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**Faculty of Behavioral, Management
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The e-health application "Geluk en zo" for chronic pain patients. A co-creation and research of user experiences.

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Abstract

The e-health application "Geluk en zo" is designed to increase the people's overall wellbeing through the identification of reasons behind their behaviours, to be aware of negative patterns of thoughts, and to practice valued life actions in their daily life. This intervention is based on Acceptance and Commitment Therapy (ACT), a therapy that aims at psychological flexibility. The current study investigated the usability and usefulness of the application "Geluk en zo" after participation in the intervention for 10 days. 12 Chronic pain patients were assessed for eligibility, 3 completed the participation and took part in this study. Participants used the application as first users and were interviewed about their opinion and experiences with the application. The interview scheme was developed based on the Mobile Application Rating Scale (MARS). The usefulness of the application was mostly experienced positively. Participants' awareness of their activities and the reasons behind it were enhanced. Also, new behaviors were adopted, and values were clearer than before, which indicates that their psychological flexibility increased. Concerning the usability of the application, several improvements need to be done, for example, correctly working reminders. Technical problems before the start and during the intervention occurred and negatively influenced the participation process. All in all, this study provides important insights in the usability and usefulness about the application "Geluk en zo" which can be used for future revision of the current version. Also, it is corroborating earlier findings of the effectiveness of ACT-based interventions.

Keywords: E-health application – Acceptance and Commitment Therapy – Usability – Usefulness – Awareness – Psychological flexibility

1. Introduction

The Dutch e-health application "Geluk en zo", literally translated as 'Happiness and so', is designed by researchers of the University of Twente. It is created in the context of chronic pain patients within the Roessingh rehabilitation centre.

Thereby, pain is defined as an unpleasant sensory and emotional experience associated with actual and potential tissue damage or described in terms of such damage (International Association for the Study of Pain (IASP), 1986). Chronic pain lasts longer than three or more months and biomedical treatment is often found to be insufficient (IASP, 1986; Turk, Wilson, & Cahana, 2011). It represents a major health problem in Europe and entails negative consequences for patients and their environment (Reid et al., 2011). In the Netherlands, one in five people experience regular and long-lasting pain (Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006). Biological, psychological, and social factors influence the persistence of pain and its process of becoming chronic (IASP, 1986). To be able to manage the pain, non-drug and drug-treatments are existing. Two-thirds of the chronic pain patients use non-drug treatments such as massage or acupuncture. According to Breivik et al. (2006), such alternative methods need to focus more on the improvement of the functioning of the patient. Only little evidence is found on the improvement of pain using these treatments (Breivik et al., 2006).

The social impact of chronic pain on daily life and the life quality of an individual is immense (Reid et al., 2011). Chronic pain patients are impaired in their daily activities and physical functioning such as sleeping, doing household activities, working, driving, and social activities (Kawai, Kawai, Wollan, & Yawn, 2017; Überlacker et al., 2015; Breivik et al. 2006). As a result, patients often get frustrated about their situation and lose sight of their values and personal goals in life which increases the risk of a vicious cycle. Patients suffering increases in turn because no improvement of the pain is noticeable (Schreurs, 2018). Furthermore, the risk of suffering from a psychiatric disorder such as anxiety and depression increases. All these negative impacts on chronic pain patient's lives show that it is crucial to search for interventions that improve their lives through acceptance of the pain and the focus on their values in life (Reid et al., 2011).
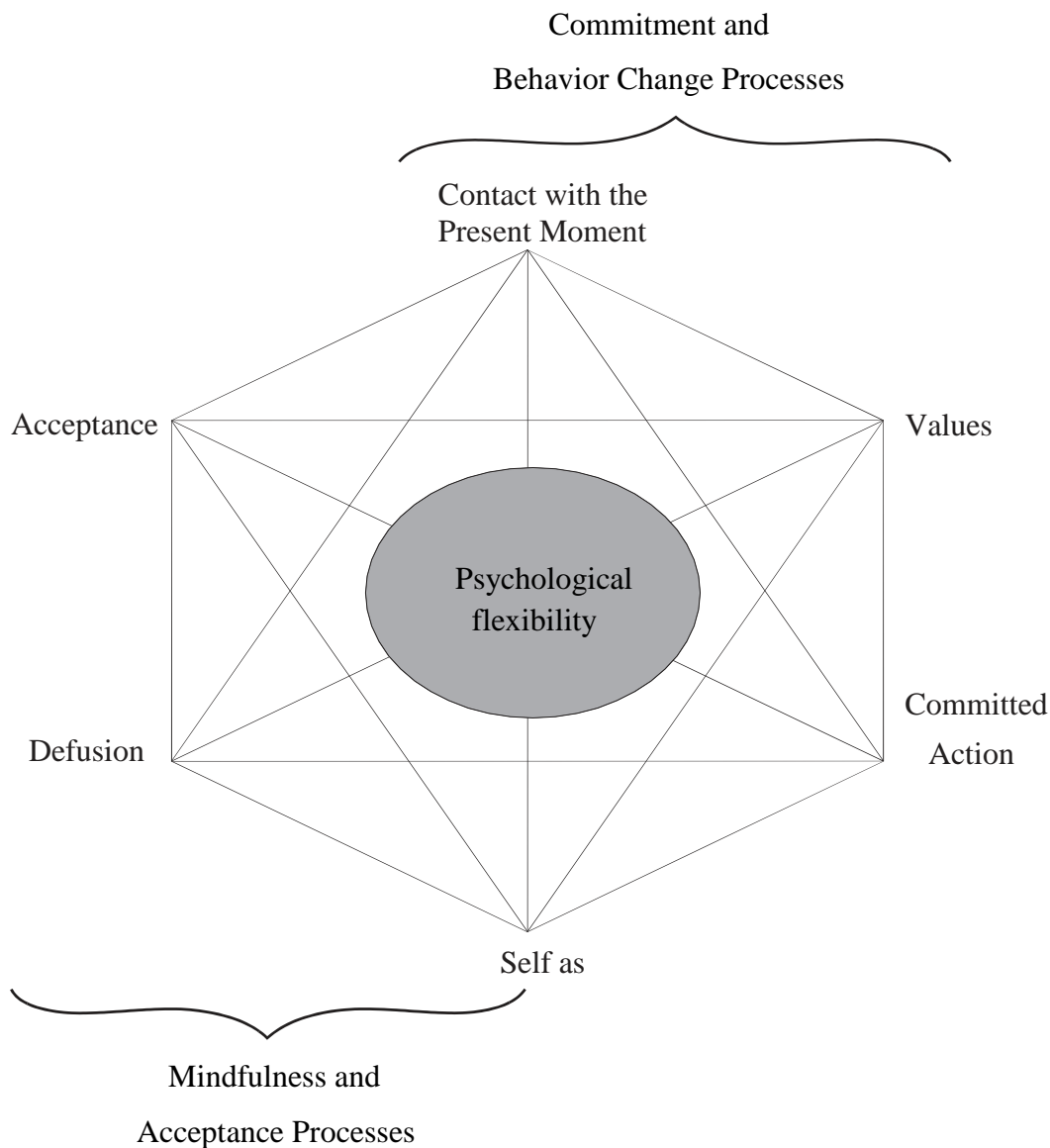
Acceptance and Commitment Therapy

