Doctoral Students' Battle of Stress - Designing BCSS to Help Them Win the Battle: Searching for Design Improvements via Workshops with End-Users

Markku Kekkonen and Harri Oinas-Kukkonen

Oulu Advanced Research on Service and Information Systems Group, Faculty of Information Technology and Electrical Engineering, University of Oulu, Finland
markku.kekkonen@oulu.fi, harri.oinas-kukkonen@oulu.fi

Abstract. Doctoral students are experiencing stress due to work and doctoral research related issues. They may also be vulnerable to technostress. Extensive stress can have negative impact on one's health via elevated stress hormone levels, which are linked to several diseases. Technostress may add to the impact via increased level of cortisol. Therefore, when intervening or trying to mitigate stress experienced by doctoral students, technostress should also be taken into consideration.

For tackling stress as well as technostress experienced by doctoral students, we designed a prototype to help them in the process. Persuasive Systems Design was used as the framework for designing the system and Self-Determination Theory was used as theoretical background. Gamification was used as a support mechanism for persuasion in the prototype.

With the help of the workshops, we were able to find both causes and ways to mitigate stress and technostress for doctoral students. We were also able to analyse how to improve the design of the prototype to better suit the end-users.

Keywords: Stress, Technostress, Doctoral students, Persuasive Systems Design, Gamification, Workshops, Design science.

1 Introduction

Stress can be positive in nature when it is desirable and deriving from exciting challenges. Negative stress or constantly being stressed out is undesirable as it is often associated with chronic fatigue, worry, frustration and inability to cope [1]. Symptoms of stress and stress related health issues are experienced by approximately 30% of European workers [2], so it is by no means an unfamiliar issue to the working population.

The situation could be even worse among students, especially those who work and study at the same time. According to a study from 2012 [3], over 70% of graduate students (N=387) reported a professional or personal stressor, which interfered with their optimal performance. Psychological stressors can affect the cardiovascular condition of people, especially if the stressor continues or people keeps imposing the

stressor through brooding; however, stress effects and cardiac risks are modifiable by changing behaviours and cognition with interventions [4]. Chronic stress can also lead to burnout, which can be described as extreme fatigue and total lack of motivation; graduate students and postdocs are especially vulnerable to excessive working, which practically means chronic stress with no time for recovery [5]. Conducting PhD research can be very stressful, but, as students are aware that it will take a lot of their time, it may not be a significant stressor when compared with other time-consuming duties related to graduate students and work [6].

The medium, information and communications technology or ICT, that is used for working in almost all fields of academic jobs, can also generate stress. The stress experienced by users of ICT is called technostress; a phenomenon, which derives from the constantly changing and evolving ICTs, which nowadays affect all aspects of life [7].

Long-term increase in cortisol, a stress hormone, can affect one's health negatively: elevated stress hormone levels may significantly influence the development of disease; and are linked for example to chronic burnout, depression, abdominal obesity, suppression of immune function, high blood pressure, hardening of arteries and sleep disorders [8]. It seems that not only traditional stress and stressors, but also technostress may increase stress hormone levels. In the study from 2012 [8], one of the most common types of technostress, system breakdown (error message), was studied from neurobiological perspective and it was shown that the level of cortisol, a major stress hormone, was significantly increased in those experiencing the on-screen error message. Therefore, managing only stress, while not trying to mitigate technostress may not be efficient. Both traditional stress and technostress affect one's body and health similarly from the neurobiological perspective. Moreover, there seems to be lack of applications that try to mitigate technostress for users [9].

To address these issues, we decided to start developing a way to help doctoral students to manage stress while taking mitigation of technostress into consideration. Thus, a functioning prototype of web-based system to help doctoral students to "battle" stress was developed. The hands-on work was done by Master students in research and design project course group. Two workshops were held with end-users to help with the design. As regards the workshops and improving the design, we wanted to know 1) *what are the causes of stress and technostress for doctoral students,* and 2) *how to mitigate stress and technostress*.

In the following sections, we will introduce the 'background' and related work regarding the topic, as well as the 'prototype'. Workshops procedure, participants, research method and analysis method will be described in 'research setting', after which 'results' are provided. Potential improvements for the design can be found from 'discussion' and the paper is concluded in the final chapter.

