The Impact a Gratitude App has on Students' Happiness and Sleep Quality

in the Covid Pandemic

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Abstract

Background: The Covid-19 pandemic had a strong influence on students' well-being in general, but a significant decrease was noticeable in happiness as well as sleep quality. Previous studies showed that practising gratitude can be effective for students to improve multiple aspects of their well-being. The aim of the present study was to investigate the impact a three-week intervention with a gratitude app has on students' happiness and sleep quality in times of the covid pandemic. Moreover, the students' satisfaction with the app was measured.

Method: This pilot study was a quasi-experimental research with a pre-post design. Twenty-nine students filled out one questionnaire in the beginning and then used an app for three weeks, five days a week. The app provided exercises intending to increase students' gratitude. Afterwards, the participants were asked to fill out a second questionnaire from which 21 participants completed it. A paired samples t-test was used to compare the scores of the pre- and post-test, and to record the participants' satisfaction with the app, the mean scores were investigated, and additional qualitative analysis of the responses was conducted.

Results: Analyzing the data of the pre- and post-test questionnaires showed non-significant results concerning the gratitude intervention increasing gratitude, happiness, and sleep quality. The satisfaction with the app is moderate to highly positive in general, but students made some remarks on how to improve the app in the future.

Discussion: The findings indicate no improvements in gratitude, happiness, and sleep quality after using the app. This can be due to multiple possible reasons, such as the small sample size or that students already scored high in the outcome measures before the intervention. Nevertheless, next to some suggestions for improvement, students stated to enjoy using the app overall.

Conclusion: Generally, this study unexpectedly obtained non-significant results that should be considered in future research. Additionally, the study provides implications for a possible implementation of the app for students suffering from mental health issues.

   Keywords: gratitude intervention, gratitude, happiness, sleep quality, app, satisfaction with the app

The Impact a Gratitude App has on Students' Happiness and Sleep Quality in

the Covid Pandemic

In 2020 the Coronavirus spread all over the world and resulted in a global pandemic. The virus spread quickly and influenced peoples' lives in many ways. Not only were the people hearing about the dangerous virus all day, but the spread of the virus also required certain safety measures for the society. More specifically, among other rules, a lockdown, as well as a curfew, were implemented in order to reduce the people's social contacts and therefore decrease the spread of the virus (Ministerie van Algemene Zaken, 2021). Although meant for the common good, these regulations also have a downside. Notably, studies showed that the steady news about the virus and the restrictions itself had a big impact on peoples' mental health (Kecojevic, Basch, Sullivan, & Davi, 2020). Staying at home most of the time by not going to work or school increased mental conditions like loneliness and depression (Chandratre, 2020; Smith et al., 2020). Especially affected by mental health issues during the pandemic are younger people with no steady income (Smith et al., 2020). Improving students' well-being should therefore be tackled in times like these and is focused on in the present study.

Notably, students experienced a decrease in happiness and sleep quality due to the pandemic and the subsequent safety regulations (Elflein, 2020; Li, Wang, Xue, Zhao, & Zhu, 2020; Martinelli, 2021; Zhou et al., 2020). Happiness is part of subjective well-being and can be described as high satisfaction with life and a high level of enjoyment (Argyle, 2001; Kim-Prieto, Diener, Tamir, Scollon, & Diener, 2005). Studies showed that especially the lockdown seems to be a reinforcer for a reduced level of happiness (Cosmas, 2020; Dragun et al., 2021; Greyling, Rossouw, & Adhikari, 2020).

