Minitraining Positiviteit en Geluk

Pilot study on the effects and user experiences of a short-term online positive psychology intervention based on positive emotions

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Master's Thesis

Enschede, January 2017

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Abstract – English

Introduction: The aim of this current pilot study was to get an overview of the effects and user experiences with a new developed short-term mHealth positive psychology intervention which consists of different evidence-based exercises. Positive Psychology focuses on improving well-being. An important component of well-being are positive emotions. Therefore, well-being can be reached by focusing on and increasing positive emotions. It is scientifically proven that positive psychology interventions as well as online (mobile) positive psychology interventions, which consist of mental exercises, can increase well-being. An example of such interventions is the 'three good things' intervention which improves well-being by increasing positive emotions. Within mHealth interventions it is not only effective to use evidence-based content, but also persuasive technology, for example to make the intervention more attractive for users and to reach a better adherence. Until now there are not many evidence-based mHealth positive psychology interventions.

Method: Eleven mentally healthy participants took part in this study. The intervention was presented via an app. It lasted over two weeks and consisted of three different exercises: 'three good things', 'savoring – positive activities' and 'active-constructive responding'. A pre- and posttest measure was done with the outcome variables well-being, positive- and negative emotions, and perceived stress. Further, user experiences were studied. The used measurement instruments were the 'Mental Health Continuum-short form', 'Positive and Negative Affect Schedule', and 'Perceived Stress Scale'.

Results: Within adherent participants (n=7) there was significant progress of well-being and marginally significant reduction of perceived stress identified. Positive and negative emotions did not show significant differences from pre- to posttest. The user experiences showed that most adherent participants rated the intervention generally rather positive and especially the exercises 'three good things'. Nevertheless, there are still several aspects on which participants made suggestions for improvement of the intervention, for example to use less notifications and reminders.

Discussion: The progress of well-being and reduction of perceived stress confirmed expectations. The results regarding positive emotions however raised a few questions and further research is required. In average, participants did like the intervention, the presentation via an app, and the notifications which were used to inform about available exercises. For future research it is recommended to study the outcomes within perceived emotions, to use a broader variety of exercises and to study causal effects of the intervention.

Abstract – Dutch

Introductie: Het doel van deze huidige pilot studie is het een overzicht te krijgen van de effecten en gebruikerservaringen met een nieuw ontwikkelde kortdurende mHealth positieve psychologie interventie die uit verschillende evidence-based oefeningen bestaat. Vanuit de positieve psychologie kan geestelijke gezondheid worden bereikt door het verhogen van welbevinden. Een belangrijk aspect van welbevinden zijn positieve emoties. Welbevinden kan dus worden verhoogd door te focussen op positieve emoties en deze te versterken. Er bestaan al een aantal positieve psychologie interventies en online positieve psychologie interventies. Een voorbeeld is de 'drie goede dingen' interventie, die welbevinden verhoogd door positieve emoties te versterken. Om effectieve en gebruikersvriendelijke online interventies te ontwerpen is het belangrijk pilotstudies te doen. Met betrekking tot mobile Health interventies, is het effectief om naast een evidence-based inhoud ook persuasieve technologie te gebruiken, bij voorbeeld om de interventie voor de gebruiker aantrekkelijker te maken en een betere adherentie te kunnen bereiken. Tot nu toe zijn er weinig evidence-based mHealth positieve psychologie interventies bekend.

Methode: Elf psychisch gezonde participanten hebben deelgenomen aan deze studie. De interventie was gepresenteerd via een app, duurde twee weken en bevatte drie verschillende oefeningen gebaseerd op positieve emoties: 'drie goede dingen', 'genieten – positieve activiteiten' en 'actief-constructief luisteren'. De effecten werden via pre- en posttest gemeten gebaseerd op welbevinden (MHC-SF), positieve- en negatieve emoties (PANAS) en ervaren stress (PSS). Daarnaast werden de gebruikerservaringen verzameld.

Resultaten: Binnen adherente participanten (n=7) was significant vooruitgang te zien op welbevinden en marginaal significant reductie van ervaren stress. Positieve- en negatieve emoties leverden geen significante verschillen op. Aan de hand van de gebruikerservaringen was te zien dat de meeste adherente participanten de interventie op zich redelijk positief vonden, vooral de 'drie goede dingen' oefening. Maar er waren ook enige suggesties van participanten om de interventie te verbeteren, bijvoorbeeld minder notificaties te gebruiken.

Discussie: De vooruitgang van welbevinden en de reductie van ervaren stress hebben de verwachtingen bevestigd. De resultaten met betrekking tot positieve emoties werpen enige vragen op en verder onderzoek is nodig. De participanten vonden de interventie op zich, de app, en de meldingen bij een beschikbare oefening redelijk positief. Voor toekomstig onderzoek is het aanbevolen om de uitkomsten op de PANAS verder te onderzoeken, meer verschillende oefeningen te gebruiken en de causaliteit van de interventie te onderzoeken.

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Introduction

According to positive psychology, mental health is more than the mere absence of disease. To improve mental health, positive psychology focuses especially on improving well-being (Seligman, 2002). Mental well-being consists of three components: emotional well-being, psychological well-being and social well-being (Keyes, 2005). See figure 1.

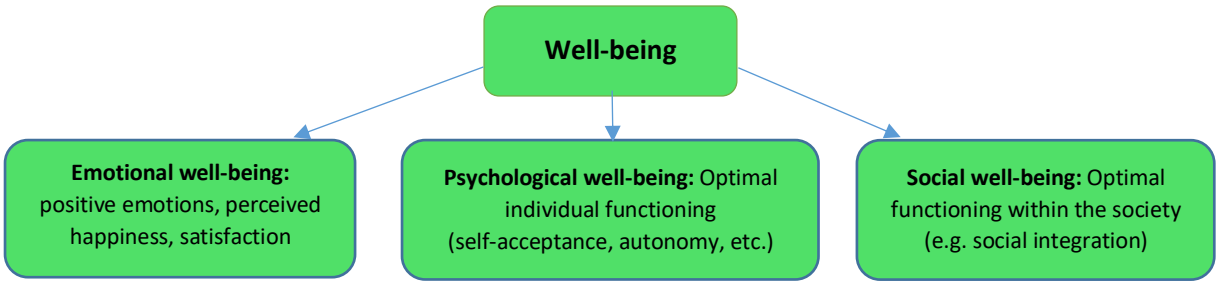

Figure 1. *Categories of well-being*

Especially the promotion of emotional well-being – consisting of perceived feelings of happiness, satisfaction with life, and primarily, the presence of positive emotions – is important because it has great influence on general health (Diener & Chan, 2011). People who experience more emotional well-being are healthier and more successful, have better social relationships, and experience more positive activities than people who have lower levels of emotional well-being (Seligman, Steen, Park & Peterson, 2005; Otake, Shimai, Tanaka-Matsumi, Otsui & Fredrickson, 2006; Lamers, Westerhof, Bohlmeijer, ten Klooser & Keyes, 2011).