2 Background

2.1 Theoretical Background

According to Johnson et al., persuasion differs from gamification in the sense that persuasion often uses extrinsic motivators, whereas gamification motivates intrinsically [10]. Self-Determination Theory (SDT), emphasizes intrinsic motivation that results from motivational needs for competence, autonomy, and relatedness [11]. However, SDT may be used successfully as the underlying theoretical background when designing persuasive behaviour change sup-port systems [12] and gamified systems [13]. Rewards, which could be associated with extrinsic motivation, albeit being internal rather than external, are a crucial part of gamification mechanisms [14]. SDT does not exclude extrinsic motivations, but rather recognizes that extrinsically motivated individuals can also become self-determined, while being committed and authentic, especially if competence, autonomy, and relatedness are supported [11].

Extrinsic rewards may not work when targeting long-term behaviour change, thus intrinsic motivation may be needed for persuading the end-user towards the target behaviour. If extrinsic rewards are removed, recently changed behaviour may relapse back to earlier habits, therefore intrinsic motivation could be needed for long-term behaviour change. Therefore, both extrinsic motivation and intrinsic motivation should be used in gamified persuasion if former is used to support the latter.

2.2 Domain Background

On one hand, there can be some short-term stress effects that are positive, for example improvement of emotional states and enhanced memory; on the other hand, repeated or long-term effects can be very harmful to one's health [8]. Stress, a phenomenon stemming from the stressors in environment, can be defined as either eustress ("good stress") or distress ("bad stress"), and it can also be a combination of both [15]. Experience of stress can be managed up to a point and individual's perception and interpretation of the experience of stress play a role in the process [15]. Stress resilience seems to differ with individuals, depending on genetics and environmental factors, but coping strategies e.g. dealing with challenges, facing fears, participation in problem solving and seeking social support can be used to minimize the effects of stress; optimism and positive reassessment on previous non-desirable experiences can also produce long-term stress resilience [16].

Technostress can result from ICT use that is related to hardware devices e.g. laptops, mobile phones, and gaming consoles, as well as software applications e.g. social networking sites, instant messaging apps and online games [17]. ICT use seems to be constantly increasing in both occupational environments and free-time activities. Technostress can result not only from active use of ICT e.g. excessive playing, but also from push notifications, interruptions, and pressure to be constantly available [17].

Users' personal perception of their control over ICT, for example how s/he controls the way ICT products and services are used e.g. email-free hours, can mitigate

technostress [18]. In addition to ICT control (pro-active), also positive reassessment (pro-active), distress venting (reactive) and distancing (reactive) from ICT can function as coping tactics; however, for those individuals with high control of ICT, distress venting and distancing may have no effect, but for those with low or medium ICT control, reactive coping strategies do help [19].

2.3 Design Background

According to Oinas-Kukkonen [20], "a behaviour change support system (BCSS) is a sociotechnical information system with psychological and behavioural outcomes designed to form, alter or reinforce attitudes, behaviours or an act of complying with-out using coercion or deception." Persuasive elements in BCSSs can engage users and keep them motivated [21]. Persuasive technologies seem to be able persuade people to change their behaviour towards a target behaviour [22] and affect individuals' health behaviours [23]. Therefore, using persuasive technologies should be beneficial for applications that aim to help users manage stress and mitigate technostress. Furthermore, one way to tackle techno-stressors in Information Systems (IS) design is to enhance enjoyment [9], for example by implementing gamification techniques. Much like persuasion, gamification seems to work [24], and as regards stress management apps, gamification techniques should be combined with a behaviour change theory [25]. Similarly, Persuasive Systems Design (PSD) [26], should utilize at least one behaviour change theory when a health BCSS is developed [20].

Persuasion and gamification seem to share other similar aspects, such as ethical considerations [27-28]. Furthermore, according to Johnson et al., persuasion and gamification both also share a similarity regarding the utilization of specific design principles aiming for behaviour change or experience [10]. Thus, gamification can support persuasive design and regarding health BCSSs, gamification techniques can even be considered as one type of persuasive design [29].

Persuasive Systems Design model is a framework for evaluating and designing persuasive systems; there are seven postulates, ways to analyse persuasion context and 28 design principles. Principles are divided into four categories: primary task support, dialogue support, system credibility support, and social support. Persuasion contexts is divided into three categories: the intent, the event, and the strategy. [26].

