









The Values of Self-tracking and Persuasive eCoaching According to Employees and Human Resource Advisors for a Workplace Stress Management Application: A Qualitative Study

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Abstract. Self-tracking and automated persuasive eCoaching combined in a smartphone application may enhance stress management among employees at an early stage. For the application to be persuasive and create impact, we need to achieve a fit between the design and end-users' and important stakeholders' values. Semi-structured interviews were conducted among 8 employees and 8 human resource advisors to identify values of self-tracking, persuasive eCoaching, and preconditions (e.g., privacy and implementation) for a stress management application, using the value proposition design by Osterwalder et al. Results suggest essential features and functionalities that the application should possess. In general, respondents see potential in combining self-tracking and persuasive eCoaching for stress management via a smartphone application. Future design of the application should mainly focus on gaining awareness about the level of stress and causes of stress. In addition, the application should possess a positive approach besides solely the focus on negative aspects of stress.

Keywords: User-centred design · eHealth · Mobile phone
Remote sensing technology · Stress Physiological · Stress Psychological
Workplace · Health promotion

1 Introduction

1.1 Stress and Employees

It is widely recognized that prolonged stress is a major burden for employees as well as for organizations and society. Stress is related to several health and wellbeing related issues, such as depression, anxiety, and cardiovascular diseases [1]. The last two decades, a trend is observed in the rise of stress risks in Europe. One of the explanations in this is the increasing use of information and communication technology [2], which resulted into a working culture characterized by increased work intensification and possibilities to work everywhere, making employees working with digital screen equipment (DSE) at risk for stress.

Many different psychological theories exist on stress among employees. Most of these theories include an overarching component: balance [3]. Being able to mobilize enough personal and social resources to overrule the demands, a positive response to stress occurs (i.e., eustress). Being unable to mobilize enough personal and social resources to overrule the demands, a negative response occurs (i.e., distress) [3, 4]. Distress might result in poor health and low performance, whereas eustress might result in good health and high performance [5].

1.2 Smartphone Stress Management Application for Prevention

The EU compass for action on mental health and well-being advocates for taking preventive measure to reduce negative responses to stress and enhance positive responses to stress [6]. However, many interventions are labour-intensive which limits the ability for all DSE employees to opt-in an intervention targeting stress at an early stage [7]. To target stress at an early stage, a smartphone stress management application that focusses on self-management might be an effective approach. Two important components for self-management via a smartphone application are self-tracking and persuasive eCoaching [8]. Self-tracking can create awareness among individuals about their current level of stress and their personal demands and resources in relation to stress. Where traditional interventions mostly gain insights into such information by means of recall [9], smartphones can capture real-time information as the smartphone is usually kept in close proximity to the user. This can result into the identification of vulnerable moments for adverse behaviour and can be used by an eCoach to send personally relevant feedback to (re)gain balance in the personal demands and resources at times when it is most needed (i.e., just-in-time suggestions [10]).

1.3 The Identification of Values for eHealth Design

We see a potential in the combination of self-tracking and persuasive eCoaching in a smartphone stress management application to target DSE employees at an early stage. However, this approach is rather new [8]. As impact and uptake of new eHealth technologies are highly dependent on the fit between design and end-users' and stakeholders' values, it is important to involve the end-users and other important stakeholders in the development process [11, 12]. Besides the identification of values for design

elements, such as self-tracking and persuasive eCoaching, it is also needed to have insights into the preconditions for the design, such as privacy and implementation [12].

This study is part of an overarching project into the development of a workplace stress management application for DSE employees and builds upon results from a previously performed scoping review [8]. This scoping review identified key components for self-tracking and persuasive eCoaching in healthy lifestyle interventions. To increase the chance of creating a fit between the design and end-users' and stakeholders' values, this study aims to answer the following research question: "What are the values according to DSE employees and human resource advisors (HR advisors) for self-tracking, persuasive eCoaching, and preconditions of a workplace stress management application?".

2 Methods

2.1 Study Design

General procedure. Qualitative, semi-structured interviews [13] were conducted with 8 DSE employees and 8 HR advisors in 2017 in different organizations in the Netherlands. DSE employees and HR advisors were recruited because of their important role in the development and uptake process with DSE employees being the end-users of the design and HR advisors for having a key role in the decision-making process concerning the organizational implementation of interventions that benefit employees' vitality. In addition, HR advisors can both place emphasis on the employees' perspective and the employers' perspective.

During interviews, the value proposition design [11] was used as a basis to identify values from DSE employees and HR advisors. In addition, a persona and low-fi prototype were presented to the participants.

