What effect does a feel-good-management app have on the stress levels and on the physical health of entrepreneurs at the Digital Hub Bonn?

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Abstract

Background: Occupational stress and low amounts of physical activity are associated with negative consequences for individual health and well-being. Research has shown that especially entrepreneurs suffer from increased amounts of occupational stress and low physical health compared to salaried workers. The eHealth application *Fit*Mit5 is an occupational health management tool, which helps decrease stress and increase physical activity. This study aimed to evaluate which effect *Fit*Mit5 had on entrepreneurs at the DigitalHub in Bonn, how they used it and how they experienced this use.

Methods: A pretest-posttest study design using the Perceived Stress Scale (PSS) and the Patient Health Questionnaire (PHQ-15) was conducted ($N = 7$) and combined with a single case study ($N = 6$) with entrepreneurs from the DigitalHub in Bonn. The participants used *Fit*Mit5 for 10 working days. During the single case study, perceived stress and physical health were measured on five occasions (1) before intervention usage, (2) during intervention usage and (3) after intervention usage to identify the direct effect the intervention had on the individual participant. Additionally, the log data and the qualitative self-reported usage data was analyzed to gain insight into the usage of *Fit*Mit5. Lastly, the expected, current and past user engagement was measured with the Twente Engagement with Ehealth Technologies Scale (TWEETS) to detect to what extent user engagement can explain the effectiveness of the intervention.

Results: The results of the pre- and posttesting showed on average a significant decrease (24%) in the entrepreneur's perceived stress levels and a non-significant increase (22%) in their physical health. The single case design revealed that all participants perceived stress scores dropped. Additionally, five entrepreneurs were able to improve their physical health. The log data showed that the entrepreneurs used *Fit*Mit5 on average for 2.6 minutes each day, revealing low adherence as the developers recommended using it for five minutes a day. The qualitative data showed that the app was mainly viewed positively. All six entrepreneurs' actual user engagement was however, lower than the expected user engagement, suggesting the intervention did not meet their expectations.

Conclusion: The eHealth application *Fit*Mit5 proved itself to be effective in decreasing stress and improving physical health in entrepreneurs. However, due to low amounts of usage and lower actual engagement than expected engagement, the use of a participatory design process

is recommended, involving users in modifying the app in order to better suit their characteristics. This would probably lead to an increase in user engagement and, thus, usage.

Keywords: eHealth, perceived stress, physical health, user engagement, single case study

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Introduction

Occupational stress has been identified as a significant problem throughout the industrialized world (McGowan, Gardner & Fletcher, 2006). The World Health Organization considers it to be the "health epidemic of the 21st century" and it is estimated to cost American businesses up to 300 billion dollars a year (Fink, 2017). Occupational stress has been defined as the harmful physical as well as emotional responses that arise when job requirements do not match or exceed a worker's capabilities, resources or needs (Levy, Wegman, Baron & Sokas, 2017). In contrast to this, healthy work environments can be defined as ones in which people feel good, achieve high performance and enjoy high levels of well-being (Quick, Tetrick, Adkins & Klunder, 2003).

Additionally, physical inactivity has been identified as a global pandemic causing more than 5 million deaths and costing billions of dollars to societies all around the world (Ding et al., 2017).

Consequently, there is a need for occupational health interventions, aimed at improving workers' health and well-being or preventing symptoms from occurring in the first place (Beehr, 2019). In this study, the eHealth application *Fit*Mit5 which aims to help people decrease stress and increase physical activity will be studied.

The negative consequences of occupational stress for individual's health and mental well-being are increasing (McGowan, Gardner & Fletcher, 2006). Chronic stress resulting from work-related stressors, such as long working hours, shift work, job insecurity or workplace injustice, can lead to a wide range of illnesses. These can include mental disorders and cardiovascular disease (CVD) with related risk factors such as hypertension, obesity, diabetes and metabolic syndrome as well as musculoskeletal disorders.

Stress has also been linked to impaired health/lifestyle practices and maladaptive behavior, such as decreased exercise and physical activity as well as increased sedentarianism (Stults-Kolehmainen & Sinha, 2015). Physical inactivity and sedentary time are risk factors for many chronic health conditions, such as obesity, type 2 diabetes, osteoporosis, and cardiovascular disease and therefore impact one's physical health and wellbeing (Draper & Stratton, 2018). Though many occupations yield high amounts of stress, often resulting in such unhealthy behaviour, entrepreneurship has been identified to be inherently stressful (Eager, Grant & Martitz, 2015).

Entrepreneurship

The term “entrepreneur” is frequently used to describe a person who sets up a business, while taking on a financial risk in the hope of generating a profit (Gartner, 2001). Entrepreneurs must engage in multiple activities necessary to form and maintain a business. For example, an entrepreneur must take care of the internal aspects of the start-up, such as staffing, as well as external factors in the environment like competition and market changes. Furthermore, an entrepreneur must take care of their own psychological needs, such as maintaining optimism and self-efficacy, in order to cope with the uncertainty of the work (Sherman, Randall & Kauanui, 2015). The negative consequences of self-employment are well-established. To be self-employed is stressful and requires a lot of hard work, long working hours, increased job stress and, most of all, risk (Cardon & Patel, 2013). Prottas and Thompson (2006) described entrepreneurship as a two-edged sword, offering greater autonomy and self-fulfillment on the one hand, but creating greater pressure on the other. Even though self-employed workers often report higher job satisfaction compared to salaried workers, they seem to pay a price in terms of their health (Grant & Ferris, 2012). An early study of 450 entrepreneurs (Boyd & Gumpert, 1983) showed that up to 65% experienced physical stress symptoms, such as insomnia, headaches and back problems, at least once a week (Grant & Ferris, 2012). Furthermore, a Canadian study showed that the self-employed suffered from more psychosomatic health problems than salaried workers did (Jamal, 1997) and a European study showed that self-employed individuals experienced high percentages of stress, fatigue and muscular pain (Benavides et al., 2000).

Until now, there has been a lack of research into the use of occupational health strategies such as the development of healthy work practices and promotion of health at work (WHO, 1994) to improve the well-being of entrepreneurs.

Occupational health management strategies

The WHO has indicated that the workplace is a specially prioritized area for public health promotion and has emphasized an almost ethical obligation for a commitment from the workplace (Dalager et al., 2016). Occupational health and safety (OHS) management systems are activities and practices which organizations are required by law, to shield their workers from work-related sickness, disease and injury (United States Department of Labor, n.d.). While organizations might have different needs regarding their health and safety programs, depending on which branch they are in, some basic items such as correct work procedure, workplace inspection or emergency procedures should be implemented in any case (Canadian

Centre for Occupational Health and Safety, 2020). Unfortunately, smaller firms often lack the necessary resources for effective occupational safety and health activities (Cunningham & Sinclair, 2015). In this study, occupational health management strategies will be referred to as "feel-good management". The feel-good management style is still relatively new in the working world and has become particularly popular within the startup sector (Li, 2013). This is due to a change in the work culture, where young people place more value in workplace benefits such as having a mentor, receiving feedback or team-building exercises. A feel-good manager handles personnel and employee-related issues such as conflicts with other employees or organizes events for employees to get to know each other better (Rassek, 2019). Feel-good management is a valuable tool, which helps shape the company culture and ensures workplace well-being (Han, 2016). Due to limited resources, traditional public health and clinical interventions cannot offer early prevention and health promotion to all people experiencing early-stage physical or mental health issues.

Well-being through digital health

One way of supplying entrepreneurs with an OHS intervention to reduce their stress levels and improve their physical health is through digital health. While eHealth has been defined by the WHO as the use of information and communication technologies for health, digital health is an umbrella term for areas including eHealth, telehealth and more (Digital Health & Informatics Network, 2017). Digital health services can be used in order to support health and well-being as well as for dealing with mental health and stress symptoms (Heikkilä & Mattila, 2018). They enable affordable, anonymous, and self-paced access to well-being services. Digital health services can be especially useful for supporting entrepreneurs as they are inexpensive to distribute, can be tailored to various needs, do not require appointments or occupational health care, and can be used independent of time and place (Heikkilä & Mattila, 2018). Furthermore, they can offer the feeling of having a virtual community of peers, which entrepreneurs often do not have (Heikkilä & Mattila, 2018).

One of the main goals of eHealth is not simply to provide information, but rather to aid individuals in their process of behavior change. However, many eHealth evaluations report no or only limited positive effects (Sieverink, 2017). There is strong evidence that this is often due to participants not using the technologies in the desired way. Either participants do not use the intervention at all, stop using the technology after a period of time or do not use the available elements of the technology as intended. Therefore, it is necessary to identify

how the use of technology relates to the engagement of the individual user and how the technology fits the user and the context (Sieverink, 2017). Engagement is seen as an important factor when trying to explain why interventions are beneficial to some and not to others (Kelders & Kip, 2019). Yet up until now, within the context of eHealth, there is no shared understanding of what engagement is. So far, engagement has been described as the extent of usage and a subjective experience characterized by attention, interest and affect, but offers only little information on what this subjective experience is, meaning there is a need for more qualitative research. Even though, the definition states that engagement is more than simply the usage of a system, most eHealth studies merely measure engagement in behavioral terms, i.e. as usage (Kelders & Kip, 2019). Therefore, this study will make use of a newly developed scale to measure user-engagement in the occupational eHealth intervention *Fit*Mit5, focusing on the users' subjective experience with the technology.