Gamification can be defined as description of features that can motivate and engage end-users by utilizing game elements and mechanics [14]. Furthermore, gamification affordances can be used at supporting and motivating the end-user towards a targeted behaviour, or a goal, e.g. healthier habits [13].

3 System Prototype

The prototype targets stress management with technostress taken in consideration in the design. The PSD model, SDT, gamification literature, and the O/C Matrix [20] were used in the design process of the application prototype. *Rehearsals*, *rewards*, *reminders*, and *cooperation* were chosen as persuasive features after PSD and O/C

matrix analyses with SDT as theoretical background and gamification as support mechanism.

3.1 Technology Context

The prototype was developed using the MEAN stack, an open source JavaScript stack. The reasons for choosing this stack were availability of support and the tools that can provide features such as email server, data logging, user login and authentication. Scalability was taken into consideration, thus database as well as back-end and front-end of the application was containerized using Docker containers, as they are more efficient than traditional virtual machines, support multi-server clusters and they can potentially use less server resources. Red Hat Linux server was used to host the system. See figure 1 for architecture.

The prototype was implanted as web-based client-server application. Via admin panel, administrators may add different type of categories and rehearsals as well as edit content, edit calendar, set up and edit user groups/views and switch each persuasive feature on/off for either whole user groups/users.

These features allow to use the application for other themes besides stress, as there is the possibility to add several different categories and/or rehearsals. It also allows having different content between same themes, as it is possible to give access to chosen content to one group/user and other context to different groups. Similarly, as each feature can be turned on/off for each user group/user, the application allows various possibilities for different experiments.

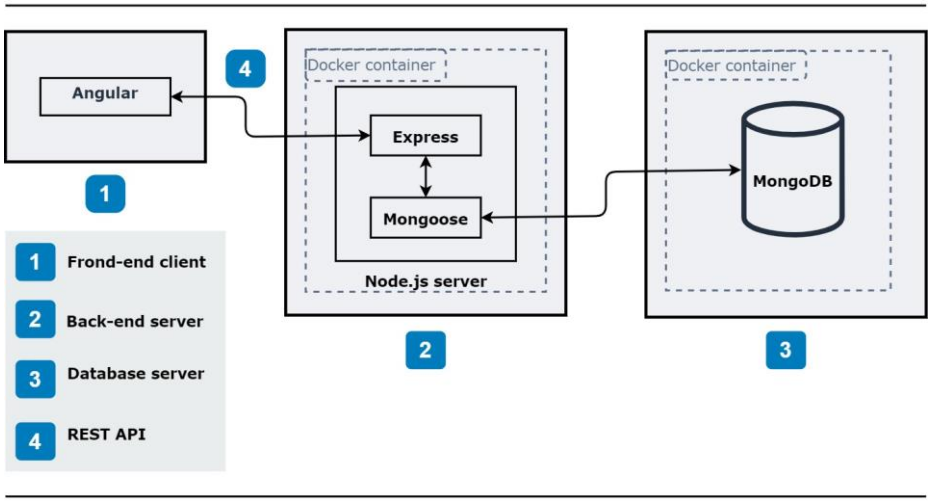

Fig. 1. Overall architecture for the web app prototype.

3.2 Persuasive features

Based on SDT, we selected to focus on four persuasive features: *Rehearsal*, *Rewards*, *Reminders* and *Cooperation*.

Rehearsals utilizing gamification techniques will provide means for rehearsing target behaviour and motivate the user intrinsically. Optimal challenge and progressive information will satisfy need for *competence* (SDT). The prototype has rehearsals for positive reassessment that may incorporate gamification mechanisms e.g. score.

Similarly, there are rehearsals for muscle relaxation and for sleep disorders, and users will be able to earn badges by completing the rehearsals, thus from rehearsing the target behaviour. Rehearsal types can be divided into animated timed rehearsals (see figure 2), manually proceeding rehearsals (see figure 3) and gamified rehearsals (see figure 4).