Value proposition design. The value proposition design is two-sided: (1) *the customer profile*, which aims at creating customer understanding, (2) *the value map*, which aims at the way the product creates value for the customer [11]. A fit between the two is believed to improve successful development and implementation of a product. The interviews were solely focused on the customer profile; creating customers understanding and identify values by mapping out *customer jobs*, *pains*, and *gains*. Customer jobs relate to the tasks users want to complete, the problems users experience, and the users' needs. Pains focus on the undesired aspects and outcomes and on expected risks and obstacles. Gains focus on the desired and expected aspects and outcomes and on expected benefits and stimulators [11].

Persona. A persona is a lively representative of possible end-users [14]. The persona was used to enable the respondent to better understand the situation of a person suffering from stress or to speak from the situation of the persona instead of their own situation, as stress is subject to stigmatization [7]. Via literature, general characteristics of DSE employees experiencing high levels of stress and general causes and symptoms

of stress were identified. Then, a female and male persona were created that represented a typical DSE employee suffering from stress, respectively for male and female respondents.

Low-fi prototype. A low-fi prototype was used as experience shows that respondents often find it difficult to formulate values without them having a concrete idea of what the technology might look like [15]. A preliminary idea for the low-fi prototype was based on the results of a scoping review performed by the researchers of this study. This scoping review identified key components of self-tracking and persuasive eCoaching in eHealth design and the way the components can be best designed [8] (e.g., from the persuasive system design (PSD) model [16] (*in italic*)). In short, the *self-tracking* element was based on the Sense-IT app, a product from the University of Twente, Scelta/GGNet, VUmc, Arkin, and Pluryn [17]. Their goal is to develop a scientifically informed, ambulatory biofeedback eCoaching app that supports its users in learning to better recognize changes in emotional arousal. The Sense-IT app collects heart rate measurements as a proxy for changes in physiological arousal due to emotional events. When a significant increase in heart rate is detected and, to a certain extent, adjusted for increases in physical activity of the subject, it is presumed that the increase in heart rate is the result of emotional arousal. Myrtek and colleagues developed and tested this concept as a proxy for emotional arousal [18]. As to find out which type of emotion caused physiological arousal, two questions followed based on the circumplex model of affect [19]: (1) “Do you experience a positive or negative emotion?”, (2) “How strong is the emotion you are experiencing on a scale from 1–10?”. The different types of measurements can be seen in a graph (*simulation*). The eCoaching components consist of helping to find out causes of stress by combining data (*reduction*) and provision of *suggestions* to reduce stress. The suggestions were based on the coping strategies by Lazarus and Folkman: emotion-focused coping strategies and problem-focused coping strategies [4]. Additional, persuasive eCoaching components were *goal-setting* and *rewards*. Also, the user is able to *personalize* settings (e.g., to set timing and frequency of messages) and to share self-tracking data with others (*social support*). The low-fi prototype was created via balsamiq.com and resulted in a clickable prototype in a PDF-document.

2.2 Participant Selection

A systematic, non-probabilistic sampling method was applied to ensure inclusion of different types of DSE employees and HR advisors. We aimed to include an equal number of male ($n = 7$) and female ($n = 9$) participants and participants from commercial ($n = 5$), semi-commercial ($n = 6$), and non-commercial settings ($n = 5$). Ages ranged from 27–61. Inclusion criteria were: (1) employees needed to be open for future use of a stress management application and HR advisors needed to be open to advise a stress management application to their organization, in order to involve only potential (end-)users; (2) employees needed to perform continuous periods of DSE work for an hour or more at a time on a more or less daily basis, to be labelled a DSE employee [20].

Respondents were recruited via representatives of suitable organizations from the personal network of the research team. Potential respondents were first contacted by

email providing them with initial information about the interviews. When they agreed to participate, they were contacted by telephone to provide additional information and to set a date. During one interview with an HR advisor, a company nurse was present and her comments were included in the data.

2.3 Data Collection

Semi-structured, in-depth interviews took place one-on-one by one researcher (AL) in the original work setting of the participants. After obtaining informed consent from participants, interviews were audiotaped and resulted in recordings of 42–82 min.

