Digital Innovations and Self-determined exercise motivation: an interdisciplinary approach

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ABSTRACT

In face of escalating health care costs, new technology holds great promise for innovative solutions and new, more sustainable health care models. Technology centers around the individual, allowing for greater autonomy and control in health issues and access to tailored information and customized health behavior interventions. While this offers good opportunities for both public health impact and improved well-being at individual levels, it also emphasizes the need for properly designed e-health models firmly based on scientific principles and adequate theoretical frameworks. Consequently, this project aims to design an interactive tool utilizing an interdisciplinary approach combining motivational theory with the fields of information technology and business model innovation. In collaboration with two companies from the e-health industry, the purpose is to design, apply and evaluate a person-centered interactive prototype for maintainable and self-determined exercise motivation.

Keywords
Health technology, exercise, RCT, motivation, self-determination theory

BACKGROUND

According to World Health Organization [WHO; 1, 2]physical inactivity constitutes the fourth leading risk factor for global mortality and risk factors for burden of disease, thereby comparable to the risks of smoking [3]. Already ten years ago WHO stated that two million deaths and 20 million DALYs (Disability Adjusted Life Years) could be prevented globally through successful physical activity (PA) promoting interventions [4], and the high importance of studying how sustainable and cost-effective PA and exercise interventions could be fashioned have been highlighted [5]. Such interventions would facilitate considerable benefits from a public health perspective as well as for the separate individual's well-being, quality of life and perceived health status [6, 7], not to mention the potential health economy benefits [8], for example related to essential domains fostering public health, like health care, schools, workplaces, fitness centers, etc.

The variety of e-health related applications and interactive tools for exercise promotion is ample and so is the amount of information regarding health benefits of regular PA. Despite this, sustainable PA and exercise behaviors have proven to be a significant challenge. According to a report from WHO [1] based on self-reports, approximately 44 per cent of Swedish citizens were insufficiently physically active in 2008, which is comparable to other Western countries. Moreover, when turning to studies using objective measures of PA these self-reported figures appears vastly overestimated [9]. In addition, exercise research has for the past 30 years steadily shown that as much as 50 per cent of exercise initiators drop out within 3-6 months [10-12]. As an example, in Sweden approximately half of those who get Physical Activity on Prescription (PaP) increase their PA level [13, 14]. Hence, it seem neither good intentions, prescriptions nor exercise initiation will be enough for some people to succeed in establishing sustainable exercise behaviors.

Health management is commonly considered a personal responsibility, hence it is easy to assume health (and health behaviors) to be of high priority for most people, but such beliefs influence the value-systems and the climate conveyed in health promoting interventions which in turn influence whether motivation and commitment is successfully stimulated or not [15]. This highlight the responsibility of professionals (and society) to stimulate motivation and commitment that can facilitate sustainable behavior change by creating adequate opportunities for people to be, and to feel, autonomous. This is not only true for face to face programs but also in e-health, regarding how tools and services are designed, and this puts high demands on the ability of applying theory to practice.

PROJECT DESCRIPTION

The high level problem addressed in this project is that potential public health and individual benefits of exercise and PA behaviors only could be reaped through proper dose-response relationships and behavior maintenance. This is a progression of

the project Digital Innovations in Self-Determined Exercise motivation [GoDIS; see 16] and the role of this second phase is to refine and test the interactive prototype in a longitudinal RCT. The interactive tools and services of the prototype will have devices and mechanisms founded in Self-determination theory [17, 18], a multidimensional theory with emphasis on the social context and its ability to facilitate or thwart optimal motivation. SDT has a considerable amount of research supporting its notions in health behavior change [19, 20] and in exercise behavior [21-23] as well as in e-health [24, 25].

In the field of exercise psychology, previous research and practice have generated ample knowledge of what works in exercise and PA promotion on a general level, but less is known more specifically about *why* it works, i.e. regarding the underlying mechanisms [26]. A fundamental strength of SDT is therefore the motivational process model [see e.g. 21, 24, 27], allowing the study of motivational sequence and specific mechanisms behind motivational processes. Since interventions operate through mediating processes, the study of indirect effects and clarifying mechanisms through mediation variable analyses (MVA) provide knowledge of how observed intervention effects could be interpreted and understood; which also endorse the evaluation of theory capacity and conceptual theory links [26]. Focusing on mechanisms assumed to increase exercise behavior enable systematic improvement and an understanding of how theory operates in successful interventions [28]. In turn, this allows for aiming at including effective components while removing ineffective ones, facilitating the design of more cost-effective programs [26, 29].

