Investigating the extent to which the processing style is associated with students' overall expected experience, engagement and usability of eHealth websites

Bachelor's thesis: Positive Psychology and Technology
Bachelor student: Lea Hohendorf
Student number: s1915665
Supervisors: MSc Hanneke Kip, Dr. Peter ten Klooster
University of Twente

Abstract

BACKGROUND: eHealth, which is the use of technology to support health, well-being, and healthcare, is a growing field of interest, however, adherence rates are low resulting in low, if any, positive effects of the technology. Research has shown that engagement and usability are related to adherence and effectiveness, but differ between individuals. It is, however, not known yet what causes these differences, but sensory processing could be a factor for this. More research is needed however to examine this association wherefore the aim of this study was to investigate the relationship between sensory processing or the five sub-categories of the Adolescent/Adult Sensory Profile (AASP) and expected experience, engagement, and usability.
METHODS: In total, 66 students volunteered to take part in this cross-sectional survey study from which 19 had to be excluded. To receive an indication of the student's sensory processing style, expected experience, engagement, and usability, the AASP, questions measuring the experience, the TWente Engagement with Ehealth Technologies Scale (TWEETS), and the System Usability Scale (SUS) were used. Screenshots from the two case websites Therapieland.nl and MindDistrict.com were used instead of the websites. Analyses were performed using multiple regression analysis with an interaction term and Spearman correlations between sensory processing or the five sub-categories of the AASP and the expected experience, engagement, and usability.
RESULTS: Overall, the results from the multiple regression analysis showed that there was no association between the sensory processing style and expected experience of, engagement with, and usability of the eHealth websites. Additionally, Spearman correlations mainly revealed no significant correlations between the sub-categories of the AASP and expected experience, engagement, and usability. The sub-category touch processing ($p = 0.014$, $r_s = -0.360$) showed a significant and moderate negative correlation to participants' experiences of MindDistrict.com.
DISCUSSION & CONCLUSION: Concluding, there seem to be no association between sensory processing or the five sub-categories of the AASP and the expected experience, engagement, and usability. However, due to the low number of participants, the focus on screenshots instead of actual websites, and the use of a neurotypical population not many conclusions can be drawn with certainty. Therefore, this topic should be investigated further in the future. This could be

done by, for example, using other measurement devices like eye-tracking and think-aloud to gain closer insight.

Introduction

The prevalence of disorders and chronic diseases like depression, anxiety, diabetes, or cardiovascular disease, is high (Deady, Choi, Glozier, & Harvey, 2017; WHO, 2020; Wong, Turner, Macintyre, & Yee, 2017). The costs to treat physical and mental diseases and disorders have increased in recent years (WHO, 2019) and challenges to improve health outcomes remain (Borelli & Ritterband, 2015). Additionally, the availability of and direct access to treatment, such as therapy, has greatly decreased, especially in the past 6 months due to the COVID-19 pandemic (Wind, Rijkeboer, Andersson, & Riper, 2020). This makes providing patients with access from a distance even more important. To make treatment more cost-efficient and to support the patient's self-management of the disease, the use of eHealth technologies has increased in recent years (Barak & Grohol, 2011; Burger, Neerincx, & Brinkman, 2020) and keeps developing (Wind, Rijkeboer, Andersson, & Riper, 2020).

Many definitions of eHealth exist and are used, but, generally, it can be said that eHealth is the use of technology to support health, wellbeing, and healthcare (Barak & Grohol, 2011; Naslund, Marsch, McHugo, & Bartels, 2015; Burger, Neerincx, & Brinkman, 2020). Its growing popularity is not only due to the recent technical developments (Barak & Grohol, 2011; Burger, Neerincx, & Brinkman, 2020), but it also bears numerous potential benefits. For example, is it easily accessible, cheap, scalable, and useful in reaching a more diverse population (Naslund, Marsch, McHugo, & Bartels, 2015; Barak & Grohol, 2011; Burger, Neerincx, & Brinkman, 2020). While chronic diseases, for example, cannot be cured eHealth technologies allow the patient to self-manage their conditions and maintain an acceptable quality of life (van Gemert-Pijnen, Kelders, Kip, & Sanderman, 2018). This can also be seen in the research done by Aresti-Bartolome and Garcia-Zapirain (2014) who investigated the impact of eHealth technologies as support tools for people with Autistic Spectrum Disorder. They found that the use of technologies did positively affect the individuals' well-being and overall quality of life. Besides these benefits, however, the uptake of eHealth technologies is rather low which might be the reason for many eHealth evaluations showing no or weak positive effects on participants (Sieverink, Kelders, & van Gemert-Pijnen, 2017). Factors contributing to the low uptake and reasons for the low adherence rates of many eHealth technologies are still largely unknown.

An individual's adherence to and usage of a certain technology is partly dependent on their engagement with the technology (O'Brien & Toms, 2008; Kelders & Kip, 2019; Hardiker & Grant, 2011). Kelders and Kip (2019) point out that a recent review on engagement described it "as the extent of usage and subjective experience characterized by attention, interest and affect". More specifically, it is conceptualized by others as high acceptability, satisfaction, and a mental state that is associated with increased enjoyment (Short et al., 2018) as well as encouraged interaction (Lalamas, O'Brien, & Yom-Tov, 2015). It can be interpreted that engagement is not only associated with the adherence to and uptake of an eHealth technology due to increased motivation and interest. It could also be linked to the information uptake of the user since while being engaged the user might be more attentive towards provided information. Additionally, engagement could mediate whether an individual gets value from their experience with the website (Lalmas, O'Brien, & Yom-Tov, 2015) since it is associated with affect such as enjoyment or satisfaction. In summary, engagement could have an influence on, not only, the adherence and uptake rates of the eHealth technology, but also on its general effectiveness. Although engagement seems to have some form of influence on the way individuals interact with eHealth technologies, more research is needed to investigate the role of engagement further.

For instance, not much is known about the process of becoming engaged, however, it seems like the usability of an eHealth technology contributes to it (Kelders, Kok, Ossebaard, & van Gemert-Pijnen, 2012; van Gemert-Pijnen et al., 2011). Usability is often characterized as one of the most important requirements for an eHealth technology and is generally defined as the extent to which a product is being used to achieve specific goals effectively, efficiently, and satisfactorily (Broekhuis, van Velsen, & Hermens, 2019). Good system usability is crucial since it assures that, for example, ability and motivation levels are less of a barrier to the use (Fuller-Tyszkiewicz, 2018). As an example, if an individual is not able to work with the technology and therefore does not achieve their set goals they might become frustrated and use it less frequently or stop using it at all. As a consequence, the eHealth technology would have no effect. One possible explanation for incorrect use or no use at all could be that there is a low fit between the eHealth technology and the user's needs and personality, or a one-size-fits-all approach. This could lead to the technology failing to motivate and push the participant to follow the programme (Sieverink, Kelders, & van Gemert-Pijnen, 2017; Borelli & Ritterband, 2015; Wykes

& Brown, 2016). There is still a need for more insight into why people differ in their perceived usability however one factor could be people's diverse sensory processing.

While personality could be a strong factor influencing the usability of, and engagement with an eHealth technology there might be other explanations why usability differs between individuals. It might be influenced by cognitive or neurological factors like a person's sensory processing style (Brindle, Moulding, Bakker, & Nedejkovic, 2015). For example, Crane, Goddard, and Pring (2009) explained in their research, investigating the relationship between eHealth technology usage and Autism Spectrum Disorder, that individuals with the disorder show sensory abnormalities, including hypersensitivity and hyposensitivity. It, therefore, seems like this could be an important factor influencing the usage of eHealth technologies which has been largely overlooked in eHealth research. To investigate the relationship between sensory processing and experience, engagement and usability of an eHealth website, sensory processing should first be defined and categorized. Most influential was Dunn's work (1997) in which he categorized sensory processing in four sensory processing styles, namely sensitivity to stimuli, sensation avoiding, low registration, and sensation seeking. The first quadrant displays behaviours related to a low neurological threshold and is characterized by distractibility, having difficulties with screening stimuli, and the feeling of discomfort with the sensation. Sensation avoiding, the second quadrant, counteracts a low neurological threshold by exhibiting behaviours that lessen the exposure to the stimuli. The third quadrant, low registration, represents responses in conformity with a high neurological threshold, like showing a slow response to or disregard of the sensation. Finally, sensation seeking reflects the fourth quadrant and counteracts the high neurological threshold. Individuals in this quadrant exhibit pleasure and satisfaction from a rich sensory environment and behaviours which create those (Dunn, 1997). As Brown, Tollefson, Dunn, Cromwell, and Filion (2001) argue Dunn (1997) illustrates the different processing styles as stable traits, wherefore they can be applied universally and are not disorder-specific. It could be important to take this into account when designing an eHealth or mental eHealth platform since, as illustrated by Dunn, individuals perceive various stimuli in diverse ways and act differently upon that. For some, a bright, colourful image might catch their attention and make them aware while others might be distracted and irritated by it wherefore they want to avoid it.

These differences in sensory processing are oftentimes influenced by different kinds of disorders. This is supported by Holyoak and Morrison (2012) as well as Siegle, Granholm,

Ingram, and Matt (2001) who explain that the sensory processing of an individual with a disorder is influenced by their condition which makes their perception of stimuli more specific. Furthermore, Eraslan, Yaneva, Yesilada, and Harper (2018) point out that those individuals often focus more on certain details, which limits their ability to process the global, contextual, and semantic information. Other disorders that affect the way individuals attend to, take up and retrieve information are depression and anxiety. For example, Siegle, Granholm, Ingram, and Matt (2001) point out that depressed individuals show negatively biased information processing in that they hold subtle negative biases which influence the way events and experiences are interpreted and remembered. This could be related to sensory processing since the presence of negative information hinder the processing of other task-relevant stimuli, which, in turn, negatively affects the individual's ability to work on or complete the task adequately (Siegle, Granholm, Ingram, & Matt, 2001) Therefore, the usage of eHealth technologies could be impaired since the individual is not able to organize the information and act upon it accordingly. While these studies investigated sensory processing in a clinical population it should be noted that sensory processing also varies between individuals in a non-clinical population as it is an individual trait people exhibit (Dunn, 1997). In summary, it might be that such processing differences affect the way eHealth health technologies are used, adhered to, and engaged with but more research is needed to confirm this.

To date, it is unclear how the different processing styles are associated with the experience with, usage of or the engagement with eHealth interventions. Even though research on eHealth and its association to sensory processing of people with mental disorders is needed, it should first be investigated in a healthy population to see whether the suspected association between sensory processing and experience, engagement, and usability is observable. From this, useful conclusions can probably also be drawn for clinical populations. This paper, therefore, aims to examine the extent to which the sensory processing styles are associated with their expected experience, usability and engagement of two different eHealth websites. Moreover, it will be explored to what extent the sensory processing style is associated with expected engagement with the two websites and the expected usability of the two websites. The study investigates expected experience, expected engagement, and expected usability since only screenshots of the actual websites were used. Additionally, as a sub-question to both research questions, this study will explore the association between the sub-category scores of the

Adolescent/Adult Sensory Profile (AASP) and the expected experience, engagement, and usability of two eHealth websites. The AASP is a new questionnaire to be used in this kind of research gaining the option of assessing an individual's sensory processing style in a unique way.

Methods

Participants

The target group consisted of university students, which meant a participant was eligible when he or she was studying at a university. Participants were excluded from the analyses if they did not study at a university, did not complete all questionnaires, giving careless answers like displaying the same value for each question in each questionnaire, or if they were diagnosed with Autism or ADHD. The participants were recruited via personal invitation or signed up to the study through the SONA system.

Materials and Procedure

The exploratory study consisted of several parts (see Table 1), which will be explained in this section. All scenarios and questions were administered in English.

