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Abstract

Regular physical activity and exercise bring about recognized health benefits and most Western countries have developed health recommendations, targeted information and programs to promote these behaviors. In spite of this, a large amount of the Western populations do not reach recommended levels of physical activity and exercise [1]. Because people in general are most likely aware of these benefits, one way to understand the modest uptake would be to study motivational aspects of these behaviors. This short communication paper is a summary of a PhD thesis entitled: "You don't have to love it - Exploring the mechanisms of exercise motivation using self-determination theory in a digital context."

Keywords

Exercise, Motivation, Self-determination

Introduction

The promotion of sustainable physical activity and exercise behaviours is considered a significant challenge and should therefore be considered a global health priority [2,3]. Research has also called for interventions with adequate theoretical foundations, enabling the study of the active ingredients of effective programs through mediating processes and indirect effects [4,5]. One way to understand human behaviour and how to tailor successful interventions, programs and policies would be to study motivational aspects and self-determination theory [6-8] is a promising framework in this area of research [9,10]. The core message in self-determination theory is that motivation quality and satisfaction of basic psychological needs will fuel the direction of human behaviour and psychological well-being [7,8]. According to self-determination theory, psychological need satisfaction will be promoted to the extent that the social environment is autonomy supportive, i.e. when fundamental human needs for autonomy (volition and feelings of choice), competence (feeling efficient and capable) and relatedness (feeling connected to and cared for by others) are nourished. It is also suggested that motivation quality matters more than mere motivation magnitude and that motivation quality is suggested to vary on a continuum ranging from completely self-determined (intrinsic) motivation, via various degrees of controlled behavioural regulations (extrinsic motivation) to amotivation (lack of motivation) at the other end. It is suggested that more self-determined forms of motivation will facilitate behaviour adoption and maintenance as well as psychological well-being. Psychological need satisfaction will also promote internalization of motivational regulations into more self-determined forms of motivation [7,8]. Recent research have suggested that a given behaviour can be fuelled by a combination of different motivational regulations simultaneously [11], also called

![Figure 1: SDT process model.](image)
the motivational soup [12] and that the regulations perhaps should be viewed as contiguous instead of continuous [13] (Figure 1).

The process model illustrating the relationships between autonomy support, psychological needs, motivational regulations and behavioural outcomes is based on mediating processes, i.e. that the effects of one variable (e.g. intervention) on an outcome variable (e.g. behaviour), works via a third variable (motivation) [9,14] (see figure 1). Therefore the study of mediating processes constitute a natural step to progress previous mean level analysis research by providing knowledge on the active ingredients of an intervention [15,16], and can together with study of moderators variable shed light on what works, for whom and why [17]. When creating health promotion programs and interventions, personal counselling is often an expensive solution and modern (digital) technology carry promising solutions for digital health promotion and e-health [18,19]. A growing amount of research supports the application of self-determination theory in digital physical activity and exercise programs [19-21], also showing sustainable effects [22].

Aims

Altogether, the main aims with this PhD thesis were to explore the underlying motivational processes of physical activity and exercise behaviour based on self-determination theory.

Methods

The PhD thesis consists of four separate studies out of which three (Study I, Study III and Study IV) took place in a digital context, more specifically a step contest provided by the participants’ employers as part of a health promotion program. In Study IV participants in the experimental group had additional access to a digital platform with autonomy supportive structures (such as goal setting tools, health experimental group had additional access to a digital platform with autonomy supportive structures (such as goal setting tools, health promoting needs satisfaction and exercise in women, but not for men, who instead had external regulation as an analogous mediator. Moderation analyses in Study IV also showed the motivational processes to vary qualitatively in different subgroups of gender and age. In essence, results from both studies indicate that women and older adults were more autonomously regulated, while men and younger adults seemed to be driven by more controlled regulations. A possible explanation might be that competition could be expected to pull for extrinsic motivation and maybe the results for men can be referred to the competitive context and external rewards (e.g. winning), while women might