A topic list was used to guide the interviews. Participants were first presented with the persona. Then, they were questioned about their *perception of stress* to better understand their perspective on stress due to its complexity. The body of the interview consisted of topics from the value proposition design [11]: *customer jobs*, *pains*, and *gains*. Customer jobs (e.g., problems and needs) were questioned in relation to stress and stress management in general. After gaining insights into the customer jobs, the low-fi prototype was shown. Thereafter, pains and gains were questioned in relation to *self-tracking* (e.g., device and validity [8]), *persuasive eCoaching* (e.g., elements from the PSD model such as personalisation and reminders [16] and existing literature on (e)coaching methods for stress [4, 21]), and *preconditions* of a stress management application (e.g., privacy and implementation [8]). A topic of interest was also to gain insights into the level of importance of the mentioned values. A final question asked them about willingness to *using* such an intervention in the *future* for DSE employees and willingness to *advising* such an intervention to implement in the organization in the *future* for HR advisors. The topic list for HR advisors differed from the topic list for DSE employees in that HR advisors were asked to provide answers from both the employees' and employers' perspective.

2.4 Data Analysis

The transcribed interviews were rendered anonymously and uploaded in the qualitative analysis software package Atlas.ti version 8.0 (Scientific Software Development GmbH, Berlin). We analysed the data separately for DSE employees and HR advisors as the authors of the value proposition design advice to create a customer profile per stakeholder group. Initial analysis included selecting relevant fragments and coding these fragments using a coding scheme based on the topic list, which included constructs from the value proposition design [11], the earlier mentioned scoping review [8], the PSD model [16], and existing literature on (e)Coaching for stress management [4, 21]. Most fragments could be coded using the initial coding scheme. For fragments that remained, we used new codes that emerged from the data. To assess and intensively discuss the consistency of coding and reliability of the codebook, two researchers (AL and LP) independently coded 2 interviews (one from a DSE employee and one from an HR advisor). This resulted in minor adjustments in the interpretation of certain codes.

After several rounds of coding, values were extracted per code. Values emerged that could be organized under the main themes *self-tracking*, *persuasive eCoaching*,

preconditions, awareness, and future use. Subthemes were created by means of the most significant values under the main themes considering the level of importance mentioned by respondents. Further analysis focused on searching for defiant cases and searching for relations between what has been said.

3 Results

3.1 Self-tracking

Self-tracking of stress. Self-tracking of both physical reactions to stress (e.g., heart rate) and psychological reactions to stress (e.g., perceived emotions) is seen as helpful for creating awareness about stress. Respondents especially perceived it useful to become aware of variables that they could hardly make an estimation about when recalling results on the variable, such as sleep or emotions. Although some respondents doubted if users need a wearable device to create awareness about stress. Another DSE employee elaborated on the added value of measuring physical stress factors: “Well, I would find it interesting, because I believe that you could signal the physical discomfort earlier than the mental discomfort. [...] So actually a sort of signal function would seem quite interesting to me” (DSE employee #8).

Both groups, especially female respondents, liked the idea of tracking positive emotions due to increases in heart rate besides negative emotions to effectuate a positive approach. In addition, the focus on solely negative emotions was expected to be a burden for use. Also, a few DSE employees mentioned that they liked the idea of receiving biofeedback after an exercise to see if their physiological reactions to stress are diminished. In addition, DSE employees and an HR advisor believed that having objective measurements about stress may encourage to start a conversation with the employer about stress. “Maybe it can help for an employer to see that it are not just complaints of the employee but that there is an actual problem. I hope that it will start a dialogue between employer and employee [...]” (DSE employee #5).

Self-tracking the causes of stress. Respondents saw the potential in combining different types of data (e.g., sleep, physical activity, connection with the planning) in order for the system to provide suggestions on possible causes of stress. Although most DSE employees believed that they are able to observe patterns themselves, they also believe that self-tracking of causes could help them in this process. Especially respondents who were more focused on the possibilities of the technology, instead of the challenges, saw the potential in discovering causes by collecting more personal data. Respondents’ opinions differed about the expected openness of DSE employees to collect more personal data due to privacy concerns. This is described in more detail below. In addition, some respondents had mixed feelings about the effectiveness of the system to suggest causes based on self-tracking data as stress is complex or the system’s analysis may lead to false conclusions.

The validity of the measurements. DSE Employees and HR advisors believed that the poor validity of physical stress measurements negatively affect usage. Though,

some margin of error is accepted by most employees. Of special importance according to employees and HR advisors was to provide proper information about what the user can expect from the validity when measuring stress.

Although respondents saw the validity as a barrier to use, some believed that inaccurate measurements might still have added value for the user as it still creates a moment of reflection, even when the increase in heart rate is not the result of stress.

3.2 Persuasive eCoaching

Guidance. After obtaining insights into the level and stress and causes of stress via self-tracking, some HR advisors believed employees are able to take the first steps by themselves. They believed that awareness stimulates action, i.e. to actually do something about stress. Other HR advisors believed that some form of guidance is necessary to effectively do something about stress. The form of guidance may be automated eCoaching via the application whereas others expect that a human coach is needed due to the complexity of stress. An advantage that was appointed for automated eCoaching was that the application could be consulted anonymously. It was expected that some employees might experience a burden to take actions on stress due to feelings of failure.