The eHealth intervention *Fit*Mit5, which will be described in more detail in the method section below, has been developed to decrease stress and increase physical activity and this study aims to evaluate its effects. Up until now, however, eHealth tools are often evaluated through randomized controlled trials (RCT's). RCTs are often used in medical research as they offer valuable insights into the effectiveness of an intervention. However, a prerequisite for this methodology is for it to employ the technology as a fixed entity for all participants throughout the entire intervention period. Yet, eHealth technology evolves quickly and continuously, therefore by the time the results of the RCTs are available the intervention may have already become redundant. Therefore, within eHealth research, only limited insight has to-date been obtained into actual process outcomes or into how the use of the technology has contributed to the user's ability to have a healthier life, increased well-being or form new habits. Therefore, eHealth is often perceived as a black box (Sieverink, 2017). In order to open this black box of eHealth, methodologies must go beyond the classic effect evaluations such as RCTs. An alternative to this traditional method therefore might be the usage of single case designs. This type of method enables high-quality research with small numbers of individuals in populations that are small, too heterogeneous, or too atypical to form a group in RCTs. They make it possible for an intervention to be tailored to the individual needs of its users, and to assess its effectiveness (Krasny-Pacini & Evans, 2017).
This current study aims to evaluate the eHealth intervention *Fit*Mit5 and in the course of this focuses on answering the following research questions:

RQ 1a: Is there a significant decrease in stress after using the feel-good management intervention *Fit*Mit*5*?

RQ 1b: Is there a significant increase in physical health after using the feel-good management intervention *Fit*Mit*5*?

RQ 2: How do perceived stress levels and the amount of physical health change during the usage of the intervention *Fit*Mit*5* for the individual participant?

RQ 3: In what way do the participants use the intervention *Fit*Mit*5*?

RQ 4: In what way do the participants experience the intervention *Fit*Mit*5*?

RQ 5: To what extent can user engagement be used to explain effectiveness and usage of the intervention *Fit*Mit5?

Method

Study design

The eHealth intervention *Fit*Mit*5* was used for five types of evaluation: (1) pretest-posttest study design, (2) single case design, (3) log data, (4) self-reported data on usage and (5) relationship between user engagement and the effectiveness of the intervention.

Firstly, a pretest-posttest study design was employed using quantitative research and online questionnaires in order to measure the entrepreneurs' perceived stress (RQ 1a) and physical health (RQ 1b) at baseline as well as after the usage of the intervention. This was necessary in order to identify what effect the intervention *Fit*Mit*5* had on the entrepreneurs' stress levels and on their physical health. In addition to the pretest-posttest study design and in order to answer research question 2, a single case study design was conducted on perceived stress and physical health among entrepreneurs. The purpose of this was to identify if or how the individual participant's stress levels and their physical health changed during the usage of the intervention. Single case studies (SCS) can be used in order to test the efficacy of an intervention using a small number of individuals. The added value of this type of method is that individual behavior is repeatedly measured both in the absence and presence of a specified intervention. By studying less subjects but more intensely, greater insight can be obtained into the intervention's effects (Krasny-Pacini & Evans, 2017). Research question 3 was answered by collecting and analyzing log data regarding the amount of usage of the intervention in order to identify individual user patterns. The analysis of log data (anonymous records or real-time actions carried out by the user) can deliver continuous and objective insights into the actual usage of and adherence to a technology. Therefore, it gives new insights into how the usage of the technology contributes to the effects of the technology (Sieverink, 2017).

Furthermore, to answer research question 4, qualitative, self-reported data regarding the users' experience with the intervention as well as feedback on the intervention were gathered. In this way, it was possible to ascertain how the individuals experienced the usage of the intervention.

Lastly, in order to answer research question 5, expected user engagement, current user engagement and past user engagement were measured throughout the intervention for the purposes of identifying to what extent user engagement can explain the effectiveness of the

intervention. All outcome measurements of this mixed method approach will be contextualized in the result section under the paragraph synthesis.
This study was assessed and approved by the Ethical Committee of the Behavioral Medicine and Social Sciences (BMS) faculty at the University of Twente in Enschede, Netherlands.

Description of the intervention

The intervention *Fit*Mit*5* is a digital training platform aimed at office workers. Its goal is, on the one hand, to help its users incorporate more physical activity into their everyday work schedule and, on the other hand, to offer mindfulness relaxation exercises in order to reduce stress. After logging in either through the web application or via the mobile app, the user can decide whether they would prefer to do a stress reducing (mindfulness) exercise or a physical exercise. The intervention offers various five-minute tutorial videos, each consisting of five different exercises lasting one minute each. The users watch these, while performing the exercise themselves. One exercise a user can do would, for example, be setting both hands on the table, while standing in front of their desk, and lifting each leg alternately towards the desk. This exercise strengthens the core muscles. A picture of this exercise can be viewed in Figure 1a. The developers recommend using the intervention twice a day for five minutes in order to achieve long-term positive results. However, using it once a day for five minutes is also considered being adherent to the technology (*Fit*Mit5, 2017). In the event that the user would prefer to do a customized exercise, the intervention asks them four questions: 1) How is the user feeling (tired, normal or good)? 2) Is the user at their desk (yes/no)? 3) Which type of exercise would the user like to focus on (back, neck, full-body workout or metabolism exercises)? 4) Does the user have any equipment on hand (no equipment, a duo ball (which is a massaging tool to be used on the back along the spine) or an elastic band). Based on this information, the intervention creates a customized intervention video, which the user can follow. Each video gives clear instructions on how to perform the exercises and offers motivational support through a pep talk. The intervention also offers dietary advice as well as training plans for intense workouts.

Many large companies, such as Deutsche Telekom (T-Mobile) or Robinson Club GmbH, have used this intervention in their company and reported positive feedback. They stated that the effectiveness and the quality of the exercises were fantastic and that their employees were highly motivated to use this intervention (*Fit*Mit5, 2017). The exercises are based on scientific sport research and can be executed at a desk or on the way to an

appointment, depending on the user's workday. The intervention's interface can be viewed in Figure 1b.

Figure 1a: Intervention interface

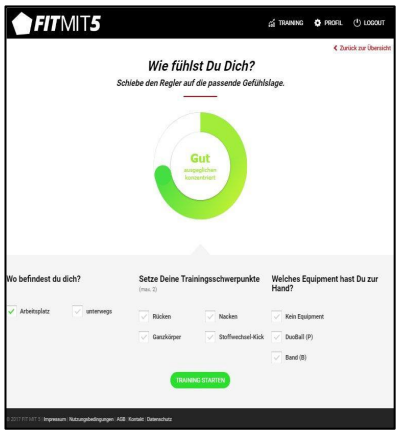

Figure 1b: Exercise example

Participants. This study was targeted at entrepreneurs working in various start-ups in the Digital Hub in Bonn. The inclusion criteria were that the participants had to be at least 18 years old and understand German, as the intervention and all related study material were only offered in German. In total 24 participants were recruited and invited to a kick-off event on the 2nd December 2019 at the Digital Hub. Ultimately, eight entrepreneurs attended the event at which motivational coaches gave an introduction into the eHealth intervention *Fit*Mit5 and the entrepreneurs were informed about the aim of the project and the purpose of the study by the researcher. They were encouraged to ask questions or state any concerns they might have about the project. When they showed interest in participating in the study, they were asked to sign a consent form and then received login details for an account for the eHealth application. Ultimately, seven participants filled in the pre- as well as the posttest questionnaire. The same participants who took part in the pretesting and posttesting were also invited to partake in the single case design. In total, six of them participated in the single case study ($N = 6$) as one participant had to be excluded, due to not filling in enough data.

Materials. The online questionnaire was generated through Survey Monkey. The content of each questionnaire used in this study will be explained in the following section. A clear overview over the procedure, of which questionnaire was employed at which point in time in this study can be viewed in Figure 2. Furthermore, the entire questionnaire can be viewed in the appendix.

Demographic questions. The entrepreneurs answered five questions about their demographics. They named their gender, their age and their highest educational qualification

attained. Furthermore, they stated how many hours per week they work and their email address to make it possible to link their amount of usage of *Fit*Mit5 to the questionnaire results.

Perceived stress. In order to measure the stress levels of entrepreneurs at baseline, the Perceived Stress Scale (PSS) was used (Cohen, 1994). It consists of ten items measuring to what degree situations in one's everyday life are interpreted as stressful. Furthermore, it measures a person's current level of experienced stress. The posed questions are regarding feelings and thoughts during the last month, for example: "In the last month, how often have you been upset because of something that happened unexpectedly?" The respondent can answer each question on a 0-4-score *Likert* scale. The individual scores on the PSS can range from 0 to 40. A score ranging from 0-13 is considered low stress, scores between 14-26 are considered moderate stress and scores ranging from 27-40 are considered high-perceived stress (EAP, n.d.). In this current study (N = 7), during the pre-testing the PSS showed α = 0.961 and during the post-testing α = 0.975. Therefore, during both the pre- and post-testing the scale demonstrated excellent reliability.