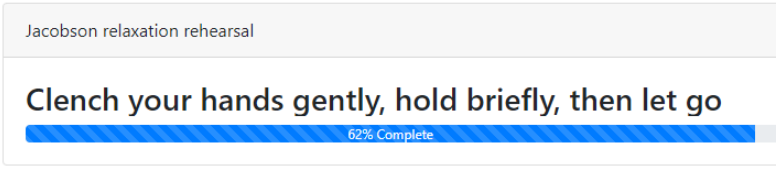

Fig. 2. Animated time rehearsals allow the users to go through the rehearsal without having to touch the keyboard.

Animated timed rehearsals allow the user for example to do breathing exercises in a predefined pace, whereas manually proceeding rehearsals allow the user to proceed in his/her own pace.

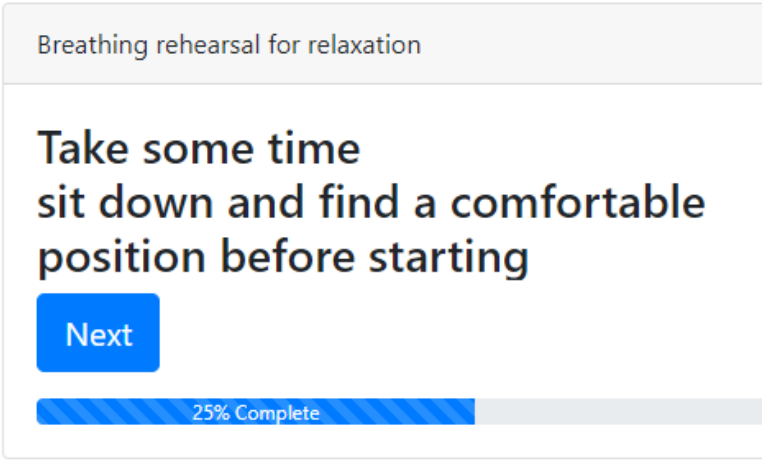

Fig. 3. Manually proceeding rehearsals allow the users to go through the rehearsal on their own pace.

Gamified rehearsals allow the user to "play" them by answering correctly to predefined statements while the rehearsals keep score and awards badges.

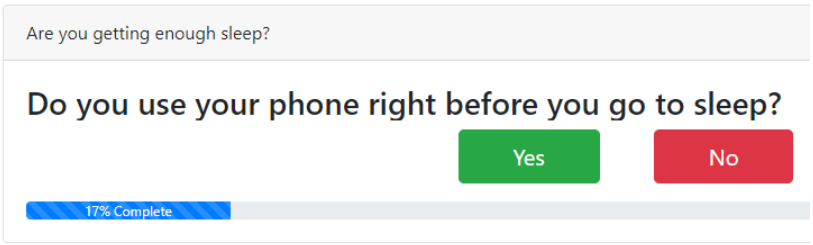

Fig. 4. Example of gamified rehearsal.

Rewards in the form of badges will be giving the users credit for performing the target behaviour, thus "playing" by completing rehearsals. Points, levels, and positive feedback will satisfy the need for *competence* (SDT). See figure 5 for example of points/score in the prototype.

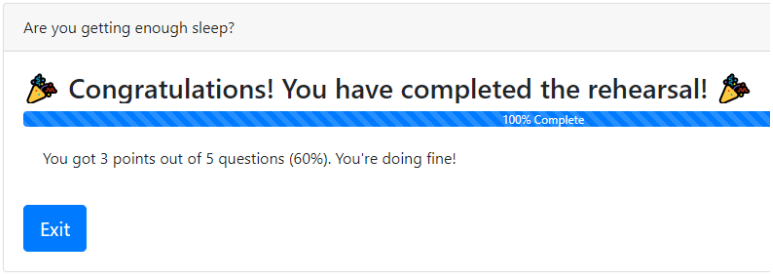

Fig. 5. Gamified rehearsals keep score on correct answers.

Users will receive badges and will be able to see which badges they are missing. However, there will not be a leaderboard nor will users be able to see what badges others have - to avoid competition. See figure 6 for example of badges.