Next to the level of happiness, young adults also seem to have poorer sleep compared to before the pandemic (Elflein, 2020; Zhou et al., 2020). The construct of sleep quality consists of sleep initiation, sleep maintenance, depth of sleep, dreams, getting up after sleep, condition

after sleep, effect on daily life, sleep amount, and satisfaction with sleep (Yi, Shin, & Shin, 2006). In one study, Casagrande, Favieri, Tambelli, and Forte (2020) showed that with regards to the pandemic 57% reported poor sleep quality. The sample had a mean age of 30 years and higher sleeping disorders were discovered in participants being younger than the reported mean age. Different studies support that being younger than 30 years is one risk factor for experiencing sleep disruption during the pandemic (Elflein, 2020; Marelli et al., 2021). Young adults with poor sleep quality can experience consequences of physical, emotional, and academic nature, such as depression, obesity, and poor academic performance (Owens, & Adolescent Sleep Working Group, 2014). Since the decrease in happiness and sleep quality can have a big impact on people's everyday life, a focus should be on how to improve these conditions during the covid pandemic.

Previous studies have, among other things, focused on these aspects and conducted studies with the aim to increase well-being and decrease mental health conditions. Results show that a heightened level of gratitude is effective for increasing well-being (Bohlmeijer, Kraiss, Watkins, & Schotanus-Dijkstra, 2020; Bono, Emmons, & McCullough, 2004; Flinchbaugh, Moore, Chang, & May, 2012; Rash, Matsuba, & Prkachin, 2011; Toepfer, & Walker, 2009; Wood et al., 2010). Sasone and Sasone (2010) define gratitude as "the appreciation of what is valuable and meaningful to oneself". Accordingly, an increased appreciation of things in life can help people experience more positive emotions (Bono et al., 2004). More generally, gratitude can improve psychological outcomes and coping abilities, support relationships, and decrease negative emotions (Bono, Reil, & Hescox, 2020; Lin, 2015). The most common gratitude intervention is journaling what one is grateful for on a regular basis (Rash et al., 2011). This was claimed to be just as effective as traditional clinical therapy techniques in order to increase well-being (Geraghty, Wood, & Hyland 2010). Therefore, individual gratitude

journaling seems to be a helpful approach to increase positive emotions and might subsequently help to improve happiness and sleep quality.

In regard to happiness which shows a decrease in students during the pandemic, multiple studies show that being grateful also enhances happiness (Jans-Beken et al., 2020; Watkins, Emmons, & McCullough, 2004). Notably, Gallup (1999 as cited in Wood et al., 2010) examined that being grateful makes over 90% of American adolescents and adults happy. Another study found out that the practice of gratitude is strongly related to happiness (Watkins, Woodward, Stone, & Kolts, 2003). This was not only investigated directly through self-reports but also through an indirect word neutral measure which showed a heightened mood of the participants. Singh, Salve, and Shejwal (2017) support this by stating that more than 40% of the individuals' happiness is predicted by gratitude. Studies have revealed that an intervention design with writing gratitude letters increases the level of happiness in students (Toepfer, & Walker, 2009; Wood, et al., 2010).

Gratitude does not only appear to be helpful for positive emotions such as happiness but also to increase sleep quality (Wood et al., 2010). Already after two weeks of gratitude intervention, the sleep quality of young adults improved significantly (Jackowska, Brown, Ronaldson, & Steptoe, 2016; Jans-Beken et al., 2020). A study by Digdon, & Koble (2011) showed that gratitude interventions help students "to quiet their minds and sleep better". These findings suggest that creating interventions with the focus on increasing gratitude might be effective for improving students' happiness and sleep quality.

Although it was already examined that generally gratitude interventions can increase happiness and sleep quality, the studies described above were not conducted online. Different studies showed that using online interventions has advantages compared to face-to-face interventions with human beings. First of all, allowing students to be active and self-ruling when interacting with an online positive psychological intervention can be an effective strategy

to increase well-being (Auyeung, & Mo, 2019). Furthermore, technology acts as a better persuader than human beings for multiple reasons (Fogg, 2002). On the one hand, technology is more persistent and will, therefore, not get tired of persuading the participant. On the other hand, technology can present information easily in different ways and can provide information on time (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006). Accordingly, students can receive reminders and pop-up messages at all times and places. Especially for the target group of students, an app is a convenient method because they use their smartphones regularly and are familiar with using apps (Sonderegger, Schmutz, & Sauer, 2016).