Physical health. Physical health was measured by using the Patient Health Questionnaire 15 Item Somatic Symptom Severity (PHQ-15) questionnaire. The PHQ-15 is a somatic symptom subscale derived from the Patient Health Questionnaire (PHQ). The PHQ-15 encompasses 15 somatic symptoms, such as stomach or back pain and each symptom scored from 0 ("not bothered at all") to 2 ("bothered a lot"). Patients are asked to indicate the severity of each symptom as 0 = not bothered at all, 1= bothered a little or 2 = bothered a lot. The PHQ-15 score is sub-divided into multiple categories in order to illustrate the relationship between graded increase in somatic symptom severity and various health outcomes. Low PHQ-15 scores indicate minimal levels of somatic symptom severity, whereas high PHQ-15 scores indicate high levels of somatic symptom severity. Scores ranging from 0-4 indicate minimal somatic symptom severity, scores between 5-9 reveal mild somatic symptom severity, scores between 10-14 show medium somatic symptom severity and scores between 15-30 display high somatic symptom severity (PHQ-15, n.d.). In this current study, during the pre-testing the PHQ-15 revealed α = 0.798 and during the post-testing α = 0.879. Therefore, during both the pre- and post-testing the scale demonstrated good reliability.

Log data. The log data (number of minutes the intervention was used per day by each entrepreneur) was collected by the *Fit*Mit5 company and shared with the researcher.

***Fit*Mit5 questionnaire and questionnaire on usage.** The *Fit*Mit5 questionnaire was developed by the creators of the *Fit*Mit5 intervention. It consists of ten items asking the participant about their physical and mental well-being such as whether they are experiencing neck pain or how stressed they feel in everyday life. The participants can indicate their answers on a scale between 0-10, herby 0 being never and 10 being always. Additionally, they pose questions about the participant's general satisfaction and give the participants the opportunity to name points of improvement for the intervention.

During the single case study, the participants received three online questionnaires on day 3, day 5 and day 7 of the intervention. These were the same as the questionnaires used for the pre- and posttesting. However, four questions were added to the online questionnaire regarding the participant's usage of the eHealth intervention *Fit*Mit5 in order to obtain relevant self-reported data. The questions were: (1) For how many minutes did you use *Fit*Mit5 today?; (2) Did you do a meditation exercise today?; (3) Did you do an activating exercise today and, if so, which one did you select? and; 4) Did you use one of the recipes provided by *Fit*Mit5?

TWente Engagement with Ehealth Technologies Scale. In order to measure user engagement, the TWente Engagement with Ehealth Technologies Scale (TWEETS) by Kelders & Kip (2019) was used. TWEETS is a newly developed scale and can measure user engagement with a specific technology at different times, such as after the first use (expectations of engagement), during the usage (current engagement) and after the intervention is finished (past engagement). An example item could be when measuring the expected user engagement: "I think I will enjoy using this technology". For this study, expected-user engagement regarding the eHealth intervention *Fit*Mit5 was measured during the pretest. Current user engagement with the eHealth intervention *Fit*Mit5 was measured during the single case study and past user engagement with the eHealth intervention *Fit*Mit5 was measured during the posttest. Respondents must indicate their answers on a five-point *Likert* scale. Due to the fact that it is a newly developed scale, it has not yet been validated. In the current study, ($N = 7$), during the pre-testing the Tweets showed $\alpha = 0.944$ and during the post-testing $\alpha = 0.947$. Therefore, during both the pre- and post-testing the scale demonstrated excellent reliability.

Procedure.

The online questionnaire for the pre- and posttest was sent to the entrepreneurs via email on the first and on the last day of the intervention period. In total the participants made use of the

eHealth intervention *Fit*Mit*5* for a period of ten working-days. The participants were allowed to use the intervention over the weekend, however it was not specifically required. A reminder was sent via email during the intervention period asking the participants to remember to fill in the posttest questionnaire. The participants had the possibility of contacting the researcher regarding the outcome of the study.

All participants also taking part in the single case study received a total of five online questionnaires during the 10-day intervention period. They received the online questionnaires for the pre- and posttest study and additionally three online questionnaires during the actual usage of the intervention on day three, day five and day seven. The participants received a reminder via email on day six of the intervention to fill in all questionnaires. Figure 2 shows a summary of the procedure.

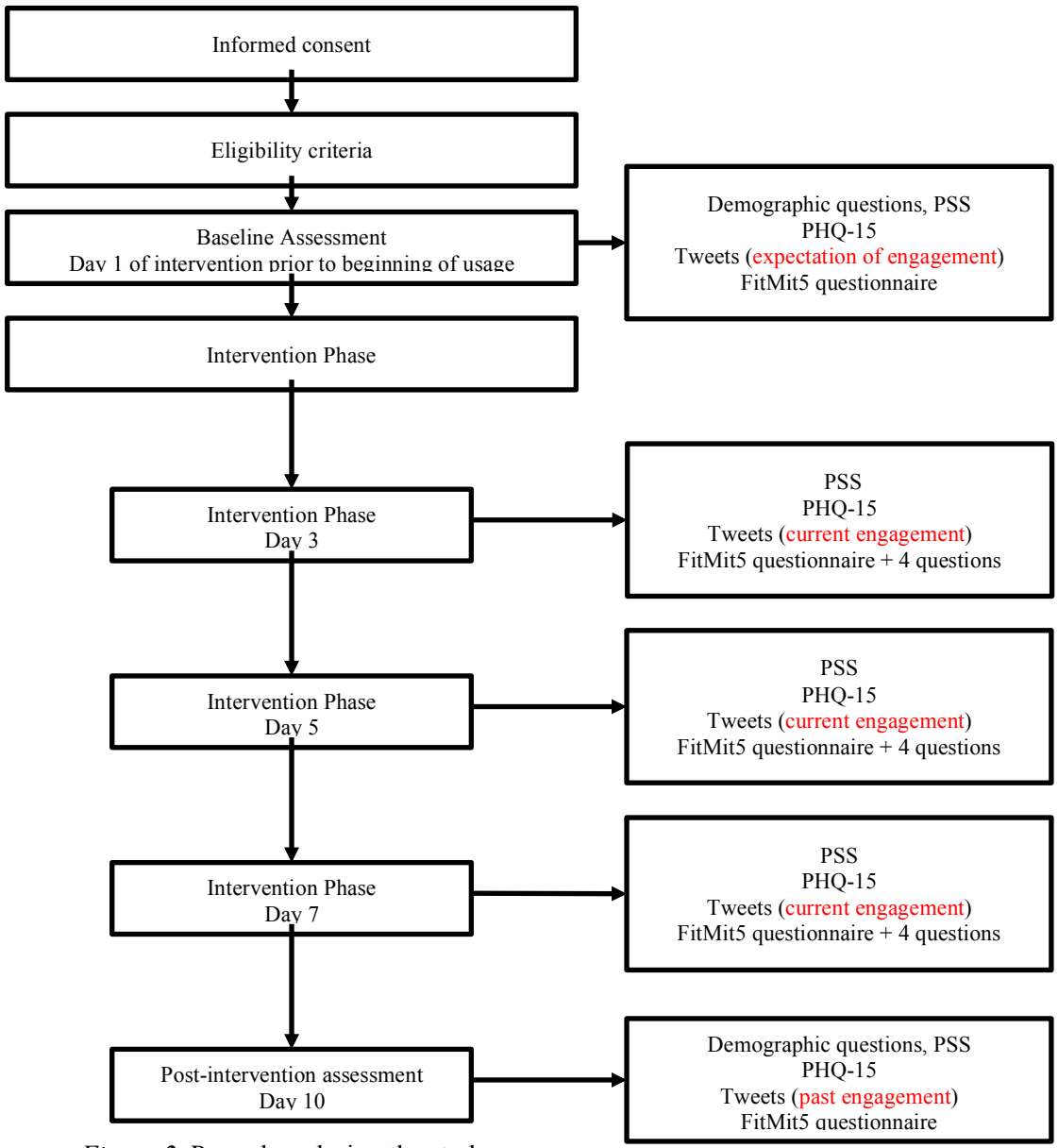

Figure 2. Procedure during the study.

Data analysis.

In order to carry out the pre- and posttest, the data was organized and analyzed by using the statistical analysis software SPSS and Microsoft Excel. The demographic data such as age, gender and highest educational qualification obtained were analyzed descriptively. The further data was then coded according to the requirements of the three questionnaires (PSS, PHQ-15 and Tweets). Due to the small sample size, it was necessary to analyze whether a normal distribution existed. According to Bortz (2016), if a small sample size exists when testing for normal distribution, the Shapiro-Wilk test with $p < .25$ is most beneficial as it takes the type II error into account. The Shapiro-Wilk test confirmed that the data did not show a normal distribution for perceived stress ($p = .065$) or for physical health ($p = .230$). On the basis of the results the Shapiro-Wilk test revealed, a Wilcoxon-test was carried out in order to determine whether or not the usage of the intervention had a significant effect on the participants. This was done both for the variables perceived stress and physical health. Furthermore, whether user engagement improved during the course of the intervention was analyzed. The Shapiro-Wilk test here fore confirmed that the data did not show a normal distribution for user engagement ($p = .001$). Additionally, Grubbs' test using the software GraphPad Prism to detect significant outliers was used.