Different interventions have been developed to improve the patient's mental health and wellbeing. One example is Acceptance and Commitment Therapy which pursues

psychological flexibility. It is applicable to different diagnosis groups and presents an adequate approach for chronic pain patients (Schreurs, 2018). ACT emphasises the acceptance of pain, negative emotions, sensations and thoughts to be able to focus more on the realisation of one's values of life and ideal functioning (Schreurs & Veehof, 2013). Pleasant activities create a worthwhile life for the patients, but because of the pain, they are often no longer able to execute them (Schreurs, 2018). Not accepting and fighting pain can lead to increased suffering and have a negative effect on a person's wellbeing (Schreurs & Veehof, 2013). The aim of ACT is to increase the psychological flexibility and positive mental health. Psychological flexibility means greater acceptance of pain, not trying to change it, and adopt value-based behaviours (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). That is why ACT fits well in the tradition of positive psychology (Schreurs, 2018).

The following six core processes form the model of the ACT: *acceptance, cognitive defusion, being present, self-as-context, values,* and *committed action* (see Figure 1 Hayes et al., 2013, p. 185; Hayes, Levin, Plumb-Vilardaga, Villatte, & Pistorello, 2013). All of them are overlapping, connected, and have the goal to increase the psychological flexibility of the patient (Hayes, Luoma, Bond, Masuda, & Lillis, 2006).

In this research the Dutch e-health intervention "Geluk en zo" is used. This e-health application includes three of the core processes of ACT, which are *acceptance, values,* and *committed action*. In the context of ACT, *acceptance* means to accept experiences as they are without trying to change them. Patients learn to accept the frequency and form of pain. Acceptance belongs to the mindfulness and acceptance processes of the ACT-model (see Figure 1) and presents not an end in itself but increases value-based actions (Hayes et al., 2006; Hayes et al., 2013). *Values* are self-chosen and verbal directions of living in different contexts such as work, friends and family, health, and wellbeing or free time (Hayes, Strosahl, & Wilson, 2012; Hayes et al., 2013). Values are always available and belong to the commitment and behaviour change processes of the ACT-model (see Figure 1; Schreurs, 2018). *Committed actions* consist of concrete goals and actions in the direction of the chosen values. In contrast to values, concrete goals can be fully achieved through short-, medium- and long-term goals. To achieve goals, the patient's behaviour should change (Hayes et al., 2013). During this process, the patient comes into contact with psychological inner barriers which no longer represent the basis of their lives. Instead, the chosen values motivate the patient to adhere to the changed and more valuable reactions to their chronic pain (Hayes et al., 2006).

Commitment and

Behavior Change Processes

Contact with the
Present Moment

Acceptance

Values

Psychological
flexibility

Committed

Defusion

Action

Self as

Mindfulness and

Acceptance Processes

Figure 1. ACT- model of health and treatment processes. Reprinted from "Acceptance and Commitment Therapy and Contextual Behavioral Science: Examining the Progress of a Distinctive Model of Behavioral and Cognitive Therapy" by Hayes et al., 2013, p. 185. Copyright 2011 by Elsevier.

The efficacy of the ACT as a positive psychological intervention for patients with psychiatric disorders such as depression, anxiety, and addiction or somatic health problems but also for chronic pain patients has been found (A-tjak et al., 2015). The meta-analysis of Veehof, Trompetter, Bohlmeijer and Schreurs (2016) confirms the efficacy of the therapy on depression and anxiety in comparison with (medical) treatment as usual or waitlist in chronic

pain patients. The patients pain intensity decreases while the quality of life increases. Also, two to six months after the integration of the ACT in patient's daily life, higher effect sizes for pain interference are found. ACT and other mindfulness-based interventions seem to be successful in the long-term (Veehof et al., 2016).

Further support is supplied by Trompetter, Bohlmeijer, Veehof and Schreurs (2015b) with their online ACT-intervention whereby participants experienced a decrease in pain interference in their daily life. Furthermore, improvement of depression, pain intensity, psychological inflexibility, and pain catastrophizing were found (Trompetter et al., 2015b). Also, it is found that the experience of less pain interference relates to higher acceptance (Trompetter, Bohlemeijer, Fox, & Schreurs, 2015a). An explanation for these positive effects could be the focus of ACT on a valued life with an activation of behaviours (Schreurs, 2018).

Further studies came up with the result that through ACT, the psychological flexibility increases and at the same time the risk of psychiatric disorders decreases. These findings imply an improved mental health (Hayes et al., 2006).

Until now, a lot of long-term and extensive ACT-interventions are existing which are executed face-to-face. The application of the current research "Geluk en zo" is a brief online intervention which can be used in the patient's daily life, for example, after rehabilitation treatment. This gives patients the possibility to hold out and use it on their own in situations when needed. According to Dahl, Wilson and Nilsson (2004), brief ACT-interventions could have positive effects on the chronic pain patient's quality of life.

E-health applications

The present research has the purpose to evaluate an e-health intervention called "Geluk en zo". Electronic-health means an application which is available online and can intervene in daily lives so that users have continuous access. The aim is to implement the application in the health care. It is designed by researchers of the University of Twente, in Enschede, and is based on ACT. The application has the aim to help patients to identify the reasons behind their behaviours, to realize negative patterns of thoughts, and to practice valued life actions in daily life to increase their overall wellbeing.

The CeHRes Roadmap for the development of e-health technologies is a useful framework to create e-health technologies along with user requirements to achieve the most favourable solution. Currently, this research is situated in the research and development activity *Design* (see Figure 2 Gemert-Pijnen et al., 2011, p. 9). Here, prototypes are built and