Table 1. *The different parts of the study*

Section	Content
1	Introduction and Socio-Demographics
2	Adolescent/Adult Sensory Profile (AASP)
3	Questionnaire about eHealth platforms
4	Visual Sensory Appeal Questionnaire
5	TWente Engagement with EHealth Technologies Scale (TWEETS)
6	System Usability Scale (SUS)
7	Single-Item Rating Question
8	Ending remarks

In this study, all data was gathered using the online platform Qualtrics. Firstly, the participants received a personal invitation or signed up to the study via the SONA systems. The SONA system is a platform on which students from the University of Twente can sign in to participate in studies and earn points for that. At the beginning of the study, the participants received an introduction (Section 1), giving contextual information such as an approximate time span for completion, an explanation of the aim of the study, and contact details in case of questions (Appendix A). The participants were then asked to agree to the informed consent for participating in this study. After that, the participants received some questions about their socio-demographics, like age, gender, ethnicity, their study programme, and previous diagnoses related to sensory processing issues such as ADHD and Autism Spectrum Disorder, as well as medication intake. However, the participants had the option to skip questions regarding diagnoses, state of mental health, and medication intake (Appendix A). In the next part of the study, the participants filled in the AASP (Section 2).

Adolescent/Adult Sensory Profile (AASP)

The AASP is a questionnaire that aids in measuring sensory processing patterns and effects on functional performance. It determines an individual's sensory processing style by administering questions regarding how the person generally responds to sensations (Brown & Dunn, 2002). The profile is a judgement-based self-questionnaire and consists of 60 items, which use a 5-point Likert scale ranging from almost never to almost always. The AASP includes 4 quadrants (see Table 2), namely low registration, sensation seeking, sensory sensitivity, and sensation avoiding, which each include 15 items. These quadrants encompass the sensory processing categories taste/smell, movement, visual, touch, activity level, and auditory (Brown & Dunn, 2002). Although the term "quadrant" is used by Dunn (1997), each participant has a separate score for each. This means all participants do not generate one score indicating the quadrant they fall into, but produce four separate scores for each quadrant. The categories taste/smell processing, movement processing, visual processing, touch processing, activity level, and auditory processing are referred to as sub-categories (Dunn, 1997).

Calculating the quadrant scores for each participant does not give an exact indication of their actual sensory processing. Therefore, a method has been developed by van den Boogert and colleagues which includes calculating two continuous scores, namely neurological threshold and

behavioural response. After calculating these they can be plotted on the x-axis and y-axis plane and therefore provide a more accurate indication of an individual's sensory processing style using both calculated scores. If the neurological threshold and behavioural response scores are both positive the person is sensory seeking and if the neurological threshold is positive and the behavioural response is negative then the person falls into low registration. If the neurological threshold score is negative and the behavioural response score is positive then the person is sensation avoiding and if both scores are negative the person is in the quadrant sensory sensitivity.

Table 2. *Overview of the 4 AASP Quadrants, definitions as explained by Dunn (1997), and example questions.*

Quadrant	Definition	Example Question
Low registration	This quadrant shows responses in conformity with a high neurological threshold, such as showing a slow response to or disregard of the sensation.	"I don't smell things that other people say they smell"
Sensory Sensitivity	The quadrant is characterized by a low neurological threshold and behaviours expressed relate to distractibility, having difficulties with screening stimuli, and the feeling of discomfort with the sensation.	"I don't like strong tasting mints or candies (for example, hot/cinnamon or sour candy)
Sensation Avoiding	The quadrant counteracts the low neurological threshold by exhibiting which lessens the exposure to the stimuli.	"I leave or move to another section when I smell a strong odor in a store (for example, bath products, candles, perfumes)"
Sensation Seeking	This quadrant counteracts the high neurological threshold by exhibiting pleasure and satisfaction from rich sensory environments and behaviours.	"I add spice to my food"

The AASP displays internal consistency scores from 0.639 to 0.775 in other studies, with 0 representing no consistency and 1 depicting perfect consistency (Pearson, 2008). The computed Cronbachs's alpha in this study showed acceptable reliability with the scores being 0.621 for the

quadrant sensation avoiding, 0.670 for sensation seeking, 0.755 for sensory sensitivity, and 0.783 for the quadrant low registration.

Questionnaire about eHealth platforms

Afterwards, the participants were tasked with working through screenshots of the modules on the two case websites Therapieland.nl and MindDistrict.com (Section 3) (Appendix B & C). Both websites are targeted at supporting people with making changes in their lifestyle to improve health and well-being. Specific modules and functions can be selected to individualize the change process and select the sources needed to achieve the goal. The screenshots of the websites were chosen according to their differing amount of triggering stimuli in order to be able to compare a website with a rather low amount of stimuli and one being higher in the number of stimuli. The used modules and tabs of the websites Therapieland.nl and MindDistrict.com were chosen by the researcher, which means all participants viewed the same screenshots of the pages. The scenarios presented at the beginning of each screenshot included the subjects “nutrition” and “relaxation”. The first scenario was supposed to guide the participant through the respected “nutrition” module of both websites (Appendix B). It asked the participant to imagine having read positive information about healthy eating and resulting positive effects like increased mood. Furthermore, the participant was supposed to imagine wanting to make similar changes to their life which made them try out the modules on the website Therapieland and MindDistrict. After reading the first scenario the participants were, in the case of the module on MindDistrict.com, asked to give a first impression of a large image (see Appendix C) (see Figure 1). In the case of the “nutrition” model on the website Therapieland.nl, the participants were asked to rate a screenshot of the module overview on the website (see Figure 2).

Figure 1. *Section of the module "nutrition" on the website MindDistrict.com*

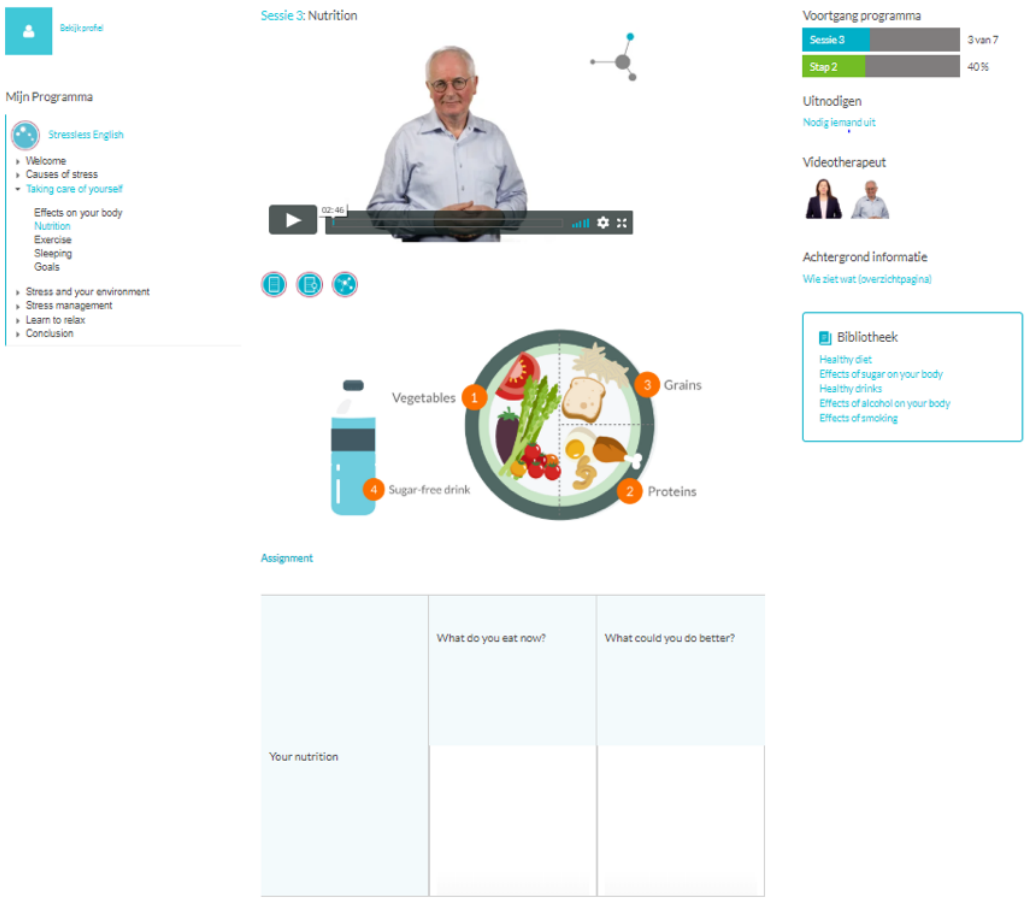

Figure 2. *Module"nutrition" overview on the website Therapieland.nl*

Then, some qualitative data were collected for research, which is beyond the scope of this research (Appendix C).

Visual Sensory Appeal Questionnaire

The participants completed another questionnaire created by the researchers which was meant to assess how triggering they found the stimuli on the website (Section 4). The task was to indicate the extent to which they found the semantic word pairs messy or well-structured, overwhelming or endurable/tolerable, distracting or calm, and not enjoyable or very enjoyable applicable to the screenshots from Therapieland.nl and MindDistrict.com. The questionnaire was generated using the questions of the sub-category visual processing of the AASP which were transformed to fit the new goal. The extent to which the participant agreed with the terms was indicated by a 5-point Likert scale between the semantic word pairs. The computed Cronbach's alphas in this

study showed good to excellent internal consistency with a score of 0.739 for MindDistrict and 0.914 for Therapieland.

TWente Engagement with Ehealth Technologies Scale (TWEETS)

The TWEETS (Section 5) was created based on interviews with engaged health app users and applies a definition of engagement that includes behaviour, cognition and affect (Kelders, Kip, & Greeff, 2020) and measures the different forms of engagement with eHealth interventions. It can be used to measure engagement at different moments in time, namely expectations of engagement, current engagement, and past engagement. In this study, the questions concerning expectations of engagement were used as the participants received screenshots of the website instead of working through the actual website. Furthermore, 9 items are included in the scale and measured on a 5-point Likert scale ranging from strongly disagree to strongly agree. Higher total scores on the TWEETS indicate more expected engagement with the eHealth website. Examples of items are "Using this (technology) can become part of my daily routine" and "This (technology) will motivate me to (goal of the technology). Earlier research showed good internal consistency with Cronbach's alpha being p = 0.87, as well as divergent and predictive validity. In this study, the computed Cronbach's Alpha of 0.927 for the website MindDistrict.com and a Cronbach's alpha of 0.915 for Therapieland.nl, indicating excellent internal consistency.

System Usability Scale (SUS)

Another scale used in this study was the System Usability Scale (SUS) (Appendix E) (Section 6) which is a method of evaluating the usability of any kind of system compared to industry standards (Thomas, n.d.). This scale measures usability by administering 10 items with a 5-point Likert scale ranging from strongly disagree to strongly agree. The SUS is one of the most efficient ways of collecting valid data about a system's usability. Items included in the SUS are, for example, "I think I would like to use the system frequently" or "I think there may be too much inconsistency in the system". Furthermore, other research has shown that the SUS has an excellent reliability coefficient (p = 0.91) and concurrent validity (Lewis, 2018). The computed Cronbach's alpha for the website MindDistrict was 0.853 and for the website Therapieland 0.880. Both scores indicate good internal consistency.

Experience of eHealth websites question

Lastly, the participants were asked to give a final rating or grade from 1 to 10 on both platforms by asking the participants "Bases on the previous questions, give a final rating of the eHealth platform Therapieland/MindDistrict"(Section 7) (Appendix F). Participants giving the website a 1 indicated that they did not enjoy using the website at all and a 10 displayed a good experience with the website and that the participant highly enjoyed it. After that, the participants were thanked for their participation and contact details in case of questions were again provided (Section 8).

Data Analysis

In order to analyse the data and compute the results the statistical programme IBM SPSS Statistics version 24 was used. The demographics like age, gender, ethnicity, and study programme were analyzed using descriptive statistics.

To investigate the association between the sensory processing style and their expected experience of, engagement with, and usability of the screenshot of the eHealth websites, the individual's neurological threshold and behavioural response first had to be calculated. In the case of the neurological threshold score, this was done by subtracting the sum of the low neurological threshold quadrant scores from the sum of the high neurological threshold quadrant scores. In order to retrieve the behavioural response score, the sum of the passive behavioural response quadrant scores were subtracted from the sum of the active behavioural response quadrant scores. Next, multiple regression analysis with neurological threshold and behavioural response and their interaction as independent variables (IVs) and expected experience, TWEETS, and SUS scores as the dependent variables (DVs) was performed. To calculate the SUS scores, reverse scores were adjusted to account for negatively formulated items.