Emotions are reactions to the individual environment, which have influence on a person's physiological responses, thoughts and actions, and which may change a person's perception and behavior (Fredrickson & Branigan, 2005). There is a lot of research done concerning negative emotions because they were already important in the human evolution, and because they play an important role in the onset of psychological disorders. Concerning negative emotions, specific emotions are usually linked to specific action tendencies and therefore, negative emotions narrow peoples thought-action repertoire (Fredrickson 1998; Fredrickson, 2001). Fear for example is linked with the urge to flight, fight or freeze. (Tooby & Cosmides, 1990). Those are quick actions which may be needed in life-threatening moments (Fredrickson, 2004).

Unlike negative emotions, in the past there was not much research done about (the consequences of) positive emotions. Intensive research based on positive emotions has started around the turn of the 21st century (Seligman, Csikszentmihalyi, 2000; Fredrickson, 1998). Examples of positive emotions are interest, pleasure, satisfaction, serenity, inspiration,

contentment, joy, love, gratitude, awe and hopefulness (Fredrickson, 2009). There is one big difference between positive and negative emotions. Unlike negative emotions, positive emotions don't yield specific action tendencies. While experiencing positive emotions, people also do have urges to act, but those actions appear to be less prescriptive compared to the specific action that should be taken while experiencing negative emotions. Therefore, positive emotions produce urges to non-specific actions (Fredrickson, 1998). Through feeling happy and full of joy, people might have the tendency to just do anything, and through feeling relaxed, people might just want to do nothing at all (Fredrickson, 2009). According to Fredrickson's (1998) *broaden-and-build theory*, positive emotions broaden people's momentary thought-action repertoire (cognition, attention and action) and are important to build people's individual resources (psychological, social, intellectual, physical). Those individual resources can be used later in life, to survive more successful and to have a better coping style (Fredrickson, 1998; Fredrickson, 2004). For example, interest broadens by creating the urge to explore, to take in new information, and to make new experiences, which then builds knowledge of the topic of interest (Fredrickson, 1998). Further, positive emotions feel good within the present moment and they work as a signal that everything is fine, that we are healthy, successful and satisfied. Additionally, positive emotions do not just signal health, satisfaction and success, but they can also produce it (Fredrickson, 2009). Through positive emotions and thus through broadening the thought-action repertoire and building new individual resources, people are healthier, happier, more successful and perceive more well-being, life satisfaction and less stress (Fredrickson, 1998; Fredrickson & Joiner, 2002). Additionally, there is a positive relation between how happy a person feels, the amount of positive emotions the person experiences, the intensity of social relations, and the amount of positive activities (Otake, Shimai, Tanaka-Matsumi, Otsui & Fredrickson, 2006). Positive emotions can be increased or strengthened through interpreting and responding to life events in certain ways, through engaging in social activities and through personal recreation (Lyubomirsky, Sheldon & Schkade, 2005).

Positive psychology interventions (PPI's) consist of mental exercises which focus, for example, on positive emotions. PPI's are designed with the aim to build positivity, thus to increase emotional, psychological and social well-being, as well as positive behavior, positive emotions, and positive cognitions, rather than to specifically reduce negativity as problematic feelings and behavior. To talk about a true positive psychology intervention, the intervention has to be evidence based and the aim has to be the same as the aim of positive psychology (Schueller, Kashdan & Parks, 2014). A lot of research as well as meta-analysis show that

PPI's are effective because they improve well-being and mental health and reduce depressive symptoms. Therefore, they not only prove effect within the promotion of mental health but also within the prevention and treatment of mental disease (Sin & Lyubomirski, 2009; Bolier, Haverman, Westerhof, Riper, Smit & Bohlmeijer, 2013). One example of an effective positive psychology intervention is 'three good things'. In the study of Seligman et al. (2005) the long-term effects of thinking about three good things at the end of each day during one week, were measured. At the last follow-up measure after six months, participants still showed increased happiness.

Online positive psychology interventions or eMental health interventions can be presented online, participants can be recruited online and data can be collected online (Gemert-Pijnen, Nijland, Limburg, Ossebaard, Kelders, Eysenbach & Seydel, 2011). In 2015, in advanced economies a median of 87% of adults used the internet at least occasionally. Concerning the worldwide usage of the internet it was a median of 67% (Pew research center, 2016). Positive psychology interventions can also be presented as mobile health interventions (mHealth) on smartphones as an app. Besides the fact that mobile phones are small and easy to carry around, in 2015 a median of 68% of adults in advanced countries reported on owning a smartphone (Pew research center, 2016). Further, benefits of mHealth interventions are that exercises can be received in real time and embedded in daily life, and therefore information can be entered directly. Additionally, through using mHealth interventions, physiological monitoring and self-reporting is possible irrespective of the location (Heron & Smyth, 2010). Ter Haar (2015) has done a systematic review of existing positive psychology apps that focus on strengthening positive emotions. This review shows that out of twenty-two evaluated positive apps, only four had a theoretical basis. There is nothing scientific found about the effects of the other eighteen apps, most of them are not evidence-based, and most of them seem to be made for long-term usage and not as short-term interventions.

To overcome these gaps, a mobile positive psychology intervention called *Minitraining Positiviteit en Geluk* was developed by choosing only evidence-based mental exercises which are all based on positive emotions, to improve positive emotions in daily life. The three exercises used in the *Minitraining Positiviteit en Geluk* are 'three good things', whereby participants think about three good things they have experienced within the last day (Seligman et al., 2005); 'savoring', whereby participants are asked to take some time to focus on and perform positive activities (Seligman, Rashid & Parks, 2006); and 'active-constructive listening/ responding', whereby participants are asked to active-constructive listening to

others' good news (Gable, Reis, Impett & Asher, 2004). The aim of this current research is to test the effectiveness of this newly developed mHealth intervention, as well as to get an overview of the user experiences. To develop this current intervention, a first quasi-experimental paper version pilot study was done in the past to get insights in possible effects and especially in user experiences. The user experiences were used to adjust the current intervention. In the first pilot study, the participants had three different exercises of which two were evidence-based: 'three good things' (Seligman et al., 2005) and 'self-compassion' (Neff, 2011). Within the third exercise 'positive activity monitor' the participants were asked to monitor their (positive) activities. The participants' well-being and life satisfaction had increased between pre- and posttest. Mindfulness and positive emotions did not show significant increase. Concerning user experiences, 'three good things' and 'positive activity monitor' were rated as effective. The self-compassion exercise was rated rather negative and difficult. Participants would have preferred the intervention online via an app (Heinrich, 2015).