tested in real-life situations. To increase adherence, the development of the prototype fits with the earlier researched values and user requirements. Therefore, users evaluate and test the prototype to look if it matches with their expectations and mental models. A useful method to research the strengths and weaknesses of an application provides the Mobile Application Rating Scale (MARS) from Queensland University of Technology. It is used to rate the quality of an application, the subjective quality and specific issues to the researched application (Stoyanov et al., 2015). This rating scale analyses the usability and usefulness of an application which agrees with the aim of the current research.
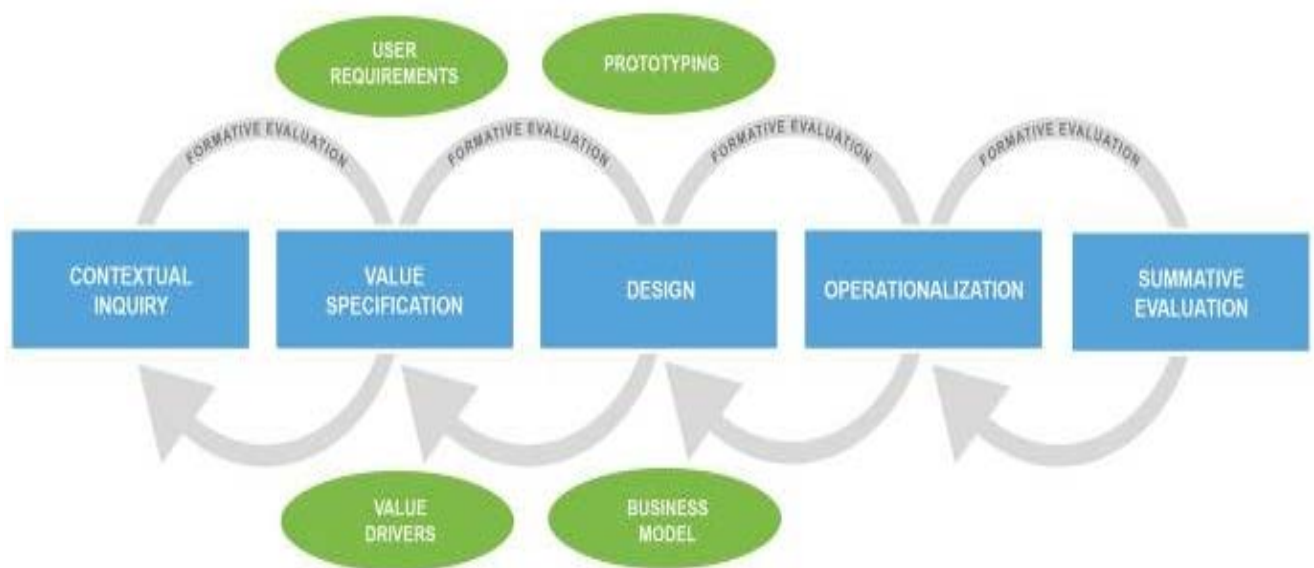

Figure 2. CeHRes Roadmap for the development of eHealth technologies. Reprinted from "A Holistic Framework to Improve the Uptake and Impact of eHealth Technologies" by van Gemert-Pijnen et al., 2011, p. 9. Copyright 2011 by Name J Med Internet Re.

This research assessed the usefulness and usability of the application "Geluk en zo". Which means the capability of being helpful and the evaluation to which extent the application is matching with user requirements (Davis, 1989; Kushniruk, 2002). These two aspects are important to make sure that the application matches with the user requirements. Through interviews, users are directly involved in the process of improvement of the application. Subsequently, the research question is formulated: "*What are the usability experiences of chronic pain patients with the positive psychology e-health application "Geluk en zo"?*".

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Furthermore, the sub-question: *"Do chronic pain patients experience the application as useful for them in their life circumstances?"* will be answered.

2. Methods

Procedure

The study was approved by the Behavioural, Management and Social Science (BMS) ethics committee of the University of Twente, in Enschede. Participants (N=12) were recruited in April 2018 by healthcare professionals working in the Roessingh rehabilitation centre. All 12 patients were assessed for eligibility. Subsequently, they were personally invited for an information meeting where they got a detailed introduction of the intervention and could ask questions. Participants were verbally informed by the researcher of the current study. Further, they received written information about the aim, risks, kind, and methods of the research and asked to sign an informed consent (see Appendix 6.1 Informed consent and 6.2 Information form). Next, screenshots were shown to facilitate the process and the researcher of the current study assisted if required. Consenting participants were asked to download the application "Geluk en zo" from the Google Play Store or App Store with their mobile phones. On a day that matched with the wishes of the participants, the intervention of ten days started. If questions or problems came up during the participation, it was offered to contact the researcher of the current study. Participants were informed about the process and purpose of the interviews. The interviews took place individually and were done in a quiet environment. Either personally or via a phone call. The interviews were recorded and lasted approximately 30 minutes. After the interview, the participants were thanked for participating and were offered to receive the study results if desired.

Participants

Participants were individuals experiencing chronic pain and receiving rehabilitation treatment in the Roessingh rehabilitation centre in Enschede, the Netherlands. Participants were asked to use the e-health application "Geluk en zo" as first users. People were included (a) who were older than 18 years old, (b) who experienced pain for longer than three months. Excluded were people (a) who experienced problems due to insufficient Dutch language skills or illiteracy, because as the application as well as the interviews were conducted in Dutch. Patients (b) who had no access to internet or e-mail address, (c) who did not own a mobile
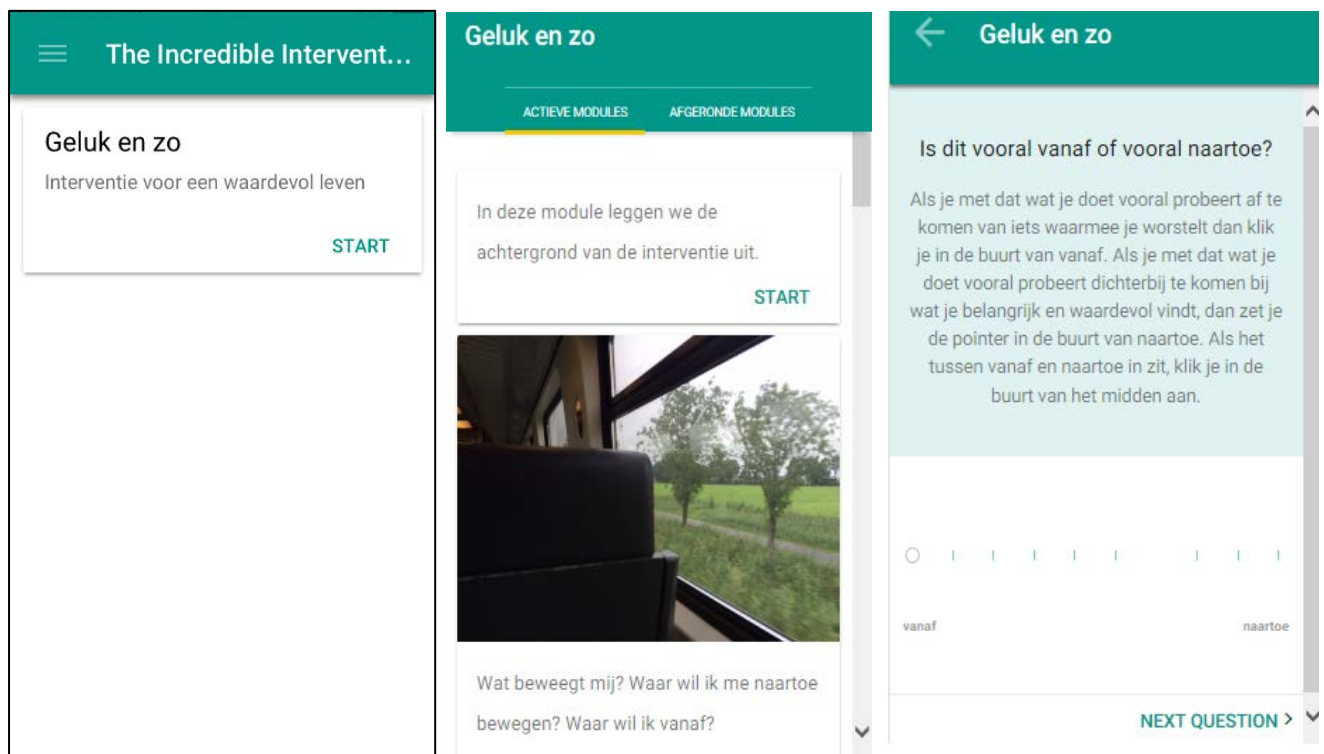
phone or tablet or (d) were unwilling to use the application approximately 10 minutes per day were also excluded.