The relationship and association of all five sub-categories of the AASP with the expected experience, TWEETS, and SUS for each website has been examined by running Spearman correlations. Spearman correlations were used instead of Pearson correlations since the data did not fulfil the normality assumption.

Results

After excluding participants from the sample, the sample size for analysis consisted of 46 participants. From these 46 participants, 17 were male and 29 were female. The youngest participant was 19 years old and the oldest was 32 years old, with an overall mean of 22.282 (SD = 2.482). In terms of nationality, most participants (n = 33) were German, 3 were Dutch, and 10 were from other countries. Additionally, most participants were studying psychology (n = 22), followed by communication science (n = 9), and others were from business administration (n = 1), biomedical engineering (n = 1), or chemical engineering (n = 1), to name a few. Most participants (n = 34) were students studying at the University of Twente and the remaining 12 participants were studying at another University.

Expected Experience.

Investigating the association between a student's sensory processing and their perceived experience of the website, the results of the multiple regression analysis show no significant correlation between the variables (see Table 3). Therefore, no relationship was found between sensory processing and expected experience with both eHealth websites. From the p-values, it can be concluded that there is no association between the changes in the sensory processing of the student and the shifts in the perceived experience. In other words, there is insufficient evidence to conclude that there is an effect of sensory processing on the expected experience with both websites at the population level. Additionally, the multiple regression shows a weak negative correlation between sensory processing and the expected experience participants had with the website MindDistrict. This indicates that if the value of sensory processing increases, the expected experience with MindDistrict decreases. The means and standard deviations of all questionnaires can be found in table 4.

Table 3. *Regression Analysis of the sensory processing and experience with the interaction of neurological threshold and behavioural response*

Dependent Variable	B	SE B	Beta	t	P
Expected Experience of Therapieland	0.080	0.302	0.082	0.265	0.792

Expected Experience of MindDistrict	-0.292	0.285	-0.293	-1.025	0.311

Table 4. *Average scores and standard deviations of all questionnaires*

Questionnaire	Mean	Standard Deviation
AASP - Low Registration	24.357	6.531
AASP - Sensory Seeking	37.621	5.444
AASP - Sensory Sensitivity	30.559	7.132
AASP - Sensory Avoiding	28.133	5.849
TWEETS Therapieland	30.195	8.226
TWEETS MindDistrict	34.217	10.883
SUS Therapieland	70.054	19.144
SUS MindDistrict	59.837	17.845
Single-Item Rating Question Therapieland	6.70	1.896
Single-Item Rating Question MindDistrict	5.46	1.929

To investigate the association between the sub-categories of the AASP and the students' experience with the website Spearman correlations were run (see Table 5). It reveals no significant correlations between most variables. It does, however, show a significant correlation between the sub-category touch processing and the students' experience of the website MindDistrict ($p = 0.014$). The correlation coefficient shows a weak negative monotonic correlation ($r_s < -0.40$) between touch processing and experience. This means that if the value of touch processing increases the experience the student has with MindDistrict decreases. Additionally, the Spearman correlations show a moderate correlation between the sub-category auditory processing and expected experience with the website MindDistrict. This indicates that as one variable increases so does the other.

Table 5. *Spearman correlation matrix of the sub-categories and experience*

Variables	Visual Processing	Auditory Processing	Movement Processing	Touch Processing	Activity Level
Expected Experience Therapieland	0.045	0.052	0.251	0.070	0.118
Expected Experience MindDistrict	-0.014	0.435	-0.256	-0.360*	-0.252

*$p < .05$. **$p < .01$. ***$p < .001$

Expected Engagement and Usability.

To investigate the relation between students' sensory processing and their expected engagement with and expected usability of the eHealth website a multiple regression analysis was run (see Table 6). The analysis was conducted with sensory processing, using the interaction term between the neurological threshold and behavioural response scores, as the independent variable and expected engagement and usability for both websites as the dependent variables. Overall, no significant correlation could be detected. As stated above, it cannot be concluded that there is an effect of sensory processing on expected engagement and usability of both websites at the population level. However, the regression analysis showed a moderate negative correlation between sensory processing and the expected usability of the website MindDistrict. This indicates that if the sensory processing score increases the expected usability of MindDistrict decreases.

Table 6. *Regression Analysis of the sensory processing and expected engagement and usability with the interaction of neurological threshold and behavioural response*

Dependent Variable	B	SE B	Beta	t	P
Expected Engagement of Therapieland	-0.133	1.338	-0.031	-0.100	0.921
Expected Engagement of MindDistrict	-2.468	1.636	-0.439	-1.509	0.139

Expected usability of Therapieland	2.377	3.058	0.241	0.778	0.441
Expected Usability of MindDistrict	-4.970	2.688	-0.539	-1.849	0.072

Concerning the association between the sub-categories of the AASP and the students' expected engagement and usability the Spearman correlation generally shows no significant correlation (see table 7). It can, therefore, be said that there does not seem to be a linear relationship between sensory processing and expected engagement or expected usability. The correlation matrix did show weak positive correlations between movement processing and expected engagement with Therapieland and visual processing and expected engagement with MindDistrict. While not being significant ($p = 0.066$; $p = 0.148$) it does indicate that if one variable increases the other decreases. Additionally, a weak negative correlation was detected between movement processing and expected usability of MindDistrict. These positive correlations, while not being significant ($p = 0.174$) point to a relationship in which one variable increases and the other decreases.

Table 7. Spearman correlation matrix of the sub-categories and expected engagement and usability

Variables	Visual Processing	Auditory Processing	Movement Processing	Touch Processing	Activity Level
Expected Engagement Therapieland	0.104	0.038	0.273	0.087	0.070
Expected Engagement MindDistrict	0.217	-0.052	-0.082	-0.184	-0.176
Expected Usability Therapieland	-0.044	-0.126	0.069	-0.053	-0.070
Expected Usability MindDistrict	-0.036	-0.054	-0.204	-0.253	-0.117

*$p < .05$. **$p < .01$. ***$p < .001$

Discussion

Main findings

The current study investigated the association between sensory processing style and expected experience, expected engagement, and expected usability of an eHealth website. The findings point out that overall there seems to be no significant association between students' sensory processing style and their expected experience of, engagement with, and usability of either of the eHealth websites. Regarding the association between the sub-categories of the AASP and expected experience, engagement, and usability the Spearman correlation mainly showed no significant correlations. However, the sub-category touch processing did show a significant negative correlation with the experience the student had with the website MindDistrict. This means that as one variable increases the other variable decreases. Additionally, the correlation matrix revealed that both the expected engagement with Therapieland and MindDistrict and positively correlated with the expected usability of the website, which confirms the findings of the literature in the introduction.

First of all, it was surprising to find no association between sensory processing and expected experience, engagement, and usability. It was expected to find some correlation since, as Dunn (1997) pointed out, the quadrants sensory sensitivity and sensation avoiding are in line with a low neurological threshold and low registration and sensory seeking are in line with a high neurological threshold. It, therefore, was assumed that participants falling into the high threshold quadrants would experience the website MindDistrict more positively and the low threshold participants would enjoy the website Therapieland more. Many factors could have influenced the findings. For example, Peek et al. (2014) conducted a systematic review concerning the factors influencing acceptance of technology for ageing in place. They found that 27 factors divided into 6 themes influenced acceptance, namely concerns regarding technology, expected benefits of technology, need for technology, alternatives to technology, social influence, and characteristics of older adults. While all of these factors could be potential influences, the need for technology, including the perceived need and subjective health status, was especially interesting. It could be that the respondents participating in this study did not perceive either of the websites as useful or necessary for them and their health or well-being as they were mainly healthy adults scoring similarly on sensory processing. If they did not perceive the websites as useful for them it could

have influenced their acceptance of the websites and therefore their expected experience, engagement, and usability resulting in no correlations. Another possible explanation could be that a relationship between sensory processing and expected experience, engagement, and usability simply does not exist in a healthy population, but only in a clinical one. This would explain why Crane, Goddard, and Pring (2014), for example, found exaggerated sensory processing in individuals with Autism Spectrum Disorders, but no association was identifiable in this study.

Another influencing factor could also be the participants' so-called health-app use efficacy, which is referred to as the cognitive ability to use health apps in order to access and seek health information (Cho, Park, & Lee, 2014). This could be considered a factor related to sensory processing since it could be that when an individual feels capable of working with a website their perception and thus their experience might be different. It might have been that participants did not have enough health-app use efficacy since, due to the healthy population, they did not have much contact with eHealth websites yet. This could have resulted in less efficacy to use the websites and access the information on it which might have led to a, for example, distorted perception of the stimuli on the websites also resulting in no correlations.

One other explanation could be that expected engagement was not accurately estimated based on the screenshots of the websites. It might be easier for the participants to give an indication of their expected or actual engagement when working with the full websites. This could have therefore distorted the results and led to no correlations between sensory processing or the five sub-categories of the AASP being found. These are just some examples of potential influences on the results and more research is needed to investigate this.

Furthermore, it was interesting to observe no association between sensory processing and expected engagement with both eHealth websites. It was assumed that there would be a correlation since engagement does include the aspect of aesthetics and sensory appeal in some definitions (O'Brien & Toms, 2008; Short et al., 2018). It was thus interpreted that there would be at least some association between the constructs sensory processing and expected engagement. Interestingly, Brindle, Moulding, Bakker, and Nedeljkovic (2015) who researched the relationship between sensory processing sensitivity and negative affect, stated that individuals being sensitive to sensory stimuli are more likely to experience negative psychological symptoms related to negative affect. Since engagement is conceptualized as a

construct characterized by attention, interest, and affect (Kelders & Kip, 2019) the findings of the study of Brindle, Moulding, Bakker, and Nedeljkovic (2015) could be interpreted as a potential link between sensory processing and the affective characteristics of engagement. It was therefore surprising to find no association between the constructs. If not sensory processing in general, a possible link between sensory sensitivity or the low neurological threshold quadrants, since Dunn's model is not used in the study, and negative affect and possibly engagement could be suggested. A potential reason this was not confirmed in this study might have been that the sample mainly consisted of sensory seeking individuals, which might have made the results of the regression analysis insignificant. Another explanation could simply be that no association between sensory processing and expected engagement exists.

Lastly, it was interesting to find a weak negative correlation between the sub-category touch processing of the AASP and the experience the individual had with the website MindDistrict. This was intriguing because most research illustrates some form of connection between visual appeal or aesthetics and usability. Visual appeal has oftentimes been found to be one of the greatest predictors of engagement, usability, and overall uptake of an eHealth website (Lazard & Mackert, 2015; Lalmas, O'Brien, & Yom-Tov, 2015). However, Lazard and King (2019) recently published a study in which the connection between visual complexity, aesthetics, and usability of eHealth was investigated. They found a positive linear relationship between visual complexity and subjective evaluations pointing towards websites exhibiting a greater amount of design complexity principles which would increase the appeal and potential use. The way Lazard and King (2019) define visual complexity as a holistic view of all the visual variation displayed. This means that both variables, design complexity and subjective evaluations, increase concurrently at a constant rate. Therefore, they suggest websites should incorporate a greater amount of design complexity principles since it would increase the appeal and usage of the website. Because of this it would have been expected to find some kind of correlation between visual processing, instead of touch processing, and the expected experience with the website MindDistrict. Unfortunately, there is no literature on the influence touch processing has on the experience with eHealth websites and therefore it is suggested to investigate it further.

Strengths and limitations

On the one hand, a strength of this study is the use of the AASP for this purpose. This is a benefit since the AASP is a unique way of identifying an individual's sensory processing patterns. It is an interesting instrument for this kind of study since it aids in considering how these patterns could create barriers to performance in daily life and, in this case, to the expected experience, engagement, and usability with the two eHealth websites. Additionally, the AASP has not been used much in this research context meaning that this study is one of the first to use it as an indicator of sensory processing. Moreover, as the AASP is a self-report measure it also bears the benefit of being a valid measure since participants are directly asked about their perceptions.