For the single case study, graphical representations of the time-series measures for the variables perceived stress, physical health and user engagement were created for each participant for the five points in measurement. Due to the fact that only a few participants filled in all five questionnaires, the graphs were created to suit the amount of measurement points the participants did partake in. This technique was employed in order to identify through visual inspection whether the effectiveness of the intervention increased over time for each individual (Krasny-Pacini & Evans, 2017). All points of measure were anticipated to be below (for perceived stress and physical health) and above (for user engagement) the dotted line, being the baseline measure, displaying the effectiveness of the intervention for each individual.

The log data was analyzed descriptively in order to identify for how many minutes on average per day the users used the intervention. Furthermore, the qualitative data regarding the users' experience with the intervention were summarized and contextualized.

Lastly, the extent to which the user engagement could explain the effectiveness of the intervention was identified by calculating a Pearson correlation. All the obtained data was finally brought together in a "synthesis" in order to detect the relationship between them.

Results

In total ten participants fully completed the pre-test questionnaire and seven participants completed the post-test questionnaire. Therefore, the total sample size consisted of seven participants ($N = 7$). Five participants were female and two participants were male. The youngest participant was 21 years old and the oldest participant was 49 years old, the overall mean age being 30 years ($SD = 8.78$). Four participants had obtained a high-school diploma while three participants had obtained a university degree.

Perceived Stress.

On average perceived stress decreased by 24% for all participants when examining the self-reported data before and after the usage of the intervention. The Wilcoxon test revealed statistically significant results for perceived stress $p = .026$; $z = 2.226$. Additionally, the effect size was determined by calculating Cohen's r. A large effect size could be identified for the PSS ($r = .84$).

In total, six participants took part in the single case study. Among them, were four females ($N = 4$) and two males ($N = 2$). The average age was 31 years old ($SD = 10.06$) and three participants had obtained a high-school diploma and three participants had obtained a university degree. One participant filled in all five questionnaires while the other five participants each filled in three questionnaires.

The measures for the single case study for perceived stress for all participants can be seen in Figure 3. The average score before the intervention was considered to be a moderate amount of stress (PSS score = 18). After the intervention the average score was considered to be a low amount of stress (PSS score = 13). The results of participant 5 were detected as a statistical significant outlier. Nevertheless, due to the small sample size the participant was included in the study results. The graphs show that overall all six participants perceived stress scores dropped when comparing the values before and after the intervention. While the amount of perceived stress decreased for all participants after the usage of the intervention, participant 4's amount of perceived stress decreased from medium to low perceived stress, resulting in scores in the "low stress category" of the PSS.

Perceived Stress (PSS)

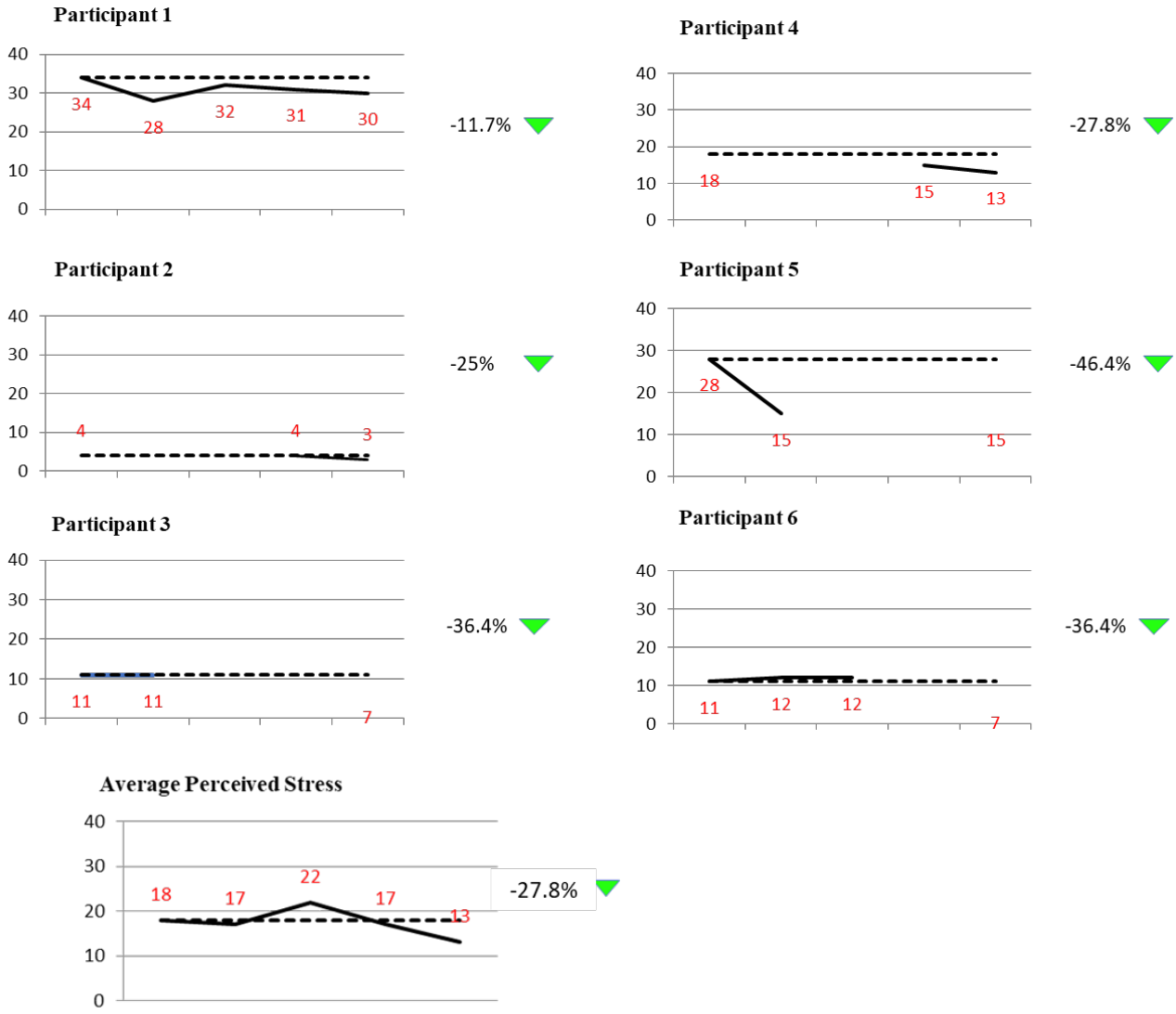

Figure 3: Perceived Stress Scale (PSS) scores representing individual user's baseline measurement (dotted line) and their individual scores (bold line) during 5 measurement points: baseline (day 1 of the intervention), during the intervention (days 3, 5 and 7) and post-intervention (day 10 of the intervention).

Physical health.

On average somatic symptom severity scores decreased by 22% for all participants when examining the self-reported data before and after the usage of the intervention. The Wilcoxon test revealed a non-statistically significant result for physical health $p = .071$; $z = 1.807$. Additionally, a large effect size could be identified for the PHQ-15 ($r = .68$). The measures for the single case study for physical health can be seen in Figure 4. The average score before the intervention was of mild somatic symptom severity (PHQ-15 score = 8). After the intervention the average score was also of mild somatic symptom

severity (PHQ-15 score = 6). The results of participant 5 were detected as a statistical significant outlier. Nevertheless, due to the small sample size the participant was included in the study results. The graphs reveal when looking at the somatic symptom severity scores that the values decreased for five participants while using the intervention (the lower the score, the less physical health problems). Participant 1's score increased. After the intervention usage participant 4 and 5 showed mild amounts of somatic symptom severity instead of medium amounts of somatic symptom severity, resulting in scores in the "mild somatic symptom severity category".