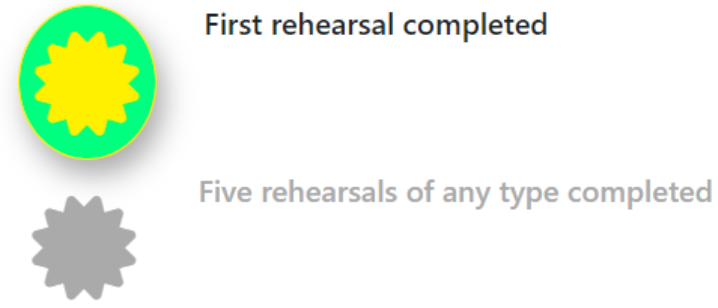

Fig. 6. Gamified rehearsals keep score on correct answers.

Reminders, in the form of emails, will be for engaging users, as well as for reminding them of the target behaviour. Email addresses of the users will not be given to other users and users have access to notification settings. Taking privacy into consideration and enabling notification control will satisfy the need for *autonomy* (SDT). Reminders will also be used for supporting other features, for example cooperation.

Cooperation in the form of groups and connection to social networks will satisfy the need for *relation* (SDT). Users will be able to use a feature for connecting with other users. They will be able to notify others that they are available for a coffee break (distancing and venting distress should also mitigate technostress).
When three people have selected the same date, time and place, a coffee break "team" will be formed and the members will be notified via separate emails. See figure 7 for example of meetup calendar.

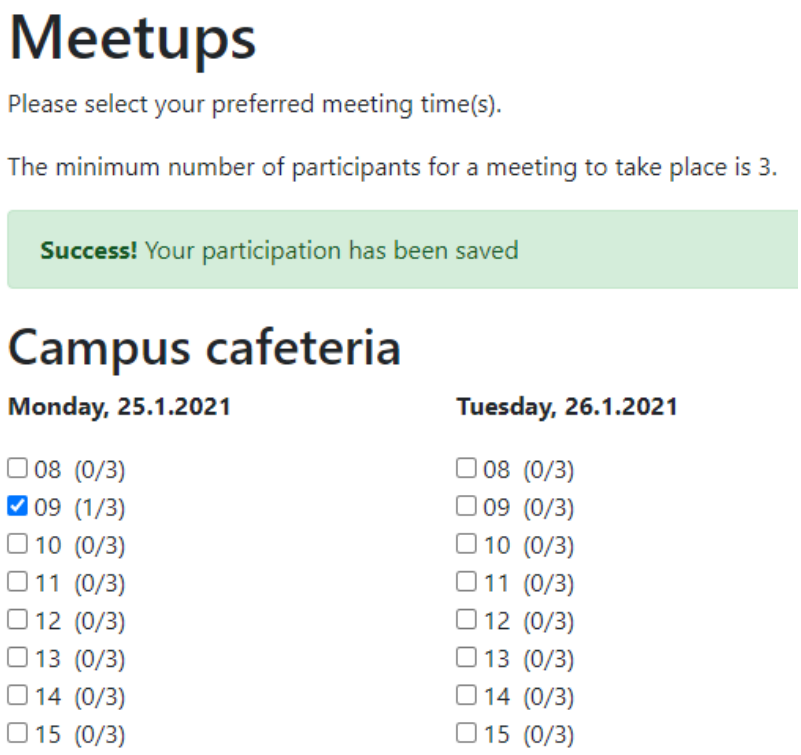

Fig. 7. In this example the user has successfully checked date and time for break and will receive an email after other users have chosen the same date and time.

4 Research Setting

4.1 Workshops

The workshops were advertised via email sent to all doctoral students of the university. They were also advertised on doctoral student sections Facebook group and web page. The workshops were meant as low threshold opportunities for discussing stress and technostress with one's peers, and pizza and soft drinks were served for participants. We managed to recruit eleven participants, who were divided into consecutive days due to their personal schedules: first workshop had four participants and the second workshop had seven participants. A statement for privacy and request for consent were provided for the participants at the beginning of each workshop.

The concepts of stress as well as technostress were explained at the beginning of each workshop to avoid any misunderstandings. Semi-structured layout was used: the participants wrote down types and causes of stress and technostress, after which they wrote down ways to mitigate stress and technostress. The results were written into A3 papers taped on walls and discussed together. New insights were written also into A3 papers discussed too. To avoid having the participants "design" the prototype, but rather inclined on gaining fresh insights, we revealed that a prototype was being designed only at the end of the workshops.