Twelve individuals were assessed for eligibility. Three participants were included for this research. All participants were Dutch female, aged between 34 to 50 years with a mean of 42 (SD= 6.55). Two of them were middle educated and one highly educated.

The Intervention "Geluk en zo"

The intervention consisted of five steps (see Table 1). Push messages at random times throughout the day reminded users to fill in new exercises. The distinction was made between modules which were active and had still to be filled in and modules which were finished (see Screenshot 2).

Screenshot 1, 2 and 3. *These screenshots show the start screen of the application "Geluk en zo", the start screen of step one with the function of the distinction of active and finished modules and an exercise of step two about if activities are towards or away from the participant's values.*

In step one *Introduction*, videos explained the functions of the application (see Screenshot 1). Also, participants had to formulate examples of valued actions and experiential avoidance. Examples were undesirable thoughts and feelings about pain.

In step two *Registration*, they had to write down their current activity. They rated if they move through this activity towards their values or away from them on a scale from 1='away' to 10='towards' (see Screenshot 3). Subsequently, they had to evaluate their activities by means of six statements, which were about interest, importance, values, self-chosen or must do it, on a 5-point-Likert scale from 1 = "completely untrue" to 5="completely true". Items were "I find this an interesting activity." or, "I think it is valuable.". Here, the aim was to increase the patient's awareness of reasons behind performed activities.

In step three *Flashback*, participants reflected on exercises which were done until now. They had to look back on which actions were valuable to them and what they tried to avoid experiential. Also, they rated again if their activities where in the direction of their values or away from them.

In step four *Do it*, participants were ready to experience more moments which are towards their life values. All exercises of step two, expect the evaluation through six statements, were repeated. Next, they were asked what they were going to do: to go ahead with their activity or do something different, and the reasons behind this decision.

Finally, the intervention ended with videos about a flashback after ten days and the conclusions that participant could draw after the usage of the application.

Table 1

Overview of the content and duration of the four steps of the e-health application "Geluk en zo".

Step	Content	Duration	Days
Step 1 - *Introduction*	Formulating examples of valued activities and experiential avoidance.	Once 30 minutes	1
Step 2 - *Registration*	Registration through the day how it feels for the participant.	1-2 minutes three times per day	2
Step 3 - *Flashback*	Reflection on what important is for the participant and what he/she tries to avoid.	Once 30 minutes	1

Step 4 – *Do it*	Ready to experience more moments towards the participant values of life.	1-2 minutes three times per day	5
Step 5 – *End*	Final flashbacks and participants draw conclusions after ten days of usage.	Once 1-2 minutes	1
Total			10

Interviews

An extensive interview scheme was developed on the base of MARS (Stoyanov et al., 2015). Two researchers, one of the current study and a fellow student, created this scheme (see Appendix 6.3 Interview scheme). The semi-structured interview consisted of three closed questions (gender, age, education) and 43 open questions related to the participant's opinions and experiences (see Appendix 6.3 Interview scheme). The questions referred to the usability and usefulness of the application. Included topics were the content of the application, participant's motivation, quantity and quality of given information, design of the application and behaviour or mind changes.

Analysis

The approach of the interviews was deductive to get as much information from the participants as possible. Interviews were transcribed verbatim and functional codes were used to ensure comprehension. For transcription, the Express Scribe Transcription Software was used. The analysis was done on the data, and selected quotes for this research were translated from Dutch into English by the researcher of the current study himself. The data were imported in Atlas.ti 8 to facilitate the coding process of the interviews. Each potentially meaningful fragment in the transcripts was a unit of analysis. Two researchers, one of the current study and a fellow student, developed a first coding scheme. Codes were designed based on MARS. Next, codes were hierarchically organised in codes and subcodes. During the coding process, the approach was partly inductive because the researcher of the current study and the fellow student coded with the framework of ACT and the interview scheme in mind. After the researcher of the current study coded the first transcript, the coding scheme was revised two times with the help of the fellow student. Thereby, names of codes were reformulated, and subcodes were added or new subsumed. The researcher of the current study and a fellow student formulated, defined, and applied the codes for a second time to the first transcript. Then, the researcher of the current study coded the second and third transcript. In

line with the constant comparison method, new interviews were compared with existing codes to identify similarities and differences. After that, no more codes had to be added and the final code structure was developed. The developed coding scheme consisted in total of nine codes whereof three had two subcodes and one had three subcodes (see Table 2).

