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Synergistic Effects of Planning and Self-Efficacy on Physical Activity

Milena Koring[1], Jana Richert, PhD[1], Sonia Lippke[2], Linda Parschau[1], Tabea Reuter, PhD[3], and Ralf Schwarzer[1,4]

Abstract

Many individuals are motivated to improve their physical activity levels but often fail to act on their good intention. This study examines the roles of planning and self-efficacy in the prediction of physical activity. A total of 290 participants (77% women, mean age = 41.9 years) were surveyed three times. Intentions, planning, and physical activity were specified as a mediator chain. Results reveal that intentions were partly translated into physical activity by planning. Self-efficacy moderated this mediation, reflected by a planning × self-efficacy interaction ($p < .05$) on physical activity accounting for 16% of the variance in behavior. If a person is self-efficacious, planning seems more likely to be translated into physical activity.

Keywords

intention, moderated mediation, physical activity, planning, self-efficacy

Health-enhancing behaviors such as physical activity and healthy nutrition are difficult to modify. Social-cognitive theories, such as the theory of planned behavior (Ajzen, 1991), assume that an individual's intention to change is the most proximal predictor of behavior change (Armitage & Conner, 2001; Sniehotta, 2009). However, several factors, such as distractions, forgetting, or conflicting bad habits, may impede the adoption and maintenance of goal-directed behavior although intentions may be strong (Schwarzer, 2008). These factors may pose a persistent risk for behavioral performance. That is why it is important that intentions are supplemented by more direct predictors of behavior that play a major role in the process of behavior change after an intention has been formed and might facilitate the translation of intention into behavior. Such postintentional variables are specified as mediators (intervening variables) between intention and behavior, which means that intention produces an indirect effect on behavior. Previous studies have found that planning and self-efficacy are important postintentional factors in physical activity (e.g., Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008) that can mediate between intention and behavior. However, it is not fully understood how these two factors interplay in bridging the intention–behavior gap. In previous studies, planning and self-efficacy were specified as mediators within a multiple mediator model. Recently, the question has been raised whether, alternatively, self-efficacy might also operate as a moderator, which influences the strength or the relationship between a predictor and a criterion variable in the *physical activity domain* (Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009).

When a mediator model has strong interrelations within one category of people, but weak associations within a different category of people, then this is a case of moderated mediation. The amount to which the mediator translates the effect of the independent variable on the dependent variable depends on the levels of a moderator variable (MacKinnon, 2008; Preacher, Rucker, & Hayes, 2007). Such moderators can be sex, age, culture, and so on and also psychological variables that are closely related to the constructs used in health behavior models. In the present study, it is examined whether the intention–planning–behavior mediation chain is moderated by self-efficacy. This is done to elucidate the mechanisms that come into play after individuals have formed an intention to change their health-enhancing behavior.

Planning as a Mediator

People are more likely to translate their good intentions into physical activity when they plan when, where, and how to perform the desired physical activity, even if barriers arise (Norman & Conner, 2005; Scholz, Schüz, Ziegelmann,

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Lippke, & Schwarzer, 2008; Wiedemann, Schüz, Sniehotta, Scholz, & Schwarzer, 2009). Intentions can foster planning, which in turn may facilitate behavior change. Meta-analyses have summarized the findings on the effects of planning on health behaviors (for an overview, see Gollwitzer & Sheeran, 2006).

Although planning usually mediates the intention–behavior relationship and accounts for more variance in the prediction of health behaviors (Lippke, Schwarzer, Ziegelmann, Scholz, & Schüz, 2010), the evidence is inconclusive as some studies failed to find mediation effects of planning (Norman & Conner, 2005, Study 1). This suggests that the relationship between intentions, planning, and behavior might differ in subgroups of participants (e.g., age, gender, psychological variables). Renner, Spivak, Kwon, and Schwarzer (2007) found that planning only mediates between intentions and behavior in older but not in younger adults. They argue that physical activity might be considered an explicit health behavior by older adults, whereas younger adults regard physical activity as a lifestyle factor. Moreover, the effects of a planning intervention to increase physical activity in adults may depend on baseline level of self-efficacy (Luszczynska & Haynes, 2009). The amount to which the mediator translates the effect of the predictor into the criterion may depend on the levels of a moderator. If a moderator has only two levels (e.g., women and men), a strong indirect effect in one group and a smaller effect or even lack of an indirect effect in the other group reflect moderated mediation (Hankonen, Absetz, Ghisletta, Renner, & Uutela, 2010). If a moderator is a continuous variable, the indirect effect might continuously change with changing values of the moderator. In both cases, moderated mediation is equivalent to an interaction between the mediator and the moderator (Preacher et al., 2007).

