

How do chronic pain patients
and professionals assess the
usability of the on Acceptance
Commitment Therapy based
mobile application and website
NaDien?

Bachelor thesis

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Abstract

Background: The center Roessingh treats patients with chronic pain and chronic fatigue with Acceptance Commitment Therapy and mindfulness training. Acceptance based interventions like ACT is an empirically-based psychological intervention that uses acceptance and mindfulness strategies to increase psychological flexibility. After the intensive eight weeks treatment it appeared that patients have difficulties to apply the learned techniques at home, because the transfer from the intensive treatment to the time afterwards is too big according to the course participants. Therefore, a mobile application and website was developed to support the patients with an e-health program during and after the ACT- treatment at the rehabilitation center. The usability is tested to make it more consumer friendly, so patients keep using it to prevent a decline in the positive effects of ACT. Method: In this qualitative usability study, fourteen participants took part, consisting of e- health experts, professionals and chronic pain patients. The think aloud method was used based on scenarios and interview questions and coded in system,- content,- and service quality to figure out the usability of the website and mobile application. Results: The respondents managed most scenarios well. Still also some difficulties managing the scenarios took place and technical errors occurred. Conclusion: The assessment of system, - content, - and service quality got in total good results. Even though the respondents valued some parts of the application, changes need to be made. It is recommended to rework the mobile application and website NaDien and change some parts of it to make it more consumer friendly. Furthermore, it is recommended to make a pre- and post- test to measure the effects of NaDien.

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Introduction

Pain - a feeling everybody already has experienced. While most people suffer from pain for a short period of time, some people suffer from it for months or years. This is also defined as chronic pain. According to the DSM IV a patient who suffers from pain six months or more receives the diagnosis chronic pain (DSM- IV). The prevalence of chronic pain in the Netherlands is 18%, one-third of the Dutch pain patients is between 41-60 years old (Breivik, Collett, Ventafridda, Cohen & Gallacher, 2006).

The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage”. Chronic pain has an impact on the quality of life of the patients; this can be physical quality of life as well as in public and social relations. In a study of Lame, Peters, Vlaeyen, Kleef and Patijn (2005) it was shown that 41.3% of chronic pain patients have impacts in physical functioning; almost 40% feel inhibited in their social functioning and more than 20% of Dutch pain patients feel affected in their mental health. Depression, anxiety and other psychological problems have high comorbidity with chronic pain (Miller & Cano, 2009). Not only is chronic pain a burden for patients and their family, it has also impact on society and economy. In the Netherlands healthcare expenditure for pain amounts to €289 million a year. With nearly nine healthcare visits a year, the Netherlands lies above the average in Europe (Pain Proposal, 2010).

Acceptance Commitment Therapy

Acceptance- based interventions such as mindfulness- based stress reduction program and acceptance and commitment therapy are alternative therapies for treating chronic pain patients (Veehof, Oskam, Schreurs & Bohlmeijer, 2011). This therapy is a type of the cognitive-behavioral therapy, also named the third generation of CBT. In a meta- analysis by Veehof et al. (2011) it was shown that ACT is not superior to CBT but can be a good

alternative.

According to the American Psychology Association experiences, thoughts, emotions and symptoms with negative impact lead to various disorders when avoided or suppressed. According to the concept of ACT it is necessary to change the relationship between the individual and for example physical sensations like chronic pain. Trying to avoid pain causes distress, therefore acceptance and mindfulness strategies are taught to patients. The aim is to accept someone's own experience rather than to change or control the symptoms. According to the American Psychological Association there is "substantial basic research supporting ACT's fundamental processes, and preliminary evidence regarding their meditational role in ACT outcomes". One essential element of ACT is mindfulness. Kabat- Zinn (1990) described mindfulness as a process of bringing a certain quality of attention to moment-by-moment experience and "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994).

Results suggest that a brief course of acceptance based treatment can have long lasting impact even among individuals with an extensive history of pain (Wetherell, Afari, Rutledge, Sorrell, Stoddard, Petkus & Hampton Atkinson, 2011). According to a study of Dahl, Wilson and Nielsson (2004) participants who had received ACT had taken fewer sick days in comparison to patients who were treated with medicaments, even though there were no significant differences in pain level itself. Still, according to a systematic review and meta-analyses of acceptance- based interventions for the treatment of chronic pain (Veehoef et al., 2011) medium effect sizes for pain intensity, depression, anxiety, physical wellbeing and quality of life were found. Even though preliminary studies included in the study of Veehoef et al. showed promising results (Roemer, Orsillo & Salters- Pedneault, 2008; Teasdale, Moore, Hayhurts, Pope, Williams & Segal, 2001) more high quality studies concerning the effects of ACT are needed.

The Dutch rehabilitation center Roessingh located in Enschede offers patients with

chronic pain and chronic fatigue ACT and mindfulness training. The treatment lasts eight weeks where the patients stay three days a week in the center and four days at home. After the intensive eight weeks treatment patients should apply the learned techniques at home and integrate them in their life to increase the effectiveness. According to a focus group it appeared that patients have difficulties to apply the learned techniques at home after treatment (Fledderus & Scheurs, 2012). The difference between the intensive treatment and the time afterwards is too big according to the participants. It was shown that the effects of ACT reduce after three month when not practiced (Het Roessingh, 2012). Therefore, a mobile application and website was developed to support the patients during and after the intensive treatment at the rehabilitation center and to prevent a decline in the effects of ACT.

EHealth and Health Apps

It was chosen to support patients with a mobile application and a website at the center Roessingh. Those health applications are part of eHealth. This concept refers to the delivery of eHealth services via the internet through for example videoconferencing, chat or web applications.