However, students do not automatically enjoy using any app. A motivating factor to continue using an app is the satisfaction students experience with the design of an app. The design consists of the interface design as well as the content design (Hong, Tai, Hwang, Kuo, & Chen, 2017). A good interface design is simplistic and allows the user to see the relevant information at first sight. The attention of the user should be guided to information in a way that it matches the mental model of the user (Wickens, 2015). The mental model is based on a belief of what the user knows and predicts about a system, in this case, the app. The app should be adapted to the predictions of what the users expect from it (Nielsen, 2010). A satisfying content design is achieved by having a good content structure that allows understanding and, for example, includes animations (Hong et al., 2017). Hence, if students are satisfied with the content and interface design this might lead to overall satisfaction with the app and can thereby increase the willingness to use it (Hsiao, Chang, & Tang, 2016). More specifically, the app used for a gratitude intervention should be easy to use and to understand by the students. Predictions on whether the students will be satisfied with this specific app cannot be made at this point.

Based on the literature, it should be explored whether a gratitude app can increase students' well-being during the covid pandemic through a three-week intervention. In addition

to the measures of happiness and sleep quality, also the students' satisfaction with the app itself

will be investigated. The aim of this pilot study is therefore to investigate the following: (a) *To*

what extent will a gratitude app increase the students' well-being in terms of happiness and

sleep quality? (b) *To what extent will the students be satisfied with the gratitude app?*

Based on this, two hypotheses evolve:

1. Using a gratitude app for 3 weeks will increase the students' happiness.

2. Using a gratitude app for 3 weeks will increase the students' sleep quality.

Methods

Design

The current study used quasi-experimental research with a pre-post design. Students

took part in a three-week gratitude intervention. One questionnaire was administered before

using a gratitude app and another questionnaire was completed after using the app for three

weeks. The study was approved by the Ethical Committee of the University of Twente

(BCE210214).

Participants

Students from the University of Twente were recruited to participate in the study.

Twenty-nine students filled out the first questionnaire, however, the second questionnaire was

only completed by 21 participants which gives a final dataset of 21 students (Table 1). The

average age of the participants was 20.67 years (SD=2.27) with a range between 18 and 27

years. Participants were mainly female (76 %). Most of them studied Psychology (81%) and

were in their first year of the Bachelor (52%).

Table 1 Demographic information about participants taking part in the gratitude intervention

	Participants	
	Pre-test (n=29)	Post-test (n=21)

Age, *M (SD)*	21.83 (2.79)	20.67 (2.27)
Gender, female (%)	22 (76)	16 (76)
Marital status (%)		
Never married	29 (100)	21 (100)
Study course (%)		
Psychology	21 (72)	17 (81)
Health Sciences	5 (17)	1 (5)
ATLAS	1 (3)	1 (5)
Communication Science	1 (3)	1 (5)
Management, Society and Technology	1 (3)	1 (5)
Study year (%)		
First-year Bachelor	13 (45)	11 (52)
Second-year Bachelor	2 (7)	2 (10)
Third-year Bachelor	5 (17)	4 (19)
Master first year	9 (31)	4 (19)
Living situation (%)		
Alone	1 (3)	-
With partner	2 (7)	-
With parents	13 (45)	10 (48)
With others	13 (45)	11 (52)
Education level (%)		
Low	2 (7)	2 (10)
Intermediate	22 (76)	17 (81)
High	5 (17)	2 (10)