Besides an evidence-based content of the intervention, the setup of the technology is also important. Within mHealth interventions, persuasive technology, which is interactive information technology, can be used to change users' attitudes and behavior (Fogg, 2003). Persuasive technology can be divided in four categories: Primary task support, dialog support, credibility support, and social support. Principles of the category 'primary task support', support the implementation of the primary tasks. Principles of the category 'dialogue support', help implementing human-computer interaction, which helps users to keep moving towards their goal behavior. Principles of the category 'credibility support', help to make the system more credible, and principles of the category 'social support' deal with different kinds of social influence to motivate the user (Oinas-Kukkonen & Harjumaa, 2009). The categories and belonging principles are illustrated in Figure 2.

Figure 2: *Persuasive technology categories and principles (Oinas-Kukkonen & Harjumaa, 2009)*

Within this current study, used principles are *tunneling* (providing means for action to guide users through a process), *self-monitoring* (providing a means for users to keep track of their own performance), *rehearsal* (enabling people to change their behavior in the real world through rehearsing the behavior), *reminders* (reminding users when an exercises is available), *liking* (visually appealing to users), *trustworthiness* (using truthful information), *expertise* (using scientific background information to show knowledge) and *surface credibility:* (using a competent looking system).

The added value of this current research is the development of a short-term mHealth positive psychology intervention consisting of three different evidence-based mental exercises, which are embedded in daily life and set up using persuasive technology. The aim of this research is to test the effects and user experiences of the new developed app and intervention *Minitraining Positiviteit en Geluk* and to get an impression of what seems to work fine, what might not work perfectly yet, and what should be changed in the future.

Five research questions are used:

1. Which effects does the intervention have on well-being?
2. Which effects does the intervention have on the increase of positive emotions and the decrease of negative emotions?
3. Which effects does the intervention have on the reduction of perceived stress?
4. What are the user experiences with the intervention?
5. What are the differences in effects and user experiences between adherent and non-adherent participants?

Hypothesis:

Through the usage of the short-term mHealth intervention *Minitraining Positiviteit en Geluk*, which focuses on positive emotions and which is embedded in daily life, an increase of positive emotions and of all parts of well-being will be reached, as well as a reduction of negative emotions and perceived stress.

To explain the expected outcomes, an increase of emotional well-being is expected because the intervention is based on (improving) positive emotions which are an important part of emotional well-being (Keyes, 2005). An increase of psychological well-being is expected because according to the *broaden-and-build theory* (Fredrickson, 1998), people build new individual resources through experiencing positive emotions which then might lead to better individual functioning (Keyes, 2005). An increase of social well-being is expected because of the exercise 'active-constructive responding' in which social relations and interaction are important and might lead to better functioning within the society (Gable et al., 2004; Keyes, 2005). Improvement of positive and negative emotions is expected because the whole intervention is based on (improving) positive emotions. Reduction of perceived stress is expected because of the positive effects that positive emotions and building new resources have on stress (Fredrickson & Joiner, 2002).

Method

Participants

In total, twelve participants were recruited through convenience sampling to participate in this study which examined the intervention *Minitraining Positiviteit en Geluk.* Therefore, people of the researchers' personal circle were invited to participate. There were three inclusion criteria for this study. The participants had to be 18 years or older, should not suffer from any psychological disorder, and had to understand the Dutch language because the intervention and the questionnaires to test the effects of the intervention were in Dutch. Of the twelve participants that started the study, eleven were actually able to start the intervention. One participant was not able to start due to technical problems. Of the eleven participants, three participants were men and eight participants were women. The average age was 24.5 (ranging from 19 to 39). Background information is summarized in Table 1.

Table 1
Overview background information participants

	All participants	Women	Men
Amount/number	11	8	3
Average age	24,5	24,37	29,67
Education level			
- WO	9	6	3
- VWO	1	1	0
- HAVO	1	1	0
Momentary work situation			
- paid work	4	1	3
- education	6	6	0
- unemployed	1	1	0

Procedure

Study procedure

The ethics committee within the faculty Behavioral, Management and Social Sciences (BMS) at the University of Twente has approved this study. After the approval, each participant received an email including a link to the pretest questionnaire, another link to the subscription page of the application, and information about the download of the application. Firstly, participants had to fill in the pretest questionnaire which consisted of an information letter, the informed consent, a few questions according to background information (Table 1), and three different questionnaires (Mental Health Continuum – short form, Positive and Negative Affect Schedule and Perceived Stress Scale). A detailed informed consent was used to inform

participants about the aim and the process of this study, and to inform about the voluntary participation and about data privacy. Filling in the pretest questionnaire took approximately fifteen minutes. In a second step, the participants subscribed using their email addresses and self-chosen passwords. As the last step before the start of the intervention, the participants were asked to download the application from the App store/Google Play store. Within the next two weeks, the participants received different short mental exercises via the app. The participants were asked to try to complete all exercises. After one week, the participants received an email to check up and to give new motivation for the second week. After the last exercise was presented, they received the link to the posttest questionnaire via an email, which they had to fill in as soon as possible after completion of the intervention. The posttest not only consisted of the three questionnaires which were used in the pretest, but also of a few questions concerning user experiences about the intervention and the app.

Intervention procedure

The positive psychology mHealth intervention consisted in total of thirty modules. The first module was an instruction module. Twenty-eight modules were exercise modules, and at the end there was one closing module. The participants received the instruction module, after subscribing and downloading the app, on the day before the start of the intervention at 6pm. Between day one and day fourteen, they received the twenty-eight exercise modules which were embedded in daily life. Thus, two exercises per day, randomly presented at two moments (either 8am, 1pm and/or 6pm). The twenty-eight modules were three different exercises, which were repeated in a random sequence. So, the participants were able to get a routine and did not have to do too many different exercises. To not have to check their smartphones continuously and to improve adherence, participants received notifications whenever exercises were available and reminders whenever they did not react within two hours. After opening an exercise, the participants had the choice to do this exercise now or later. If they chose to do it now, an input field popped up wherein it was possible to write down what they were planning to do or what they already had done within a given exercise. If they chose to do it later, the exact same input field popped up two hours later. When receiving each exercise for the first time, people also received some background information that explained the exercise in detail and some extra tips for the implementation.