4.2 Participants

Participants from the two workshops (11 in total) were anonymized for this study as per statement of privacy, since the workshops dealt with stress, which may be sensitive subject for some. The participants represented several different fields of study, e.g. education, science, and technology. Average age was 32,5. Most of the participants were either on their first or second year of studies with two participants on their third year or more. Five were employed by the university without a grant or stipend, whereas five others had a grant or stipend while being employed by the university; only one participant was funded by other means. Only two participants were from Finland, whereas nine participants were from different parts of the world with different cultural backgrounds.

4.3 Research method

For this paper, "Workshops as a Research Method: Guidelines for Designing and Evaluating Artifacts Through Workshops" was utilized as research method [30]. Thoring et al. discuss evaluation rather than design in more details, but their work can be adapted for designing as well [30]. Thematic analysis [31] was utilized for the actual analysis process for the results. See table 1 for principles as regards the research method and how they were set for this study

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Table 1. Workshop evaluation and design principles.

Principle	
Focus definition	People's Opinion and Ideas; What may be causing stress and technostress for doctoral students and how to mitigate stress and technostress; Focus is on improving our prototype; Survey and Group Discussion was used (good suitability for design goal). Notes submitted after group discussion by the participants were also used for the analysis.
Role allocation	One researcher was both facilitating discussion and collecting data. Bias was minimized as member of the student group developing the prototype was present taking notes. Further minimization of bias was done by discussing and deciding terms together and by participants making notes.
Triangulation	Participants' background survey and the results of group discussion are presented.
Transparency	Design goal and research questions. Methods and analysis. Participants anonymized details. Workshop course and workshop results are presented.
Reflection	Insights about the design process would be the following: we feel that Observation & Notes as regards People's Opinion and Ideas could be suitable up to a point as recording may put people off; Role allocation may be difficult, as it could take several different stakeholders to eliminate risk of bias – same could be achieved with fever stakeholders and proper planning beforehand; Currently the proposed evaluation process suits evaluation better than design – but it seems to work for both.

4.4 Thematic analysis

Thematic analysis [31] was used for analysing the data from the workshops. The analysis process was conducted in two separate analyses: 1) inductive thematic analysis and 2) deductive thematic analysis. Inductive thematic analysis was for deriving the context as regards causes of stress and technostress. The deductive thematic analysis used PSD and the four persuasive features of the prototype as the frame for deducting potential improvements for prototype design while taking the context into consideration. NVivo 12 by QSP International was used as the software tool for the analysis.

5 Results

Ten out of eleven participants had experienced stress during the past year regarding their work and studies. One participant without an experience of stress explained that s/he had ways of coping with stress; s/he also answered that s/he had not experienced technostress during the past year. The others had experienced not only stress during the past year, but all of them had also experienced technostress during that period.

5.1 Causes of Stress

The causes of stress for doctoral students could be divided into two main themes: 1) Work, and 2) Life. See tables 2 and 3 for sub-categories and refined themes.

Table 2. Sub-categories and refined themes for "Work".

Sub-category	**Refined themes**
Doctoral research issues	Deadlines Reading and writing Unable to meet targets set for self Uncertainty about the future Research pressures Lack of support (for research) University curriculum Monthly meeting with supervisor
Other work-related issues	Heavy workload Abilities and competencies Changes in work requirements Difficulties to plan ahead Time management

Doctoral research issues discussed were mostly related to conducting studies (writing, reading, deadlines et cetera), which is natural when considering the participants of the workshops. However, lack of support and pressure from supervisor and other stake-holders were discussed also, as well as uncertainty of what happens after doctoral dissertation. Also, university curriculum requirements as source of pressure were brought up. It seems that as the actual work of gradually becoming a Ph.D. could mean a lot of work, the hardship is elevated by external pressure. Doctoral students may struggle with the idea or fear that the research of larger group of people may depend on their work while they are still learning how to do research and thus they would need more support.

As for causes related to personal life of doctoral students, loneliness was brought up and discussed several times in both workshops. This was due to most of participants being from abroad. Those participants thought that it was difficult to be in a strange country, where the language is different from theirs. Difficulty of finding a partner was also tied to being in different culture and/or language-area. For those that were from a more family-oriented culture, it seemed also very difficult to reside in different country than their family. However, also starting family life and losing free-

dom after having kids was discussed as a cause of stress. As some of the issues reflected cultural differences, they may not affect doctoral students at large.