EHealth is a fast growing and popular subject in healthcare, because of the possibility to store patient's information digitally, to share experiences and thoughts with other authorized people, availability for nearly everybody and the cost-efficiency. The World Health Organization defines eHealth as "... the use, in the health sector, of digital data - transmitted, stored and retrieved electronically- in support of health care, both at the local site and at a distance" (WHO, 2013).

Mobile Health Apps have several practical and financial advantages. Patients can use the mobile app where ever they are, they do not have necessarily to go to an expert if they have any questions. This has also impact on financial aspects and because of the cost-effectiveness it is likely that healthcare will increasingly focus on eHealth and apps. Mobile

applications offer mobility, no time-delay by switching on the computer and the possibility to use the course in a short moment of time. According to Kratzke and Cox (2012) health applications are changing health promotion sustainable. With the development of eHealth and the growing potentials of technology, especially smartphones, a more personalized and direct healthcare is possible. Further it is stated that apps are getting more the source of information instead of the usual used browser (Ebeling, 2012). Health specialists can use behavior change interventions in eHealth to be more interactive, because of the mobility mobile apps entail. In addition e-health offers benefits for experts, patients and health economy. It helps health professionals being more efficient and to be able working at distance. Patients can use their Smartphone's for mobile self-monitoring as well as health behavior maintenance.

Even though eHealth has many advantages, there are also some disadvantages and problems which can occur and need to be respected. Luxton, McCann, Busch, Mishkind and Reger (2011) define some considerations of Smartphone's in health. According to them, there are people who do not have a Smartphone or do not want to or cannot use health apps on Smartphone's. For those people an alternative should be available. Therefore the center Roessingh also offers a website of the application NaDien. Furthermore, it is important that the safety and quality of health apps are assured. The content should always be accurate, up to date, reliable and evidence based. Data security, privacy and personal data should always be secured.

Short description of Mobile Health App of Roessingh

The website and mobile application provided by the center Roessingh consists of six main menus- "*Values and Actions, How are you, Exercises, Tips, Text message coach and Frequently Asked Questions*". This gives patients the possibility to apply and maintenance learned strategies and to exchange views with other patients. More information of the app will be given in the method section of this paper.

It is the aim of this usability study to find out how the participants experience the website and mobile application *NaDien*; research is necessary to identify its potentials. This research will be the first usability study on this subject. It will focus on the system quality, content quality and service quality with the method of user based usability testing; scenario based think aloud and semi-structured audio taped interviews.

The *system quality* of the application refers to the placement of buttons and the layout; so the user friendliness of the application. The *content quality* refers to usefulness and persuasiveness of the information of the application including spelling and understandability of all texts, so the provided content. The *service quality* focuses on the process of care given by the application (Kelders, Pots, Oskam, Bohlmeijer & Van Gemert-Pijnen, 2012), so the provided services and auxiliaries for health.

According to Jaspers (2009), the *think aloud method* is a widely applied user based method to find errors and to get impressions of the user thoughts and view. The usability of the mobile application and website will be discovered to improve it. The assessment of the respondents is important to find possible errors and to get a good evaluation. The quality of the usability of *NaDien* is important, so patients like to use it. A high quality leads to more usage, this improves and stabilize learned techniques and thus supports people with chronic pain.

This research tried to find an answer to the question whether chronic pain patients and professionals think the usability of the on Acceptance Commitment Therapy based mobile application and website *NaDien* is sufficient.

Note: In this paper the pronouns *he* and *himself* are used for both genders.

Method

Participants

In the study 14 participants were interviewed. There were five chronic pain patients who were treated in the eight week treatment at the center Roessingh. The chronic pain patients were invited by mail, which we received by the course leader of the treatment for chronic pain patients of the center Roessingh. Ten of the patients were invited to take part and five respondents were willing to participate. Furthermore, five professionals with psychological or medical background from the center Roessingh took part and four experts in ehealth. The experts and professionals were invited by mail, which we received by our tutor of this thesis. Nine people of this group were asked, all of them participated. In total eleven women and three men took part in this study. The average age was 28 years. All of them have experience with computers, 12 have experience with mobile applications and five respondents have also experience with health apps (Appendix A, table 9). The mobile application was evaluated six times; the website was evaluated eight times.

Interview procedure

A first version of the website and the mobile application called *NaDien* was developed and offers the possibility to realize a usability test. In this study the think aloud method for usability testing is used to identify the problems of the mobile application and website.

The user is asked to comment every step he takes while using the mobile application or website by scenarios. By this he should also say out loud his thoughts, view and critiques which are coming to his mind. By recording it, the advantage of this method is that there are no long-term memories needed and distortion can be minimized. The user based usability evaluation was conducted with semi-structured interviews and scenario-based think aloud protocols.

According to Hwang and Salvendy (2010) nine users are recommended when ‘think aloud’ is used to detect 80% of usability problems. Furthermore *system quality*, *content quality* and *service quality* are measured which belong to usability testing.

The procedure of the usability test started with an introduction in which the participant was informed about the study and its aim. He was introduced about the method how to *think aloud* during the scenarios. Furthermore, he was informed that the interview will be recorded and that everything will be handled anonymously. When the participant agreed, the experiment started officially with the audiotape.

The first questions contained demographical data and the experience with computers, mobile apps and health apps. After that the researcher read out the scenarios step by step and the participant said out loud what came to his mind. All of the six menus got a few scenarios, as well as the *Log in* and *Log out*. Scenarios were composed of questions like “You would like to share a tip with other users, how would you do that?” (Appendix A, table 8).

As the participant reached a point of the mobile application or website where he got stuck anywhere, the researcher gave little clues; if it took too long the researcher stopped with this part and went to the next step. If the participant forgot to *think aloud* the researcher made him aware of it. If there was not lot information about the quality of the website or mobile application and the thoughts of the participants, more questions were asked. At the end, questions were asked concerning general attitude towards the website and mobile application. Questions concerning *content quality*, *service quality* and *system quality* were also asked. With the completion of the interview the participant was released.