The tasks for the eCoach were mostly seen in the provision of guidance throughout the awareness process and the provision of short and practical suggestions. An important step in the awareness process was to, together with the eCoach, reflect on the moments of stress experienced to better understand their own situation. “It goes on and on, so it would be appropriate to build in time for reflection. Just to stand still with what I was up to the past few hours and what effect did that have on me? Also to find out what you could do differently in the future. [...] I think that this could have a substantial effect on the reduction of work-related stress” (DSE employee #5). Some employees said that the eCoach could help them throughout this process by asking open and reflective questions.

Timing and frequency of messages. Opinions of respondents on the appropriate timing and frequency of messages was depended upon the type of message: (1) messages for self-tracking or (2) messages to perform exercises or reflection. According to some employees, it is acceptable to respond to simple questions for self-tracking during the stress moment (e.g., when the heart rate is increased) that will cost as much time as checking new messages on the smartphone. DSE employees and HR advisors expected both negative and positive effects of providing messages in the stress moment based on self-tracking data. Negative effects were that providing a message in the stress moment might lead to annoyance and it might distract users from work. A positive effect was that sending a message during the stress moment was perceived as essential for creating awareness. In addition, respondents expected positive effects for the validity of measurements as there are no recall problems. Older respondents (46–65 years) were more positive about sending a message during the stress moment than younger respondents (25–45 years).

Asking to perform reflection or an exercise may cost more effort and might, therefore, be less appropriate during the stress moment. One HR advisor expected users to be

incapable of performing reflection during the stress moment as stress narrows your mind. “Reflection asks time and space, but there is no time and space because stress narrows. So there is no point in sending a message in my opinion” (HR advisor #8).

Natural breaks during the day are often mentioned as convenient times for sending messages, such as at the end of the morning, end of the afternoon, or evening. Especially a moment of reflection seemed appropriate during these moments.

Opinions differed between respondents about users having the ability to adjust when to receive messages or to mute the system. Being able to choose settings increases feelings of control over the system, which was found important for usability. In contrast, some employees mentioned that it may not be ideal to set messages on personally chosen moments as it interferes with the awareness function of the system. In the past, a light obtrusive form (e.g., not with sound but lights) of sending messages was experienced as somewhat annoying but effective for behaviour change.

Goals and rewards. DSE employees and HR advisors had different opinions about the usefulness of setting goals and receiving rewards in relation to stress. Some believed that goals and rewards can increase motivation to change behaviour, which was more often mentioned by male respondents. One HR advisors and one employee saw the goal setting feature as an essential element: “If you do not know where to go, you will not get there of course” (HR advisor #7). Other respondents mentioned that it seems strange to motivate people to reduce stress by setting goals and providing rewards as is it is not fully in their ability to control the stress reactions. In addition, a few HR advisors mentioned that it is preferable to set a goal in the form of a personal value (e.g., I want to take a break every day).

3.3 Awareness

Awareness emerged to be a desired value for stress management. Before the low-fi prototype was shown, respondents mentioned that a first necessity for effective stress management is to obtain awareness about the employee’s stress level and causes of stress. “Everything starts or coincides with some degree of awareness. As long as you do not have that, you keep on going” (HR advisor #6). Both groups believed that creating awareness should be the main focus of the intervention and believed that this is an achievable goal for a stress management application using self-tracking and persuasive eCoaching. “I think that it would be mostly a tool for the employee himself. As to find out ‘hey’ what are my moments of stress, how is that so, and during which moments do I suffer from stress, in order to obtain insights into the patterns” (HR advisor #7).

3.4 Preconditions

Privacy. Respondents had differing expectations about privacy concerns for the collection of additional personal data. Some employees expected no issues as the collection of personal data already happens on a large scale via the internet or smartphones. Others believed that not all employees would feel comfortable to collect more personal data. Also, some types of data are expected to raise more privacy concerns (e.g., location) than other types of data.

Respondents' opinions differed about the willingness of sharing data with others. Half of the respondents felt that the application would be something for the user self, which was more often perceived in this way by female respondents. Sharing of data with others is something that they only want to do on a voluntary basis. Furthermore, it is seen as helpful by some and dubious by others when the organization has access to the data on an aggregated level.

Some respondents believed that it might withhold potential users to use the system due to privacy concerns. According to HR advisors, conditions concerning privacy that should be met were to inform intensively about data security, the user should agree with conditions, and data may not be deduced by others at the individual level. According to employees, conditions concerning privacy were that they want to have control over who has insights into their data and what kind of data the system is allowed to collect.