Procedure

Participants were recruited to participate in the study via the SONA system and through advertisements from a professor. The professor invited students from his course to participate in a gratitude intervention study. Inclusion criteria to participate in the study was to be a student, have a sufficient understanding of the Dutch language, and to have an internet connection and a valid e-mail address. Students that were interested in the study and met the criteria received an information form via a website and could afterwards agree with the informed consent. After agreeing, the first questionnaire was presented to the participants. The online questionnaire was implemented to estimate the students' level of gratitude, happiness, and sleep quality previous to the intervention. Next to that, also other measurements focussing on different aspects of well-being such as mental well-being were included in the questionnaire but are not taken into

consideration in this research. After completing the first questionnaire, the participants received information to download the gratitude app. The students were asked to use the app for five days a week, three weeks in total. They could perform the exercises in their own time and at their desired location. Since the journaling took place in the participants' own notebooks, the answers were not recorded or checked in any way. After completing the gratitude exercises instructed by the app, the participants filled out a second questionnaire which measured the same constructs of the first questionnaire and in addition also questions about the satisfaction with the app.

Materials

Zenn Gratitude APP

The app that the participants used for three weeks is called "Zo Erg Nog Niet" (ZENN) app and was designed by Ernst T. Bohlmeijer. The app was based on a previous gratitude intervention from Bohlmeijer et al. (2020) which showed effective results. Here, participants conducted gratitude exercises that were explained by the app for five days a week. In total, there were six modules to complete. The interface design of the app included a sunflower from which the petals got coloured every time one exercise was completed. After completing all modules, the sunflower was fully yellow. One example of an exercise was to write down three things the person was grateful for on that day and why. Additionally, the app sent pop up messages with reminders, positive quotes, or invitations to add a photo of something the participant was grateful for.

Outcome measures

Gratitude. The six-item grateful questionnaire (GQ-6) was measured with a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 *(strongly agree)*. The scale score is

being calculated by adding the mean score of every item and dividing it by the number of items

which results in the lowest possible mean score of 1 and the highest possible score of 7. One

of the questions is: "I have so much in life to be thankful for". McCullough (2002) showed

good internal consistency reliability with a score of .83 whereas the Cronbach's alpha in this

study showed a reliability of .76 which is acceptable. Four additional questions were asked to

assess the participants' grateful mood (McCullough et al., 2004). The answers were also

measured with a seven-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Scoring high in both gratitude questionnaires indicates having a high level of gratitude. An

example question of this scale is: "I appreciated the simple things in life". The Cronbach's

alpha of the grateful mood questionnaire scored .84 which shows good reliability (McCullough

et al., 2004). The score for the reliability of this questionnaire is supported by the Cronbach's

alpha in this study which was .83.

Happiness. To assess the level of the participants' happiness, the Oxford Happiness

Scale was used (Hills, & Argyle, 2002). The 29 items were translated in Dutch and each item

used the six-point Likert scale, answers ranging from 1 (*strongly disagree*) to 6 (*strongly*

agree). The scale score consists of the mean score of every item divided by the number of

items. Having a high score indicates that the person is happy, whereas a low score indicates

unhappiness. One example item of the questionnaire is: "I feel I have a great deal of energy".

The internal reliability correlation between the items was reported to be excellent with a score

of .90 in the study of Robins et al. (2010). Cronbach's alpha in the current study even shows a

reliability of .93.

Sleep Quality. The sleep quality scale was used to assess the sleep quality of the

participants. The 28-items were translated to Dutch. Each item had a four-point Likert type

answer scale from 1 (*rarely*) to 4 (*almost always*). Adding the mean scores of every item and

dividing it by the number of items creates the scale score. Scoring high in this questionnaire

indicates that the person has more sleeping problems, scoring low means having a better sleep quality. One example item is: "I have difficulty falling asleep". In previous literature, a high internal consistency with a score of .92 was investigated (Yi et al., 2006) which is similar to the Cronbach's alpha of this study with a score of .89.