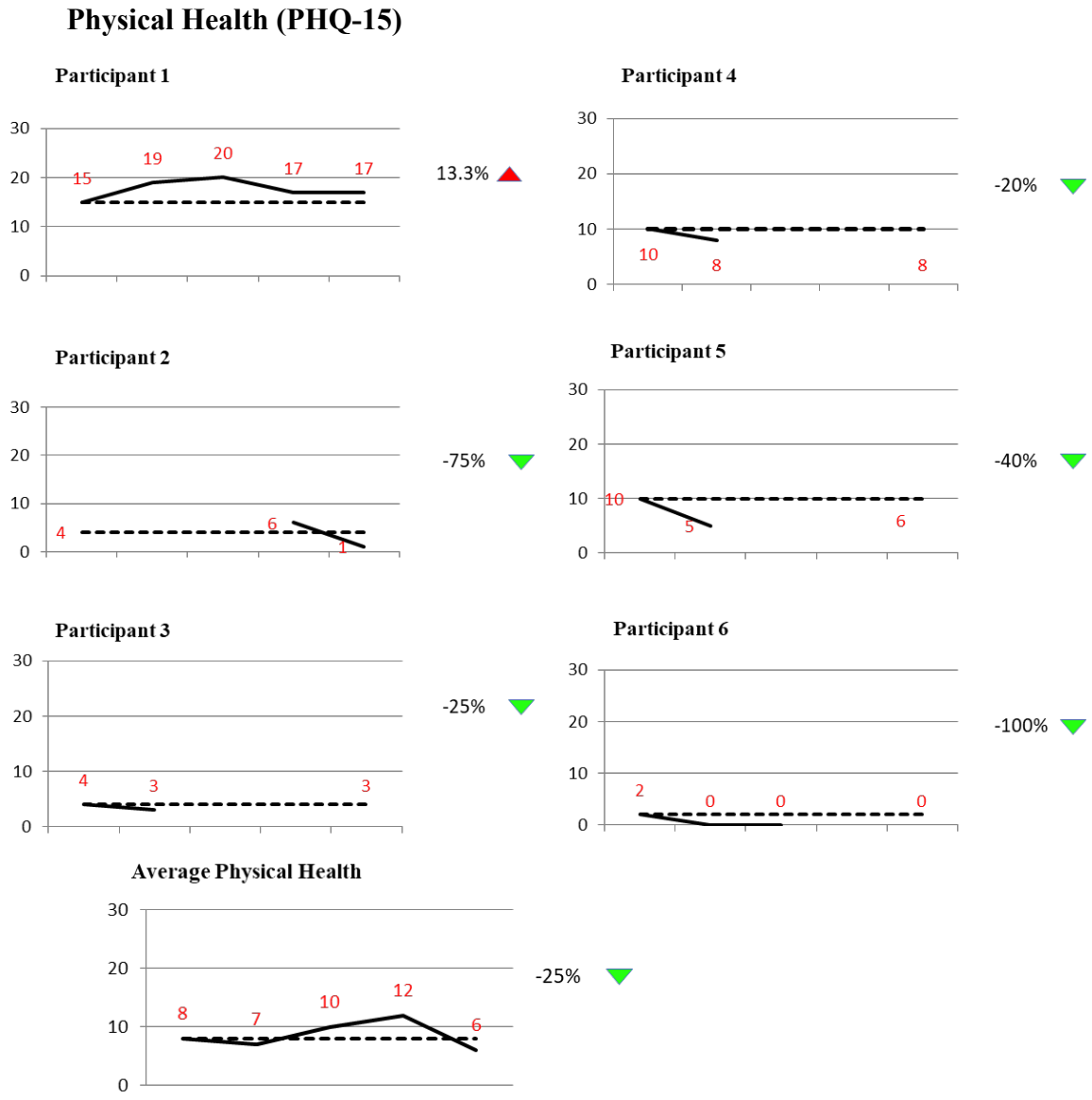

Figure 4: P*atient Health Questionnaire 15-Item somatic Symptom Severity Scale (PHQ-15) scores representing individual user's baseline measurement (dotted line) and their individual scores (bold line) during 5 measurement points: baseline (day 1 of the intervention), during the intervention (days 3, 5 and 7) and post intervention (day 10 of the intervention).*

Log data.

The log data shows that the entrepreneurs used the *Fit*Mit5 application on average for 2.6 minutes each day. Only one participant (participant 1) was adherent to the intervention according to the developers, as they used *Fit*Mit5 on average for six minutes each day. The log data for each participant regarding the average usage of the intervention per day can be seen in Table 1.

Table 1

Log data

Participant	Average usage of intervention in minutes per day (SD)
Participant 1	6.0 minutes (3.74)
Participant 2	1.5 minutes (3.20)
Participant 3	2.0 minutes (3.31)
Participant 4	3.6 minutes (3.95)
Participant 5	2.0 minutes (3.31)
Participant 6	0.6 minutes (1.89)
Total average for all participants	2.6 minutes (1.92)

Note. Intervention usage for 10 working days.

Self-reported usage.

Question 1 asked the users how many minutes per day they trained with *Fit*Mit5. However, most entrepreneurs did not answer this question and can therefore not be analyzed. Question 2 asked the users whether they made use of a meditation exercise. Only one participant used this, while the others stated that they had not. Question 3 asked the participants whether they used an activating exercise. All participants indicated that they did not perform an activating exercise. Question 4 inquired whether the participants made use of any of the recipes provided by *Fit*Mit5. None of the participants had used this function when asked about it

Positive Feedback. The *Fit*Mit5 questionnaire gave the entrepreneurs the possibility to give feedback on the intervention. The qualitative data revealed that the participants, overall, viewed the intervention *Fit*Mit5 positively. Multiple positive aspects were mentioned in regard to the usage of the intervention. One participant commented that it was easy to use and

self-explanatory. Another one responded that it was challenging in a good way. Additionally, one participant praised the fact that the exercises could be done at one's desk. Lastly, one participant stated that they enjoyed the meditation exercises

Points of improvement. The answers to the *Fit*Mit5 questionnaire showed that, despite the overall positive feedback, the users had some ideas as to how to improve the intervention. In total, the participants named five different points of improvement during the usage of the intervention. Two users mentioned that it would be nice to get a daily reminder to do the exercises. Four participants thought that the design and user interface of the intervention could be user-friendlier, however did not mention any suggestions as how to improve it. Furthermore, two participants wished for the intervention to be more personalized. Additionally, two participants wished for the intervention to have a progress bar and two thought that the meal plans could be improved.

User engagement.

On average user engagement decreased by 22% for all participants when examining the self-reported data before and after the usage of the intervention. The Wilcoxon test revealed a statistically significant result for user engagement $p = .018$; $z = 2.375$. Additionally, a large effect size could be identified for the Tweets questionnaire ($r = .9$).

The measures for user engagement can be seen in Figure 5. The results of participant 3 were detected as a statistical significant outlier. Nevertheless, due to the small sample size the participant was included in the study results. The graphs show that all six participants expected to be more engaged in the technology than they in fact were after the usage of the technology. During the course of the intervention usage, the current user engagement was measured which revealed lower engagement scores compared to the expected user engagement. When measuring the expected user engagement before the start of the intervention, participants 1, 3 and 5 expected to be very engaged, but after the intervention, when measuring the past user engagement, participant 3 reported not being engaged. Participant 2 did not expect to be so engaged before the intervention and also reported not being engaged after the intervention. Participants 4 and 6 expected to be somewhat engaged in technology before the intervention and stated still being engaged after the intervention.

User engagement (Tweets)

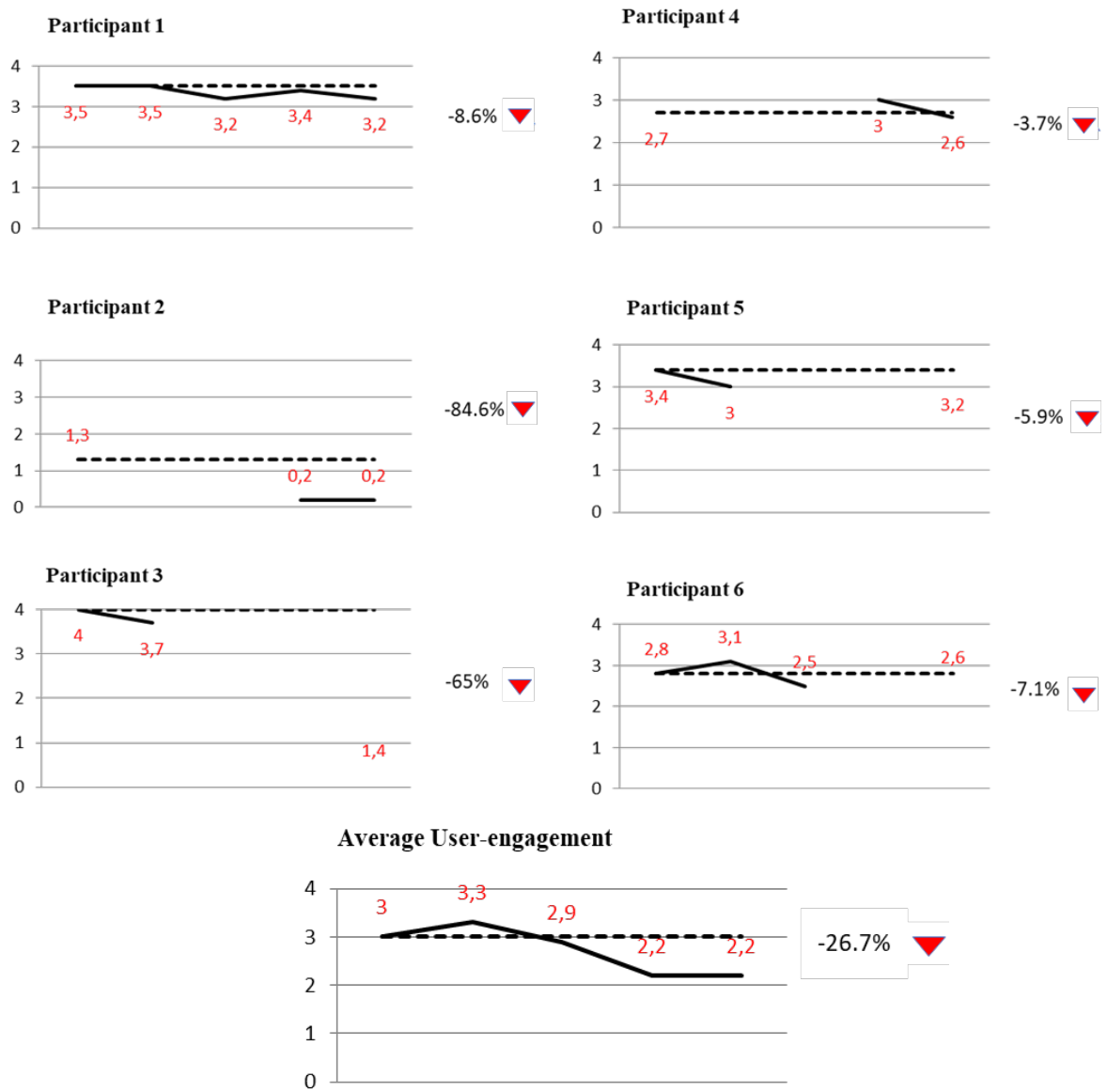

Figure 5: Twente Engagement with Ehealth Technologies Scale (TWEETS) scores representing individual user's baseline measurement (dotted line) and their individual scores (bold line) during 5 measurement points: baseline (day 1 of the intervention), during the intervention (days 3, 5 and 7) and post intervention (day 10 of the intervention).