Material

The intervention: Minitraining Positiviteit and Geluk

Instruction module

The instruction module consisted of important information, which gave participants some knowledge about the utility of positive emotions and the *broaden-and-build theory* (Fredrickson, 1998) and which informed about the own influence one can have on feeling more positive. Additionally, the participants received information about the setup of the intervention, and finally it was explained that the intervention wasn't to teach people not to have any negative feelings anymore, but rather to let them see that they can have influence on their positivity and that there are simple things to improve positivity.

Exercise 1: Three good things

For this exercise, people were asked to take five to ten minutes and think about three moments or events within the past 24 hours in which they had experienced positive feelings as happiness, gratitude, hopefulness, inspiration, calmness, satisfaction, pride or interest, and then try to experience this feeling again. Background information by this exercise was that positive emotions and positive events usually do not get as much attention as negative emotions and negative events because negative emotions often work as an alarm sign, and positive things are easier forgotten. Extra tips were to not just pay attention to big events but also to small things such as a short chat with a friend since these are important, too. Further, it was explained they should not worry, if they could not think of three positive moments on some days.

Exercise 2: Savoring - Positive activities

To do this exercise, people (were able to) have a look at a list of pleasurable activities (PAL) (Roozen, Wiersema, Strietman, Feij, Lewinsohn, Meyers, Koks & Vingerhoets, 2008) and were asked to choose an activity from this list or to choose another pleasurable activity and to take a minimum of five to ten minutes to perform this activity. Background information by this exercise was that people do have a lot of routine activities and necessary activities, but besides those, there are also pleasurable activities. With this exercise, the participants were stimulated to savor pleasurable activities. Extra tips by this exercise were that even though it

might not always be easy to find some free time to do something pleasurable, it is important to keep in mind that it's only for about ten minutes.

Exercise 3: Active-constructive responding

For this exercise, people were asked to take ten to fifteen minutes and ask somebody in their own surrounding (colleague, friend, family member, etc.) about something positive which he or she has come across today or yesterday. Hereby, it was the task to listen carefully, to let the person notice that you are listening, and to ask for positive details and feelings and to give compliments. Background information for this exercise was that social interactions are an intensive part of our daily lives and that research has shown that sharing our positive experiences is good for us and helps to relive the associated positive feelings. Also, it magnifies the feeling that somebody listens to us and that we are important to others. In the long-term, it also contributes to good relations. Extra tips for this exercise were that even though this exercise might feel weird, a lot of people have had positive experiences with this exercise and the people one listens to often react positively about one's interest.

Measurement tools

Well-being – mental health

The Mental Health Continuum – Short Form (MHC-SF; Keyes, 2002) consists of fourteen questions and measures mental health in total (M = 2.98; SD = 0.85) and on three separate dimensions: emotional well-being items 1-3 (M = 3.67; SD = 0.94), social well-being items 4-8 (M = 2.33; SD = 1.01) and psychological well-being items 9-14 (M = 3.18; SD = 0.99). (Lamers, Westerhof, Bohlmeijer, ten Klooster & Keyes, 2011). Participants are asked to fill in how often they were having certain feelings within the last month on a six-point Likert scale. An example of a question is 'During the past month, how often did you feel satisfied with life?'. The six answer possibilities are between 'never (0)' and 'every day (5)'. The higher the scores, the better is peoples' well-being (Keyes, 2009). The Dutch version of the MHC – SF, which was used for this study, has a good validity and the internal consistency of the total scale is 0.89. The test-retest reliability of the total scale is 0.65. The reliability of the social well-being scale is 0.74 and the reliability of the psychological and emotional well-being scales is 0.83 (Lamers et al. 2011). Within this study, the time range "during the past month" was changed to "during the past two weeks". This decision was made because the intervention only takes two weeks.

Positive and Negative Emotions

The Positive and Negative Affect Schedule (PANAS; Watson, Clark and Tellegen, 1988) consists of twenty items, which belong to either the positive affect scale (PA; items 1, 3, 5, 9, 10, 12, 14, 16, 17, 19) or the negative affect scale (NA; items 2, 4, 6, 7, 8, 11, 13, 15, 18, 20). Participants are asked to answer on a five-point Likert scale. Examples of the items are 'interested' and 'upset'. The time range which was used for this study was not 'at the moment' but 'the highest intensity within the last twenty-four hours'. The five answer possibilities are between 'very slightly or not at all (1)' and 'extremely (5)' (Crawford and Henry, 2004). The sum scores range on both scales between 10 and 50. Higher scores on the positive affect scale (M = 31.31; SD = 7.65) imply more positive emotions, and lower scores on the negative affect scale (M = 16.00; SD=5.90) imply fewer negative emotions. The internal consistency of the positive affect scale is 0.89 and the internal consistency of the negative affect scale is 0.85 (Crawford and Henry, 2004).

Perceived Stress

The Perceived Stress Scale (PSS; Cohen, Kamarck and Mermelstein, 1983) consists of ten questions, which measure the perceived stress within the last month. In this study the time range was changed to 'the last week' instead of 'the last month'. The participants are asked to answer on a five-point Likert scale. An example of a question is 'In the last week, how often have you been able to control irritations in your life?'. The five answer possibilities are between 'never (0)' and 'very often (4)' (Cohen & Williamson, 1988). The sum scores range between 0 and 40. The means and standard deviations are gathered for different age groups. In this study, the participants were between 19 and 39 years old. For people between 18-29 M = 14.20 (SD = 6.20). For people between 30-44 M = 13.00 (SD = 6.20).

User experiences – Client satisfaction

To refer to the user experiences with the intervention and with the application, multiple choice questions were developed based on the Client Satisfaction Questionnaire (CSQ; Clifford Attkisson & Zwick, 1982). It was asked about the perceived quality and difficulty of the intervention, the time needed for the intervention, and the perceived positive effect of the intervention on a stressful day. Moreover, it was asked if the participants would follow the intervention again to improve positive emotions, and if they would recommend it to friends. Finally, they were asked to grade the intervention. Within this study, some questions of the

Client Satisfaction Questionnaire, which were compatible with this intervention, were only modified a little bit, so that 'How would you rate the quality of service you have received?' was modified to 'How would you rate the quality of the intervention *Minitraining Positiviteit en Geluk,* which you have followed within the last two weeks?'. Also, 'If a friend needed similar help, would you recommend our program to him or her?' was modified to 'Suppose your friends were interested in improving positive emotions, would you recommend the *Minitraining*?'. Some other questions were modified more, so that 'Have the services you received helped you to deal more effectively with your problems?' was modified to 'Through making the exercises, did you have the feeling that a stressful day was more positive than expected?'. Additionally, a few questions were developed to get some more information out of the user experiences which might be important for further research: 'How did you like the implementation of the intervention?' and 'How did you find the time investment needed for the intervention?'. In addition to the multiple-choice questions, the participants were asked to mention up to three things which they would rate most effective and least effective and to make any suggestions for improvement. The complete questionnaire can be found in Appendix A.

