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The influence of vicarious experience provided through mobile technology on self-efficacy when learning new tasks

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ABSTRACT

Background: A high level of self-efficacy is a major contributor to the effectiveness of physical activity interventions. However, it is insufficiently known whether techniques that are used to influence self-efficacy in face-to-face or printed text interventions can also be successfully incorporated in modern-day, mobile technology-supported interventions. We performed an experiment to investigate whether self-efficacy regarding a specific task can be influenced through vicarious experience provided through mobile technology.

Method: 36 subjects were asked to walk from A to B in exactly 14, 16, or 18 s, wearing scuba fins and a blindfold. The task guaranteed equal level of task experience at the start of the experiment. Before every trial, subjects in group 1 viewed a video on a smartphone of a subject successfully performing the task, subjects in group 2 did not view a video.

Results and conclusion: Although subjects found the video helpful for successful performance of the task and reported high perceived similarity, subjects' level of self-efficacy regarding the task, as well as task performance did not differ significantly between the two groups. However, a secondary outcome parameter did indicate a possible difference between how subjects walked forward while wearing the scuba fins (either shuffling forward, or raising their knees high up). Future studies should investigate whether such instructional videos can contribute to higher levels of self-efficacy in mobile, technology-supported interventions in more ecologically valid settings.

1. Introduction

Smartphones and other mobile technologies like activity sensors are used more and more in coaching programs to improve physical activity patterns (Bielik et al., 2012; Consolvo et al., 2008; Lin et al., 2012). However, the present coaching programs hardly take into account knowledge from behavioral science, which is hypothesized to improve interventions in terms of persuasiveness and adherence (Achterkamp et al., submitted for publication). One way of doing this is by incorporation of tailoring, i.e. personalization of feedback or coaching based on information from the individual (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008). op den Akker, Jones, and Hermens (2014) describe a literature survey about coaching in mobile physical activity applications in relation to techniques to apply tailoring, which have repeatedly been associated with higher effect sizes of interventions (Noar, Benac, & Harris, 2007). The techniques op den Akker et al. (2014) identified are: feedback, inter-human interaction, adaptation, user targeting, goal setting, context awareness, and self-learning. The most interesting finding: whereas the tailoring technique described as adaptation – i.e. tailoring based on constructs from behavioral science – is a common technique in traditional, non-technology supported interventions, the authors show that this specific tailoring technique is rarely applied in modern-day mobile, technology supported physical activity interventions (op den Akker et al. (2014)).

Constructs that are used for adaptation in traditional interventions include, for example, attitudes towards the target behavior, stage of change, social support, processes of change and self-efficacy (Noar et al., 2007). For example: adaptation of interventions based on stage of change means that subjects in the maintenance stage of change receive different information or feedback than subjects in the contemplation stage of change;

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subjects receive information based on their stage of change. Among the constructs used for adaptation, especially self-efficacy seems of major importance (Achterkamp et al., 2016 submitted for publication). Self-efficacy is defined as "one's belief in one's ability to succeed in specific situations" (Bandura, Adams, & Beyer, 1977). Higher levels of self-efficacy are associated with higher levels of physical activity, and the percentage increase in physical activity in a twelve week intervention period is higher when self-efficacy is high (e.g. (Achterkamp et al., 2016; submitted for publication; Trost, Kerr, Ward, & Pate, 2001). Furthermore, research shows that self-efficacy is a powerful predictor of actual performance of the desired behavior (e.g. (Bandura, 1994; Gist & Mitchell, 1992; Roach et al., 2003). So, when self-efficacy is low, it should be increased to achieve optimal result of the intervention. Bandura (1994) describes four sources of self-efficacy that can be used to achieve this, which are still widely applied (e.g. Rowbotham & Owen, 2015; Willis, 2015):

- Mastery experience: the subject successfully performs the target behavior;
- Vicarious experience: the subject observes a similar other perform the target behavior;
- Verbal (or social) persuasion: verbally expressed faith in the subject's capabilities by others;
- Physiological/affective states: (mis)interpretations of bodily states.