The Pearson correlation revealed no significant association between the expected user engagement scores and the discrepancy between the perceived stress scores before and after the intervention ($r_{(5)}$ = .555, p = .196). Neither did a significant association become apparent between the expected user engagement and the discrepancy between the physical health scores before and after the intervention ($r_{(5)}$ =.405, p = .367). Furthermore, no significant association could be proven between the

expected user engagement and the discrepancy between the engagement scores before and after the intervention ($r_{(5)}$ =.358, p = .430). Lastly, no significant correlation was found between the expected user engagement and the average amount of time spent using the intervention ($r_{(5)}$ =.739, p = .093). Thus, high expected user engagement scores do not seem to explain the effectiveness of the intervention when looking at the difference in perceived stress scores, physical health scores, engagement scores or the amount of usage of the intervention compared to users with low expected user engagement scores.

Synthesis.

Table 2 shows each participant's decrease in perceived stress and de- or increase in physical health related to their past user engagement. Furthermore, the average amount of time spent on using the intervention can be seen.

Table 2

Perceived stress and physical health linked to past user engagement and log data.

Participant	Log data in minutes	Decrease in perceived stress	Increase in physical health	Past user-engagement scores
Participant 1	6.0 minutes	-11.7%	-13.3%	Engaged (3.2)
Participant 2	1.5 minutes	-25.0%	+75.0%	Not engaged (0.2)
Participant 3	2.0 minutes	-36.4%	+25.0%	Not engaged (1.4)
Participant 4	3.6 minutes	-27.8%	+20.0%	Somewhat engaged (2.6)
Participant 5	2.0 minutes	-46.4%	+40.0%	Engaged (3.2)
Participant 6	0.6 minutes	-36.4%	+100%	Somewhat engaged (2.6)

Trying to relate the data to each other indicates that there might be a relationship between the amount of usage of the intervention and the user engagement. For instance, participant one, who used the intervention for the most amount of time per day, was also most engaged in the technology. Furthermore, this participant showed a decrease in perceived stress, indicating that the intervention can be successful when the user shows adherence as intended by the developers. In addition to that, participant four used the intervention the second most and was also somewhat engaged with the technology and managed to decrease perceived stress and

increase physical health scores. Even though a relationship between usage and engagement cannot be seen or statistically proven in this sample, most likely due to the small sample size, the possibility that it exists cannot be excluded.

Discussion

The current research used a mixed methods approach in order to identify the effectiveness of the eHealth intervention *Fit*Mit5 for entrepreneurs. Due to the small sample size, this was difficult. However, the findings do point towards the intervention *Fit*Mit5 in fact being effective in reducing one's stress levels within a short period of time, as the results revealed significant outcomes. The pre- and posttest showed that the perceived stress levels were significantly reduced in all participants. Additionally, the single case design identified, by graphically displaying the measured variables over five points in measurement, that all six entrepreneurs managed to decrease their individual perceived stress levels. In regard to improving one's physical health, even though the results did not reveal significant outcomes, the pre- and posttest showed a decrease in physical health scores (the lower the score the better). The single case design identified that five of the entrepreneurs were successful in decreasing their individual physical health score.

Regarding the usage of the intervention, only one participant made use of the app for the recommended amount of time per day. This shows that the entrepreneurs were not adherent to the technology. Additionally, the entrepreneurs did not in fact use most of the options offered by the app. The qualitative data showed that overall *Fit*Mit5 was viewed positively by the participants. However, they also had some suggestions for improvement. Lastly, and contrary to the researcher's expectations, the expected user engagement was higher than the past engagement, indicating that the intervention might not have met the users' expectations.

According to the recommendation of *Fit*Mit5, the intervention should be made use of for at least five minutes a day, preferably twice a day in order to lead to positive results (*Fit*Mit5, 2017). However, the collection of log data showed that most entrepreneurs did in fact not use the technology as recommended, which leads to the conclusion that the users were not adherent to the technology. Yet, research shows that people often need to stick with the technology and use it in the way that the developers intended in order to benefit from it. Thus, simply starting to use it, is often not enough (Gemert-Pijnen et al., 2018). Furthermore,

a relationship between the concepts of adherence and effectiveness has been identified, emphasizing the importance of improving adherence to *Fit*Mit5. However, as past research has shown, adherence is a major issue in eHealth. For example, web-based interventions have revealed that often less than half the participants adhere to interventions (Gemert-Pijnen et al., 2018). One solution to this might be to add persuasive features to the technology. Persuasive technology can be defined as computerized software designed to reinforce, change or shape attitudes and/or behaviors without using coercion or deception (Oinas-Kukkonen & Harjumaa, 2009). The Persuasive Systems Design (PSD) model is a recent state-of-the-art approach for designing and evaluating persuasive systems. It defines four categories of software features for persuasive systems, namely primary task support, computer-human dialogue support, system credibility support and social support. Consequently, different types of persuasive software features, grounded in psychological theories, can be implemented in order to (1) support the users' primary activities such as personalizing the technology, (2) represent information sufficiently in the computer-human dialogue such as praising the user for "good" behavior, (3) convey the credibility of the presented information through i.e. trustworthiness of the technology and (4) leverage social influence through social comparison (Gemert-Pijnen et al., 2018).

When asked about recommendations for improving the intervention *Fit*Mit5, the entrepreneurs said that it would be nice to receive a reminder to do the exercises on a daily basis. A reminder is a persuasive element from the dialogue support category, which facilitates an interaction between the user and the system with the aim of motivating the user to achieve the desired goal with the intervention. Accordingly, a recommendation for the makers of *Fit*Mit5 would be the addition of such a feature. A reminder at the right time might give the user just that little bit of extra motivation to stick with the program (Gemert-Pijnen et al., 2018). For example, the app could send daily messages to users encouraging them to perform the target behavior. Additionally, the entrepreneurs indicated that they would prefer a more personalized intervention. Personalization is a persuasive element from the primary task support category, which aids the users in carrying out the primary activities to reach the goal of the intervention (Gemert-Pijnen et al., 2018). Thus, *Fit*Mit5 could improve the app by further personalizing the intervention content. This would involve users having to disclose some personal information about themselves, for example, through registering or by creating a personal profile (Lehto & Oinas-Kukkonen, 2011). Within the *Fit*Mit5 intervention, the user could, for example, state what their specific goal is or at what time of day it best suits them to perform the exercises.

Thus, the non-adherence of the entrepreneurs to the eHealth intervention *Fit*Mit5 may well have been due to the fact that the intervention was simply not persuasive enough and the above recommendation could alleviate this problem.

According to Sieverink (2017), adherence is related to the concept of user engagement. Regarding the user-engagement results in this study, a discrepancy was found between the expected user engagement and the actual user engagement, revealing, possibly, that the entrepreneurs' expectations of the technology were not sufficiently met. Consequently, one reason for the low user-engagement scores might be the low-adherence to the *Fit*Mit5 intervention. According to Eysenbach (2008), many eHealth technologies are known to have acceptance problems, which can be due to their not meeting the users' needs. The Centre for eHealth Research and Disease management (es) provides a "roadmap": a framework for the participatory development and implementation of eHealth technology (Wentzel et al., 2014). It consists of five intertwined phases and connecting cycles: (1) contextual inquiry, (2) value specification, (3) design, (4) operationalization and (5) summative evaluation. The connecting cycles link the formative evaluation cycles, which ensure that activities during a phase are related to the stakeholder perspective, the context and outcomes of previous phases (Gemert-Pijnen, 2018). The framework suggests an approach to systematically anticipate stakeholders' needs and values, and helps guide design and facilitate implementation. Especially during early stages of development, stakeholder involvement is crucial to develop sustainable technologies. A participatory development approach can help avoid mismatches between work practice and technology. It can be achieved by identifying the needs, context, and possible design and functionalities of various relevant stakeholders during each stage of development (Wentzel et al., 2014). There are multiple ways for stakeholders to be involved in the development process, i.e. they can either simply be asked for input and feedback or they can be seen as co-designers and be closely involved in the actual creation of the design. Regarding the development of the intervention *Fit*Mit5, there is nothing to indicate that such a process was implemented during development. Therefore, the researcher recommends that *Fit*Mit5 follow the guidelines of the CeHRes roadmap, especially the contextual inquiry to identify and involve relevant stakeholders, such as the users (office workers) or investors (health insurance companies) in future modifications of the application. This could, for example, be achieved by organizing a focus group to help identify the stakeholders' individual needs regarding the technology. After identifying these, they could be implemented or added to the intervention's content and design.