Results and Discussion

To summarize, a number of findings could be highlighted. On a general level, all four studies support the suggested relations between psychological need satisfaction, motivation quality and behaviour according to self-determination theory. This thesis also extends previous mean-level (direct effects) research by examining motivational mechanisms via mediation and moderation analyses (indirect effects). In Study I, self-determined exercise motivation (i.e. identified regulation) mediated the relationship between basic psychological need satisfaction and exercise and this pattern was repeated in Study II, where the effect of the intervention was mediated by identified regulation. These findings not only support the utility of self-determination theory as a guiding framework in this context but also could add to the knowledge of how the effects of programs and interventions could be interpreted via underlying mechanisms (in this case the effect of identified regulation). It also supports the importance of self-determined motivation and internalizing meaningful values behind exercise participation for successful regulation of the behaviour [7]. This is why “you don’t have to love it”; referring to the suggestion that intrinsic motivation might not be the most salient drive in successful regulation of behaviours as physical activity and exercise (see e.g. Teixeira, et al. [10]). In Study I, identified regulation acted as a mediator between psychological need satisfaction and exercise in women, but not for men, who instead had external regulation as an analogous mediator. Moderation analyses in Study IV also showed the motivational processes to vary qualitatively in different subgroups of gender and age. In essence, results from both studies indicate that women and older adults were more autonomously regulated, while men and younger adults seemed to be driven by more controlled regulations. A possible explanation might be that competition could be expected to pull for extrinsic motivation and maybe the results for men can be referred to the competitive context and external rewards (e.g. winning), while women might

Table 1: Overview of study design, results and contributions.

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Theoretical foundation</th>
<th>Participants</th>
<th>Measures</th>
<th>Analyses</th>
<th>Results</th>
<th>Limitations</th>
<th>Contributions</th>
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<tbody>
<tr>
<td>Study I</td>
<td>Cross-sectional, digital platform</td>
<td>SDT</td>
<td>1091 adult men (n = 286) and women (n = 805), aged 18-78 years (M = 45.0; SD = 11.7), all were active members of a web based Swedish exercise program.</td>
<td>BPNES, BREQ-2, LTEQ</td>
<td>SEM, MVA</td>
<td>Self-determined exercise motivation (identified regulation) mediated the relationship between basic psychological need satisfaction and exercise in the full sample.</td>
<td>Cross-sectional design, sample constitution (mainly women, high mean age) and self-reported exercise.</td>
<td>Validation of Swedish translations of BPNES and BREQ-2</td>
</tr>
<tr>
<td>Study II</td>
<td>Two-wave RCT (face to face) intervention</td>
<td>SDT, MI, RPM CBT</td>
<td>64 Swedish undergraduate university students (women n = 49 and men n = 15) aged 19-49 years (M = 27.3, SD = 7.4).</td>
<td>PNES, BREQ-2, LTEQ</td>
<td>ANCOVA, MVA</td>
<td>Post-intervention effects showed increased levels of total and strenuous exercise, and this effect was mediated by self-determined motivation (identified regulation).</td>
<td>Small sample of convenience, self-reported exercise, exclusion of the relatedness need dimension and only having two measure points.</td>
<td>Employing a large sample of middle-aged adults in an e-health context</td>
</tr>
<tr>
<td>Study III</td>
<td>Cross-sectional, digital platform</td>
<td>SDT</td>
<td>Sample A: N = 1084, web-based exercise service members, mean age 45 (SD = 11.7). Sample B: N = 511 university students with a mean age of 22 years (SD = 3.3).</td>
<td>BPNES, BREQ-2, LTEQ</td>
<td>LPA</td>
<td>Six profiles were found in both samples. Some profiles were found in both samples whereas others were unique to each sample. More self-determined profiles demonstrated higher scores on need satisfaction and exercise.</td>
<td>Cross-sectional design, sample constitution (mainly women, high mean age) and self-reported exercise.</td>
<td>Using SEM and advanced and modern recommended MVA</td>
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<tr>
<td>Study IV</td>
<td>Three-wave RCT (digital) intervention</td>
<td>SDT, RPM, TTM</td>
<td>318 adult women (n = 279) and men (n = 40) aged 23-67 years (M = 46.7; SD = 9.4) participating in a digital step contest provided by their employer.</td>
<td>BPNES, BREQ-2, LTEQ</td>
<td>ANCOVA, MVA</td>
<td>The intervention increased levels of total, strenuous and light exercise and predicted mediators in terms of motivational quality. Moderations of gender and age were also found.</td>
<td>High drop-out, sample constitution (mainly women, high mean age), self-reported exercise.</td>
<td>Generating a full mediation model of steps 3-5 in the SDT process model along with moderating effects of gender and age, hence not only examining general relationships between variables but also when, for whom, and why they are associated.</td>
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</tbody>
</table>