Ashford, Edmunds, and French (2010) showed that using mastery experience is the most powerful source to increase self-efficacy, followed by vicarious experience. Although little is known about applying these techniques in mobile, technology supported interventions, recent research does indicate that mastery experience can indeed be an effective source to influence self-efficacy in these types of intervention (Achterkamp, Hermens, & Vollenbroek-Hutten, 2015). Considering that the systematic review with meta-analysis by Ashford et al. (2010) indicates vicarious experience as the most powerful source to influence self-efficacy after mastery experience (Ashford et al., 2010), the goal of the current study is to investigate whether it is possible to successfully apply vicarious experience when using mobile, technology supported feedback strategies.

Regarding vicarious experience, traditional face-to-face interventions typically involve a model and an observer. The observer learns from the model who demonstrates how the task should be performed. By observing the model, the observer can identify certain principles, rules or responses relevant for successful performance (Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986; Schunk & DiBenedetto, 2016). Bandura, Adams, and Beyer (1977) states that through this observation of others, subjects obtain knowledge about how new behavioral patterns are formed, which they can then use when performing the new behavior themselves. Two aspects are of major importance for this to lead to an actual increase in self-efficacy:

1) The model should be similar to the observer, so that the observer can identify with the model; comparable age, gender and appearance are crucial (Bandura et al., 1977; Kassin, Fein, & Markus, 2010; Schunk & DiBenedetto, 2016; Strecher et al., 1986).
2) The model should perform the target behavior with some difficulty; research shows that phobic subjects benefit more from observing models who overcome their problem by exerting effort than from models who overcome their problem easily (Bandura et al., 1977; Schunk & DiBenedetto, 2016).

Summarizing, traditional non-technology supported physical activity interventions commonly apply knowledge from behavioral sciences, leading to larger effect sizes, whereas modern-day mobile technology supported physical activity interventions do not apply this type of knowledge. Therefore, the focus is on investigating whether this knowledge from behavioral sciences can contribute to the effectiveness of mobile technology supported physical activity interventions in the same way as in traditional interventions. More specifically, we tested whether vicarious experience leads to an increase in self-efficacy when using mobile technology-supported feedback strategies. Two groups were compared in a lab experiment: subjects in group 1 viewed an instructional video before performing a new task, subjects in group 2 did not view this video. Thereby, the aim is to answer the following questions: what is the effect of a feedback strategy that incorporates vicarious experience and is delivered through technology on 1) self-efficacy regarding a specific task, and 2) task performance?

2. Method

2.1. Participants

Convenience sampling was applied in this study. The call for participation was distributed through e-mail, social media and the involved researchers personally. Subjects were included if they were Dutch-speaking and did not have walking disabilities.

In total, 36 subjects were included; 17 women and 19 men. Age ranged from 19 to 61 years and averaged 25.6 ($SD = 7.2$). All participants signed an informed consent. A local ethics committee reviewed and approved the study.

2.2. Procedure

The study used a repeated measures design. Subjects came to the lab of Roessingh Research and Development once, but performed the required task six times. Subjects first signed an informed consent, after which they completed a questionnaire assessing demographical variables. Hereafter, they were randomly assigned to one of two groups.

Group 1 – vicarious experience: subjects in this group viewed a video of a same sex model who successfully performs the task before the start of every trial.

Group 2 – control: subjects in this group did not view a video. Otherwise the procedure was equal to group 1.

Next, subjects received information about the task they would have to perform. See below for a detailed description. The goal was to walk from A to B in exactly 14, 16, or 18 s, wearing scuba fins and a blind fold. They were asked to put on scuba fins and were allowed to practice walking in a straight line, after which the subjects were asked to put on a blindfold and could again practice walking. Following this introduction, subjects completed a total of six trials of the task.

2.3. Task

Subjects were asked to walk from one side of the lab to the other (8 m), in exactly 14, 16, or 18 s (target time), wearing scuba fins and a blindfold. Subjects were explained that the goal was to get as close to the target time as possible; the closer they were, the better they performed. However, subjects did not receive feedback after trials. Subjects started between a red light laser and reflector, which functioned as a starting gate on one side of the lab. A second laser and reflector combination functioned as a finishing gate and was placed at the other side of the lab. The distance from start to finish was approximately eight meters. The sensors were linked to a