Intervention NaDien

The application provided by the center Roessingh is in Dutch and is composed of six main menus- “Values and Actions, How are you, Exercises, Tips, Text message coach and Frequently Asked Questions”, which will be described here. Pictures of the menus are

available in the Appendix B.

In the section „Values and Actions“ the user can register his personal values and matching actions. It is possible to add the number of actions if the user performed it. From the library the user can add sample actions to his own list. In the section “How are you” the user can give his self a score how he feels, once per day or in how far he lived his values. In the overview he gets a graphical representation of the scores. In the section “Exercises” the user can add exercises he learned in the treatment or figured out by his self. Further it is possible to add exercises to the own list from the library, which also contains sound clips for mindfulness exercises. The sound clips can be listened to and can be downloaded. In the section “Tips” it is possible to add own tips in *my own tips*, which can be shared with other users of the mobile application and website. In *shared tips* the user can see the shared tips from other users which he can like. In *Top 10 of the week* the user sees an overview of the most liked tips, which are ranked weekly.

In the section “Text message Coach” the user has different options. It is possible to get standardized motivating text messages, getting text messages as a reminder and to get messages the user writes to his self. All those options can be switched on and off by the user individually. In *settings* the user has the possibility to choose between mail and mobile phone to get the messages. The services of the text message coach are for free. In the section “Frequently asked questions” the user gets a legend of the icons used in the mobile application and website.

Data analysis

The comments yielded through the scenarios were recorded. The records were used to assure the completeness of the results. They were transcribed and categorized in relevant verbalizations of thought, problems encountered by the participants, tasks that were completed smoothly and relevant feedback the participant provided during the interview

(Kelders et al., 2012). The same procedure was adapted on the interview questions, during and after the scenarios. Answers were firstly categorized by the researcher in the three different qualities, then in likely comments and finally in subgroups. If there was no comment about one of the qualities it will not be listed. The website and mobile application were evaluated together in each scenario. Different problems occurring during the scenarios were discussed apart. The most important answers, suggestions, opinions and critics of the usability test were discussed and listed in the main improvement suggestions in the discussion.

Results

Log in

None of the participants had problems to login on the website or the mobile application NaDien. They valued the ease of use and the clarity of it and valued that it is possible that the log in data can be remembered. The only negative point mentioned by the users of the mobile application was that the logos of the university of Twente and the center Roessingh were not identifiable.

System quality	Mobile application	Number of statements	Website	Number of statements
Ease of use	-duidelijk	1x	-duidelijk	1x
Efficient feedback channel	-goed dat men keuze heeft om te onthouden	2x	-geen probleem -goed dat men keuze heeft om te onthouden	1x 2x
Design/ Presentation	-overzichtelijk, fris	2x	-overzichtelijk	1x
Readability of tekst	-onderste letters zijn niet leesbaar	1x		

Table 1 Main statements of respondents on the qualities of the application NaDien, Menu Log in

Values and Actions

The users valued the ease of use, the navigation throughout the menu, the design and the efficient feedback channel “*Het is duidelijk en overzichtelijk; gewoon via het plusje, want dat betekent toevoegen; als ik op het vinkje ga wordt duidelijk aangegeven wat het betekent*”. But also some difficulties concerning the system quality occurred. After changing or deleting

something the setting was still open, this was confusing to the users. In one scenario four participants had difficulties to delete an action, because they had trouble finding the icon to delete, which is placed under settings *“Oh daar! Daar had ik die niet verwacht, dacht meer zo aan een min”*. When the participants were asked to rate their day, some participants clicked double, so the number also doubled and it was not possible to make it undone. Furthermore, during this scenario errors occurred- the number did not always raise or the counter got stuck. This was annoying for the respondents. Furthermore, there was some uncertainty concerning the buttons of the different menus of the mobile application *“Ik zie boven een aantal icoontjes, die op de homepage ook stonden, die ik nu kwijt ben”*.

Concerning the mobile application there was some bothering about the missing button to go back. When the users tried to use the back button on their mobile, they got back to the main menu or they were thrown out of the website *“Terugknopje mist, als ik die van mijn telefoon gebruik word ik er uitgegooid.”* Furthermore, there were some problems with the design *“Icoontjes zijn te klein voor mijn vingers, tricky”*. On the mobiles appeared a black timber sometimes, so it was not always possible to read the text or perform well on the task.

The content quality was valued positive because the patients learn to formulate their thoughts and values in the treatment *“In onze therapie zijn we bezig met het leren van formuleren van onze waarden, gedachten en gevoelens; Nuttig onderdeel”* and valued that they can do so on the application. Furthermore the perceived usefulness and the psychological influence was valued *“Goed dat ze hun waarden kunnen opschrijven, dat leren ze ook in therapie”*.

Furthermore, a problem of comprehensibility occurred during the scenarios by the mobile application. Some users of Smartphone's could not see the difference between *values* and *actions* *“Het is vreemd: Hier staat de waarde elkaar steunen, maar op het scherm staat “Actie: elkaar steunen” Ik zie hier niet het verschil tussen waarden en acties; Vind het*

verwarrend, ik wist niet in welk menu ik zat, bij waarden of bij acties; Ik vind het lastig het verschil tussen waarden en acties te zien; Onderscheid is niet duidelijk”.