Analysis

Effects of the intervention

To test the hypothesis, the three questionnaires MHC-SF, PANAS and PSS were analyzed with the Statistical Package of the Social Sciences (SPSS) version 24. First of all, the sum scores of the given data were calculated with SPSS, and the normal distribution was checked. Normal distribution was tested with the Shapiro-Wilk test. This test was used because the Shapiro-Wilk is on the one hand the most effective test for normal distributions, and on the other hand, it is applicable for a sample size between 3 and 2000 (Razali & Wah, 2011; Royston, 1992). The normal distribution is confirmed when W is close to 1 and $p > 0.05$ (Razali & Wah, 2011).

Through the metrics of the app, the researcher was able to control the adherence of participants, thus to see which participant completed which exercises. After noticing that a few participants had not completed a lot of exercises, it was possible to analyze all participants, as well as separately adherent participants only, and non-adherent participants only. The participants were counted as non-adherent whenever they completed less than half of the intervention.

Within all participants, the scores on the MHC-SF total well-being scale, the MHC-SF emotional well-being scale, the MHC-SF psychological well-being scale, the PANAS positive affect scale, and the Perceived Stress Scale were normally distributed. The scores on the MHC-SF social well-being scale and on the PANAS negative affect scale were not normally distributed. Within the adherent participants only, all scales were normally distributed except for the PANAS negative affect scale. Within the non-adherent participants only, all scales were normally distributed.

To test the effects of the intervention, the differences between T_0 and T_1 were analyzed separately for each scale. For the scales on which the data was normally distributed, the analysis was done with a 'paired samples t-test'. For the scales on which the data was not normally distributed the 'nonparametric Wilcoxon Signed Ranks test' was used. To confirm a statistical significance, the results had to be $p < 0.05$. Because of the difficulty of analysis with only a small sample size, it was also looked at individual indications for clinical relevant effects based on known standard deviations. To confirm an individual indication for clinical relevant progress between T_0 and T_1, the difference had to be minimum half of a standard deviation.

User experiences

By using multiple choice questions based on the Client Satisfaction questionnaire (Clifford Attkisson & Zwick, 1982) and further open questions, the user experiences were analyzed qualitatively, to get an impression of the experiences, the users made with the intervention. The participants' experiences with the intervention as well as their suggestions for future improvement of the intervention were summarized.

Results

Seven of the eleven participants were adherent and four participants were non-adherent.

Effects of the intervention

Table 2 shows an overview of the results of all participants on the normally distributed scales, which were analyzed with the 'paired samples t-test'. Table 3 shows the results of all participants on the nonparametric distributed scales, which were analyzed with the 'nonparametric Wilcoxon Signed Ranks test'. These overviews illustrate, within all participants, there is significant progress between T_0 and T_1 on the PSS and marginally significant progress on the MHC-SF total well-being scale, MHC-SF psychological well-being scale, and MHC-SF social well-being scale. The analysis of the MHC-SF emotional well-being scale and of the PANAS do not illustrate significant progress.

Table 2
Overview of the results of all participants on the normally distributed scales

Scales	Measuring Moment	M (SD)	t (df)	P
MHC-SF total	T_0	2.76 (0.93)	1.99 (10)	0.08*
	T_1	3.18 (0.85)		
MHC-SF emotional	T_0	3.00 (0.95)	1.64 (10)	0.13
	T_1	3.36 (1.15)		
MHC-SF psychological	T_0	3.03 (0.92)	1.83 (10)	0.10*
	T_1	3.47 (0.76)		
PANAS Positive affect	T_0	31.73 (8.37)	1.02 (10)	0.33
	T_1	33.64 (6.64)		
PSS	T_0	17.55 (7.01)	-2.41 (10)	0.037**
	T_1	13.91 (7.05)		

Note. N=11. **Significant progress with $p<0.05$. *Marginally significant progress with $p\leq0.10$. M=mean. SD=standard deviation. df=degrees of freedom.

Table 3
Overview of the results of all participants on the nonparametric distributed scales

Scales	Measuring moment	M (SD)	Z	P
MHC-SF social	T_0	2.29 (1.04)	1.79	0.07*
	T_1	2.71 (1.04)		
PANAS Negative affect	T_0	20.27 (5.83)	-0.92	0.36
	T_1	18.91 (7.38)		

Note. N=11. *Marginally significant progress with $p\leq0.10$. M=mean. SD=standard deviation.

Table 4 and Table 5 illustrate the same overviews as Table 2 and Table 3 but only for the seven adherent participants who completed (almost) the whole intervention. The analysis shows a significant progress between T_0 and T_1 on the MHC-SF total well-being scale, MHC-SF emotional well-being scale, MHC-SF social well-being scale, and MHC-SF psychological well-being scale. The analysis of the PANAS does not show significant progress, and the analysis of the PSS shows marginally significant progress.

Table 4
Overview of the results of only adherent participants on the normally distributed scales

Scales	Measuring moment	M (SD)	t (df)	p
MHC-SF total	T_0	2.64 (0.73)	4.16 (6)	0.006***
	T_1	3.43 (0.56)		
MHC-SF emotional	T_0	3.00 (0.82)	2.79 (6)	0.032**
	T_1	3.71 (0.97)		
MHC-SF Social	T_0	2.11 (0.92)	3.22 (6)	0.018**
	T_1	2.80 (0.94)		
MHC-SF psychological	T_0	2.90 (0.68)	4.80 (6)	0.003***
	T_1	3.81 (0.26)		
PANAS Positive affect	T_0	31.00 (8.83)	1.11 (6)	0.31
	T_1	33.71 (7.87)		
PSS	T_0	17.29 (6.52)	-2.17 (6)	0.07*
	T_1	13.14 (7.17)		

Note. N=7. ***Significant progress with $p<0.01$. **Significant progress with $p<0.05$. *Marginally significant progress with $p\leq0.10$. M=mean. SD=standard deviation. df=degrees of freedom.

Table 5
Overview of the results of only adherent participants on the nonparametric scales

Scales	Measuring moment	M (SD)	Z	p
PANAS Negative affect	T_0	19.14 (3.34)	-1.19	0.24
	T_1	16.86 (5.70)		

Note. N=7. M=mean. SD=standard deviation.

Table 6 gives an overview of the results of the four non-adherent people. The analysis shows that the non-adherent participants do not show any significant effects between T_0 and T_1.