On the other hand, a limitation of this research is that data on the taste/smell sub-category of the AASP (Dunn, 1997) was missing. This happened due to a technological error with the website Qualtrics and was not detected by the researcher while pilot testing the study. Therefore, the calculation of the neurological threshold and behavioural response, as well as the interaction of the two to indicate the sensory processing style may not be valid. This could give a biased impression of the correlation since it does not provide a precise sensory processing indication. Moreover, could it be argued that using a self-report measure as a means to identify individuals' sensory processing may also not be valid because it is not known whether people can fully rate sensory processing entirely by themselves. It might as well be that it does not entirely catch sensory processing or that some unconscious processes distort the perception. Either way, it is a factor that could possibly distort the results.

Another limitation of this study is that the measurement of the participants' experience by a rating question, as well as the Visual Sensory Appeal Questionnaire is not validated. The rating question and the questionnaire have been developed by the researchers without pre-testing it which means it is not obvious whether they measure the full concept of experience or maybe just a facet of it. A statement about whether or not the reliability of the single item rating scale does or does not support this can also not be made since a test-retest reliability score would first have to be computed.

Furthermore, the rather small sample size and the target group could also be limitations to this study. First of all, the small sample size could have affected the generated results and might be a reason for generally not finding associations. This can be seen in the moderate correlations found between auditory processing and the expected experience with the website MindDistrict. If the sample size would have been larger this correlation might have turned out to be significant

for example. Second of all, the target group of university students could also have influenced the results it could have produced an unequal distribution of sensory processing. Most participants were identified as sensory seeking which might be related to them being students which might also have influenced the correlations.

Concluding, while investigating an important and highly under-researched topic with the benefits of using self-reported data the results received from it should be taken cautiously. However, limitations like the missing of the taste/smell sub-category and the reliability and validity of the single-item rating scale, as well as the small sample size and homogeneous target group could heavily influence the gathered findings.

Practical implications and Recommendations for Future Research

Even though the results gained from this study should be treated with caution practical implications can still be drawn. Firstly, the gained knowledge could be used to further investigate the association between sensory processing and expected experience, expected engagement, and expected usability. When examining this topic in the future a few aspects could be changed. Firstly, the study could be done with a larger sample size to generate more reliable results. Secondly, when investigating this topic in the future the whole AASP should be used to compute more valid neurological threshold and behavioural response scores. Thirdly, other measures in addition to the AASP could be used, such as eye-tracking devices, to identify triggering stimuli more closely. Eye-tracking could be particularly useful in combination with the think-aloud method since it provides not only a quantitative measure of triggering stimuli but also the participant's thought processes (Farnsworth, 2019).

If future research further investigates the relationship between sensory processing and the mentioned DVs its findings could be used when designing an eHealth website or app since it potentially gives insight into sensory processing and which sensory modalities could influence the user's interaction with the technology. Otherwise, it could also be confirmed that there is no relationship between sensory processing and the DVs. This would mean website or app designers could focus more on other factors actually influencing the DVs and therefore creating more tailored websites or apps.

Another aspect that is important to point out is that future research, as well as, eHealth website or app development should not solely focus on visual appeal. It might be important to

know which visual aspects users find appealing or disturbing on a website. However, as seen in the findings, the sub-category touch processing, instead of visual or auditory processing, was correlated with the expected experience with the website MindDistrict. This relation should also be further investigated in a more controlled environment as the now observed correlation could be the result of some other behaviour the participant was performing while filling out the online study. It might have been, for example, that participants had a lot of stimuli touching the skin while completing the study. The study should, therefore, be made experimentally, meaning it should take place in a building and be supervised by the researchers to ensure that other stimuli are not influencing the results.

Conclusion

To conclude, the results suggest that self-reported sensory processing style does not seem to be associated with either the expected experience, expected engagement, or the expected usability. Additionally, touch processing correlated with some aspects of experience even though it is not yet known which since it only correlated with the experience of one website. However, the low number of participants, the focus on screenshots instead of the actual websites, and the use of a neurotypical population may have influenced the results and future research is needed since we cannot draw conclusions with certainty yet. Generally, this study provides a basis for further research and investigation and gives some form of direction on aspects to further research. This topic should be investigated further in the future since it potentially provides useful insights which could help make eHealth websites and apps more tailored to the individual and therefore more effective.

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Appendices

Appendix A.

Sensory Processing

Start of Block: Intro

Q1.1 In this study, we want to figure out how university students perceive the usability of different types of eHealth platforms, which are digital platforms that aim to improve the health and well-being of its users. We are curious about your first impressions and your likes and dislikes regarding screenshots of two different platforms. Specifically, we would like to gain insight on how different sensory processing styles contribute to the perceived usability and engagement of eHealth platforms. The survey should take approximately 30 minutes. We would like to ask you to answer the questions in full honesty, and with full attention. If you have any questions regarding the questionnaire, feel free to send these to Niels Brouwer (n.brouwer@student.utwente.nl) or Hanneke Kip (h.kip@utwente.nl).

Thank you in advance for your time and effort.
Johannes Kerz, Lea Hohendorf, & Niels Brouwer.

End of Block: Intro

Start of Block: Informed consent

Q2.1 I understand that this study consists of questions regarding the processing of sensory information and my perception of eHealth websites. I agree with my own free will to participate in this research. I reserve the right to withdraw this consent without the need to give any reason and I am aware that I may withdraw from the study at any time. If my research results are to be used in scientific publications or made public in any other manner, then they will be made completely anonymous. My personal data will not be disclosed to third parties without my expressed permission. If I request further information about the research, now or in the future, I may contact either Hanneke Kip (h.kip@utwente.nl), who is the thesis supervisor, or Niels Brouwer (n.brouwer@student.utwente.nl). I am aware that if I have any complaints about this research, I can direct them to the secretary of the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente, Drs. L. Kamphuis-Blikman P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 3399; email: l.j.m.blikman@utwente.nl).

Q2.2 I hereby declare that I have been informed in a manner which is clear to me about the nature and method of the research as described above, and am willing to proceed with the study.

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If I hereby declare that I have been informed in a manner which is clear to me about the nature and... = No

Page Break

End of Block: Informed consent

Start of Block: Socio-demographics

Q3.1 How old are you?

_____

Q3.2 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Other (3)

Q3.3 What is your nationality?

- ○ German (1)

○ Dutch (2)

○ Other, namely: (3) _____

Page Break

Q3.4 I am:

▼ A university student at the University of Twente (1) ... Not a student (3)

Skip To: End of Survey If I am: = Not a student

Display This Question:

If I am: != Not a student

Q3.5 My study programme is:

_____

Page Break

Q3.6 Literature shows that there might be a connection between certain disorders and the way information on websites is processed. Therefore we want to know whether you are diagnosed with any disorders. The following questions are **not obligatory** - answer the questions only if you feel comfortable doing so. Otherwise, you can move on to the next section.

Q3.7

Were you diagnosed with (a) neurodevelopmental or neurological disorder(s) such as Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), or Attention Deficit Disorder (ADD)?

- ○ Yes (1)
- ○ No (2)

Q3.8

Are you currently diagnosed with (a) psychological disorder(s) such as depression or anxiety?

- ○ Yes (1)
- ○ No (2)

Q3.9

Do you currently use medication that may have an effect on how you process sensations?

- ○ Yes (1)
- ○ No (2)

End of Block: Socio-demographics

Appendix B.

MindDistrict.com

Start of Block: Nutrition MD

Q5.1

You are now going to evaluate screenshots of different eHealth platforms. These eHealth platforms are MindDistrict and TherapieLand.

Before starting with the next set of questions, we'd like you to read a scenario. Try to picture yourself experiencing this scenario in real life. Please keep the scenario in mind when answering the upcoming questions.

"You've read on social media that studies found that healthy eating increases your happiness, mood, and overall quality of life. This finding triggered your curiosity. You wonder if you would be able to make some changes to meals yourself, in order to make them more healthy and nutritious. As such, you have decided to look into websites that provide you with guidelines on how to develop a healthier eating pattern. This search has brought you to two eHealth websites; Therapieland and MindDistrict, which you believe may help you further."

Page Break

Q5.2 Below you can find a screenshot of the module 'Healthy Eating' on the eHealth platform MindDistrict. Observe the screenshot carefully while keeping the scenario in mind.

Q5.3
What is your first impression of the screenshot?

_____

Q5.4

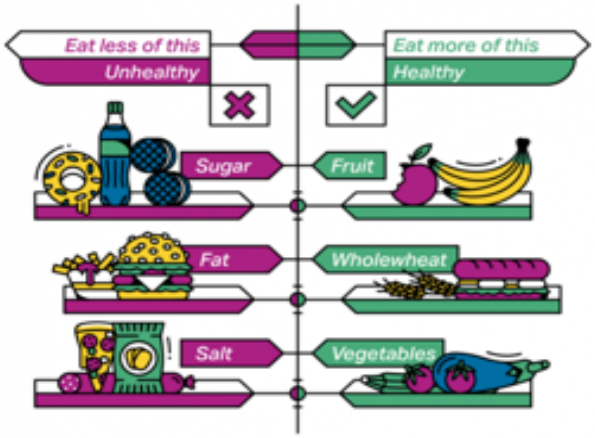
Information on nutrition and healthy eating habits

Healthy eating habits

Healthy, nutritious eating habits form an important part of our life. We often think about what tastes nice, where we are going to eat and with whom. But nutrition is also a large determining factor of how we feel and how healthy we are. In this part of the self-help module you will be given information and tips about healthy food. You are going to set a goal for yourself and work towards this step by step.

3x less, 3x more

Healthier eating actually boils down to the following: less sugar, less saturated fats and less salt. And on the other side: more fruit, more wholewheat products and more vegetables.



Less sugar

We need sugar. It gives you easy energy which is useful for your body. But these days it is very easy to exceed your daily requirement. Free sugars, in particular, are unhealthy. This is sugar that is added to products as biscuits and sweets, but also to pasta sauces. Types of sugar that do not fall in this category are those which are a natural part of a product, such as in milk, fruit and vegetables. Try and reduce free sugar. Below a few tips on how to go about this:

- Cool drinks contain rather a large amount of free sugar. Try switching to water, tea or coffee.
- Replace your sweet evening snack with something healthy such as an apple or a bowl of yoghurt with fruit and nuts.
- Look at the labels in the supermarket and choose the product with the least amount of sugar.
- 'Sugar-free' sweets can be used as substitute occasionally, but please note: not all sugar-free products are good for you.

- Choose Greek yoghurt: it contains less sugar than normal yoghurt, has more good fats and leaves you feeling full.
- Eat products with good fats to make you feel full such as avocado, fish, nuts.
- Rather eat quinoa, buckwheat, almond flour, nuts and seeds instead of white wheat flour, rice or potatoes. They contain less sugar.

Alcoholic beverages also contain lots of sugar. Rather go for an alternative such as sparkling mineral water, fresh lemonade or a fruit and vegetable smoothie.

Page Break

Q5.5

Please select the elements that **capture your attention in a positive way**. You can do so by clicking on an element. You can select up to 3 elements. If there is nothing specific that catches your attention, you do not have to select anything.

Information on nutrition and healthy eating habits

Healthy eating habits

Healthy, nutritious eating habits form an important part of our life. We often think about what tastes nice, where we are going to eat and with whom. But nutrition is also a large determining factor of how we feel and how healthy we are. In this part of the self-help module you will be given information and tips about healthy food. You are going to set a goal for yourself and work towards this step by step.