To summarize, a number of findings could be highlighted. On a general level, all four studies support the suggested relations between psychological need satisfaction, motivation quality and behaviour according to self-determination theory. This thesis also extends previous mean-level (direct effects) research by examining motivational mechanisms via mediation and moderation analyses (indirect effects). In Study I, self-determined exercise motivation (i.e. identified regulation) mediated the relationship between basic psychological need satisfaction and exercise and this pattern was repeated in Study II, where the effect of the intervention was mediated by identified regulation. These findings not only support the utility of self-determination theory as a guiding framework in this context but also could add to the knowledge of how the effects of programs and interventions could be interpreted via underlying mechanisms (in this case the effect of identified regulation). It also supports the importance of self-determined motivation and internalizing meaningful values behind exercise participation for successful regulation of the behaviour [7]. This is why “you don’t have to love it”; referring to the suggestion that intrinsic motivation might not be the most salient drive in successful regulation of behaviours as physical activity and exercise (see e.g. Teixeira, et al. [10]). In Study I, identified regulation acted as a mediator between psychological need satisfaction and exercise in women, but not for men, who instead had external regulation as an analogous mediator. Moderation analyses in Study IV also showed the motivational processes to vary qualitatively in different subgroups of gender and age. In essence, results from both studies indicate that women and older adults were more autonomously regulated, while men and younger adults seemed to be driven by more controlled regulations. A possible explanation might be that competition could be expected to pull for extrinsic motivation and maybe the results for men can be referred to the competitive context and external rewards (e.g. winning), while women might
have participated for more social reasons, which would involve more autonomous drives. Given the specific conditions (e.g. digital setting, competition based exercise context and sample composition), results should however be interpreted with caution and additional research is needed before generic conclusions can be drawn. Altogether, these novel findings are interesting and suggest that interventions and programs possibly should be tailored differently to subgroups based on for example age and gender.

Study III show some preliminary support for the notions behind motivational soup proposed byPatrick [12], by revealing different motivational profiles linked to exercise behaviour. Out of the six profiles found, three of them were quite similar in shape and possibly representing more stable patterns of motivation quality subgroups according to theoretical expectations and previous research [see e.g. 23,24]. The other three profiles represent more complex and dynamic results of within-person effects of interacting motives and might in part also support the critique against the continuum structure raised by Chemolli, et al. [13]. In Study IV, results showed that the digital intervention had positive main effects on motivation quality, psychological need satisfaction and exercise behaviour and that the effects on total exercise was mediated by amotivation. Moreover, moderation analyses showed the digital intervention to have most effect on participants with low scores on identified regulation and those who mainly engaged in low intensity exercise at baseline. The fact that participants who did not feel motivated to exercise at baseline (i.e. amotivated persons) displayed best intervention effects in terms of exercise behaviour is one of the most interesting results in this study. Approximately 30 per cent of a general population can be expected to be amotivated to exercise and physical activity [25] and they are often hard to reach in interventions and campaigns, simply because they rarely seek out such activities or situations and do not feel related information to be meaningful to them [26,27]. Hence, this is a challenging but also highly relevant group to reach and the results of Study IV constitute a preliminary step towards the understanding of how to reach and work with amotivated persons and stimulate motivation among those who yet have not found the way on their own. In sum, results of Study IV might indicate that this digital tool has a potential to be most efficient for those who need it most and longitudinal follow-up studies over a nine month period have been initiated to further explore these mechanisms.

In conclusion, the results in this thesis generally support the suggested mechanisms of motivation according to self-determination theory and that these mechanisms can be manipulated in interventions. It also extends previous research by applying moderation and mediation analyses and within-person profile analyses, adding to the understanding of what motivational strategies might work, and for whom. Future research should further examine the observed effects, especially the mediating effect of amotivation, the moderating effects of gender and age and the within-person motivational profiles to illuminate potential explanations and to inform practical implications. For example, acknowledging the potential significance of identified regulation (i.e. valuing the outcomes of engagement) might be a useful approach in the promotion of demanding behaviours such as physical activity and exercise. Moving from introjects like guilt towards a more internalised regulation as identified motivation has the potential to increase sustainability and maintenance of behaviour as well as psychological well-being. The full text thesis can be obtained at https://gupea.ub.gu.se/handle/2077/42217.

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Ethical Statement
The data collection and treatment of the participants has been in line with the APA ethical standards and approved by the regional ethical board. The author declares that there are no competing interests and that the ClinMed author guidelines are followed.

References