System quality	Mobile application	Number of statements	Website	Number of Statements
Ease of use	-makkelijk	3x	-duidelijk	2x
	-spreekt voor zich	1x	-simpel	1x
	-duidelijke icoontjes	2x		
Efficient feedback channel	-opslaan duidelijk	2x	-wordt duidelijk aangegeven wat het betekend	2x
Design	-icoontjes meer uit elkaar	2x		
Navigation	-terugknop mist	2x	-instellingen blijft open staan	2x
	-instellingen blijft open staan	2x		
Presentation of content	-icoontjes kwijt	2x	-overzichtelijk	
	-verschil tussen actie en waarde onduidelijk	2x		
Clarity	-zwart balkje op scherm	2x		
Content quality				
Evidence based			-in therapie zijn patienten ook bezig met leren van formuleren van waarden	1x
Comprehensibility	-ziet het verschil tussen waarde en actie niet	3x		
Relevance	-nuttig	1x		
	-waardevol onderdeel	1x		

Table 2 Main statements of respondents on the qualities of the application NaDien; Menu Values and Actions

How are you

The system quality of the website and mobile application was valued positive concerning the ease of use “*Makkelijk; duidelijk*”. Respondents valued the design “*Lay-out is leuk; Bij overzicht krijg ik een grafiekje, leuk; Dat is leuk met die smilies*” and the efficient feedback channel “*Uw waarde voor vandaag is opgeslagen- prettig dat men het dan zeker weet*” even though most of the users did not value the scroll bar in the website and mobile application “*In eerste instantie zou ik op de getal klikken*”. The presentation of content was

also rated positive *“Positief dat er smilies staan, die het positieve benadrukken”*. All respondents managed the scenarios, even though ten out of 14 respondents clicked first on the number itself to rate their day.

There were further comments about the mobile application and the problems which occurred. Concerning the system quality there was some trouble with the overview of the scores *“Had niet gezien dat je meer scores kan zien, pijl is niet duidelijk genoeg dat er nog andere scores zijn”*. The slider to rate the users day was not working good *“Schuifbalk gaat niet soepel, zou er gefrustreerd van raken”*.

Some respondents missed a diary for the scores *“soort dagboek zou beter zijn-dat je niet alleen een cijfer kunt invullen, maar ook terug kunt zien en waarom je je zo een cijfer geeft”*. The social influence of the website and mobile application would be rated higher if it would be more interactive *“Zou goed zijn als je op je score een reactie krijgt, alsof het lijkt dat er aan de andere kant echt iemand mee kijkt”*. The black timber the respondents receive when they scored under six in the overview should be changed in color, because of the negative psychological influence *“De zwarte balk, dat geeft een negatief gevoel, de stemming gaat wat omlaag; Nu zie ik er alleen drie zwarte balkjes, dan ben je helemaal verdrietig”*. This has also influence on the perceived usefulness *“Geen idee wat de zwarte balk zou bijdragen, had het gevoel dat je bestempeld wordt”*.

System quality	Mobile application	Number of statements	Website	Number of Statements
Ease of use	-Duidelijk	1x		
Efficient feedback channel	-Bevestiging, dat het is opgeslagen	2x		
Design	-Leuk met de smilies	3x	-Lay-out is leuk	2x
			-Fijn dat men overzicht verkrijgt	2x
Presentation of content	-Smilies benadrukken het positive	2x		
Navigation	-Cijfer aanklikken in eerste instantie	5x	-Duidelijk aan de linkerkant “Overzicht”	2x
			-Cijfer aanklikken in eerste instantie	5x

Service quality				
Perceived usefulness	-Goed dat ze hun waarden kunnen opschrijven, dat leren ze ook in therapie	1x	- waardevol onderdeel	1x
Social influence	-zwarte balk	1x		
	-meer interactief	1x		
Content quality	-dagboek/aantekeningen	1x	-dagboek/aantekeningen	1x

Table 3 Main statements of respondents on the qualities of the application NaDien; Menu How are you

Exercises

13 respondents managed to perform well on the three given scenarios, so the ease of use is evaluated as positive. The system quality on the website and mobile application was valued *“Heel makkelijk; Ik vind het voor zich sprekend”*. It is rated positive that the icons of the mobile application and website are used continuous *“Het is een mooie rode draad door de website; Weer plusje”*.

During the scenarios occurred some technical errors. The text in the library did not always open, when the respondents were asked to read the text. Furthermore, there occurred a black timber in the mobile application, so the users were not able to read the text. Scrolling in the mobile application was not pleasant for the user, because it did not work fluently.

The content quality was rated well by the users of the website *“Mooi dat er niet te veel tekst wordt gebruikt; Mooi dat er geluidsfragmenten inzitten”*. Also the service quality got quite good results, but there was also a suggestion *“Het is mooi met de oefeningen, maar ook daar zou het goed zijn als men nog aantekeningen zou kunnen maken- dat je ook van jezelf leert”*.

System quality	Mobile application	Number of statements	Website	Number of Statements
Ease of use	-Makkelijk	2x	-Makkelijk	2x
Efficient feedback channel	-Duimpje wordt oranje	3x	-Groene kruisje is een mooie rode draad door de website	1x
Design/ Presentation			-komt duidelijk naar voren wat de opties zijn	1x
Navigation	-Toevoegen is via het plusje	2x		

Readability of text			-Lettertype goed	1x
Technical error	-Scrollen is heel gek, blijft hangen	2x	-Tekst bij teruglezen klapte niet uit	2x
	-Zwarte balk, dus kan men hele tekst niet goed lezen	2x		
Content quality				
Relevance			-geluidsfragmenten	2x
Language			-niet te veel text	1x
Service quality	-mogelijkheid zelf iets te kunnen toevoegen	1x	-mogelijkheid zelf iets te kunnen toevoegen	2x

Table 4 Main statements of respondents on the qualities of the application NaDien; Menu Exercises

Tips

Respondents described this section as easy to use. 12 respondents managed to complete all scenarios of *Tips* easily. The respondents were asked to like and share tips and valued the efficient feedback channel “*Goed dat het oranje wordt, dan weet je het zeker*”. But they missed information with whom and where a tip would be shared with “*Delen, maar waar naartoe?*” Further the design of the icon to share was confusing for some users “*Ander icoontje, lijkt meer op exit of eruit halen, is irritant*”.