Also, people from different continent were not used to lack of sun (in the winter) and bad weather, which stressed them out. Additionally, as people in general may, participants also suffered from some health difficulties: elevating heartbeat, musculoskeletal problems, insomnia, and irritation; of which the latter two may either be signs and/or causes of stress.

Table 3. Sub-categories and refined themes for "Life".

Sub-category	**Refined themes**
Relationships	Loneliness Managing family life Finding a romantic partner
Personal health	Insomnia Quality of sleep Irritation Elevating heartbeat Musculoskeletal problems
Environment	Lack of sun and bad weather Different culture or language Family is in another country

5.2 Causes of Technostress

Similarly, as for stress, causes of technostress were mostly around work-related issues. However, there were some issues related to everyday life. See table 4 and 5 for sub-categories and refined themes.

Table 4. Sub-categories and refined themes for "Work"

Sub-category	**Refined themes**
Research related issues	Learning new programs Using specific software Bugs in software Updating software Compiling new datasets and/or instruments Different syntax/logic in new program code Research results
Non-research related issues	Overload on communication Using programs Usability/user interface problems with programs Overload on information

Participants seemed to struggle with learning to use new work-specific software, for example R, SPSS and RefWorks. Updating software, requirements for technical knowledge, bugs, and differences in syntax and/or logic in code were discussed and seen as causing technostress. Additionally, compiling new datasets and/or instruments, unexpected results and reporting were deemed also causing technostress.

Communication, especially mobile communication, was brought up as the participants felt that smartphones have changed the way how one must be constantly "reachable" not only via calls or text messages, but also via email and social media. Phone addiction was causing a lot of technostress, as some participants mentioned having difficulties at leaving their phones alone (and computers as well) and had to be constantly checking their phones up until before going to bed.

Table 5. Sub-categories and refined themes for "Life"

Sub-category	**Refined themes**
Communication	Phone and/or computer addiction Social media
Personal health	Game addiction TV addiction

Phone addiction may be a reflection from major changes of how nowadays people have to be "reachable" at all times. The evolution of smartphones during the last decade or two have enabled mobile communication in ways that could have seemed like science fiction if someone would have predicted the future at the beginning of the new millennium. However, the downsides of this evolution may be causing stress and especially technostress via the notion that everyone everywhere could be instantly reached thanks to new technology.

5.3 Stress and Technostress mitigation

The inductive analysis main themes (Work and Life) were used as starting point for the deductive analysis to reflect on the persuasive features of the prototype. In the deductive thematic analyses, findings were integrated and set into the PSD model principles present in the prototype*: cooperation, rehearsal*, *reminders*, *rewards.* Analysis on both stress and technostress were done separately. See table 6 for stress mitigation and table 6 for technostress mitigation.

Table 6. Stress mitigation in the prototype context

Persuasive feature	**Refined themes**
Rehearsal	Physical exercises Positive attitude Mental concentration Learning time management Relaxation exercises
Reminders	Deadlines
Rewards	Positive feedback
Cooperation	Working with others

As found out from causes of stress, loneliness was a major issue especially among foreign students, so having someone to talk with and talking with peers were seeing as easing the loneliness somewhat. The prototype already has a feature for *cooperation*, basically enabling the opportunity to meet people. One of the original ideas were to

enable the ability to cooperate on doing rehearsals with the people one can meet via the app, but unfortunately as the prototype was developed as student project, we did not have resources to finish the idea. Some form of evolved cooperation function will be considered to be implemented in the future.

Exercising, time management, sleeping, mental concentration, thinking positive and trusting yourself were seen as ways of mitigating stress, and in the app, we already had implemented ways to have basic *rehearsals* as regard mental concentration, breathing et cetera. Busting deadlines was seen as mitigating work-related stress and could be connected to *reminders*. Having fun, playing games, and getting positive feedback, and compliments and assurances could similarly be connected to *rewards* in the prototype, as users may receive rewards for "playing" the rehearsals

Table 7. Technostress mitigation in the prototype context

Persuasive feature	Refined themes
Rehearsal	Distancing Positive attitude
Reminders	Device/application setting reminder
Rewards	Technology free time
Cooperation	Working together