Table 6
Overview of the results of only the non-adherent participants on normally distributed scales

Scales	Measuring moment	M (SD)	t (df)	P
MHC-SF total	T_0	2.96 (1.31)	-0.99 (3)	0.40
	T_1	2.76 (1.18)		
MHC-SF emotional	T_0	3.00 (1,31)	-1.57 (3)	0.22
	T_1	2.75 (1.32)		
MHC-SF Social	T_0	2.60 (1.31)	-0.12 (3)	0.92
	T_1	2.55 (1.35)		
MHC-SF psychological	T_0	3.25 (1.35)	-1.57 (3)	0,22
	T_1	2.88 (1.02)		
PANAS Positive affect	T_0	33.00 (8,60)	0.16 (3)	0,89
	T_1	33.50 (4.80)		
PANAS negative affect	T_0	22.25 (9.11)	0.09 (3)	0,93
	T_1	22.50 (9.47)		
PSS	T_0	18.00 (8.83)	-0.99 (3)	0.40
	T_1	15.25 (7.68)		

Note. N=4. M=mean. SD=standard deviation. df=degrees of freedom.

According to the individual scores, five of six participants who showed progress of well-being on all scales also showed an indication of clinically relevant progress. Two participants only showed progress on two to three of the well-being scales. Further, two participants showed regression on all well-being scales and one participant showed an indication for clinically relevant progress on social well-being, regression on psychological well-being and no differences on the other scales. A detailed overview can be found in Table 7 in Appendix B.

According to perceived positive and negative emotions, five of six participants who showed progress of positive emotions, also showed an indication for clinically relevant progress. Seven of the eight participants who showed reduction of negative emotions also showed an indication for clinically relevant reduction. Further, five participants showed decline of positive emotions and two participants showed an increase of negative emotions,

plus one person scored within negative emotions the same on the T_0 and T_1. A detailed overview can be found in Table 8 in Appendix B.

According to perceived stress, seven of eight participants who showed a reduction of perceived stress also showed an indication for clinically relevant reduction. The other three showed an increase of perceived stress. A detailed overview can be found in Table 9 in Appendix B.

User experiences

Within each of the user experience categories that were studied, of the seven adherent participants, five to six participants rated the intervention rather positive (71%-86%). Of the four non-adherent participants, one to two participants rated the intervention rather positive (25%-50%). This shows that within this study adherent participants experienced the intervention more positive than non-adherent participants.

Therefore, most of the adherent participants perceived the quality of the intervention as good, the difficulty of the intervention as quite easy and the time investment as quite little. Further most of them (think they) would recommend the intervention to other people, would follow it themselves again and would grade the intervention as good. More than half of adherent participants had at least once the feeling that they experienced a stressful day more positive than expected through doing the exercises. One to two adherent participants rated the quality as moderate, the intervention as very difficult, the time investment as quite a lot, and don't think they would recommend it to someone else, follow it themselves again, or have experienced a day more positive by following the intervention. An overview of the user experiences per topic within adherent participants can be found in Table 10.

In contrast, most non-adherent participants rated the quality of the intervention as moderate, the difficulty as (relative) difficult, and don't think that they experienced a stressful day more positive by doing the exercises. About half of non-adherent participants perceived the time investment as much, the other half perceived it as quite little, and half of them do think they would follow it themselves again as well as recommend it to someone else, the other half does not think so. Finally, half of the non-adherent participants graded the intervention as bad and the other half graded it as good. An overview of all user experiences per topic within non-adherent participants can be found in Table 11.

Concerning the aspects, participants experienced as most effective, almost everyone mentioned the 'three good things' exercise and about half of the participants mentioned the

'savoring - positive activities' exercise as most effective. Further, about half of the participants mentioned the intervention presented as an app, the notifications the participants received whenever a new exercise was available, and the detailed information about the intervention in the beginning of the intervention. Moreover, two people mentioned that the exercises were easy to do, and one participant mentioned the idea of such an intervention, with the focus on positive things, in general as effective. Another participant mentioned that it was positive to learn to show more interest to others.

In terms of the aspects participants experienced as least effective or interfering, seven participants mentioned the large number of notifications and reminders they have received, and incorrect notifications and reminders which popped up even if there was no exercise available at that moment. Additionally, half of the participants mentioned the small amount of different exercises without any variety. Three participants mentioned the fact, that you must do a specific exercise without having the chance to decide which exercise oneself wants to do. Further, two participants mentioned that the 'active-constructive responding' was difficult and it was not easy to think about a question to ask somebody as well as to find a person you wanted to ask. Additionally, two participants mentioned that it was too much time needed to do all the exercises every day, and two participants mentioned that it would be more effective if the app would also work without internet connection. In addition, two participants did not perceive the app as really positive and would like it to look more positive and more appropriate with the topic and exercises. Finally, one participant mentioned that it is not easy to focus on the intervention whenever you don't feel well.

Table 10
Overview of the user experiences within adherent participants

Topic	Rather negative		Rather positive	
Quality of the intervention in general	Bad 0	Moderate 2	Good 4	Excellent 1
Degree of difficulty	Very difficult 1	Relatively difficult 0	Quite easy 5	Very easy 1
Time investment	Very much 0	Quite a lot 2	Quite little 5	Very little 0
Recommending to people who are interested in strengthening positive emotions	No, surly not 0	No, I don't think so 2	Yes, I think so 3	Yes, sure 2
Follow the intervention again, if having the feeling of needing some positivity	No, surely not 1	No, I don't think so 1	Yes, I think so 3	Yes, sure 2
Feeling that a stressful day was more positive than expected, through doing the exercises	Completely never 1	I don't think so 1	Maybe 1	Yes, once or more 4
Grades for the overall intervention	Very bad 0	Bad 2	Good 3	Very good 2

Table 11
Overview of the user experiences within non-adherent participants

Topic	Rather negative		Rather positive	
Quality of the intervention in general	Bad 0	Moderate 3	Good 1	Excellent 0
Degree of difficulty	Very difficult 2	Relatively difficult 1	Quite easy 0	Very easy 1
Time investment	Very much 2	Quite a lot 0	Quite little 2	Very little 0
Recommending to people who are interested in strengthening positive emotions	No, surly not 0	No, I don't think so 2	Yes, I think so 2	Yes, sure 0
Follow the intervention again, if having the feeling of needing some positivity	No, surely not 0	No, I don't think so 2	Yes, I think so 2	Yes, sure 0
Feeling that a stressful day was more positive than expected, through doing the exercises	Completely never 0	I don't think so 3	Maybe 1	Yes, once or more 0
Grades for the overall intervention	Very bad 0	Bad 2	Good 2	Very good 0

Discussion

Conclusion

The aim of this pilot study was to test the effectiveness of this newly developed mHealth intervention, as well as to get an overview of the user experiences.