Furthermore, in their feedback users praised multiple positive aspects of the intervention, such as its ease of use and the self-explanatory exercises. So it would seem that they did in fact like the technology. However, they were not as engaged in it as expected. This shows that user engagement cannot simply be achieved on the basis of positive emotions towards the technology, i.e. by providing positive feedback. In eHealth it is important that the technology fits the characteristics of the users and that the design takes the users' specific needs and goals into account (Gemert-Pijnen et al., 2018). Consequently, it would seem that this was not the case for the entrepreneurs in regard to the intervention *Fit*Mit5.

All in all, based on the low engagement scores and the low adherence to the technology, the researcher would recommend that, for the purposes of future research, the intervention be altered so that it better fits the users' needs. As mentioned above, a participatory development process that follows the CeHRes roadmap guidelines could be used to ensure that the technology fits the users' characteristics. This would increase the likelihood of the users being engaged. Furthermore, persuasive elements, such as reminders or personalization could be added to the technology, which might lead to higher adherence to the technology. After the suggested alterations have been incorporated in the app, it would need to be tested on a large sample in order to achieve more meaningful results.

However, despite the small sample size and the need for further improving the intervention, *Fit*Mit5 was able to significantly decrease stress and to improve physical health in entrepreneurs within only 10 days. One reason for this might be that brief interventions (no longer than five minutes) to alter behaviors, such as increasing physical activity, have proven to be effective as they are not too long to include in daily routines (Sutton, 2017). Thus, delivering a short intervention seems to be better than users not making use of an intervention in the first place. Furthermore, the participants might not have been aware of their own stress levels before the intervention usage. Recognizing the degree to which one is affected by stress is an important step towards using strategies to make it better (Matheny & McCarthy, 2000). Thus, offering the entrepreneurs the intervention *Fit*Mit5 might have been the first tool to help them become aware of their increased stress levels and reduce them, and would explain the positive outcomes.

Strengths and limitations

The main strength of this study was that a single case design was employed in order to identify how the intervention affected each individual participant. Thanks to this

methodology, it was possible to detect how the perceived stress levels and the physical health scores changed during the course of the intervention usage for each individual entrepreneur. Additionally, the discrepancy between the expected user engagement and the actual user engagement as well as the amount of usage could be determined. By gaining insight into this data, the researcher was able to connect the individual components and, based on this, make suggestions as how to increase usage and engagement. Thus, by investigating how, why and for whom the technology was effective, this study can be helpful in opening the black box of eHealth.

However, this study also suffers from a few limitations. One limitation was that even though the data of the single case study could be used for this study, almost all of the participants failed to fill in all questionnaires, leaving the researcher with a lot of missing data. Possibly if more reminders had been sent out, this could have been avoided.
A further limitation of this study was the small sample size for the pre- and posttest. If a larger sample had been used, possibly more reliable outcomes could have been achieved. Furthermore, a larger sample size would have made it possible for *Fit*Mit5 to gather more log data, for instance regarding the time of day when the user used the intervention or which exercise was performed. Additionally, the average age of the entrepreneurs who participated in this study was 30 years, one entrepreneur being 49 years old. Therefore, it is questionable whether this sample of entrepreneurs is representative.

Conclusion

Based on the results of this study, it was concluded that the *Fit*Mit5 eHealth intervention is a valuable occupational health management tool, which has the potential to successfully decrease stress and increase physical health in a short period of time. However, the intervention was not used as much as expected, revealing low adherence. Furthermore, a discrepancy between the expected user engagement and the actual user engagement was identified, suggesting that the users' expectations of the technology were not met. Therefore, the intervention should be modified by using a participatory development process to ensure the technology fits the user's characteristics and preferences. This might automatically lead to higher adherence and user engagement. Nevertheless, *Fit*Mit5 was successful in significantly decreasing each participant's stress levels, which is the main goal of this intervention.

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Appendices

Appendix A

Informational text about the study (in German)

Liebe Studienteilnehmer,

Mein Name ist Sonia Goessler und ich studiere zur Zeit an der University of Twente Gesundheitspsychologie und Technologie. Im Rahmen meiner Masterarbeit befasse ich mich mit dem Thema: What effect does Feel-Good-Management have on the stress levels and on the physical health of entrepreneurs at the Digitalhub in Bonn?

Ich arbeite gemeinsam, mit der Barmer und den Entwicklern des Fitmit5 Programms daran, eine Gesundheitsintervention für Entrepreneure im DigitalHub in Bonn zu implementieren. Studien zeigen: Wir sitzen Tag für Tag viel zu lange, und das meist auch noch in einer ungünstigen Position. Für den Rücken, die Gelenke, die Muskulatur und die Bänder ist das Gift und oft sind Rückenprobleme so vorprogrammiert.
Damit es aber erst gar nicht so weit kommt, laden wir Sie herzlich ein, mit der digitalen Trainingsplattform www.fitmit5.de, mehr Bewegung und Entspannung in ihren Arbeitsalltag zu bringen. Ob im Büro, in der Produktionsstätte oder unterwegs – die 5-minütigen Videos sind jederzeit und überall online abrufbar, lassen sich in Arbeitskleidung ausführen und passen in jeden noch so vollen Terminkalender.

Die Teilnahme an der dieser Studie bedeutet, dass Sie die digitale Trainingsplattform FitMit5 über einen Zeitraum von 14 Tagen nutzten, in dem Sie den Übungen der fünf-minütigen Videos folgen. Darüberhinaus bitten wir Sie die Fragebögen auszufüllen vor (1 Mal), während (3 Mal) und nach (1 Mal) der Nutzung von FitMit5. Hierfür benötigen Sie ca. 5 Minuten pro Fragebogen. Das Ziel dieser Studie ist heraus zu finden, welchen Effekt FitMit5 auf Ihr Stressempfinden und Ihre körperliche Aktivität hat. Zusätzlich sind wir daran

interessiert wie Sie FitMit5 nutzen und welche Erfahrungen Sie mit der Intervention gemacht haben.
Diese Studie wurde von der Ethischen Kommission der Fakultät Behavioural Medicine and Social Sciences (BMS) an der University of Twente in Enschede, Niederlande genehmigt.
Die Teilnahme an der Studie ist freiwillig und der Teilnehmer hat jederzeit die Möglichkeit die Teilnahme abzubrechen.
Zur Durchführung dieser Studie ist es notwendig die Email Adressen der Teilnehmer einzuholen da ein Fragebogen mehrmals während dieser Studie verschickt werden muss.
Ihre persönlichen Daten werden jedoch umgehend nach dem Beendigungszeitraum der Studie gelöscht, welcher für Februar 2020 angesetzt ist.

Bei weiteren Fragen oder Anliegen können Sie sich jederzeit gerne an mich wenden:
s.i.goessler@student.utwente.nl
Vielen Dank im Voraus für Ihre Teilnahme.
Mit freundlichen Grüßen
Sonia Goessler

Appendix B

Informed consent (in German)

Einverständniserklärung für die Studie:

What effect does Feel-Good-Management have on the stress levels and on the physical health of entrepreneurs at the Digitalhub (in Bonn)?

Teilnahme an der Studie

Ich habe die Informationen über die Studie vom 18.11.2019 gelesen und verstanden. Ich hatte die Möglichkeit Fragen zur Studie zu stellen welche zu meiner vollsten Zufriedenheit beantwortet werden konnten.

Ich bin mir bewusst, dass ich mich freiwillig an der Studie beteilige und bin darüber informiert worden, dass ich jederzeit eine Antwort verweigern kann bzw. jederzeit die Studie abbrechen kann, ohne hierfür einen Grund angeben zu müssen.

Ich habe zur Kenntnis genommen das ich für die Studie mehrere Fragebögen zu mehreren Zeitpunkten während der Studie beantworten muss. Ich werde darum gebeten vor Beginn der Intervention, während der Intervention und nach der Intervention Fragebögen ausfüllen.

Verwendung der Angaben zur Studie

Ich habe zur Kenntnis genommen das ich Informationen zur Verfügung stelle die für eine Masterarbeit verwendet werden. Für den Fall, dass die Ergebnisse in einem wissenschaftlichen Beitrag veröffentlicht werden sollten, dann werden diese anonym gehandhabt.

Ich habe zur Kenntnis genommen das meine persönlichen Daten, welche auf mich zurück geführt werden können, so wie z.B. meine Emailadresse nicht an Dritte weitergegeben werden und lediglich mit meinen Untersuchungsteam (bestehend aus meinen 2 Supervisorinnen von der University of Twente) geteilt werden.

Zukünftige Verwendung der Daten von Dritten

Hiermit erlaube ich meine angegeben Daten, welche in einer sicheren Datenbank gespeichert werden für zukünftige Studienzwecke zu verwenden. Ich habe verstanden, dass meine Daten anonymisiert werden.

Stimmen Sie zu an dieser Studie teilzunehmen?