      Satisfaction with the App. Qualitative, as well as quantitative analysis, was used to investigate the participants' satisfaction with the app. 16 questions covered various aspects of the app, the interface as well as the content. Three open questions focused on the good and bad aspects of using the app for three weeks. One example question is: "Are there things in particular that you liked?". In 13 additional questions, students indicated the extent they agreed with statements about the app. The CSQ- 8 consists of 8 items and was used for the general satisfaction with the app (*General_Satisfaction*) and scores ranged from 1 (*not at all*) to 4 (*fully*). Five further questions (*Feature_Satisfaction)* were about special features of the app like quotes, for example, and ranged from 1 (*bad*) to 5 (*very good*). The scale score was calculated by adding the mean scores of each item and dividing it by the number of items. A higher score indicates a higher level of satisfaction. The internal consistency for the CSQ-8 was high in previous studies (Kelly et al., 2018) and this can be confirmed by an excellent score of .92 for *General_Satisfaction* in this study. In contrast, *Feature_Satisfaction* scores poorly with .58.

Data analysis

      In order to analyse the data received from the questionnaires, IBM SPSS Statistics Version 25 was used. All responses were recorded for the pre- and post-test. Only the data of participants that did not complete the second questionnaire were excluded from the data set which resulted in a smaller sample size that was used for the analysis compared to the number of participants that were recruited. The analysis started with descriptive statistics of demographics and outcome measures. The alpha level was set to .05 and a paired samples t-

test was applied to investigate the mean difference between the pre- and the post-test for the

outcome measures gratitude, happiness, and sleep quality. Additionally, the effect size,

Cohen's d, was calculated for the comparison of the two means for each outcome measure. In

order to calculate the effect size, the mean from the paired samples t-test gets divided by the

standard deviation. For the interpretation of Cohen's d, the benchmarks suggested by

Fergusson (2009) were used which indicate a small, medium and large effect size for d = 0.2,

0.5, and 0.8, respectively.

The satisfaction with the app of the participants was analysed based on two different

outcomes. On the one hand, the mean score of the two satisfaction scales was calculated. On

the other hand, the answers from the open questions were analysed through qualitative analysis

by creating a coding scheme of the most important topics addressed by the participants. The

coding scheme was created in an inductive manner which means that the answers from the

questionnaire were used for bottom-up processing to create the codes. More specifically, the

coder looked at the answers the participants gave and highlighted all reappearing topics by

hand. In the end, 11 codes were created.

Results

Descriptive Statistics

The mean score for gratitude is relatively high already before the intervention and

increased by .03 at post-test (Table 2). The mean score for happiness was also rather high

before the intervention and increased by .04 at post-test. The mean score for sleep quality was

at around half of the scale at pre-test and decreased by .04 at post-test.

Main Analysis

In order to compare the scores of pre- and post-test, a paired samples t-test analysis was conducted for the outcome measures. The analysis for the outcome measure gratitude showed non-significant results and thereby no difference in the post-test compared to the pre-test *t(20)= -.13, p=.90, d=-.03*. The first hypothesis stated that using the gratitude app will increase students' happiness. However, the paired samples t-test indicated that there is no difference in the level of participants' happiness from pre- to post-test *t(20)=-.23, p=.82, d=-.05*. Therefore, the hypothesis needs to be rejected. The second hypothesis stated that using the gratitude app will increase students' sleep quality. Also here, the paired samples t-test for the outcome measure sleep quality showed no difference in scores by displaying non-significant results in regard to sleep quality in pre-test compared to post-test *t(20)=.36, p=.72, d=.08*. This means that also the second hypothesis needs to be rejected.