Within all participants there is significant reduction of perceived stress and marginally significant progress of total well-being, social well-being and psychological well-being. There is no significant improvement of emotional well-being and positive emotions and no significant reduction of negative emotions. Since positive emotions were the basis of the intervention, it was expected that especially positive emotions and emotional well-being would show most effects. The individual scores of the participants confirm the analysis.

Compared to analyzing all participants, within adherent participants only, significantly better effects were reached for well-being. There is significant improvement of total well-being, emotional well-being, psychological well-being and social well-being. Thus, for adherent participants all expected effects on well-being are confirmed. Further, there is marginally reduction of perceived stress. Also within adherent participants only there is no significant progress of positive emotions and no significant reduction of negative emotions. As expected, the results of only the non-adherent participants did not show any significant effects at all.

It can be concluded, that even though the focus of the intervention was set on (improving) positive emotions and the outcomes within well-being and perceived stress confirm the hypothesis, the hypothesis can only be confirmed partly. Effects were present in well-being and perceived stress but not in perceived emotions.

Because this was a quasi-experimental pilot study without using a control condition, it is at this point not possible to draw any conclusions about the causality of the intervention. Still interesting is the comparison of adherent and non-adherent participants, because the differences are tremendous, especially the obvious significant effects on well-being within adherent participants compared to non-adherent participants. Therefore, this gives an idea of possible causal effects of the intervention, because only when completing most of the intervention all components of well-being improved. The improvement of well-being also matches the outcomes of different other positive psychology interventions (Seligman et al., 2005; Sin and Lyubomirsky, 2009) and confirms the underlying *broaden-and-build theory* (Fredrickson, 1998). Additionally, the results also match with the results of the first pilot

study in which there was as well significant progress in well-being as no significant effects on positive emotions identified (Heinrich, 2015).

No increase of positive emotions is an unexpected outcome. Not only the whole intervention was based on positive emotions, also emotional well-being did increase, and according to the *broaden-and-build theory* (Fredrickson, 1998) this is an unexplainable result. *The broaden-and-build theory* assumes an upward spiral: through reinforcing positive emotions, well-being increases, and through an increased well-being, also positive emotions further increase (Fredrickson & Joiner, 2002). So, what could be the reason that there was no significant increase of positive emotions as well within the first pilot study as within this current pilot study? One possible reason could be the usage of an inappropriate measurement instrument. The PANAS (Watson, Clark and Tellegen, 1988) which was used as measurement instrument, is a valid, reliable, and much used instrument. The usual time range of perceived emotions used within the PANAS is 'at this moment'. This time range was also used within the first pilot. Within the current pilot study, it was widened to 'within the past 24 hours', to make it more independent of a persons' current feeling. Still, participants were asked about a relatively momentary/ short-term perception within both studies. In comparison, the time range used within the MHC-SF (Keyes, 2002) and the perceived stress scale (Cohen, Kamarck and Mermelstein, 1983) was 'during the past week'.

According to the user experiences, it can be concluded that adherent participants rated the intervention as more positive than non-adherent participants. It could be that participants stopped following the intervention because they perceived (parts of) the intervention as rather negative. It could also be the other way around and non-adherent participants rated it as rather negative because they stopped following it and therefore eventually haven't had any positive experiences with the intervention. Concluding, when following (almost) the whole intervention, most of the participants rated the intervention in total as rather positive. Further, even though someone might not perceive all studied aspects of the intervention as rather positive, this does not immediately stop people from taking part in the intervention.

Limitations of the current research

A limitation of this current research is the small number of participants which might influence the power of the intervention. Therefore, the intervention could be underpowered. With a bigger sample size the results might be more representative. Another limitation is the sampling method used within this study. The participants were highly educated and mostly

young adults. Therefore, the effects and user experiences might be totally different when using for example older and less educated participants. A third limitation of this study is the fact that it was a quasi-experiment, with using only one experimental group without any control condition. This limitation makes it impossible to say anything about the causality of the intervention because it is not known if any other, external factors caused the effects. Therefore, it is not possible to draw conclusions concerning the causality, thus that the intervention is the reason for the significant progress in well-being. A last limitation of the study was a technical problem, which was responsible for sending out more notifications to the participants than planned. It seemed that if the participants once did not complete any exercise they kept receiving notifications and reminders even though they completed any exercises that were available at a given moment.

Recommendations for future research

One recommendation for future research belongs to the results on the Positive and Negative Affect Schedule (Watson, Clark and Tellegen, 1988). In contrast to the time range used within the PANAS ('within the past 24 hours'), the time range used within the MHC-SF and PSS ('during the past week'), is more irrespective of short-term moments of not feeling well, and of momentary stress situations. Therefore, the used time range within the PANAS could be a possible influencing factor on the outcomes. It is recommended to do further research concerning the used time range, to see if this might change the effects within perceived emotions. One possibility of future research could be, to use the same time range within the PANAS as within the MHC-SF and the PSS, to see if the outcomes are different when using a broader time range. Additionally, it is recommended to make a trial with another measurement instrument, for example the mDES (Fredrickson, Tugade, Waugh, & Larkin, 2003), to gain more information and ideas on this unexplainable phenomenon.

In reaction to the user experiences and the participants' suggestions, a recommendation for future research is to make a trial with a broader variety of exercises. Therefore, either to use in addition to the three existing exercises a few more exercises based on positive emotions, or to use some other evidence-based positive psychology exercises, as 'gratitude visit', 'life summary' or 'strengths', which could make the content broader and provide more variety (Seligman et al., 2005; Seligman et al., 2006; Schueller & Parks, 2012). Using more different exercises could make the intervention more attractive, but it does not immediately have to. At this moment, it is only known that half of the participants would have

liked a broader variety. The current pilot study didn't give any insights, if more variety could make the intervention too complicated, complex or unattractive.

An additional recommendation regarding the user experiences is to use more persuasive technology principles to make the intervention and the app more attractive to users. According to the positive and negative experiences the participants made with the intervention and according to their suggestions, recommended principles are mainly 'personalization', 'tailoring', 'praise' and 'rewards'. 'Personalization' means to offer the users personalized content and services through presenting information in an order which matches with the users' relevance. 'Tailoring' means to provide tailored information for different groups of users regarding for example their interests or needs. 'Praise' means to give feedback through for example text messages or images. 'Rewards' means to give people credit and provide rewards for performing target behavior or in this case for completing the exercises (Oinas-Kukkonen & Harjumaa, 2009).