Furthermore, the icons could be further apart, because it was not easy for the user to push just one button without pushing the other one on the Smartphone. Concerning the content quality an error occurred in accuracy on the Smartphone. On the screen appeared “*oefening toevoegen*” instead of “*tip toevoegen*”. Social dynamics concerning the service quality was rated high “*Dan leert men van elkaar; interessant te weten wat andere doen; men kan van elkaar profiteren*”.

System quality	Mobile application	Number of statements	Website	Number of Statements
Ease of use			-makkelijk	2x
Efficient feedback channel	- goed dat het oranje wordt (delen/likken)	3x	-goed dat het oranje wordt (delen/likken)	4x
	-onduidelijk waar naartoe wordt gedeeld	2x	- onduidelijk waar naartoe wordt gedeeld	2x

Design/ Presentation	-meer uit elkaar (delen/likens)	2x	-duidelijk icoontje voor liken	2x
	-voor delen ander icoontje, onduidelijk	2x	-voor delen ander icoontje, onduidelijk	3x
Content quality				
Accuracy	-oefening toevoegen i.p.v. tip toevoegen	1x		
Service quality				
Social dynamics	-van elkaar profiteren	1x	-van elkaar leren	2x

Table 5 Main statements of respondents on the qualities of the application NaDien; Menu Tips

Text message coach

The text message coach got good ratings, but there occurred also some problems. Positive rating concerning system quality got the ease of use “*Heel simpel; Dat werkt in een keer, prima*”. Also the respondents valued the efficient feedback channel “*Fijn dat men steeds zo een melding krijgt, of je het zeker weet iets te willen doen; Wordt duidelijk groen*”. But the navigation and the clarity got some less good reactions “*Mail en telefoon, wisselt altijd, vind ik irritant*”; concerning the app respondents mentioned “*Ik vind het eerlijk te veel tekst; Terugknop mist*”.

The message coach was also valued concerning the perceived usefulness “*Als jezelf iets omschrijft, blijft het het beste hangen.*” But there were also some consideration about the use of the of the message coach “*Ik vraag me af of er mensen meer voor automatisch berichtjes kiezen, dat is makkelijker*”. Further a respondent mentioned “*Weet niet of ik het zou doen, klinkt een beetje gek mezelf een berichtje te sturen*” and another one stated “*Dat jezelf motiverend toe kan spreken vind ik een beetje gekunsteld*”.

System quality	Mobile application	Number of Statements	Website	Number of Statements
Ease of use	-prima -makkelijk	1x 2x	-heel simpel	3x
Efficient feedback channel	-staat nu op rood en dan wordt die groen -fijn dat men steeds zo	2x	-fijn dat men steeds zo een melding krijgt of je het zeker weet	1x

	een melding krijgt of je het zeker weet		-wordt duidelijk groen	1x
Navigation	-mail en telefoon, irritant	1x	-mail en telefoon is irritant, beter een keuze hebben	2x
Clarity	-te veel tekst	1x		
Service quality				
Perceived usefulness	-raar zichzelf te motiveren/smsje sturen	2x		
Content quality				
Relevance	-nuttig	1x	-nuttig	2x

Table 6 Main statements of respondents on the qualities of the application NaDien; Menu Text Message Coach

Frequently Asked Questions

Concerning the navigation some difficulties occurred with the scrolling “*Scrollen gaat weer niet vanzelf, lastig*”.

The content quality was rated positive “*Weet precies wat de bedoeling van de icoontjes is; Mooi dat er niet te veel tekst wordt gebruikt*”, but concerning language a respondent advised to check the sentences “*Er zitten spelfouten in en ook de grammatiek...*”. Furthermore, it was advised to add the icons of the menus for the mobile application.

The respondents valued the usefulness of this menu “*Handig dat het wordt uitgelegd*”, but the content of this menu was rated as a legend “*Het lijkt me meer op een agenda*” which had influence on the relevance “*Als je echt een vraag hebt, zou je teleurgesteld zijn als je alleen de uitleg ziet* and also contact details were missing “*Hier zou ergens contact gegevens moeten zijn*”.

System quality	Mobile application	Number of statements	Website	Number of Statements
Ease of use	-prima	1x	-heel simple	3x
	-makkelijk	1x		
Clarity	-Vind het te veel tekst	1x		

Content quality			
Relevance	-handig dat het wordt uitgelegd	1x	
	-als je echt een vraag hebt zou je teleurgesteld zijn als je alleen de uitleg ziet	1x	-lijkt me meer op een soort agenda 2x
Contact	-hier zou ergens contact gegevens moeten zijn	2x	
Comprehensibility			-weet precies wat de bedoeling is van de icoontjes 1x
Language			-mooi dat niet te veel tekst wordt gebruikt 1x
			-zitten spelfouten in 1x

Table 7 Main statements of respondents on the qualities of the application NaDien; Menu FAQ

Log out

Logging out was easy for the users, 13 respondents managed the last scenario. There were just two suggestions of two respondents concerning the design. First one expert mentioned it is a wrong icon for logging out “*volgens mij verkeerd icoontje, dit is uitschakelen*” and for the website the size of the icon “*icoontje is te klein*”.