Implementation and embedding. A negative atmosphere in the organization to do something about stress was perceived as a burden for successful implementation. Respondents believed that starting the implementation with a pilot to collect and represent first positive reactions might lead to quick adoption throughout the organization.

According to HR advisors, it is important to have a clear vision about how the application would fit into the health and safety policy of the organization. "I think that you should carefully look into why would you implement it? What is the goal of this in the overall plan? How do we want to deal with employability and how can we support employees in this? I think you need a good story about this, a proper vision [..]" (HR advisor #3).

Respondents believed that the application should not be stand-alone but should be part of a complete programme. With some employees, especially older employees, seeing potential in a broader application that also focuses on other health aspects relevant for the employee. Other employees and HR advisors said this in relation to embedding the application in a total programme of measures for improving employees' vitality in the organization, with the app being one step in the total programme.

3.5 Future Use

All DSE employees were willing to use such an application in the future, or at least try the intervention. Most HR advisors hesitate whether to advise the design to their organization although nobody refused the idea. The most mentioned argumentation for hesitation was that the intervention should be part of a whole and the design should be further developed before making a final call.

4 Discussion and Conclusion

In this study, we identified values related to self-tracking, persuasive eCoaching, and preconditions to inform future development of a workplace stress management application for DSE employees. In general, DSE employees and HR advisors see potential in a stress management app combining self-tracking and persuasive eCoaching.

Respondents mention that an initial need for stress management is to obtain awareness about the stress level and causes of stress and believe that the application could play a part in the process of gaining awareness. Earlier research also emphasizes that self-tracking using wearables can create awareness [8]. However, Patel et al. argue that more is needed [22]. Self-tracking is only one of the persuasive strategies that can be deployed for health behaviour change [16]. Other strategies can be offered via persuasive (e)Coaching, such as personalized suggestions for behaviour change [16], and may be necessary to bridge the gap between awareness and real behaviour change.

Specifically for the eCoach, respondents see potential in receiving guidance throughout the awareness process via reflection on moments of stress. In relation to technologies for behaviour change, reflection is one of the stages in the model of personal informatics systems and precedes the action stage for behaviour change [23]. This model indicates that reflection is necessary to activate the participants.

Furthermore, it is important during design and implementation to emphasize expected gains whereas avoiding pains [11]. First, the future design should include tracking of positive emotions to avoid the risk of setting the focus too much on negative emotions. In addition, focusing both on positive and negative emotions can help (re)gaining balance in personal demands and resources. Positive emotions can be seen as a resource. From the positive psychology theory, setting the focus on positive emotions increases resilience in moments when negative emotions are experienced [24]. In addition, collecting and reminding the user real-time about negative emotions enables the provision of just-in-time suggestions [10]. Just-in-time suggestions increase the resources of a DSE employee to deal with negative emotions at an early stage when it is most needed. Second, another important aspect mentioned was appropriate timing and frequency of sending messages to the users. Discrepancies exist among respondents for sending messages during the stress moment. Positive expectations are creating a moment of awareness of the experienced emotions and negative expectations are annoyance and distraction from work. Future research could focus on finding the appropriate balance for timing and frequency of sending messages. Third, respondents in this study consider it important, but not a prerequisite, that the design entails a proper validity and data safety of collected data about stress. Respondents want to be informed extensively about what to expect from the design on these aspects. According to the expectations-confirmation model, users will form their level of satisfaction with a product based on their prior expectations and the extent to which these expectations are met [25]. By communicating to the user what they can expect from the design with respect to validity and privacy, it may be less likely that they will be disappointed [25]. Also, the persuasive power of the system could be enhanced by providing trustworthy and unbiased information about these aspects [16]. Furthermore, it might be worthwhile to further study the necessity of validity in light of relevance of the data for the user. This study found that self-tracking of physical measures of stress might still have added value although the physical measures do not always reflect a moment of stress. Fourth, as the culture within the organization towards stress management is of importance for the adoption of use, a positive approach for implementation should be deployed and should focus not just on individuals but on the organization as a whole.

Identification of values before actual design is advocated by many to be important for successful eHealth design [11, 12, 15]. However, it should be kept in mind that our

findings are in reference to expectations based on a low-fi prototype shown during the interviews. These expectations might not reflect values based on user experience.

We conclude that DSE employees and HR advisors see potential in combining self-tracking and persuasive eCoaching for stress management via a smartphone application. Future design of the application should mainly focus on gaining awareness about positive and negative emotions and personal demands and resources in order to (re)gain balance.

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