3. Results

Analysis of the Participant flow

In total, 12 patients were approached by their healthcare professionals working in the Roessingh rehabilitation centre and assessed for eligibility (see Figure 3).
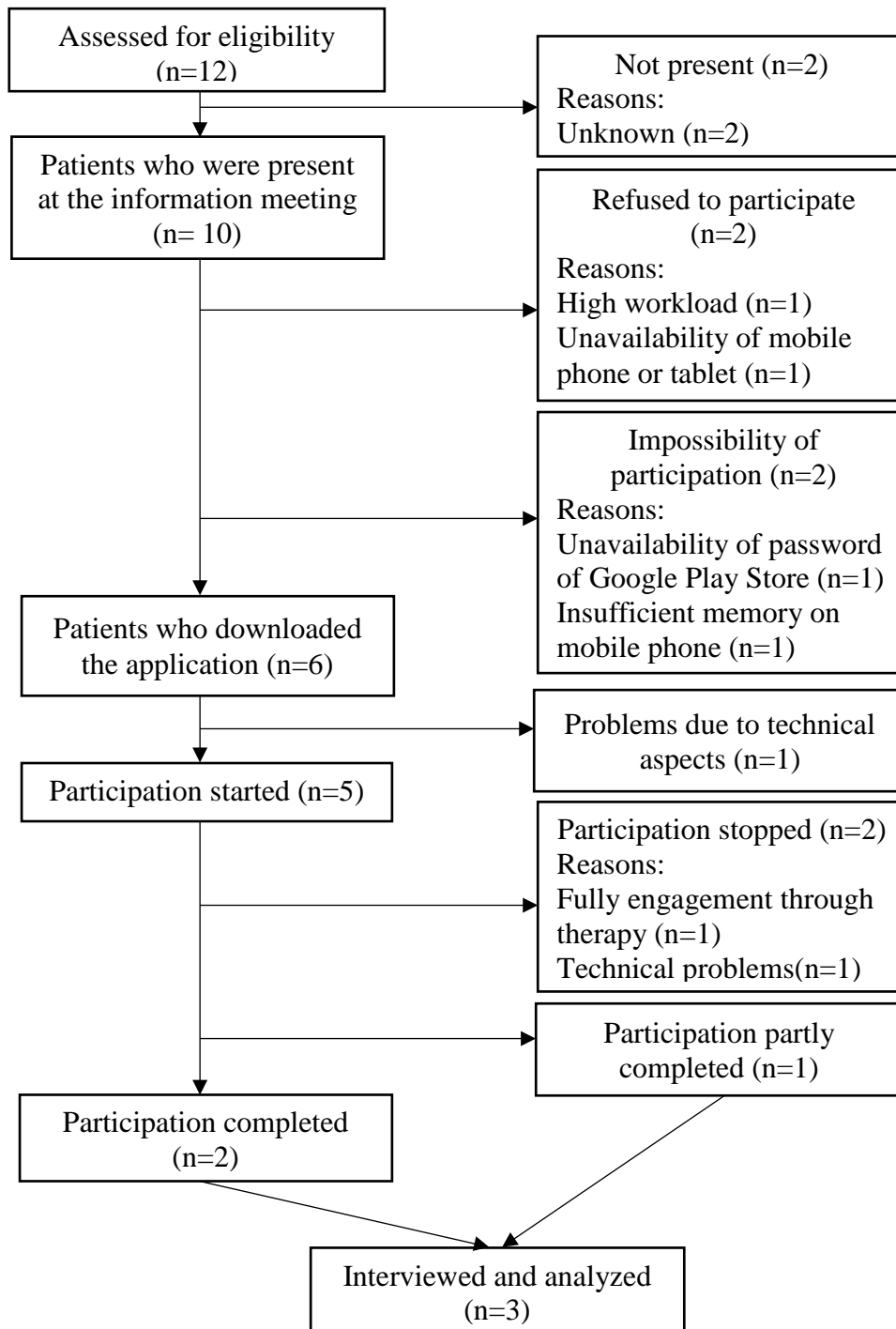

Figure 3.

Participants flow chart of the participation process including cancellations.

Ten of them were present at the information meeting. During this meeting given by the researcher of the current study, two patients refused to take part in the intervention. The first patient refused because she did not have a mobile phone or tablet available to be able to download the application. She was interested in the content of the intervention but added that she would not be able to fill in the application due to missing technical understanding. The second patient refused to participate because of a high workload. For two further patients, it was impossible to download the application due to insufficient storage on the mobile phone and unavailability of the Google Play Store password to be able to log in. This patient wanted to search for it at home and download the application afterwards, but she did not do it. Next, the remaining participants (N=6) downloaded the application, but only five of them started to participate in the intervention. One participant had difficulties to create an account for the application and to remember the password so that he was not able to log in. After the first days of usage, two participants stopped using the application. Reasons were technical problems of the application such as that the reminders did not work very well, difficulties to get to the next screen of an exercise, and full engagement with the rehabilitation therapy. Furthermore, another participant stopped using the application after three to four days, due to looking after her child so that she could not fill in the exercises on time. Nevertheless, this participant and the two who fully completed the usage of the application could be interviewed and analysed for the current research.

Main Topics

The MARS displayed a good method for the development of the nine codes used for the analysis of the qualitative data. All codes including subcodes, definitions, and examples are displayed in Table 2. The codes printed in bold type could be found back in the main topics of the MARS as well as in the interviews. Here, only small changes and additions were made. Every code was mentioned by all participants but varied in frequency (see Appendix 6.4 Frequency Distribution of the Codes).

Table 2

Coding scheme which entails the code structure with definitions and examples per code and subcode, developed by the researcher of the current study and a fellow student.

Code	Subcode	Definition of code or subcode	Example
Usability			
Design	Layout	The visual structure and presentation of the application.	"It was very clear and good."
	Interactions	The interplay between the participants and the application.	"I think it will be easy to use for everybody."
	Time	The duration of the whole intervention and its modules.	"To fill it in three times a day was good, and the intervention does not need to be longer than ten days."
Information	Quality of information	The appreciation of the content of the application by participants.	"It was really clear, also because we spoke about it in the Roessingh."
	Quantity of information	The amount of information presented to the participants.	"Enough. The videos were not too long. It was clear and concrete."
Improvement		Suggestions of the participant which could be added or changed in the application.	"It would be more practical if the app reminds you to fill in exercises."
Usefulness			
Expectations		The assumption or hope that the application works after the participant's ideas and wishes.	"I hope to can have an advantage of the usage."
Impression	Impression previously	The opinion about the application before the start of the intervention.	"I thought the word "Happiness" sounds interesting but I wanted to wait and see."
	Impression afterwards	The appreciation and interest in the application after the intervention.	"In my opinion, it was interesting and positive."
Goals		The purpose of the application and what the participant wants to achieve.	"To get more conscious of yourself and what you are doing."
Motivation		Being prepared and willing to carry out the exercises and personal perceptions.	"It is a simple exercise but with huge effect to get more aware of it."
Changes	Mental changes	Changes concerning the cognition of the participants.	"I am more conscious of my values, activities and why I choose for it."
	Physical changes	Changes concerning the body and activities of the participants.	"I began to listen to relaxing stories."
Future		The usage of the application after the participation in the intervention being targeted on oneself and others.	"I think you can always use the application to get more conscious of something."

Usability of the Application

The evaluation of the usability of the application "Geluk en zo" can be analysed through the interpretation of the codes *Design*, *Information,* and *Improvement*.

The general opinion about the *layout* of the application is positive and satisfactory. All participants stated that it was "clear and good" (Participant A, B and C). One participant mentioned that she is "not a computer freak but… knew how it works" (Participant C). About the videos and images were said that they were spoken calm and are not too long to be able to keep paying attention. Only small suggestions were made. One participant found the *layout* too "simple and boring to see" (Participant A). Participants would have suggested more images and "joyful things" (Participant A) to stimulate and make the user more enthusiastic.

With regard to *Interactions*, the participants stated that the application was self-explaining, instructions were clear, and that "You can learn it on your own." (Participant B). The function of active and finished modules was used by two participants. They wanted to reread their answers, watch videos for the second time or to get an overview. A more unambiguous manner of order is wished for easier orientation and one participant criticizes that no answers to finished exercises could be added. Furthermore, it is wished for reminders that work well. Only one of three participants received reminders. Participant A, who did not receive reminders, could help herself by setting an alarm on her mobile phone to not forget to fill in the application.