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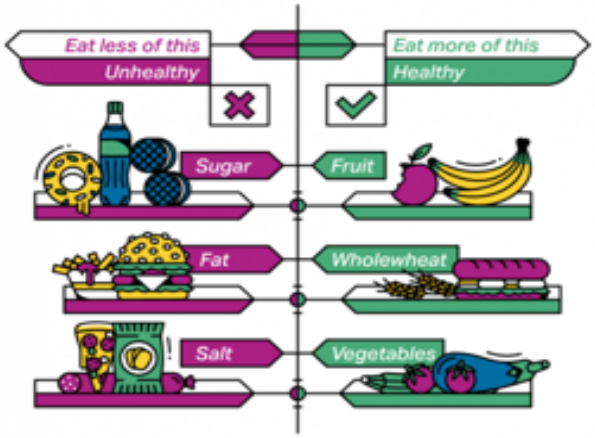

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Alcoholic beverages also contain lots of sugar. Rather go for an alternative such as sparkling mineral water, fresh lemonade or a fruit and vegetable smoothie.

Q5.6 Please explain what areas you have selected, and why these areas are **eye-catching** and **enjoyable** to you.

- ○ Area 1 (1) _____
- ○ Area 2 (2) _____
- ○ Area 3 (3) _____

Page Break

Q5.7 Please select the elements that capture your attention in a negative way. You can do so by clicking on an element. You can select up to 3 elements. If there is nothing specific that catches your attention, you do not have to select anything.

Information on nutrition and healthy eating habits

Healthy eating habits

Healthy, nutritious eating habits form an important part of our life. We often think about what tastes nice, where we are going to eat and with whom. But nutrition is also a large determining factor of how we feel and how healthy we are. In this part of the self-help module you will be given information and tips about healthy food. You are going to set a goal for yourself and work towards this step by step.

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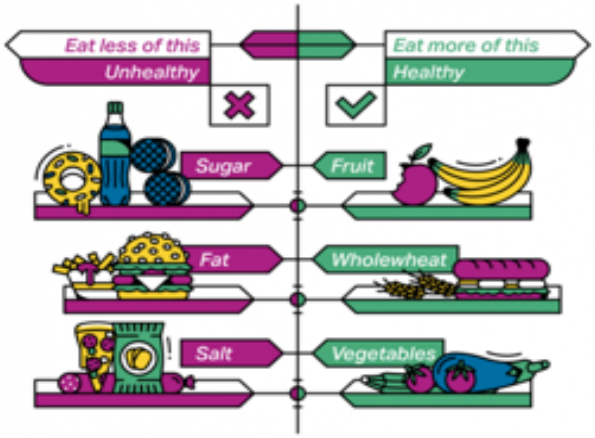

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- Rather eat quinoa, buckwheat, almond flour, nuts and seeds instead of white wheat flour, rice or potatoes. They contain less sugar.

Alcoholic beverages also contain lots of sugar. Rather go for an alternative such as sparkling mineral water, fresh lemonade or a fruit and vegetable smoothie.

Q5.8 Please explain what areas you have selected, and why these areas are eye-catching and **less enjoyable** to you.

- ○ Area 1 (1) _____
- ○ Area 2 (2) _____
- ○ Area 3 (3) _____

Page Break

Q5.9 Please indicate the extent to which you find the following terms applicable to the screenshot of the eHealth platform MindDistrict:

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
Messy	○	○	○	○	○	Well-Structured
Overwhelming	○	○	○	○	○	Endurable/Tolerable
Distracting	○	○	○	○	○	Calm
Not enjoyable	○	○	○	○	○	Very enjoyable

End of Block: Nutrition MD

Therapieland.nl

Start of Block: Nutrition TL

Q6.1 Now you will engage with the module 'Nutrition' on the eHealth platform TherapieLand. Note that TherapieLand is a different platform. Keep the scenario you have read previously in mind. If you have forgotten about the scenario, you can find it below this text. Feel free to move over to the next questions when you are certain that you have memorized the scenario.

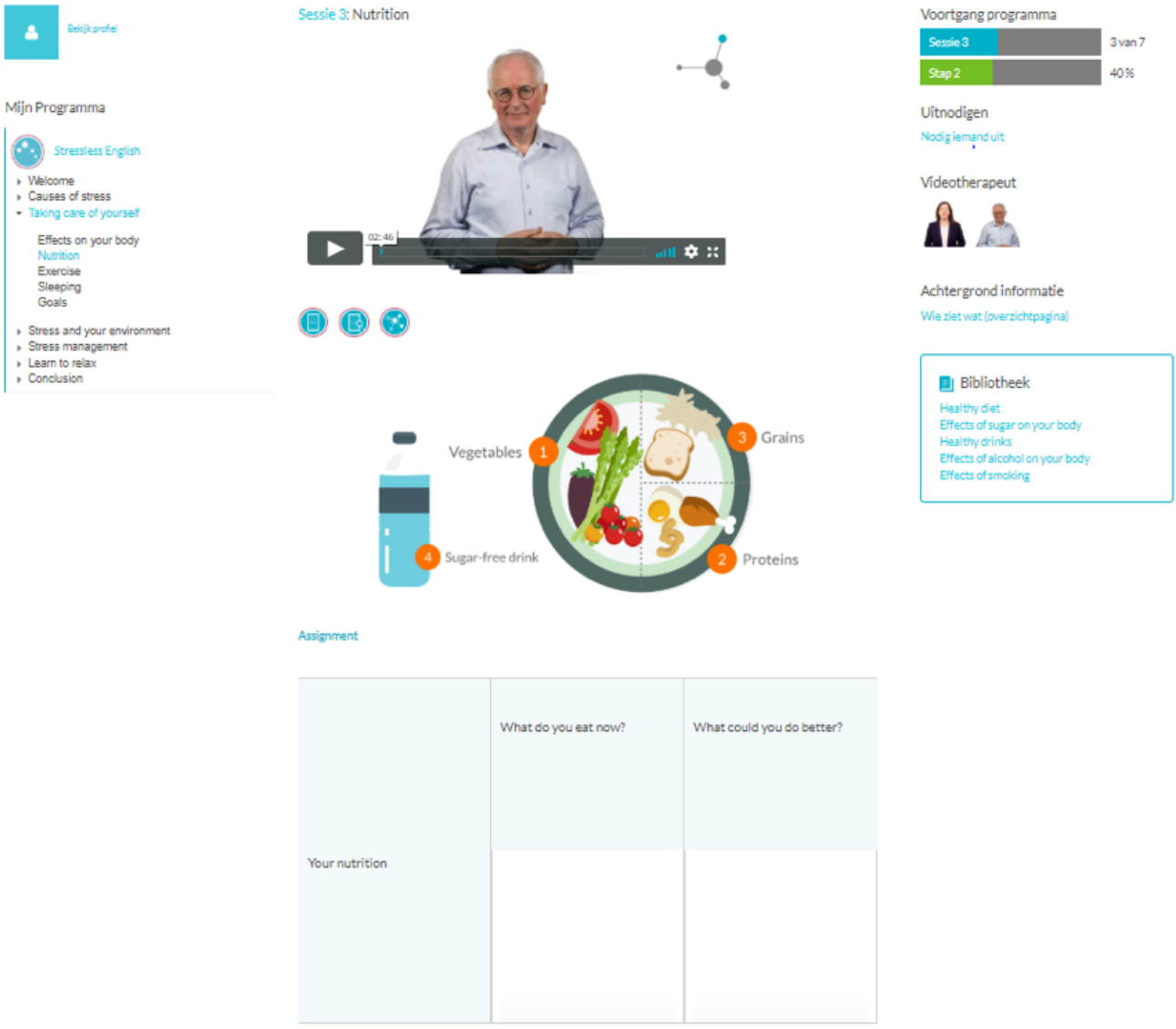
"You've read on social media how studies found that healthy eating increases your happiness, mood, and overall quality of life. This finding triggered your curiosity. You wonder if you would be able to make some changes to meals yourself, in order to make them more healthy and nutritious. As such, you have decided to look into websites that provide you with guidelines on how to develop a healthier eating pattern. This search has brought you to two eHealth websites; Therapieland and MindDistrict, which you believe may help you further."

Page Break

Q6.2 Below you can find a screenshot of the module 'Nutrition' on the eHealth platform TherapieLand. Observe the screenshot carefully while keeping the scenario in mind.

Q6.3 What is your first impression of the screenshot?

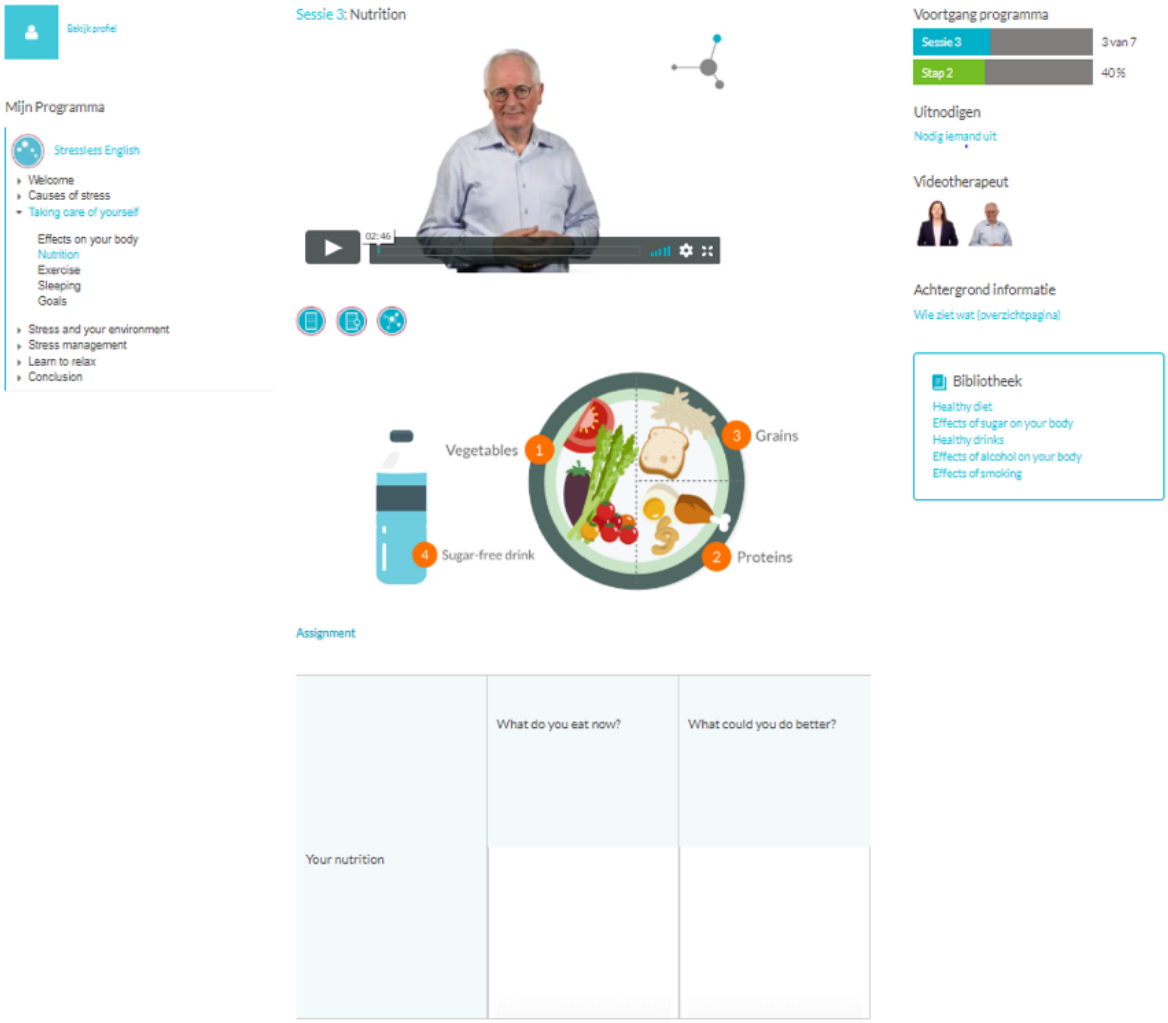
_____



Q6.4

Page Break

Q6.5 Please select the elements that capture your attention in a positive way. You can do so by clicking on an element. You can select up to 3 elements. If there is nothing specific that catches your attention, you do not have to select anything.