Table 2

Raw means (SD's) for outcome measure of pre- and post-test of gratitude intervention

	Scale	Pre-test		Post-test		p	Cohens d'
		n	M (SD)	n	M (SD)		
Gratitude	1-7	21	5.42 (.71)	21	5.45 (.95)	.90	-.03
Happiness	1-6	21	4.23 (.59)	21	4.27 (.67)	.82	-.05
Sleep Quality	1-4*	21	2.11 (.46)	21	2.07 (.31)	.72	.08

*High score means increased sleeping problems

Satisfaction

Students were moderate to highly positive towards the app on the quantitative questions. The variable about the general satisfaction with the app (*General_Satisfaction*) displayed a moderate to high mean whereas the variable concerning the special features (*Feature_Satisfaction*) has a relatively high mean (Table 3). Besides, the participants answered

three open questions (see Appendix). The main three aspects that were mentioned as a response to the question on what they took away from using the app was increased awareness of positive things in life, self-reflection, and being able to see the positive in negative things. The most frequent responses from students towards the question of what they liked most about the app were the quotes, the design of the app, the exercises themselves, and the option to add photos. The last open question was about the aspects the participants did not like about the app. The aspect that was mentioned most was that students got annoyed by the number of reminders they received from the app. Additionally, it was brought up that it would be more convenient to be able to complete the exercises within the app and to not need extra paper and pencil. The other two most often mentioned aspects were that the quotes should be more matching the student since it was sometimes difficult to grasp and that some students had trouble adding photos to the inspiration board.

Table 3

Raw means (SD's) for Satisfaction with the app

	Scale	n	M (SD)
General_Satisfaction	1-4	21	2.95 (.46)
Feature_Satisfaction	1-5	21	4.12 (.42)

Discussion

The aim of this study was to investigate the impact a three-week intervention with a gratitude app can have on students' happiness and sleep quality in the covid pandemic. Especially, since previous literature suggested that students suffered from a decreased level of happiness and sleep quality during the pandemic, the idea in this study was to explore the possible effects the gratitude app can have. Additionally, the study's purpose was also to examine the students' satisfaction with the app to receive some practical feedback which allows

improvement. The main focus of this study was therefore to investigate how much the gratitude app can increase students' happiness and sleep quality. Next to that, the focus was also on the level of satisfaction students experience when using the app.

Effects on Happiness

The results showed that the participants' happiness did not increase after the three-week gratitude intervention. The findings do not match with previous literature which indicates that students' happiness increases through gratitude interventions (Singh, Salve, & Shejwal, 2017; Toepfer, & Walker, 2009; Wood, et al., 2010). There can be multiple underlying reasons why this research showed different results. On the one hand, it could be that the type of gratitude intervention, more specifically the app, is not as effective as previous studies and caused nonsignificant results. Support for this would be that students reported feeling annoyed at some point by the reminders they received from the app which might have decreased their happiness. On the other hand, one reason for such a small improvement could be that the level of happiness in students was already high in the beginning. In other studies, participants with high mental health were excluded from the analysis (Bohlmeijer et al., 2020). Another study also found out that people who need gratitude the most also benefit the most from gratitude interventions (Watkins et al., 2004). Next to that, also external, environmental factors like changes in the covid regulations might have influenced the results. At the time the students used the gratitude app, the covid cases rose and thereby also the lockdown was not terminated in the Netherlands which could have had an impact on the students' mood (*Confirmed cases: Coronavirus Dashboard*. Government.nl., 2021). Generally, the current intervention did not have an effect on students' happiness.

Effects on Sleep Quality

The analysis for the outcome measure sleep quality showed no difference from pre- to post-test. In the present study, students scored relatively low regarding sleeping problems in the pre-test already, whereas previous literature often focused on people with severe sleeping problems (Wood et al., 2010). This could be one possible explanation of why the effect of the intervention in this study cannot be expected to be as high as in most previous studies. The fact that students did not seem to have sleeping problems was surprising as well because the literature stated that young people suffer from poor sleep during the pandemic (Casagrande et al., 2020; Elflein, 2020; Marelli et al., 2021). A possible explanation for this could be that students got somewhat used to living with the pandemic. As a recent study examined, the daily routine and thereby also the sleeping habits of people changed at first, but over time they got adapted to the new routines so that they are not as affected by the pandemic anymore (Rome et al., 2021). Hence, the gratitude intervention did not influence students' sleep quality after living with the pandemic for over a year.