According to the negative opinions about the large number of notifications and reminders which were received when a new exercise was available or when exercises were uncompleted yet, it is recommended to program the app more user friendly. More suitable would be using only one notification when an exercise is available, and a maximum of one reminder per exercise instead of an arbitrary number reminders until all available uncompleted exercises are completed. Moreover, even though the participants were asked to adjust the pop-up notifications, to not miss any exercises, another recommendation for future research could be to let the participants decide for themselves if they want to use notification or if they do not want to use notifications. Within the current study the adherence was about 64%. If letting anyone decide for themselves to (not) use notifications, it would be interesting research to see if the adherence would be higher or lower. According to Kelders, Kok, Ossebaard, Gemert-Pijnen (2012) the average adherence within online interventions is around 50%, which is less than within the current study.

Finally, it can be concluded that even though there was no progress of positive emotions and no reduction of negative emotions measured within this study, the progress of well-being as well as the effects on perceived stress are promising. Furthermore, through the user experiences it was possible to draw useful conclusions and recommendations for future research, to develop an effective and user-friendly short-term mHealth intervention *Minitraining Positiviteit en Geluk*.

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Appendix A

User experience questions	Rating rather negative		Rating rather positive	
Wat vind je van de kwaliteit van de interventie Minitraining Positiviteit en geluk, die je binnen de laatste twee weken hebt gevolgd?	Slecht	Matig	Goed	Uitstekend
Hoe vond je het om de minitraining uit te voeren?	Heel moeilijk	Tamelijk moeilijk	Tamelijk makkelijk	Heel makkelijk
Hoe vond je de tijdsinvestering, die je voor de minitraining nodig had?	Heel veel	Tamelijk veel	Tamelijk weinig	Heel weinig
Stel dat jouw kennissen geïnteresseerd zijn aan het versterken van positieve gevoelens, zou je deze minitraining aanbevelen?	Nee, beslist niet	Nee, ik denk het niet	Ja, ik denk het wel	Ja, zeker
Zou je de minitraining nog een keer doen, als je het gevoel hebt wat positiviteit nodig te hebben?	Nee, beslist niet	Nee, ik denk het niet	Ja, ik denk het wel	Ja, zeker
Had je door de oefeningen eens het gevoel dat een stressvolle dag eigenlijk toch positiever was dan verwacht?	Helemaal nooit	Denk van niet	Denk van wel	Ja dat had ik een of meerdere keren
Welk cijfer zou je de Minitraining Positiviteit en Geluk geven?	Heel slecht	Slecht	Goed	Heel goed
Wanneer je terugkijkt op de minitraining: Kun je drie dingen noemen uit de minitraining waar je het meest aan hebt gehad?	1. 2. 3.			
Wanneer je terugkijkt op de minitraining: Kun je drie dingen noemen uit de minitraining waar je het minst aan hebt gehad?	1. 2. 3.			
Heb je nog enige suggesties ter verbetering van de Minitraining Positiviteit en Geluk?				

Appendix B

Table 7

Individual Sum scores and difference scores of all scales on the MHC-SF

Sample	Total			Emotional			Social			Psychological		
	T_0	T_1	Diff.	T_0	T_1	Diff.	T_0	T_1	Diff.	T_0	T_1	Diff.
1	4.64	4.21	-.43[1]	4.67	4.33	-.34	4.20	4.00	-.20	5.00	4.33	-.67[1]
2	1.50	2.64	**1.14**	2.00	3.00	**1.00**	0.60	1.40	**.80**	2.00	3.50	**1.50**
3	3.36	4.00	**.64**	3.33	4.00	**.67**	3.20	3.80	**.60**	3.50	4.17	**.67**
4	2.14	3.36	**1.22**	2.33	3.00	**.67**	2.20	3.40	**1.20**	2.00	3.50	**1.50**
5	3.57	3.79	.22	4.00	4.00	.00	3.20	3.60	.40	3.67	3.87	.20
6	3.07	3.57	**.50**	4.00	4.67	**.67**	2.20	2.40	.20	3.33	4.00	**.67**
7	2.43	3.93	**1.50**	3.00	5.00	**2.00**	1.60	3.20	**1.60**	2.83	4.00	**1.17**
8	2.43	2.71	.28	2.33	2.33	.00	1.80	1.80	.00	3.00	3.67	**.67**
9	2.57	1.79	-.78[1]	2.33	1.67	-.66[1]	2.60	1.40	-1.20[1]	2.67	2.17	-.50[1]
10	3.14	3.14	.00	3.33	3.33	.00	2.60	3.40	**.80**	3.50	2.83	-.77[1]
11	1.50	1.79	.29	1.67	1.67	.00	1.00	1.40	.40	1.83	2.17	.34

Note. **Bold**=indication for clinically relevant progress. [1]=indication for clinically relevant regression.

Table 8

Individual Sum scores and difference scores on the PANAS

Sample	Positive affect			Negative affect		
	T_0	T_1	Difference scores	T_0	T_1	Difference scores
1	42.00	38.00	-4.00¹	12.00	12.00	.00
2	13.00	20.00	**7.00**	19.00	29.00	10.00¹
3	36.00	38.00	2.00	17.00	15.00	-2.00
4	33.00	29.00	-4.00¹	25.00	17.00	**-8.00**
5	40.00	33.00	-7.00¹	19.00	14.00	**-5.00**
6	36.00	41.00	**5.00**	14.00	11.00	**-3.00**
7	31.00	43.00	**12.00**	20.00	16.00	**-4.00**
8	28.00	32.00	**4.00**	20.00	16.00	**-4.00**
9	29.00	27.00	-2.00	20.00	17.00	**-3.00**
10	38.00	36.00	-2.00	23.00	31.00	8.00¹
11	23.00	33.00	**10.00**	34.00	30.00	**-4.00**

Note. **Bold**=indication for clinically relevant progress. [1]=indication for clinically relevant regression.

Table 9

Individual Sum scores and difference scores on the PSS

Sample	T_0	T_1	Difference scores
1	9.00	4.00	**-5.00**
2	25.00	20.00	**-5.00**
3	18.00	14.00	**-4.00**
4	22.00	23.00	1.00
5	15.00	16.00	1.00
6	6.00	3.00	**-3.00**
7	22.00	8.00	**-14.00**
8	13.00	8.00	**-5.00**
9	18.00	17.00	-1.00
10	15.00	19.00	4.00[1]
11	30.00	21.00	**-9.00**

Note. **Bold**=indication for clinically relevant reduction of perceived stress. [1]=indication for clinically relevant increase of perceived stress.