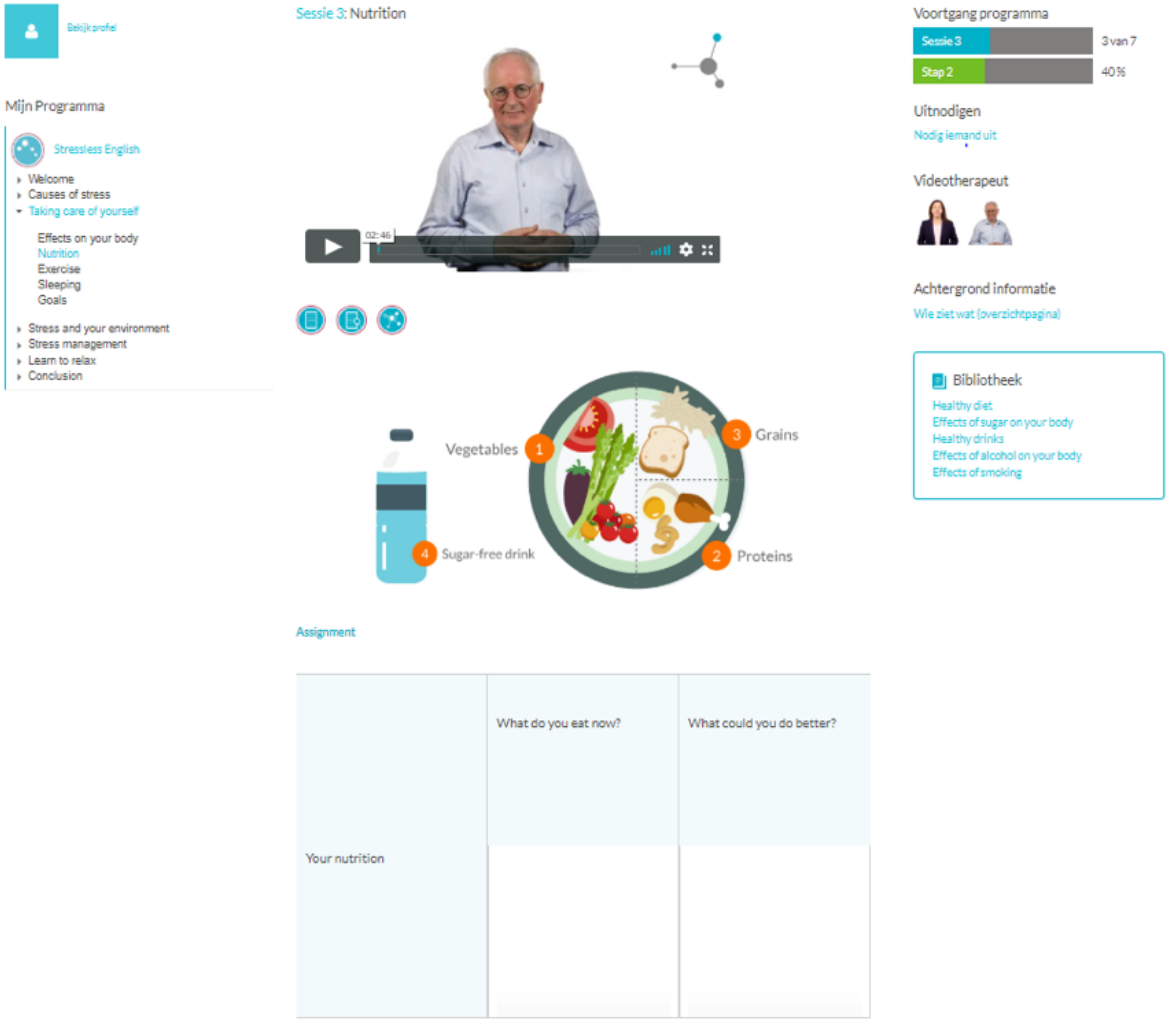


Q6.6 Please explain what areas you have selected, and why these areas are **eye-catching** and **enjoyable** to you.

- ○ Area 1 (1) _____
- ○ Area 2 (2) _____
- ○ Area 3 (3) _____

Page Break

Q6.7 Please select the elements that capture your attention in a negative way. You can do so by clicking on an element. You can select up to 3 elements. If there is nothing specific that catches your attention, you do not have to select anything.



Q6.8 Please explain what areas you have selected, and why these areas are eye-catching and **less enjoyable** to you.

○ Area 1 (1) _____

○ Area 2 (2) _____

○ Area 3 (3) _____

Page Break

Q6.9 Please indicate the extent to which you find the following terms applicable to the screenshot of the eHealth platform TherapieLand:

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
Messy	○	○	○	○	○	Well-Structured
Overwhelming	○	○	○	○	○	Endurable/Tolerable
Distracting	○	○	○	○	○	Calm
Not enjoyable	○	○	○	○	○	Very enjoyable

End of Block: Nutrition TL

Appendix C.
MindDistrict.com

Start of Block: Relaxation MD

Q7.1 Before starting with the next set of questions, we'd like you to read a new scenario. This scenario differs from the one mentioned before. Try to picture yourself experiencing this scenario in real life. Please keep the scenario in mind when answering the upcoming questions.

"You've read on social media that studies found that relaxation exercises reduce your stress and *increase your happiness, mood, and overall quality of life. This finding triggered your curiosity. You wonder if you would be able to perform relaxation exercises in your daily life, in order to reduce stress and feel calm. As such, you have decided to look into websites that provide you with guidelines on how to reduce stress and increase relaxation This search has brought you to two eHealth websites; Therapieland and MindDistrict, which you believe may help you further."*

Page Break

Q7.2 Below you can find a screenshot of the module 'Relaxation' on the eHealth platform MindDistrict. Observe the screenshot carefully while keeping the scenario in mind.

Q7.3 What is your first impression of the screenshot?

_____

Learn to relax

Most people think of relaxation in terms of activities such as watching TV or reading a good book. However, the kind of relaxation that can really make a difference in reducing tension, anxiety and stress is called 'deep relaxation'. In this session, you'll practise with different techniques to help you learn to deeply relax.

Become aware of tension

We are often not aware of the tension in our bodies. This might not seem like a problem, but even when you're unaware, the tension still affects you. Becoming aware of signs of stress and tension is the first step towards learning to relax. One way to gain more awareness of your body and tension is by practising a mindfulness technique: the body scan.

In the video clip, therapist Katie explains how to practise with the body scan technique.

We are often not aware of the tension in our bodies. This might not seem like a problem, but even when you're unaware, the tension still affects you. Becoming aware of signs of stress and tension is the first step towards

The body scan

Try this short body scan to gently explore tension and other sensations in your body. Keep the following in mind:

- Find a spot where you won't be disturbed for at least five minutes.
- Lie down on your back in a comfortable position.
- It doesn't matter what happens while you practise. Just keep on doing the exercise. Try to stay awake and concentrate.
- You don't have to relax.
- Be open to your experience by not judging it as good or bad. If you notice yourself becoming judgemental, congratulate yourself for observing it and try to focus your attention back on the exercise.
- When you become distracted, gently return your attention to the recording.
- Remember that you don't have to achieve anything with this exercise.

How did it go?

What did you notice?

What went well?

What was difficult?

Q7.4

Page Break

Q7.5 Please select the elements that capture your attention in a positive way. You can do so by clicking on an element. You can select up to 3 elements. If there is nothing specific that catches your attention, you do not have to select anything.

Learn to relax

Most people think of relaxation in terms of activities such as watching TV or reading a good book. However, the kind of relaxation that can really make a difference in reducing tension, anxiety and stress is called 'deep relaxation'. In this session, you'll practise with different techniques to help you learn to deeply relax.

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The body scan

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- Find a spot where you won't be disturbed for at least five minutes.
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- You don't have to relax.
- Be open to your experience by not judging it as good or bad. If you notice yourself becoming judgemental, congratulate yourself for observing it and try to focus your attention back on the exercise.
- When you become distracted, gently return your attention to the recording.
- Remember that you don't have to achieve anything with this exercise.

How did it go?

What did you notice?

What went well?

What was difficult?

Q7.6 Please explain what areas you have selected, and why these areas are **eye-catching** and **enjoyable** to you.

- Area 1 (1) _____
- Area 2 (2) _____
- Area 3 (3) _____

Page Break

Q7.7 Please select the elements that capture your attention in a negative way. You can do so by clicking on an element. You can select up to 3 elements. If there is nothing specific that catches your attention, you do not have to select anything.

Learn to relax

Most people think of relaxation in terms of activities such as watching TV or reading a good book. However, the kind of relaxation that can really make a difference in reducing tension, anxiety and stress is called 'deep relaxation'. In this session, you'll practise with different techniques to help you learn to deeply relax.

Become aware of tension

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- Find a spot where you won't be disturbed for at least five minutes.
- Lie down on your back in a comfortable position.
- It doesn't matter what happens while you practise. Just keep on doing the exercise. Try to stay awake and concentrate.
- You don't have to relax.
- Be open to your experience by not judging it as good or bad. If you notice yourself becoming judgemental, congratulate yourself for observing it and try to focus your attention back on the exercise.
- When you become distracted, gently return your attention to the recording.
- Remember that you don't have to achieve anything with this exercise.

How did it go?

What did you notice?

What went well?

What was difficult?

Q7.8 Please explain what areas you have selected, and why these areas are eye-catching and **less enjoyable** to you.

- ○ Area 1 (1) _____
- ○ Area 2 (2) _____
- ○ Area 3 (3) _____

Page Break

Q7.9 Please indicate the extent to which you find the following terms applicable to the screenshot of the eHealth platform MindDistrict:

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
Messy	○	○	○	○	○	Well-Structured
Overwhelming	○	○	○	○	○	Endurable/Tolerable
Distracting	○	○	○	○	○	Calm
Not enjoyable	○	○	○	○	○	Very enjoyable

End of Block: Relaxation MD

Therapieland.nl

Start of Block: Relaxation TL

Q8.1 Now you will engage with the module 'Relaxation exercise' on the eHealth platform TherapieLand. Keep the scenario you have read previously in mind. If you have forgotten about the scenario, you can find it below this text. Feel free to move over to the next questions when you are certain that you have memorized the scenario.

"You've read on social media that studies found that relaxation exercises reduce your stress and *increase your happiness, mood, and overall quality of life. This finding triggered your curiosity. You wonder if you would be able to perform relaxation exercises in your daily life, in order to reduce stress and feel calm. As such, you have decided to look into websites that provide you with guidelines on how to reduce stress and increase relaxation This search has brought you to two eHealth websites; Therapieland and MindDistrict, which you believe may help you further."*