Effects on Gratitude

The gratitude intervention aimed at improving happiness and sleep quality by practising and increasing gratitude. However contrary to the expectations, the results of this study showed no difference in gratitude between pre- and post-test. This finding raises the question of how happiness and sleep quality should have improved when gratitude itself did not improve. Accordingly, this might also explain the indifference of scores for happiness and sleep quality. The results for gratitude are not in line with previous studies that found meaningful increases in gratitude after gratitude interventions (Toepfer, & Walker, 2009; Wood et al., 2010). Especially surprising is that in the article of Bohlmeijer et al. (2020) a significant increase of gratitude and multiple measures of well-being was investigated even though the content of the gratitude app in the present study was based on Bohlmeijer's study. One point to ponder here

is that the intervention of Bohlmeijer et al. (2020) lasted at least six weeks whereas this intervention stopped after three weeks. Another difference is that in the present study an online intervention was conducted with a small sample size. Still, even though the scores do not display an increased level of gratitude, students report being more aware of positive things in life and being more thankful for small things.

Satisfaction with the app

Participants were generally relatively satisfied with the app. Even though the app seems to be accepted and acknowledged overall, the students also criticized the app in some aspects. Most frequently mentioned was that students got annoyed by the number of reminders they received. At some point, participants ignored the reminders or got mad at the app for feeling forced to do the exercises. This negative feeling that got evoked in the students might have influenced the results of the study in regard to feeling happy or grateful. The suggestion of the participants was to reduce the number of reminders in order to keep up the satisfaction to use the gratitude app. A previous study supports this by pointing out that app users agree that "too many reminders may alienate rather than retain them as users of … Health apps" (Woldeyohannes, & Ngwenyama, 2017). Next to that, participants of this study criticized not being able to do the exercises within the app. The request of adding the function to complete the exercises within the app is in line with the article of Sonderegger et al. (2016) who described that young people are familiar with smartphones and apps which makes it convenient for the target group to use it. The other tips students voiced are more related to the technological functions like the malfunctioning of adding pictures, but this is not concerning the content and could therefore be resolved easily.

Strengths & Limitations

The present study researched one of the first online gratitude interventions conducted with an app and overall, it seems to be accepted by the participants which can be seen by the fact that students stated to be satisfied with the gratitude app, design- as well as content-wise. It is likely that students would continue to use the app if their suggestions on improvements were implemented. Moreover, the online gratitude intervention gave new insights into gratitude practices with university students after a long period of living with a covid pandemic. It was not investigated before that after a year of living with the covid pandemic students' happiness and sleep quality are relatively high, at least in this sample, so that an online gratitude intervention does not improve these scores.

However, the current study does also have some limitations. The findings do not show significant results, and this might have the following underlying reasons. First of all, the sample size should be increased. This study was only a pilot study to investigate the general tendencies and satisfaction with the app, but a study with less than 30 participants could influence the chance of finding significant results because of low power. The standard deviation was relatively high which also implies that the sample size should be increased in order to decrease the standard error since the samples will be clustered nearer to the true value. Moreover, the study design was a pre-post design. The downside of using this kind of study design is that it only receives responses from two points in time. To increase the validity of the results one should either include multiple responses from more than only two points in time or include a control group in the study (Babbie, 2016).

Besides the study design, another limitation could be the possible influence of the covid pandemic on the results. As previous studies showed, the lockdown seems to have a big influence on people's mood and well-being (Cosmas, 2020; Dragun et al., 2021; Greyling, Rossouw, & Adhikari, 2020). At the time the participants practised their gratitude by using the app the covid cases rose, and the regulations became stricter (*Dutch measures against COVID-*

19. Government.nl., 2021, May). The hope students had on returning to their old lives soon

might have shrunk and thus influenced their gratitude and happiness. Implementing a control

group would allow a comparison between groups to see whether the restrictions had an impact

on the results. Nevertheless, it was still important to conduct this study because the results of

this pilot study gave insights for future research and future implementation of the app.

