave me motivation to work on my thesis.
  - o The emails let me work more on my thesis.
  - o The emails gave me anxiety.
  - o The emails let me procrastinate less.
  - o Due to the emails I feel more in control.
  - o The emails reminded me to work on the thesis.
  - o The emails made me work more consistently on my thesis.
  - o I felt that others could help me with my thesis due to the emails.

Appendix B: Priori analysis
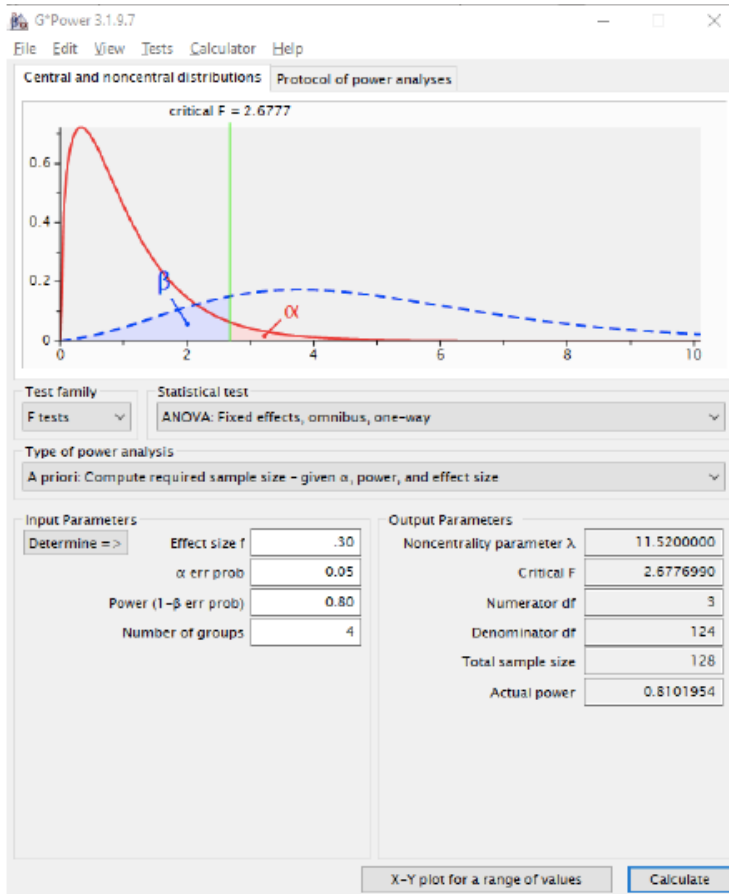
Figure 9: Priori analysis

Appendix C: Statistical tests

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means								
							Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p			Lower	Upper
What is your age?	Equal variances assumed	.603	.446	.331	21	.372	.744	.356	1.074	-1.878	2.590
	Equal variances not assumed			.337	19.295	.370	.740	.356	1.056	-1.851	2.564
What is your gender?	Equal variances assumed	1.236	.279	1.937	21	.033	.066	.386	.199	-.028	.801
	Equal variances not assumed			1.927	20.196	.034	.068	.386	.200	-.032	.804
What is your country of origin?	Equal variances assumed	.880	.359	-.636	21	.266	.532	-.136	.215	-.582	.310
	Equal variances not assumed			-.637	20.933	.266	.531	-.136	.214	-.582	.309
What is your master's program?	Equal variances assumed	1.943	.178	-.677	21	.253	.506	-.098	.146	-.401	.204
	Equal variances not assumed			-.667	17.958	.257	.513	-.098	.148	-.409	.212

Table 17: Independent samples t-test for demographics: age, gender, origin and masters

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | | | |
		F	Sig.	t	df	Significance One-Sided p	Significance Two-Sided p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
Intent1	Equal variances assumed	7.974	.010	.596	21	.279	.557	.45202	.75792	-1.12416	2.02820
	Equal variances not assumed			.582	15.461	.284	.569	.45202	.77608	-1.19787	2.10191
Attitude1	Equal variances assumed	2.056	.166	-.962	21	.173	.347	-.49545	.51477	-1.56598	.57508
	Equal variances not assumed			-.976	19.999	.170	.341	-.49545	.50754	-1.55417	.56326
SN1	Equal variances assumed	.444	.512	.642	21	.264	.528	.39394	.61327	-.88143	1.66931
	Equal variances not assumed			.636	19.257	.266	.532	.39394	.61922	-.90093	1.68881
PBC1	Equal variances assumed	6.431	.019	.742	21	.233	.467	.49621	.66910	-.89525	1.88768
	Equal variances not assumed			.722	14.573	.241	.482	.49621	.68729	-.97246	1.96488
P1	Equal variances assumed	.641	.432	.172	21	.433	.865	.04293	.24995	-.47688	.56274
	Equal variances not assumed			.174	19.773	.432	.863	.04293	.24616	-.47094	.55680

Table 18: Independent samples t-test for baseline intent, attitude, subjective norm, perceived behavioral control and procrastination