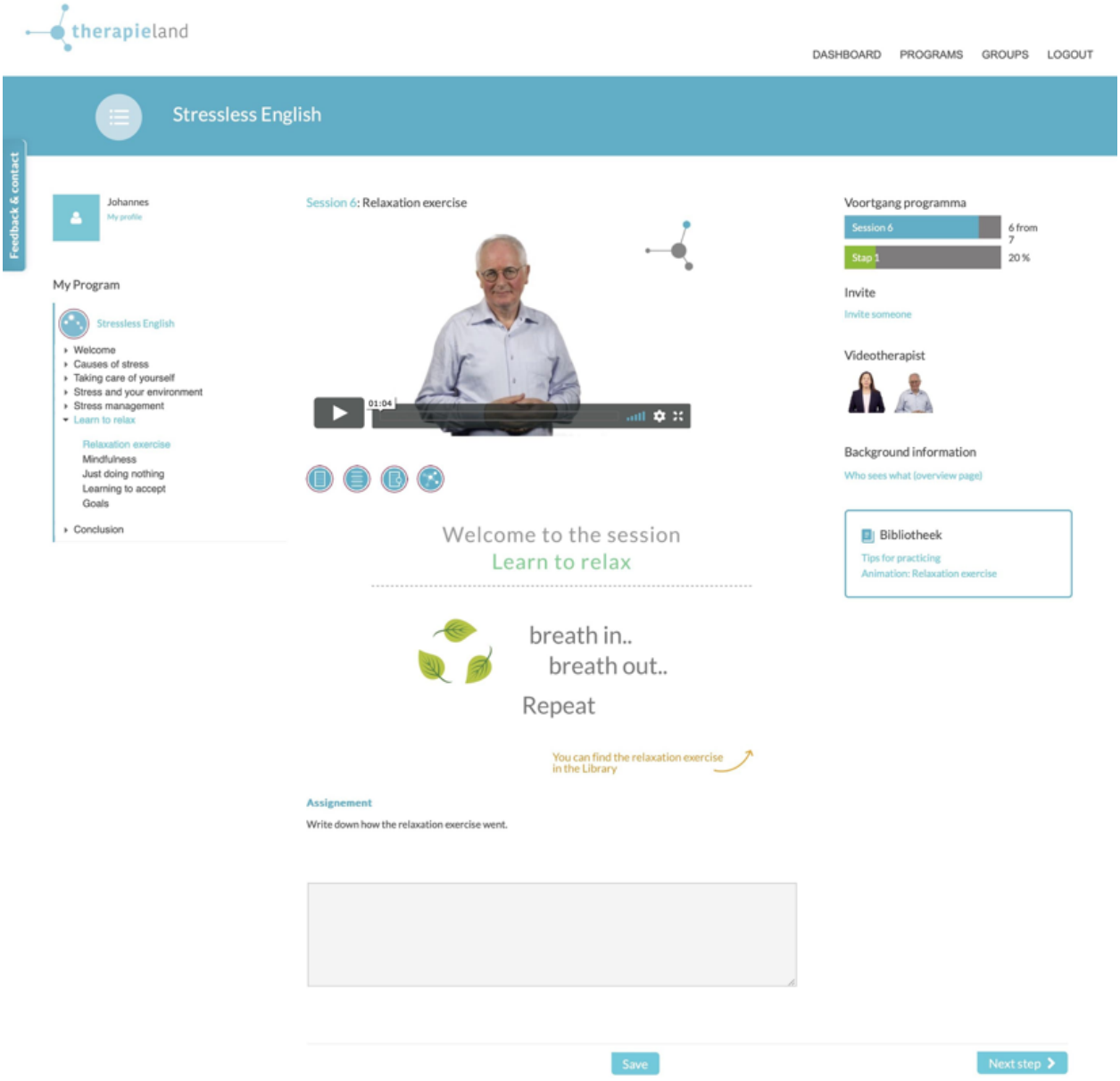
Page Break

Q8.2 Below you can find a screenshot of the module "Relaxation exercise" on the eHealth website TherapieLand.
Observe the screenshot carefully while keeping the scenario in mind.

Q8.3 What is your first impression of the screenshot?

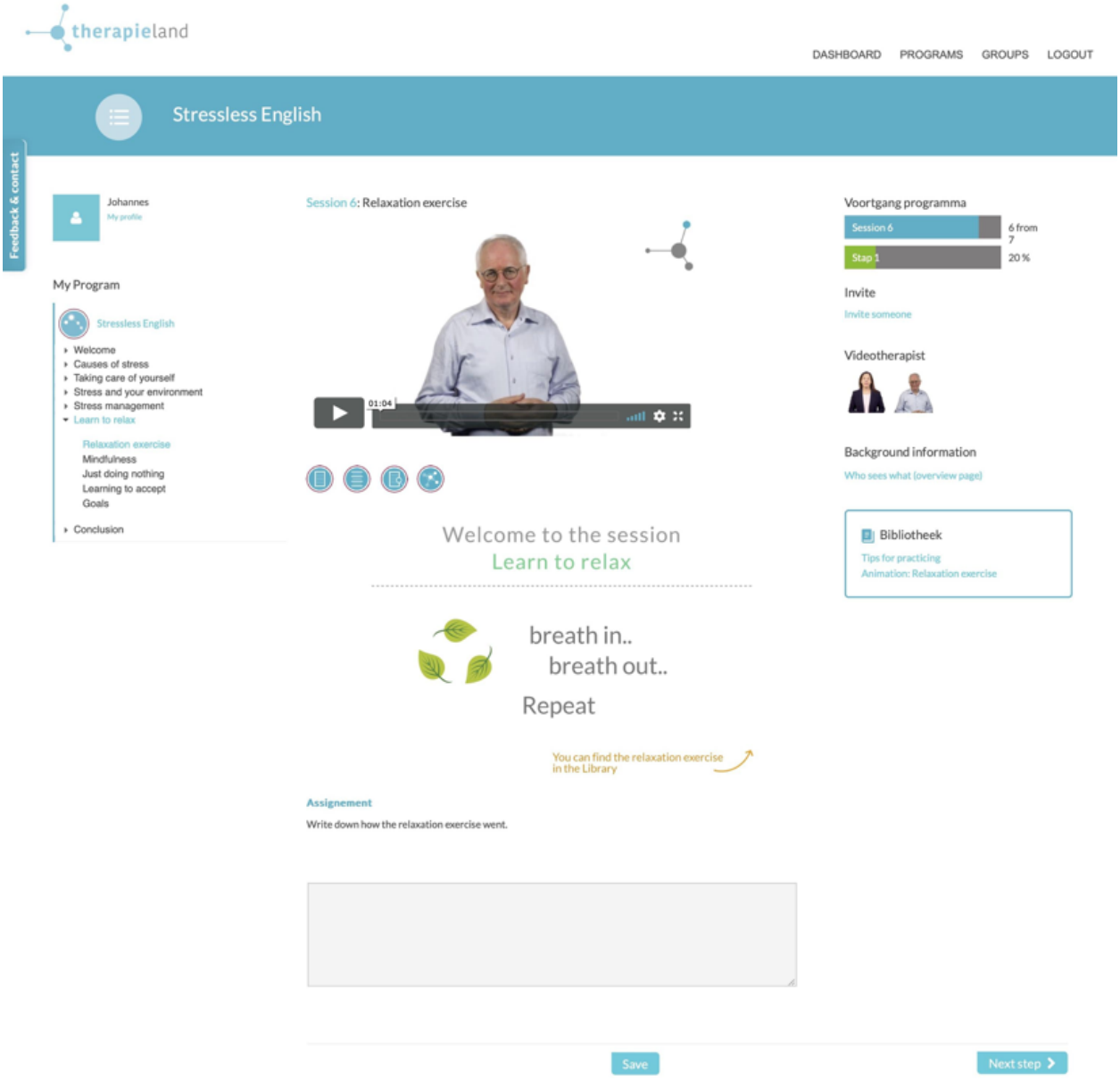
_____

Q8.4



Page Break

Q8.5 Please select the elements that capture your attention in a positive way. You can do so by clicking on an element. You can select up to 3 elements. If there is nothing specific that catches your attention, you do not have to select anything.



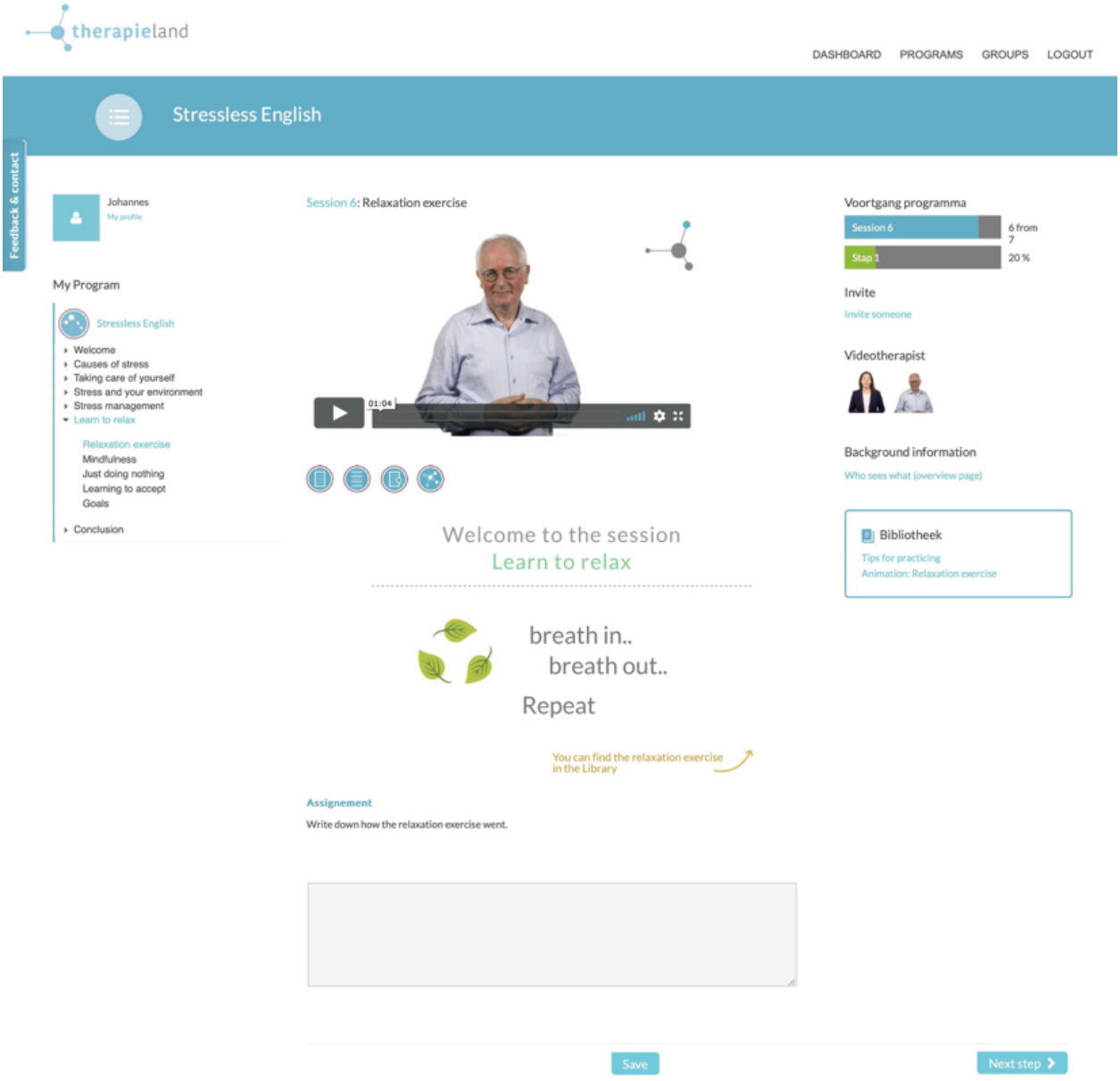
Q8.6 Please explain what areas you have selected, and why these areas are **eye-catching** and **enjoyable** to you.

- ○ Area 1 (1) _____
- ○ Area 2 (2) _____

○ Area 3 (3) _____

Page Break

Q8.7 Please select the elements that capture your attention in a negative way. You can do so by clicking on an element. You can select up to 3 elements. If there is nothing specific that catches your attention, you do not have to select anything.



Q8.8 Please explain what areas you have selected, and why these areas are eye-catching and **less enjoyable** to you.

- ○ Area 1 (1) _____
- ○ Area 2 (2) _____

○ Area 3 (3) _____

Page Break

Q8.9 Please indicate the extent to which you find the following terms applicable to the screenshot of the eHealth platform TherapieLand:

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
Messy	○	○	○	○	○	Well-Structured
Overwhelming	○	○	○	○	○	Endurable/Tolerable
Distracting	○	○	○	○	○	Calm
Not enjoyable	○	○	○	○	○	Very enjoyable

End of Block: Relaxation TL

Appendix D.
MindDistrict.com

Start of Block: SUS/TWEETS MD

Q9.1 You have now observed screenshots of both the eHealth platforms MindDistrict and TherapieLand. In the next few questions, you will be given these screenshots to observe again. Herein, questions are asked on how you expect the usability of, and your engagement with both eHealth platforms.

Please note that some questions might be hard to answer since you don't have the full experience of the website. In that case, try to pick the option that is closest to your first impressions and ideas about the website.