The last subcode of *Design* was *Time*. Here the participant's opinions differ. One participant thinks that the intervention is long enough, but it should not be shorter than ten days. Also, the amount per day is fine and doable*:* "It does not take much time, about 2 minutes a day. It is perfect." (Participant B). The remaining two participants stated that the intervention could be longer. Participant A suggests a length of 11 to 15 days.

The *Quality of information* given in the modules is experienced as logically ordered. Asked questions in step two *Registration* were evaluated as interesting and relevant to get more conscious of the reasons behind their actions. Information given through videos and exercises were experienced as clear, varying, and complementary to the participant's rehabilitation therapy. In relation to this, one participant assumes that users outside of the Roessingh rehabilitation centre could lack information about what values are.

The opinions about the *quantity of information* differ among the participants. One participant thinks that three times a day exercising and watching short videos in between are perfect. In contrast, others wish for more variety between watching videos and filling in

exercises. Beside, participant C stated that step one *Introduction* might be longer to be able to think more about one's values in life. Furthermore, she added that the given information was too much.

Through the questions about *Improvement*, most participants came up with criticism about technical aspects of the application. Generally, this code has the most overlap with all other codes and subcodes. Following participant C, nothing is missing in the intervention. In contrast, participant A criticized the application a lot. First, she said that reminders are required to be able to fill exercises on an unexpected moment in. Second, she mentioned difficulties to be able to watch a video twice. Users have to go to the finished modules, search the video and copy the link into the internet. This is time-consuming and decreases the motivation because of the effort. Third, she wishes for a more equal distribution of the different media interactions such as videos, images, and exercises. Relating to this, it is wished for more images which make the user more enthusiastic. The participant summarized that: "There are apps on the market which can do more than this one." (Participant A). Additionally, one participant suggests starting the intervention when the patients are still in rehabilitation therapy to be more motivated to keep on participating.

Usefulness of the Application

For the analysis of the participant's experiences concerning the usability of the application "Geluk en zo" the subsequent codes are interpreted: *Expectations*, *Impression*, *Goals*, *Motivation*, *Changes,* and *Future*.

The first asked question in the interview, after the time of use, was if they had *expectations* before they started to use the application. Here, all three participants indicated to had less or no expectations of the usage. They wanted to wait and see what the intervention offers. Two participants wished that they can learn something new from the exercises.

Further, all participants had a good first *impression* of the application. One said if it is not for her it could help somebody else, but first, she had to wait and see. The word "Happiness" sounded very interesting to participant A and she liked to use online applications which aimed to help her.

Concerning the code *Goals*, two of three participants could mention the aim of the application. Every participant stated that they were more aware of their actions and values.

The code *Motivation* indicated that the usage of the application is positively for all participants. One participant stopped doing activities that were not in the direction of her

values in life which gave her "a nice feeling" (Participant A). Questions about their activities, if they were away or towards their value, are experienced as practical and very essential. Participants were motivated to fill in exercises because of the uncomplicated, short and fast way of use.

With regard to *Mental Changes*, all three participants said that their consciousness of their activities increased. Now they are more aware of their values and if activities are away or towards them. They think about the reasons behind their activities and one participant could find out that she is already acting a lot towards her values in life. Two participants could formulate what they learned through the application. Step four, *Do it,* gave them the opportunity to try out new activities. Also, they stated to become more aware of their own body than before. One participant stated that she has to use the application for a longer time period to be able to learn something new. She stopped participating after three to four days due to personal circumstances (see Figure 3).

Mental changes such as increased awareness of behaviour influences *physical changes* of the participants. The exercises in the application motivated the participants to try out new value-based behaviors such as riding the bike, go walking every day and listening to relaxation stories.

In comparison to the *Impression previously*, the *Impression afterwards* are more detailed. Participants stated that everything in the application was succinct in comparison with other online-applications. Exercises are clear, easy and useful. Participant C added that it would also be useful for older people because of the ease of usage. The application was rated on a scale from 1 to 10, with one 6 and two 8's.

Directed towards the *Future*, all three participants stated that they would use the application again, for example, when they want to remind themselves of valuable activities to decrease their pain. Two participants think that it would also be helpful for people outside of the Roessingh rehabilitation centre and also for non-chronic patients. Participant A would suggest the application to others if all improvements are revised in a second version of the application.

4. Discussion and Conclusion

The purpose of this research was to study the usability and usefulness of the brief psychological e-health application "Geluk en zo". Generally, the usability was experienced as problematic due to technical issues. In contrast, the usefulness was mostly seen as positive.

A number of chronic pain patients, who were assessed for eligibility, had difficulties with the usability of the application. As consequence, they were not able to take part in the intervention or stopped after a few days, despite their willingness to participate. This shows that every small step in the process of this intervention is experienced as an obstacle for the patients which costs energy. They only have little energy resources available and gave the participation quickly up. The implementation of the intervention has to be more straightforward to facilitate the start and use, and to ensure that chronic pain patients are able to use it on their own, for example at home. According to van Gemert-Pijnen et al. (2011), an intervention needs support from all stakeholders who are involved in its implementation. For example, healthcare professionals should be actively involved to be able to assist patients in the beginning (Gemert-Pijnen et al., 2011).

The current version of the application is a first version and did not work correctly. All three interviewed participants experienced problems due to technical issues of the application. Primarily, the lack of reminders displayed a significant difficulty for the users who started the intervention. The actual purpose of the reminders is to inform the users, at a random moment, when a new module is available. Working reminders would facilitate the usage for these three participants and prevent a high number of cancellations after the start of the intervention.

About the usefulness of the intervention, it can be said that the user's experiences were mostly positive. Participants frequently mentioned, to be more aware of their activities and the reasons behind them and their values in life. Also, two participants adopted new value-based behaviors. The videos and exercises in the application displayed ACT-functionalities and reminded the patient of their earlier formulated values in life. The application was seen as useful, especially in conjunction with the therapy they receive in the Roessingh rehabilitation centre. Themes such as values and goals in life were known. In general, e-health applications allows the user to implement it in their personal environment as at home or in their therapy.

After a first evaluation of the application "Geluk en zo", user requirements are clearer than before, so the current version could be revised. Viewing the application "Geluk en zo" in larger context illustrates the support of the development of psychological flexibility as a

change mechanism in chronic pain patients. This includes that participants adopted new value-based behaviors as suggested by Schreurs (2018), which makes it reach the goal of this ACT-intervention. These findings corroborate outcomes of previous studies suggesting that ACT- based interventions improves psychological flexibility and therefore mental health (Hayes et al., 2006; Trompetter et al., 2015b). Furthermore, support is founded on earlier findings of Atjak et al. (2015), that ACT is effective as a positive psychology intervention for chronic pain patients. In addition to Veehof et al. 2016, who stated that more extensive acceptation-based interventions are successful in the long-term, this study came up with new insights in the usefulness of short-term online interventions for private use. The application has the potential to be successful in the short-term, which supports the findings of Dahl et al. (2004).