Future research and implications

Based on the previous analyses and the results, it becomes apparent that the app shows

almost no effect. A possible explanation for this finding could be that students seem to be quite

happy and have a good sleep quality already which subsequently does not leave much room

for improvement. Therefore, in the future, it would be advisable to introduce the gratitude app

to students that are suffering from or struggling with unhappiness or sleeping problems. An

important aspect to take into account when implementing the app in the student environment

is to evaluate the suggestions students made in order to be fully satisfied with the app.

Reducing, for example, the number of reminders would be promising to achieve better results.

To be more concrete, future studies could replicate the present study, but make

improvements in a way of increasing the sample size, adding a control group, and increasing

the users' satisfaction by implementing the suggestions made by the participants. The recent

study from Bohlmeijer et al. (2020) showed promising results and since the app was based on

their gratitude intervention it would be wise to replicate the study design of their study in a way

that sample size is increased, and a control group is added. The only difference then would be

that the tool is a gratitude app, and the participants are university students. Moreover, in the

study of Bohlmeijer et al. (2020), participants with high scores of well-being were excluded

from the study which indicates that the app should especially be introduced to students

struggling with mental health issues.

Conclusion

To sum up, the present study provides an insight into the effectiveness a gratitude app has on students' happiness and sleep quality. Even though the results were not significant, the findings revealed some interesting implications. On the one hand, it yields a clearer picture of how to implement the app and which target group would benefit the most from such an intervention. On the other hand, the input gained from the responses concerning the satisfaction with the app provides a lot of information on how to improve the app such as reducing the number of reminders and enabling the option to write the answers to the exercises in the app. Moreover, the input gained from the students' responses showed that they like the general idea of using a gratitude app and becoming more aware of the positive things in life.

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Appendix

Table A

Coding of the responses for satisfaction with the app

Codes/topics	Example Quote
What is the most important thing Zo Erg Nog Niet (Zenn) did for you?	
Awareness of positive things in life	„Ik ben meer stil gaan staan bij de kleine dingen die ik heb en ik ben mij meer gaan beseffen dat er een hele hoop is waar ik dankbaar voor kan zijn/ben!"
Self-reflection	„Een mogelijkheid voor zelfreflectie"
Re-evaluation from negative to positive	„Het deed me stilstaan bij kleine dingen en heeft me geholpen om de positieve kant te bekijken in situaties die eerst vrij negatief oogden."
Are there things in particular that you liked?	
Quotes	„Ik vond de dagelijkse quotes en de mogelijkheid om een vast te pinnen een leuke mogelijkheid."
Design of the app	„De bloem en hoe de blaadjes één voor één opfleurden."
Exercises	„dat het onderdeel was in verschillende stappen"
Photos	„Ik vond het heel leuk om elke dag een foto toe te voegen die ervoor zorgde dat je er stil bij stond waar je die dag dankbaar voor was. Het was bijzonder om die hele 'tijdlijn' soms terug te bekijken"

Are there things in particular that you did not like?

Reminder	„The first two weeks were nice, after that I felt it was more annoying to get three E-Mails a day to be reminded of the study. Also, I used to always think about my gratitude and expressed that on an everyday basis. Having the app telling me to do so made it less fun. "
Writing in the app	"Dat je apart nog dingen moest opschrijven. Waarom is het niet geïntegreerd? Het nut van een app verdwijnt daardoor een beetje"
Quotes	„Ook viel mij op dat het grootste deel van de quotes mij niet echt aansprak en soms ook wel een beetje stoorde."
Malfunction of adding photos	„Sommige dagen kon ik geen foto's plaatsen op het inspiratiebord."