Before moving on, we would like you to read the following scenario. Try to keep this scenario in mind throughout all questions:

'You have had the opportunity to make use of the eHealth platform in question for a month. You have used it in a way that suits your needs, and that you feel comfortable with. As such, you determined how often per day/week you use the eHealth platform by yourself.'

Q9.2 Please take a last look at the screenshots of MindDistrict. Try to keep the scenario in mind while observing them. Feel free to move onto the next set of questions when you are ready.

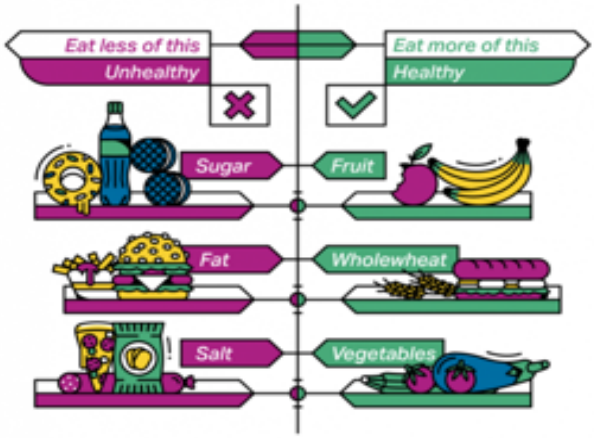
Information on nutrition and healthy eating habits

Healthy eating habits

Healthy, nutritious eating habits form an important part of our life. We often think about what tastes nice, where we are going to eat and with whom. But nutrition is also a large determining factor of how we feel and how healthy we are. In this part of the self-help module you will be given information and tips about healthy food. You are going to set a goal for yourself and work towards this step by step.

3x less, 3x more

Healthier eating actually boils down to the following: less sugar, less saturated fats and less salt. And on the other side: more fruit, more wholewheat products and more vegetables.



Less sugar

We need sugar. It gives you easy energy which is useful for your body. But these days it is very easy to exceed your daily requirement. Free sugars, in particular, are unhealthy. This is sugar that is added to products as biscuits and sweets, but also to pasta sauces. Types of sugar that do not fall in this category are those which are a natural part of a product, such as in milk, fruit and vegetables. Try and reduce free sugar. Below a few tips on how to go about this:

- Cool drinks contain rather a large amount of free sugar. Try switching to water, tea or coffee.
- Replace your sweet evening snack with something healthy such as an apple or a bowl of yoghurt with fruit and nuts.
- Look at the labels in the supermarket and choose the product with the least amount of sugar.
- 'Sugar-free' sweets can be used as substitute occasionally, but please note: not all sugar-free products are good for you.

- Choose Greek yoghurt: it contains less sugar than normal yoghurt, has more good fats and leaves you feeling full.
- Eat products with good fats to make you feel full such as avocado, fish, nuts.
- Rather eat quinoa, buckwheat, almond flour, nuts and seeds instead of white wheat flour, rice or potatoes. They contain less sugar.

Alcoholic beverages also contain lots of sugar. Rather go for an alternative such as sparkling mineral water, fresh lemonade or a fruit and vegetable smoothie.

Q9.3 Now you will answer questions concerning your engagement with the eHealth platform MindDistrict. Try to answer the questions to the best of your abilities.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
MindDistrict can become part of my daily routine. (1)	○	○	○	○	○	○	○
MindDistrict is easy to use. (2)	○	○	○	○	○	○	○
I will be able to use MindDistrict as often as needed to be more relaxed. (3)	○	○	○	○	○	○	○
MindDistrict will make it easier for me to work on being more relaxed. (4)	○	○	○	○	○	○	○
MindDistrict will motivate me to be more relaxed. (5)	○	○	○	○	○	○	○

MindDistrict will help me to get more insight into how to be more relaxed. (6)	○	○	○	○	○	○	○
I will enjoy using MindDistrict. (7)	○	○	○	○	○	○	○
I will enjoy seeing the progress I make in MindDistrict. (8)	○	○	○	○	○	○	○
MindDistrict will fit me as a person. (9)	○	○	○	○	○	○	○

Therapielan.nl

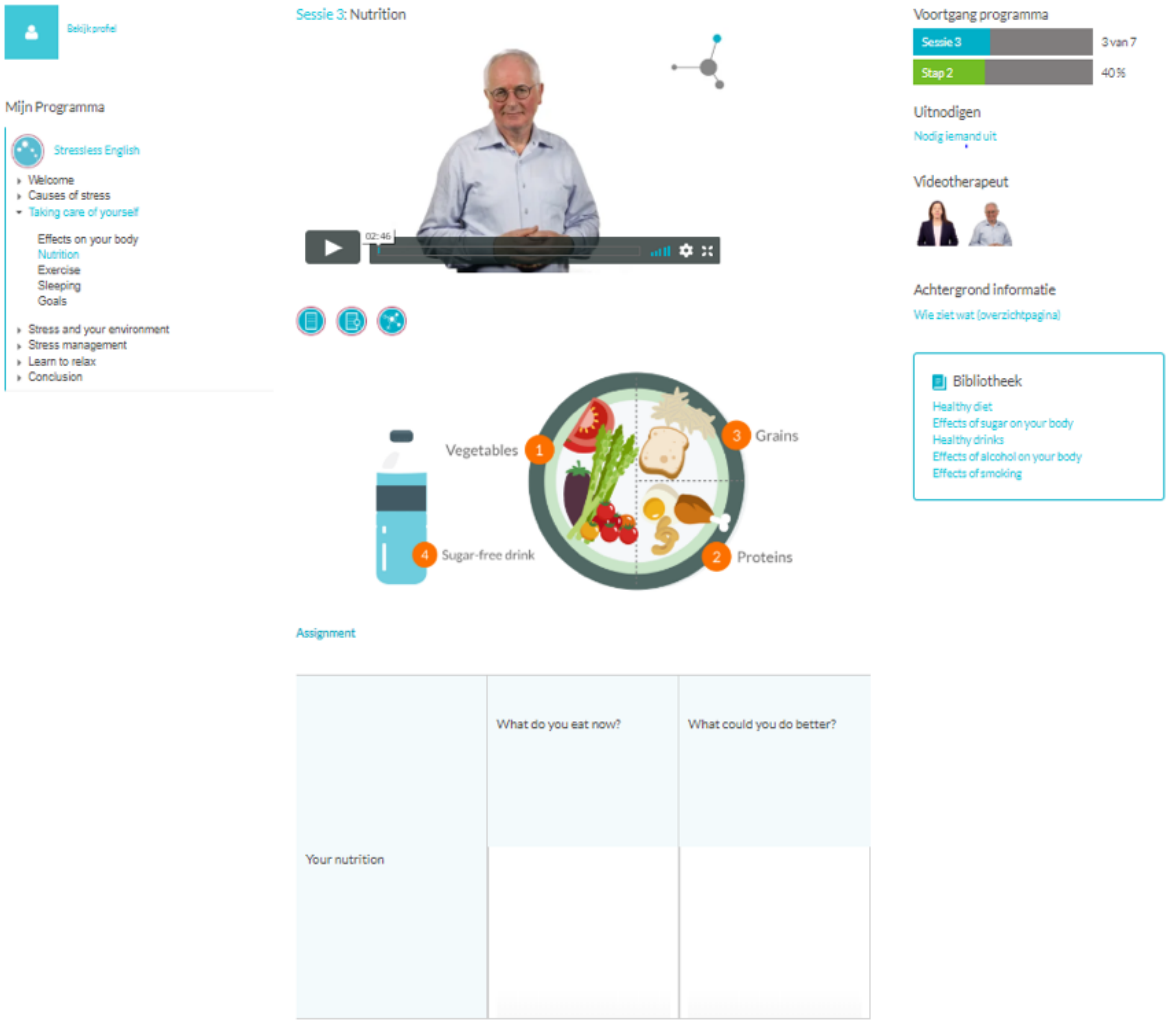
Start of Block: SUS/TWEETS TL

Q10.1 Now you will judge the usability of, and your engagement with the eHealth platform TherapieLand.

Again, please note that some questions might be hard to answer since you don't have the full experience of the website. In that case, try to pick the option that is closest to your first impressions and ideas about the website.

Try to keep the scenario in mind. If you still remember the scenario, feel free to move onto the next questions. If you feel like you have forgotten parts of the scenario, it can be found below.

'You have had the opportunity to make use of the eHealth platform in question for a month. You have used it in a way that suits your needs, and that you feel comfortable with. As such, you determined how often per day/week you use the eHealth platform by yourself.'



Q10.2 Please take a last look at the screenshots of TherapieLand. Try to keep the scenario in mind while observing them. Feel free to move onto the next set of questions when you are ready.

Q10.3 Now you will answer questions concerning your engagement with the eHealth platform TherapieLand. Try to answer the questions to the best of your abilities.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
TherapieLand can become part of my daily routine. (1)	○	○	○	○	○
TherapieLand is easy to use. (2)	○	○	○	○	○
I will be able to use TherapieLand as often as needed to be more relaxed. (3)	○	○	○	○	○
TherapieLand will make it easier for me to work on being more relaxed. (4)	○	○	○	○	○
TherapieLand will motivate me to be more relaxed. (5)	○	○	○	○	○
TherapieLand will help me to get more insight into how to be more relaxed. (6)	○	○	○	○	○

I will enjoy using TherapieLand. (7)	○	○	○	○	○
I will enjoy seeing the progress I make in TherapieLand. (8)	○	○	○	○	○
TherapieLand will fit me as a person. (9)	○	○	○	○	○

Appendix E.
MindDistrict.com

Q9.4 The following questions concern the usability of the eHealth platform MindDistrict. Try to answer the following questions to the best of your abilities.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I think that I would like to use MindDistrict frequently. (1)	○	○	○	○	○
I think MindDistrict may be unnecessarily complex. (2)	○	○	○	○	○
I think MindDistrict may be easy to use. (3)	○	○	○	○	○

I think that I would need the support of a technical person to be able to use MindDistrict. (4)	○	○	○	○	○
I believe the various functions in MindDistrict may be well integrated. (5)	○	○	○	○	○
I think there may be too much inconsistency in MindDistrict. (6)	○	○	○	○	○
I would imagine that most people would learn to use MindDistrict very quickly. (7)	○	○	○	○	○
I believe that MindDistrict may be very cumbersome to use. (8)	○	○	○	○	○

I believe I would feel confident using MindDistrict. (9)	○	○	○	○	○
I might need to learn a lot of things before I could get going with MindDistrict. (10)	○	○	○	○	○

Therapieland.nl

Q10.4 The following questions concern the usability of the eHealth platform Therapieland. Imagine you have used the information as provided in the screenshot. Try to answer the following questions to the best of your abilities.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I think that I would like to use TherapieLand frequently. (1)	○	○	○	○	○
I think TherapieLand may be unnecessarily complex. (2)	○	○	○	○	○
I think TherapieLand may be easy to use. (3)	○	○	○	○	○

I think that I would need the support of a technical person to be able to use TherapieLand. (4)	○	○	○	○	○
I believe the various functions in TherapieLand may be well integrated. (5)	○	○	○	○	○
I think there may be too much inconsistency in TherapieLand. (6)	○	○	○	○	○
I would imagine that most people would learn to use TherapieLand very quickly. (7)	○	○	○	○	○
I believe that TherapieLand may be very cumbersome to use. (8)	○	○	○	○	○

I believe I would feel confident using TherapieLand. (9)	○	○	○	○	○
I might need to learn a lot of things before I could get going with TherapieLand. (10)	○	○	○	○	○

Appendix F.

MindDistrict.com

Q9.5 Based on the previous questions, give a final rating of the eHealth platform MindDistrict.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)	10 (10)
(1)	○	○	○	○	○	○	○	○	○	○

End of Block: SUS/TWEETS MD

Therapieland.nl

Q10.5 Based on the previous questions, give a final rating of the eHealth platform TherapieLand.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)	10 (10)
(1)	○	○	○	○	○	○	○	○	○	○

End of Block: SUS/TWEETS TL