In addition, this research gave much information about the usability of the application. The CeHRes Roadmap for the development of eHealth technologies emerged as a useful method for development and co-creation of a health-application (Gemert-Pijnen et al., 2011). Based on this framework, the researcher of the current study conducted interviews asking for user requirements and experiences. Also, it gives recommendations for future research, for example to involve more stakeholders in the implementation process. Following these authors, the development of an e-health technology is an iterative and long-term process. The application needs to be continuously evaluated and improved. This iterative process aims to ensure the most possible accordance between the users, technical aspects of the application and the context of usage.

Furthermore, the high experienced usefulness of the MARS allows evaluating it as a valuable method for developing an interview scheme in the current study and for future research. Without many changes could the main topics of the questionnaire be formulated into codes. Conducting the interviews verbally, displayed a useful method for the purpose of this study. The number of questions was high, and the aim was to collect broad information concerning a first evaluation of the application. For future studies it could be possible to conduct the interviews in written form. In a later stadium of the evaluation process less questions would be asked so that it would be less effort for chronic pain patients. Now, it seemed to be advantageous to conduct it verbally.

All in all, these results add to a growing body of literature that emphasizes the usefulness and usability of ACT-based and short-term online interventions. Furthermore, the CeHRes Roadmap and MARS were evaluated as valuable methods for the current research.

Limitations and Recommendations

This research has several limitations. First of all, the numbers of cancellations before and during the participation were high. Reasons varied between the participants. As a result of cancellation, the sample size in this research was small (N=3). A bigger sample size would entail a greater diversity of perspectives and experiences with the application (Tong, Sainsbury & Craig, 2007). Now the participants were a less heterogeneous group than wished, however useful qualitative data could be collected. For more diverse results it is recommended to have a bigger and less homogeneous sample.

Second, all data gathered in this study was self-assessed by the researcher of the current study, which could have influenced the findings and makes it susceptible to an interpretation bias (Tong, Sainsbury & Craig, 2007). The interview scheme was developed on the base of an approved questionnaire, the MARS, and formulated together with a fellow student to improve the quality of the interviews and qualitative data. Also, the coding process of the interviews was conducted together and in an iterative way, to improve the objectivity and reliability of the current study. Further, the researcher of the current study already had experiences in conducting interviews and coding them through earlier research at the University which decreases the probability for mistakes.

Third, the person and his status who conducts the research can be of influence. The participant's openness could depend on it. The researcher of the current study was a University student and participants knew this. It could make a difference if the researcher would be a healthcare professional who is already known for the chronic pain patients from their therapy or an unknown person. It is possible that participants answer more open or do not dare to express criticism because of familiarity or anonymousness with the researcher. In short, the researcher of the current study did not have the impression that his status influenced the data collection negatively.

As a potential implementation issue, it could be taken into consideration to let healthcare professionals participate in this study as well. It was found that it is important to involve stakeholders to guarantee the uptake of an e-health application (Eysenbach, 2008). From a professional perspective, the value of the application for the chronic pain patients therapies as well as the usefulness of the intervention could be evaluated. It would enrich future research because of insights in the health care sector and the patient's rituals and habits (Gemert-Pijnen et al., 2011).

Future research would still be situated in the research and development activity design of the CeHRes Roadmap for the development of eHealth technologies (Gemert-Pijnen et al., 2011). It is recommended to conduct a second pilot study of a revised version of the application "Geluk en zo". Thereby, a shorter interview scheme would be conducted. Furthermore, it could be think about the development of more than one version of the application. These versions could differ in duration of the modules and the whole intervention. Before the start of the intervention, every participant could decide which version he or she would like to use.

In summary, the usage of the application "Geluk en zo" was mostly experienced positively. It has the potential to offer the individual user an improvement of the awareness of values and activities, and the possibility to adopt new value-based behaviors. As a result, their psychological flexibility might increase. Concerning the usability of the application a revised version is strongly required. After this research, the user requirements and experiences are more precise than before. Brief e-health interventions such as "Geluk en zo" provide users with practical support to cope with their chronic pain.

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6.   Appendixes

6.1 Informed consent

Toestemmingsverklaringformulier (informed consent)

Titel onderzoek: De applicatie Geluk en zo bij chronische pijnpatiënten. Co-creatie en onderzoek naar gebruikerservaringen.

Verantwoordelijke onderzoekers: Marleen J. en Karlein Schreurs, Universiteit Twente, Enschede

In te vullen door de deelnemer

Ik verklaar op een voor mij duidelijke wijze te zijn ingelicht over de aard, methode, doel en belasting van het onderzoek. Ik weet dat de gegevens en resultaten van het onderzoek alleen anoniem aan derden bekend gemaakt zullen worden. Mijn vragen zijn naar tevredenheid beantwoord.

Ik begrijp dat het materiaal of bewerking daarvan uitsluitend voor het verbeteren van de app wordt gebruikt en voor presentaties daarover.

Ik stem geheel vrijwillig in met deelname aan dit onderzoek. Ik behoud me daarbij het recht voor om op elk moment zonder opgaaf van redenen mijn deelname aan dit onderzoek te beëindigen.

Naam deelnemer: …………………………………………………………………………..

Datum: …………… 	Handtekening deelnemer: …...…………………………………….

In te vullen door de uitvoerende onderzoeker

Ik heb een mondelinge toelichting gegeven op het onderzoek. Ik zal resterende vragen over het onderzoek naar vermogen beantwoorden. De deelnemer zal van een eventuele voortijdige beëindiging van deelname aan dit onderzoek geen nadelige gevolgen ondervinden.

Naam onderzoeker:

Datum: ……………   Handtekening onderzoeker: ..………………………………….

6.2 Information form

Enschede, 27 Maart 2018

E-health applicatie, Geluk en zo'

Geachte heer/mevrouw,

U behandelaar heeft u gevraagd of u wilt deelnemen aan het gebruik van de e-health applicatie "Geluk en zo", ontwikkeld aan de Universiteit Twente. U beslist zelf of u mee wilt doen. Voordat u de beslissing neemt, is het belangrijk om meer te weten over de studie. Met deze brief geven we u meer informatie over de studie en wat deelname voor u betekent. Lees deze informatie rustig door. Bespreek het met anderen. Als u na het lezen van deze brief nog vragen heeft, kunt u terecht bij onderstaande onderzoekers. De contactgegevens vindt u aan het eind van deze brief.

1. **Wat is het doel van de studie?**

   Het doel van de studie is om de gebruikersvriendelijkheid en nuttigheid van de applicatie "Geluk en zo" te testen.

2. **Wat houdt de e-health applicatie in?**

   Aan het begin van de studie krijgt u toegang tot de applicatie "Geluk en zo". Deze applicatie is bedoeld als ondersteuning bij chronische pijn. In de applicatie komen thema's aan bod als acceptatie, mindfulness en leven naar waarden, om u bewust te maken voor uw persoonlijke doelen en waarden in het leven.