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.848[a]	.719	.675	1.02025	.719	16.213	3	19	<.001

a. Predictors: (Constant), PBC1, Attitude1, SN1
b. Dependent Variable: Intent1

Table 19: Model summary multiple regression model: attitude, subjective norm, and perceived behavioral control on intent

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	50.628	3	16.876	16.213	<.001[b]
	Residual	19.777	19	1.041		
	Total	70.406	22			

a. Dependent Variable: Intent1
b. Predictors: (Constant), PBC1, Attitude1, SN1

Table 20: ANOVA multiple regression model: attitude, subjective norm, and perceived behavioral control on intent

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.078[a]	.006	-.041	.59739	.006	.129	1	21	.723

a. Predictors: (Constant), Intent1
b. Dependent Variable: P1

Table 21: Model summary linear regression model: intent on procrastination

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.046	1	.046	.129	.723[b]
	Residual	7.494	21	.357		
	Total	7.540	22			

a. Dependent Variable: P1
b. Predictors: (Constant), Intent1

Table 22: ANOVA linear regression model: intent on procrastination

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Intent2	Equal variances assumed	8.738	.008	-1.575	21	.065	.130	-.72727	.46162	-1.68725	.23271
	Equal variances not assumed			-1.626	15.188	.062	.125	-.72727	.44737	-1.67979	.22524
Attitude2	Equal variances assumed	.001	.982	.587	21	.282	.564	.26212	.44665	-.66674	1.19099
	Equal variances not assumed			.589	21.000	.281	.562	.26212	.44488	-.66306	1.18730
SN2	Equal variances assumed	.689	.416	.102	21	.460	.920	.04848	.47561	-.94061	1.03758
	Equal variances not assumed			.101	19.830	.460	.920	.04848	.47894	-.95111	1.04808
PBC2	Equal variances assumed	.574	.457	.094	21	.463	.926	.02652	.28062	-.55706	.61009
	Equal variances not assumed			.095	20.917	.463	.926	.02652	.28026	-.55645	.60948
P2	Equal variances assumed	.000	.998	-1.920	21	.034	.069	-.46402	.24170	-.96666	.03863
	Equal variances not assumed			-1.917	20.660	.035	.069	-.46402	.24211	-.96802	.03999

Table 23: Independent samples t-test intervention effects: treatment and control group

Tests of Normality

	Kolmogorov–Smirnov[a]			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
DIF_Intent1_Intent2	.164	23	.108	.965	23	.565

a. Lilliefors Significance Correction

Table 24: Test of normality: intent pre-test and post-test

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval	
					Lower	Upper
Pair 1	Intent1 – Intent2	Cohen's d	2.13317	-.564	-.999	-.117
		Hedges' correction	2.20950	-.544	-.965	-.113

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Table 25: Effect size: intent

Tests of Normality

	Kolmogorov–Smirnov[a]			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Intent1	.205	23	.013	.890	23	.015
Intent2	.368	23	<.001	.648	23	<.001
Attitude1	.166	23	.102	.917	23	.057
Attitude2	.129	23	.200*	.953	23	.336
SN1	.162	23	.119	.924	23	.081
SN2	.110	23	.200*	.967	23	.610
PBC1	.176	23	.063	.881	23	.011
PBC2	.142	23	.200*	.930	23	.109
P1	.091	23	.200*	.975	23	.815
P2	.177	23	.060	.941	23	.192

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 26: Tests of normality pre-test and post-test: intent, attitude, subjective norm, perceived behavioral control and procrastination

Box's Test of Equality of Covariance Matrices[a]

Box's M	1.891
F	.565
df1	3
df2	111064.484
Sig.	.638

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Group
Within Subjects Design: PREPOSTPROCRAS

Table 27: Box's test of equality of covariance matrices

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | | |
| | | | | | | Significance | | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
		F	Sig.	t	df	One-Sided p	Two-Sided p			Lower	Upper
P1	Equal variances assumed	.641	.432	.172	21	.433	.865	.04293	.24995	−.47688	.56274
	Equal variances not assumed			.174	19.773	.432	.863	.04293	.24616	−.47094	.55680
P2	Equal variances assumed	.000	.998	−1.920	21	.034	.069	−.46402	.24170	−.96666	.03863
	Equal variances not assumed			−1.917	20.660	.035	.069	−.46402	.24211	−.96802	.03999

Table 28: Independent samples t-test: procrastination

Tests of Normality

| | Kolmogorov–Smirnov[a] | | | Shapiro–Wilk | | |
	Statistic	df	Sig.	Statistic	df	Sig.
DIF_P1G2_P2G2	.184	11	.200[*]	.951	11	.659

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 29: Tests of normality: procrastination control group

Paired Samples Effect Sizes

| | | | Standardizer[a] | Point Estimate | 95% Confidence Interval | |
					Lower	Upper
Pair 1	P1G2 – P2G2	Cohen's d	.48734	−.684	−1.331	−.010
		Hedges' correction	.52814	−.631	−1.229	−.009

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Table 30: Effect size: procrastination control group