Discussion

In this qualitative study the usability of the application NaDien was tested. In the rehabilitation center Roessingh chronic pain patients are treated in an eight week course with the acceptance- based intervention ACT. Afterwards the patients have difficulties to apply the learned techniques at home (Fledderus & Scheurs, 2012), because the difference between the intensive treatment and the time afterwards is too big according to the course participants. Therefore an application was developed which is available as a website and mobile app to support the patients during, and above all, after the intensive treatment at the rehabilitation center. The study consisted of a scenario based think aloud method and interview questions to gather comments concerning the system-, content-, and service quality of the website and mobile application NaDien. This was done to answer the question how chronic pain patients and professionals assess the usability of the ACT based app and website NaDien. The more

consumer friendly the applications are, the higher the usage of them will be which avoids a decline in effects.

It can be stated that in total the usability of the first version of the website and mobile application NaDien got quite good results by the users, even though there were some improvement suggestions made, which will be discussed later in this section.

The users valued the ease of use, the clear navigation structures, the efficient feedback channel and the design of the applications. Also the content of NaDien was rated positive concerning the relevance and comprehensibility. The service quality got good results concerning the psychological and social influence as well as the perceived usefulness.

It can be mentioned that a difference between the experts, the professionals and the pain patients in focusing on the three qualities occurred. The experts focused more on the system-, and content quality, less on the service quality. The chronic pain patients focused above all on the system quality of the application and the service quality. The professionals had a balanced evaluation on all three qualities. The reason for those differences in focusing could be the background of the three groups. The experts have a more technical background; therefore the focus lies more on the structure or design of the applications. The patients are more involved in the essence of ACT, therefore they were more focusing on the user-friendliness and provided services of the applications. The professionals have knowledge about the psychological as well as a bit of the technical background. This could be a reason that they focused on all three qualities.

The respondents rated the system, - content, - and service quality positive on:

- The ease of use
- Clear navigation structures
- Efficient feedback channel

- Design
- Relevance
- Comprehensibility
- Perceived usefulness
- Social dynamics
- Psychological influence

Even though NaDien was rated positive on some points, problems and technical errors occurred. During the use of the mobile application were occurring more problems, than using the website. Users of the mobile application objected the design concerning the buttons: a back button is missing in some menus and it was suggested to place the buttons more apart. The scrollbar is too modest and the respondents of the mobile application also missed a home button. Furthermore, a black bar appeared on the Smartphone sometimes, so it was not possible to manage a scenario or read the text. Also scrolling was not working fluently. Furthermore, some icons overlapped sometimes with the text. Further problems and improvement suggestions were named in both applications: The design of the share button was not valued in both applications. It was rated negative that the setting did not close automatically after changing something and some technical errors occurred.

Recommendations for the application NaDien

The main improvement suggestions for the mobile application are to:

- Enlarge logos on front page
- Add a home button to see the meaning of the icons or add icons in the operating instruction

- Use another structure for values and actions
- Use a back button for all menus
- Place buttons more apart
- Make the scrollbar more visible

The main improvement suggestions for both applications are to:

- Change the color of the black timber in the menu How are you
- Add contact details
- Add an operation construction
- Add a diary or possibility to make notes
- Add automatic closing of setting
- Not use a scrollbar, but possibility to click on number to rate the day
- Add an explanation in FAQ where tips are shared to and with whom
- Use other icon for sharing
- Use two buttons for receiving message via mail/ short message
- Rework the technical errors which occurred

The outcomes of the assessments by the users were partly predictable. When using the mobile application and website the first time as researcher, most of the same problems occurred. It was clear, that some functions needed to be reworked as the function to rate the day. Furthermore, it was predictable that the mobile application needs more revision than the website concerning technical errors and structure.

Still, through the scenario based think aloud method with the 14 participants it was possible to discover information about the mobile application and website, which was not gathered before. As mentioned in the method of this paper nine users are recommended when 'think aloud' is used to detect 80% of usability problems (Hwang, W. and Salvendy, G., 2010). According to Jaspers (2009), the think aloud method is a widely applied user based method to find errors and to get impressions of the user thoughts and view. Working with 14 participants using the think aloud method can be rated as strong point of this study. Furthermore participants consisted of the target group, professionals and e-health experts, which made it possible to draw from a broad scope of different opinions and thus increased the generalizability and validity of this study.

Possible limitations

This study is the first usability test about the first version of the website and mobile application NaDien. Even though this study was realized with best purposes some limitations exist.

The first limitation of this study is that the participants were lead through the website and mobile application. The scenarios were structured straight, beginning with the Log in, one menu followed after the other ending with Log out. This may have had influence on the ease of use of the system quality. It would have been better to randomize the scenarios and not leading the respondents straight through the applications.

A second limitation is that the interviews were taken by three interviewers who each decided by himself when to help or when to stop with a scenario, which could have had some influence on the evaluation of NaDien. This could have been forestalled if arrangements would have been done between the researchers. Third- like in most qualitative studies- the interpretation of the interviewer by coding the interviews in a scheme could be a limitation of the study.

Fourth, three of the four experts, two of the five professionals and just one of the five pain patients used the mobile application. The experts are not only using mobile applications nearly every day, but also develop them. This fact could have had influence on the evaluation of the mobile application of NaDien. A better division of the applications between the three groups would have been better.

Furthermore, the participants were higher educated than the average of the Dutch population, which could have had an influence on the assessment and use of the mobile application and website. It appeared that the two participants with the education MBO had more trouble managing the scenarios. But those participants were also the oldest of the respondents, which could have also influenced their performance. If the education level had an impact on the performance and assessment on the applications is doubtful, still it is requested to balance the education levels for next research.

One more limitation could be the laboratory setting, which could have had an influence on the participant. It is possible that some participants experienced nervousness, even though it was pointed out that the interview and scenarios are not to test the respondents' knowledge. During the interviews some respondents showed some nervousness and insecurity and acted conservative, which maybe would have not occurred without the researcher sitting next to them.