By including customer and user experience design methods and techniques in this work, it will also be possible to study how to deliver meaningful experiences in the exercise and PA domains, thereby strengthening sustainable exercise behaviors and possibly in turn also increase quality of life. The general user-centered design (UCD) process can be thought of as a collection of methods and techniques that allows designers to move from definition, discovery, synthesis, construction, refinement, and reflection in their formalization of design knowledge [30]. In this project, the overall aim is to investigate, design and evaluate aspects of digital support for health and motivation to exercise by focusing on self-determined motivation. A generic UCD approach is well suited to examine motivation and behavior, since contextual observation and interview in order to empathize with end-user's needs and goals lie at the heart of this process.

According to Chesbrough [31], every new technology has the potential value which could be realized through perfectly suiting business model, but companies face many barriers before arriving to this perfect state of business model which will realize all the potential value from technology. It means there are many different business models which can be used for commercialization of one technology, but they may yield different returns [31]. Consequently, the question is how firms can overcome those barriers and find the business model that would allow the firm to capture the highest possible return. This puts focus not only on the output (the new business model) but also the process that allows finding this new business model.

METHOD

Participants

The total sample (N > 10 000) consists of Swedish clients of Tappa AB and HPI AB and is therefore expected to be diverse in aspects such as fitness level, age and gender, as well as the addressed motivational aspects. The sub-sample selections will be made based on aspects relevant to the study objectives (geographical location, duration of membership, motivational readiness etc) and participants will then be randomly assigned to the different data collection steps and control group.

Procedure

A person-centred iterative design approach will be employed, where continuous user and stakeholder feedback on design solutions is essential. An intervention prototype will then be tested in longitudinal RCT-studies carried out in the two companies' digital structures respectively, by means of their existing clients. The RCT will contain three measure points (baseline, 3 months and 6 months) and one follow-up measure (9 months) in order to allow advanced analyses of the mechanisms (i.e. mediating and moderating effects) behind behaviour change and thereby identify the active ingredients of the intervention.

Measures

Exercise motivation and activity levels will be measured both subjectively by self-report measures, and objectively by sensors, which is uncommon and therefore highly warranted in this line of research [e.g. 32]. This combination provides exclusive possibilities to cross-reference data; not only the subjective and objective measures with each other, but also with essential psychological variables like need support, self-determined motivation and motivational readiness. The self-report measures consists of a battery of behavioural and motivational instruments: a) *Godin Leisure-Time Exercise Questionnaire* [GLTEQ; 33], measuring exercise frequency; b) *Physical Activity Stages of Change Questionnaire 2:1* [34], measuring behavioural change preferences; c) *The Basic Psychological Needs in Exercise Scale* [BPNES;

35]; and d) *The Behavioural Regulation in Exercise Questionnaire-2* [BREQ-2; 36], the latter two measuring factors related to motivation and based on Self-determination theory, with Swedish versions recently validated by Weman-Josefsson [15].

These quantitative measures will be complemented by accelerometers (objective PA data) and with qualitative cross-disciplinary interaction design methodologies, such as qualitative analysis of interviews, workshops and contextual observation, capturing deeper understanding of such things as end-user goals, behavior, preferences, attitudes and barriers.

PURPOSE

The main focus is to understand the relationship between a (set of) digital service(s) and different end-users' motivation to exercise and health and the overall aim is to refine, implement, test and evaluate a digital exercise motivation intervention prototype.

Specific research questions from a Psychological perspective concern: a) the efficacy of using Self-determination theory (SDT) in designing, constructing and evaluating an exercise motivation intervention; b) how sustainable behavior change and exercise motivation could be facilitated in a digital intervention; c) how SDT concepts and proposed psychological mechanisms of the SDT process model relate to and promote exercise behaviors over time (3, 6 and 9 months follow-up), focusing on identifying effective mediators and moderators.

Research questions guiding Interaction Design include: a) how UCD methods and techniques can be customized to fit self-determined exercise motivation; b) how behavioral and motivational effects of digital services in relation to exercise could be understood, designed, and evaluated.

From a Business model innovation perspective the aim is to explore how the e-health industrial partners develop knowledge in order to identify suitable business models for this interactive solution.

SUMMARY

One of the greatest strengths of this project is the interdisciplinary, firm and comprehensive theoretical foundation informing e-health design in collaboration with experienced and established companies. Although e-health services are manifold, current literature express a distinct need for advanced theory based interventions [24] and science based technical innovations [37], hence we are filling warranted gaps in both theory and practice. Furthermore, this project holds the potential to generate knowledge and experience on human-centered design methodology for health innovation, which is currently incomplete [38].

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