□ **Ja, ich stimme zu**

□ **Nein, ich stimme nicht zu**

Kontakt Informationen bei weiteren Fragen: Sonia Goessler: s.i.goessler@student.utwente.nl

Kontaktdaten für Fragen bezüglich meiner Rechte als Proband

Für den Fall dass Sie Fragen bezüglich Ihrer Rechte als Proband in dieser Studie haben oder weitere Informationen, Anliegen oder Fragen zur Studie haben, die Sie mit jemand anderem als dem Forscher besprechen möchten, können Sie sich gerne an das Büro der ethischen Kommission der Faculty of Behavioural, Management and Social Sciences an der University of Twente wenden. Email: ethicscommittee-bms@utwente.nl

Appendix C

Demographic data (in German)

Demographische Angaben

Im Folgenden können Sie Fragen zu Ihrer eigenen Person beantworten.

Geschlecht: weiblich/ männlich/anders/keine Angabe

Alter: „Drop-down-Button“

Höchster erreichter Schulabschluss: kein Schulabschluss, Hauptschule, Realschule, (Fach)-Abitur, Hochschulabschluss, Universitätsabschluss,

Wie viel Stunden arbeiten Sie ungefähr pro Woche? (freie Eingabe)

Emailadresse: (freie Eingabe)

Zur Durchführung dieser Studie ist es notwendig die Email Adressen der Teilnehmer einzuholen da ein Fragebogen mehrmals während dieser Studie verschickt werden muss. Ihre persönlichen Daten werden jedoch umgehend nach dem Beendigungszeitraum der Studie gelöscht, welcher für Februar 2020 angesetzt ist.

Appendix D

Perceived Stress Scale (PSS) German version

Die folgenden Fragen beschäftigen sich mit Ihren Gefühlen und Gedanken während des vergangenen Monats. Bitte geben Sie an wie oft Sie sich im vergangenen Monat so gefühlt haben bzw. so gedacht haben. Sie können die Antwortmöglichkeiten nie, selten, manchmal, häufig oder sehr oft hierfür verwenden.

1. Wie oft hatten Sie sich im letzten Monat darüber aufgeregt, dass etwas völlig Unerwartetes eingetreten ist?
2. Wie oft hatten Sie im letzten Monat das Gefühl, wichtige Dinge in Ihrem Leben nicht beeinflussen zu können?
3. Wie oft hatten Sie sich im letzten Monat nervös und „gestresst“ gefühlt?
4. Wie oft hatten Sie sich im letzten Monat sicher im Umgang mit persönlichen Aufgaben und Problemen gefühlt?
5. Wie oft hatten Sie im letzten Monat das Gefühl, dass sich die Dinge nach Ihren Vorstellungen entwickeln?
6. Wie oft hatten Sie im letzten Monat das Gefühl, mit all den anstehenden Aufgaben und Problemen nicht richtig umgehen zu können?
7. Wie oft hatten Sie im letzten Monat das Gefühl, mit Ärger in Ihrem Leben klar zu kommen?
8. Wie oft hatten Sie im letzten Monat das Gefühl, alles im Griff zu haben?
9. Wie oft hatten Sie sich im letzten Monat darüber geärgert, wichtige Dinge nicht beeinflussen zu können?
10. Wie oft hatten Sie im letzten Monat das Gefühl, dass sich die Probleme so aufgestaut haben, dass Sie diese nicht mehr bewältigen können?

Appendix E

Patient Health Questionnaire 15-Item Somatic Symptom Severity Scale (PHQ-15) German version

Bei den folgenden Fragen geht es um körperliche Beschwerden die Sie möglicherweise in den vergangenen 4 Wochen wahrgenommen haben. Bitte geben Sie an wie sehr die folgenden körperlichen Beschwerden Sie beeinträchtigt haben.

	Nicht beeinträchtigt	Wenig beeinträchtigt	Stark beeinträchtigt
a. Bauchschmerzen	□	□	□
b. Rückenschmerzen	□	□	□
c. Schmerzen in den Armen, Beinen oder Gelenken (Knie, Hüften usw.)	□	□	□
d. Menstruationsschmerzen oder andere Probleme bei der Menstruation (nur bei Frauen)	□	□	□
e. Schmerzen oder Probleme beim Geschlechtsverkehr	□	□	□
f. Kopfschmerzen	□	□	□
g. Schmerzen im Brustbereich	□	□	□
h. Schwindel	□	□	□
i. Ohnmachtsanfälle	□	□	□
j. Herzklopfen oder Herzrasen	□	□	□
k. Kurzatmigkeit	□	□	□
l. Verstopfung, nervöser Darm oder Durchfall	□	□	□
m. Übelkeit, Blähungen oder Verdauungsbeschwerden	□	□	□
n. Schwierigkeiten, ein-oder durchzuschlafen oder vermehrter Schlaf	□	□	□
o. Müdigkeit oder das Gefühl, keine Energie mehr zu haben	□	□	□

Appendix F

Twente Engagement with Ehealth Technologies Scale (TWEETS) German version

Die folgenden Fragen beschäftigen sich mit den Nutzungserwartungen die Sie gegenüber der Technologie der Gesundheitsintervention FITMIT5® haben.
Bitte geben Sie an in wie weit Sie den folgenden Aussagen zustimmen.
Hierfür können Sie folgende Antwortkategorien auswählen:
0=diese Aussage trifft überhaupt nicht zu; 1=diese Aussage trifft kaum zu; 2=keine Meinung; 3=diese Aussage trifft etwas zu; 4=diese Aussage trifft in hohem Maße zu

Fragebogen vor Intervention

Nutzungserwartung der Technologie:

Ich denke, dass:

- ich FITMIT5® in meinen Alltag integrieren kann
- FITMIT5® nutzerfreundlich ist
- ich FITMIT5® so lange nutzen werde, bis ich meine Ziele erreiche
- FITMIT5® es mir leichter machen wird mein Stresserleben zu reduzieren und mein Maß an körperlicher Aktivität zu erhöhen
- FITMIT5® mir dabei behilflich sein wird mein Stresserleben zu reduzieren und mein Maß an körperlicher Aktivität zu erhöhen
- FITMIT5® mir einen konkreten Einblick in mein Stresserleben und in mein Maß an körperlicher Aktivität liefern wird
- ich FITMIT5® gerne benutzen werde
- ich mich über die Fortschritte die ich mithilfe von FITMIT5® machen werde, freuen werde
- FITMIT5® zu mir als Person passen wird

Fragebogen während der Intervention

Gegenwärtige Nutzung der Technologie:

Ich denke, dass:

- ich die Nutzung von FITMIT5® in meinen Alltag integriert habe
- FITMIT5® nutzerfreundlich ist
- ich es schaffe FITMIT5® so häufig zu benutzen, dass ich meine Ziele erreichen kann

- FITMIT5® es mir leichter macht mein Stresserleben zu reduzieren und mein Maß an körperlicher Aktivität zu erhöhen
- FITMIT5® mir dabei behilflich ist mein Stresserleben zu reduzieren und mein Maß an körperlicher Aktivität zu erhöhen
- FITMIT5® mir einen konkreten Einblick in mein Stresserleben und in mein Maß an körperlicher Aktivität liefert
- ich FITMIT5® gerne benutze
- ich mich über die Fortschritte die ich mithilfe von FITMIT5® mache freue
- FITMIT5® zu mir als Person passt

Fragebogen nach der Intervention

Nutzung der Technologie in der Vergangenheit

Ich denke, dass

- ich die Nutzung von FITMIT5® in meinen Alltag integriert habe
- FITMIT5® nutzerfreundlich ist
- ich es geschafft habe FITMIT5® so häufig zu benutzen, dass ich meine Ziele erreichen konnte
- FITMIT5® es mir leichter gemacht hat mein Stresserleben zu reduzieren und mein Maß an körperlicher Aktivität zu erhöhen
- FITMIT5® mir dabei behilflich war mein Stresserleben zu reduzieren und mein Maß an körperlicher Aktivität zu erhöhen
- FITMIT5® mir einen konkreten Einblick in mein Stresserleben und in mein Maß an körperlicher Aktivität geliefert hat
- ich FITMIT5® gerne benutzt habe
- ich mich über die Fortschritte die ich mithilfe von FITMIT5® mache gefreut habe
- FITMIT5® zu mir als Person gepasst hat

Appendix G

FITMIT5® questionnaire (in German)

1) Wie zufrieden bist Du mit Deiner Bewegung bzw. Deinem Sportprogramm in der Woche?
2) Leidest du unter Nackenverspannungen?
3) Hast du Rückenschmerzen?
4) Wie beurteilst Du Deine Essgewohnheiten?
5) Fühlst Du Dich im Alltag gestresst?
6) Denkst Du häufig an negative Dinge und grübelst vor Dich hin?
7) Wenn Du morgens aufwachst, fühlst Du Dich ausgeruht, wach und bist voller Energie?
8) Nach der Arbeit fällt es Dir schwer loszulassen und zu entspannen?
9) Arbeitest Du unter Zeit- und Termindruck?
10) Fühlst Du Dich während der Arbeit angespannt, gereizt und unausgeglichen?

Appendix H

Self-reported usage questions (in German)

1. Wie viele Minuten hast du FITMIT5® heute genutzt?
2. Hast du heute eine Meditationsübung genutzt?
3. Hast du heute eine aktivierende Übung genutzt? Wenn ja, welche?
4. Hast du mit Hilfe von FitMit5 ein Rezept erstellt?