Recommendations for further research

It is requested that the chronic pain patients already get used to the applications during the treatment, so if questions occur they can ask the course leader. Therefore the course leader who manages the eight week course at the center Roessingh should be involved. The course leader should have knowledge how to use the website and mobile application of NaDien, so he can explain it to the course participants.

As mentioned in the introduction it was shown that the effects of ACT reduce after

three month when not practiced (Roessingh, 2012). If the application NaDien will be reworked on the mentioned points and make it more consumer friendly, the quality of the usability will raise. This will have an impact on the commonness of the usage so it will prevent a decline in the positive effects of ACT. To measure this hypothesis it is requested to realize further research by a pre- and posttest study to measure the effects of the application NaDien.

This study shows that the assessment of the usability of the on ACT based application NaDien is rated quite well by the respondents. Still changes need to be made- the development of a program like NaDien always remains to be an iterative process.

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Appendix A

Introductie van de onderzoeker en het onderzoek

Welkom, fijn dat u gekomen bent. Ik zal mezelf eerst even voorstellen, voordat ik precies vertel wat de bedoeling is. Mijn naam is _____, ik ben psychologie student aan de Universiteit Twente en in het kader van mijn bachelorthese voer ik dit onderzoek uit in samenwerking met het Roessingh.

Allereerst wil ik u nogmaals bedanken dat u tijd heeft willen en kunnen vrij maken om ons bij dit onderzoek te helpen. Ik verwacht dat het onderzoek ongeveer een half uur zal duren en ik wil u er op wijzen dat u te allen tijde het recht heeft om met het onderzoek te stoppen. Ook wil ik nogmaals benadrukken dat er een audio-opname van het gesprek gemaakt zal worden en dat uw gegevens uiterst zorgvuldig en anoniem verwerkt zullen worden.

Dan zal ik nu wat meer vertellen over hoe het onderzoek/interview zullen worden uitgevoerd.

Het doel van dit onderzoek is dus om de gebruikersvriendelijkheid van de gezondheidsapplicatie “NaDien” te evalueren aan de hand van een aantal scenario’s. Daarbij is het de bedoeling dat u hardop denkt, terwijl u de scenario’s doorloopt, zodat het voor mij inzichtelijk wordt welke stappen u maakt en wat er zoal in u opkomt tijdens dit proces. Ik wil nogmaals benadrukken dat er geen foute antwoorden zijn en dat u alles mag zeggen, zowel positieve als negatieve dingen. De applicatie is niet bedoeld om uw kennis te testen, maar het gaat puur om het achterhalen van de gebruikersvriendelijkheid. Het blijkt namelijk dat veel chronische pijn patiënten na afloop van de behandeling, moeite hebben om het geleerde voort te zetten in de thuissituatie. Om die reden is het van belang dat er een nazorg applicatie komt dat zo gebruikersvriendelijk mogelijk is, zodat de revalidanten het ook daadwerkelijk kunnen en willen gebruiken en er zichtbare resultaten mee behaald kunnen worden. Goede feedback is daarom uitermate belangrijk.

Heeft u tot zover al vragen?

Voordat we beginnen met de scenario’s wil ik u graag eerst aantal korte vragen stellen over uw demografische gegevens en uw internetgebruik. En na afloop van de scenario’s zal ik nog een aantal vragen stellen over de applicatie zelf.

Bent u er klaar voor?

Tip voor onderzoeker: Doorvragen tijdens de scenarios, als niet voldoende informatie naar voren komt bvb:

Wat vindt u van de navigatie door de app?

Wat vindt u van de plaatsing van de buttons?

Wat vindt u van de lay-out?

Wat vindt u van de inhoud van de app?

Algemene vragen voor het interview

- Geslacht
 - Wat is uw leeftijd?
 - Wat is uw hoogst genoten opleiding?
 - Heeft u ervaring met computers en/of internet? Zo ja, hoe vaak maakt u hier gebruik van?
 - Heeft u ervaring met mobiele applicaties? Zo ja, welke
 - Heeft u ervaring met gezondheidsapplicaties? Of app's die met gezondheid te maken hebben? Zo ja, welke
 - U kunt nu kiezen tussen de mobile versie of de website (**alleen pijnpatienten**)
- Gekozen voor: mobiele app ☐ website ☐

Scenario's and performance on tasks

Scenario	Correctly done, without difficulties	Done with difficulties
Inloggen U wilt inloggen in het programma NaDien. Hiervoor heeft u de onderstaande gegevens tot uw beschikking: - Gebruikersnaam: test@test.nl - Wachtwoord: test	14/14	
'Waarden en acties' U wilt de waarde "elkaar steunen" toevoegen. Hoe zou u dat dan doen?	12/14	2/14
U wilt een actie toevoegen bij de waarde "elkaar steunen", namelijk "samen eten koken". Hoe zou u dat dan doen?	11/14	3/14
U wilt een actie uit de bibliotheek toevoegen aan deze nieuwe toegevoegde waarde. Hoe zou u dat dan doen?	12/14	2/14
U wilt de actie die u net heeft toegevoegd verwijderen. Hoe zou u dat dan doen?	9/14	4/14 1x not done
U wilt de waarde "elkaar steunen" wijzigen. Hoe zou u dat dan doen?	12/14	1/14 1x not done
U heeft de actie "samen eten koken" uitgevoerd en u wilt deze aanvinken in de app. Hoe zou u dat dan doen?	12/14	1/14 1x not done