3. **Hoe wordt het onderzoek uitgevoerd?**

   Aan het begin van de studie krijgt u uitleg over de e-health applicatie en krijgt u toegang tot "Geluk en zo". We zijn geïnteresseerd in uw meningen en waarnemingen over het gebruik van de applicatie.

4. **Wat wordt er van u verwacht?**

   Als u meedoet, vragen we u om de e-health applicatie gedurende 9 dagen te gebruiken, waarin elke dag een andere module aan bod komt van ongeveer 10 minuten.

   Na het gebruik van de applicatie worden face-to-face interviews afgenomen van ongeveer 30 minuten per persoon.

5. **Wat gebeurt er als u niet wenst deel te nemen aan dit onderzoek?**

   U beslist zelf of u meedoet aan deze studie. Deelname is vrijwillig. Als u besluit niet mee te doen, hoeft u verder niets te doen. U hoeft niets te tekenen. U hoeft ook niet te zeggen waarom u niet wilt meedoen. Als u wel meedoet, kunt u zich altijd bedenken en ten aller tijden stoppen met uw deelname.

6. **Wat gebeurt er met uw gegevens?**

   Al uw gegevens blijven vertrouwelijk en worden anoniem verwerkt. Alleen de onderzoekers hebben toegang tot u gegevens en het wordt niet aan derden verstrekt. Als u de toestemmingsverklaring ondertekent, geeft u toestemming voor het verzamelen en bewaren van u gegevens.

7. **Zijn er erxtra kosten/is er een vergoeding wanneer u besluit aan dit onderzoek mee te doen?**

   Deelname aan deze studie is gratis, maar er is ook geen vergoeding voor deelname.

8. **Wat doet u als u mee wilt doen?**

   Wanneer u heeft aangegeven geïnteresseerd te zijn in deelname aan de studie, ontvangt u vrijdag 30 maart 2018 nadere instructies en de toegang tot de applicatie "Geluk en zo" en kunt u het toestemmingsformulier invullen.

   Met vriendelijke groeten,
   Marleen en Karlein Schreurs

6.3 Interview scheme

Interviewschema "Geluk en zo"

Demografische gegevens:

Participant:

Leeftijd:

Geslacht:

Opleiding:

Algemeen:

    1) Wat was uw eerste indruk en waarom?

    2) Wat waren uw verwachtingen?

Inhoudelijk:

Interesse

    3) Vond u het interessant om de app gebruiken? Waarom wel? Niet?

Gebruiksgemak

    4) Hoe gemakkelijk is het om te leren de app te gebruiken? Waren de innstructies duidelijk?

Doelen

    5) Kunt u in uw eigen woorden aangeven wat het doel van de app is?

    6) Wat vond u van de uitleg over het doel van de app?

    7) Is dat doel behaald?

Kwaliteit van informatie

    8) Hoe vond u de manier waarop de inhoud van de app werd omschreven?

    9) Wat vond u van de informatie richting het doel van de app?

Kwantiteit van informatie

    10) Wat vond u van de hoeveelheid informatie die werd gegeven?

    11) Wat vond u van de vragen waarbij u moest invullen wat u aan het doen was?

    12) Wat vond u van de vraag of de activiteit vandaan of naartoe was?

    13) Wat vond u van de meerkeuze vragen over de activiteit in dag 2 en dag 3 (registreren) van de app? (interessant, belangrijk, zelf gekozen, waardevol, moet je doen)

    14) Wat vond u van de vraag of u door wilde gaan met de activiteit of iets anders zou doen in de laatste 5 dagen (doen) van de app?

    15) Wat vond u ervan dat u de modules terug kon kijken?

16) Wat vond u van de opbouw van de modules?

<u>Design</u>:

Prestatie

17) Werken de reminders? Indien reminders ontvangen: Wat vond u van de hoeveelheid reminders? Wat vond u van de formulering van de reminders?

18) Heeft u er zelf aan gedacht met de modules bezig te gaan of moest u eraan herinnerd worden?

Navigatie

19) Wat vond u van de optie om af te wisselen tussen de schermen van actieve modules en afgeronde modules?

Ontwerp

20) Hoe waren de interacties tijdens het invullen van de modules in de app?

Layout

21) Wat vond u van grootte en opbouw van de knoppen/menu's op het scherm?

22) Wat vond u van de opmaak van de app?

Visuele informatie

23) Wat vond u van de visuele uitleg van concepten door middel van video's/afbeeldingen?

24) Wat vond u van de manier waarop de informatie en modules werd gepresenteerd?

Tijd

25) Wat vond u van de duur van de modules?

26) Wat vond u van de duur van de gehele interventie?

<u>Motivatie</u>:

27) Hoe vond u het om de oefeningen in te vullen wat u aan het doen was? Waarom?

28) Hoe vond u het om aan te geven of deze activiteit vandaan of naartoe was? Waarom?

29) Hoe vond u het om te beslissen om door te gaan of te stoppen? Waarom?

30) Wat vond u van de oefeningen? moeilijk/makkelijk etc.? Waarom?

<u>Veranderingen</u>

31) Op welke manier zijn er door de app veranderingen opgetreden in hoe u over uw activiteiten denkt?

32) Bent u andere activiteiten gaan doen door de app? Welke wel/niet?

33) Welke veranderingen zijn er opgetreden m.b.t. bewustzijn van persoonlijke waarden en doelen?

34) In hoeverre bent u zich bewuster geworden van uw lichaam?

35) Op welke manier heeft het gebruiken van de app invloed gehad op uw waardevolle acties?

36) Wat heeft u door het gebruiken van de app geleerd?

37) Hoe heeft de app invloed gehad op uw motivatie om te veranderen?

Einde

38) Welke suggesties heeft u voor verbetering van de app?

39) Wat zou u zelf graag nog toegevoegd zien? Mist er iets?

40) In welke mate kwam de app overeen met uw verwachtingen?

41) Op welke momenten/in welke situaties zou u de app zelf gaan gebruiken?

42) Wanneer zou u de app aan anderen aanbevelen?

43) Welke cijfer zou je aan de app geven? (van 0 tot 10)

6.4 Frequency Distribution of the Codes

Table 3

Code frequency per participant and code or subcode arranged in alphabetical order.

	Participant A	Participant B	Participant C	Total
Goals	1	2	3	6
Physical changes	2	1	2	5
Impression afterwards	1	3	3	7
Impression previously	3	1	1	5
Interactions	6	6	8	20
Quality of information	8	8	8	24

Quantity of information	1	1	1	3
Layout	4	4	4	12
Mental changes	4	4	4	12
Motivation	8	5	7	20
Time	2	2	2	6
Future	2	2	2	6
Improvements	14	5	3	22
Expectations	2	3	1	6
Total	58	47	49	154

The Reasons for the distribution of frequencies were that a different number of interview questions was coded together in one code. Noticeable was that there was a significant difference in frequency of the code *Improvements* between the participants. In comparison, participant A mentioned twice as much information as the other participants in conjunction with this code.