Regarding mobile phones as major causes of technostress, setting one's phone to grey scale (with the help of *reminders*) at evening was discussed as one way to deal with the issues, and the same could be applied to computer screens as well. It should be noted however, that such features already exist in major operating systems as regards phones and computers/screens. Thus, it should not have need for external reminders, unless one has phones or computers/screens without such function. As for taking breaks and thinking positive, those could be implemented similarly as *rehearsals* and could even be basically same rehearsals as those aiming to mitigate stress. As for 'helping someone' that was brought up in the group discussions, *cooperation* feature could be used for working together. Meeting people with different skillsets could open new opportunities to not only learn something new, but also to share one's own knowledge and help others. Technology free time e.g. going to the nature was seen *rewarding* per se.

6 Discussion

Based on the workshops and preliminary results after the workshops, we have already improved design on cooperation. Loneliness and not belonging was constantly brough up by the workshop participants, and the participants thought that it could help if you could meet people from your own cultural background and converse with your native language. Therefore, we decided to add a feature into the 'coffee break' meetup interface: one can also determine whether the other parties should speak the same language e.g. Finnish, English or Arabic. Based on the results of the analysis, other options could also be added e.g. field of study or faculty, country of origin et cetera. The

cooperative meetup feature could also be used for example setting up teams that could together cooperate on practicing using work specific programs e.g. R or SPSS.

As for reminders, it could be possible to implement an advanced reminder function for reminding about deadlines, but since there should be plentiful of those available e.g. basic smartphone calendar reminders, it might not serve the purpose. However, if the users would use the web app anyway, having work related deadlines separated from personal smartphones into specific place e.g. view in the app coupled with email reminder could work for some. Balancing personal life and work was also discussed in the workshops and thus separating personal and work mediums e.g. smartphone could reduce stress on as instead of push notifications on your personal phone, the reminder would be sent to your work email.

As for rewards in the prototype, there could be room to improve the design of the rewards to make them more fun. The badges used for rewards as well as the actual mechanics of the gamified rehearsals should also better resemble the users that when doing the gamified rehearsals - they are "playing", and they should not take it too seriously. However, the score system should make one want to positively "beat the system" and could be used for seeing and reflecting the "right" strategies. Doing the rehearsals should also be fun, as they are designed to be simple, easy to use and easy to follow.

The rehearsals in the prototype are currently for positive image and reassessment, as well as for classic solutions e.g. muscle relaxation and breathing exercises. The categories and rehearsals can be added and edited relatively flexibly, but the actual rehearsal types may not support themes like time management that well. Therefore, there may be room for improvement also on the set up of rehearsals.

Naturally, there were limitations in our work. Even though there were only two workshops, similar themes and issues were discussed in both workshops by the participants. Therefore, we think that in this case it was possible to reach saturation with two workshops, but if there would have been more enrolled participants, third workshop may or may not have given some additional (but minor) insights. The thematic analysis process was done by single researcher, but preliminary themes and the actual codes in the data sets were collected and discussed together in the workshops, thus reducing researcher bias.

7 Conclusions

Designing applications for specific target groups should utilize ways to learn more about the actual end users. Via the workshops and their analysed results, we managed to learn much about doctoral students' stress and technostress. These findings had an immediate effect on the prototype design right after the workshops and as we continue the project, findings will be taken into consideration for further improving the design. As practical implications, this paper describes one way of improving existing persuasive designs and how to involve end users into design process. Additionally, university staff members may find it useful to know the causes of stress and technostress for doctoral students e.g. excessive workload and lack of support.

As for theoretical implications, it may not always be clear on how one should do design science research or persuasive design for that matter. In this paper we have presented on example of doing research on improving design. This paper used the guidelines and general principles for evaluating and designing artefacts through end-user workshops, and as the framework concept as research method is new, the reflection we provided could help improve the framework further.

There are also plans for future research. As the prototype was developed as a student project, we hired a student trainee for a month to continue some aspects of the prototype. We also placed an order for another student project group to continue the development with us. In addition to technical issues as regards the prototype, we will be improving the design of the prototype and the workshop results will be useful for that. Once all necessary improvements are implemented and technical aspects of the prototype are functioning well enough, we aim to do an experiment with the prototype.

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