‘Hoe gaat het?’ Stel u heeft vandaag een hele goede dag gehad en u bent tevreden over hoe u naar uw waarden heeft geleefd. Dit wilt u voor uzelf aangeven bij de beantwoording van de vraag. Hoe zou u dat dan doen?	14/14 10/14 wanted to click on the number itself	
Stel u wilt een overzicht zien van uw scores van de afgelopen dagen. Hoe zou u dat dan doen?	14/14	
‘Oefeningen’ Stel u wilt een interessante oefening die u tijdens de behandeling heeft geleerd toevoegen aan ‘mijn oefeningen’. Hoe zou u dat dan doen? Stel u wilt uit de bibliotheek de oefening ‘5 stappenplan (SAMDA)’ terug lezen. Hoe zou u dat dan doen? Stel u wilt de oefening ‘5 stappenplan (SAMDA)’ vervolgens toevoegen aan ‘mijn oefeningen’. Hoe zou u dat dan doen?	14/14 14/14 13/14	1/14
‘Tips’ Stel u wilt de tip “eet vandaag je lunch met aandacht” toevoegen. Hoe zou u dat dan doen?	14/14	
Stel u wilt de net toegevoegde tip graag delen met andere gebruikers. Hoe zou u dat dan doen?	12/14	2/14
Stel u wilt een gedeelde tip liken. Hoe zou u dat dan doen?	12/14	1/14 1x not done
Stel u wilt zien welke tip het meest is geliked. Hoe zou u dat dan doen?	13/14	1/14
‘Sms coach’ Stel u wilt elke maandag om 10:00 uur een herinneringssmsje ontvangen voor het invullen van de vraag bij “Hoe gaat het”. Hoe zou u dat dan doen?	12/14	1/14 1x not done
Stel u wilt instellen dat u een smsje met een motiverend bericht wil ontvangen nadat u de vraag ‘hoe gaat het’ heeft ingevuld? Hoe zou u dat dan doen?	14/14	


Stel u wilt uw berichten niet meer via de telefoon ontvangen, maar via e-mail. Hoe zou u dat dan doen?	11/14	2/14 1x not done
Stel u wilt zelf een smsje schrijven en deze 1 keer per week naar uzelf laten sturen. Hoe zou u dat	11/14	2/14 1x not done
 Stel u wilt weten wat dit icoontje betekent. Hoe zou u dat dan doen?	12/14	2x not done 1 because participant looked it up at “tips”
Uitloggen Stel u bent klaar en wilt uitloggen. Hoe zou u dat dan doen?	13/14	1/14

Table 8 Scenario's and performance on tasks

Vragen na het interview

- Hoe vond u dat het ging? (stoom afblazen)
- Heeft u nog aanbevelingen en/of opmerkingen voor de mobiele app/website? (tips)
- Zou u na uw behandeling gebruik willen maken van de mobiele app/website?
- Wat vindt u nuttig/minder nuttig aan de applicatie?

Listing participants

Participants	Gender	Education	Age	Experience with computers	Experience with mobile applications	Experience with health apps
1	F	MBO	51	Yes	No	No
2	F	MBO	58	Yes	No	No
3	F	WO	41	Yes	Yes	No
4	F	HBO	50	Yes	Yes	No
5	F	HBO	26	Yes	Yes	No
6	F	HBO	43	Yes	Yes	No
7	M	HBO	56	Yes	Yes	No
8	F	Master	35	Yes	Yes	Yes
9	F	HBO+	39	Yes	Yes	Yes
10	M	University	27	Yes	Yes	No
11	M	University	31	Yes	Yes	Yes
12	M	WO	25	Yes	Yes	Yes
13	F	WO	29	Yes	Yes	Yes
14	F	WO	26	Yes	Yes	No
Total/Mean	11		28,36	14/14	12/14	5/14

Table 9 Listing of the participants

Appendix B

NaDien Menu's

Values and Actions

The screenshot shows the 'Waarden en acties' menu selected in the top navigation bar. The left sidebar contains 'MIJN WAARDEN' with a green plus icon, and two sub-items: 'Elkaar steunen' and 'Dingen doen waar geen druk op zit'. The main content area is titled 'Acties' and shows a single action: 'Boek lezen' with a green checkmark and a '0' in a circle. To the right of the 'Acties' title are three icons: a green plus, a document, and a gear.

How are you?

The screenshot shows the 'Hoe gaat het' menu selected in the top navigation bar. The left sidebar contains 'Invullen' and 'Overzicht'. The main content area is titled 'In hoeverre heb je geleefd naar je waarden?' and features a horizontal scale from 1 to 10. The number '1' is highlighted in a blue box. At the bottom right of the main content area is a blue button labeled 'opslaan'.

Exercises



Mijn oefeningen
Bibliotheek oefeningen




Mijn oefeningen   

- ▼ *Acties uitvoeren*
Vergroten van activiteitsniveau.
- ▼ Bij de oefening over hoe ik herinnerd wil worden heb ik gekozen voor de eigenschap

Tips

Mijn eigen tips
Top 10 van de week
Gedeelde tips

Mijn eigen tips  

- boekje lezen  
- De bodyscan doen voordat ik ga slapen  

Text message coach

Motiveren
Herinneren
Zelf berichten schrijven
Instellingen

Herinneringsberichten instellen

NaDien stuurt mij een herinnering als ik 1 week niet heb ingelogd. 

NaDien stuurt mij een herinnering om de vraag bij "hoe gaat het?" in te vullen op: 

Om: : uur



Frequently Asked Questions

Veelgestelde vragen



Hiermee kunt u een item toevoegen, zoals bijvoorbeeld een waarde, een actie of een item uit de bibliotheek.



Dit icoon verwijst naar een bibliotheek waar u items kunt kiezen en toevoegen, zoals bij de acties en de oefeningen. icoon bij een item aan dat deze uit de bibliotheek komt.



Door op dit icoontje te klikken, komt u in de edit modus. U kunt dan items uit uw lijst verwijderen of aanpassen.



Dit icoontje geeft aan dat u in de edit modus zit. Als u klikt op dit icoontje, dan verlaat u de edit modus.