Self-Efficacy as a Moderator

Planning can mediate the intention–behavior relationship as individuals might be more likely to translate their plans into behavior if they have confidence in their competencies (Richert et al., 2010). Self-efficacy reflects optimistic self-beliefs when overcoming temptations or adopting a novel course of action (Bandura, 1997). Different challenges have to be met during the course of physical activity change, and self-efficacy beliefs are required to master these tasks successfully (Luszczynska & Tryburcy, 2008). It is expected to moderate the intention–planning–behavior relation, because people harboring self-doubts might fail to act on their plans. For individuals with a high level of self-efficacy, planning might be more likely to facilitate goal achievement because self-efficacious people feel more confident about translating their plans into actual behavior. In other words, whether intentions affect behavior via planning (mediation) might depend on the individual's level of self-efficacy (moderator).

In the context of dietary behaviors such a moderated mediation has been found (Gutiérrez-Doña, Lippke, Renner, Kwon, & Schwarzer, 2009; Richert et al., 2010). Three studies in the physical activity domain have also found preliminary evidence, one in China, one in Poland (Study 1 and Study 2, Luszczynska et al., 2010), and one in Germany (Lippke, Wiedemann, et al., 2009). Although in the three studies a moderated mediation materialized, it is premature to infer that a causal chain between these variables exists. Intention, planning, and self-efficacy were measured in these studies at one point in time, and only the behavioral outcome was measured at follow-up.

Aim of the Study

The aim of the present study was to further uncover the mechanisms of health behavior change by analyzing the mediating effect of planning on the intention–behavior relationship as a function of the underlying level of self-efficacy. We expected to replicate the frequently found intention–planning–physical activity chain in our sample and to extend such evidence by adding a moderator effect. The idea was that only individuals with high levels of self-efficacy would translate their plans into actual behavior, whereas those with low levels of self-efficacy might fail to act on their intentions and plans. To our knowledge, this was the first study to test moderated mediation over a 6-week interval with three measurement points in time analyzing the different variables of the change process in a temporal order. We expected planning at Time 2 (T2; 3 weeks after baseline) to mediate between Time 1 (T1) intentions and self-reported physical activity at Time 3 (T3; 6 weeks after baseline). Furthermore, we hypothesized self-efficacy at T3 to moderate this mediation.

Method

Procedure

We conducted an online study to investigate physical activity in Germany. Data collection started in December 2009. Participants were recruited by personal invitations, press releases (radio, newspaper, TV), and advertisements posted on a university website with a link to the questionnaire; no incentives were provided. After giving informed consent, participants followed a link to a self-administered questionnaire. Three weeks later, all participants who provided their e-mail address received an e-mail invitation to answer a second online questionnaire (T2). The follow-up online questionnaire (T3) was provided another 3 weeks later also by e-mail invitation. The study has followed the Helsinki Declaration statement on research on human participants.

Participants

At baseline, 2,122 participants took part in the study and provided their e-mail address to receive an invitation for a follow-up assessment. At T2, 3 weeks later, 660 of them revisited the

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website and completed the follow-up assessments (31.1%). Finally, 290 participants (13.7%) took part in the third questionnaire and were therefore included in the analyses.

Significant differences between dropouts and study participants appeared in terms of sex (more men dropped out) and T1 self-reported physical activity (participants reported to perform more physical activity at baseline). No significant differences were found in age, marital status, education, and different social-cognitive variables such as baseline intention and self-efficacy. Thus, the longitudinal sample was only roughly representative of the initial one given the differences in baseline physical activity and gender. The final sample consisted of 290 participants, aged 19 to 76 years ($M = 41.9$, $SD = 14.3$), 77.1% of whom were women, 61.6% were living with a partner, and 76.6% had completed senior high school.

Measures

At T1 we measured intentions to be physically active and the baseline physical activity level as a control variable; at T2, planning was assessed. Physical activity was measured again at T3, along with self-efficacy. By this, a temporal order was achieved.

Physical activity was assessed by using a part of the International Physical Activity Questionnnaire (IPAQ; Craig et al., 2003). The IPAQ has acceptable measurement properties (test–retest reliability: Spearman ρ = .8, criterion validity: ρ = .30). With two open formatted items, participants were asked to report the frequency of moderate as well as strenuous physical activity that they had exerted during the last week. The item to assess intention was worded in analogy to performance in order to attain a correspondence of specificity levels: "How often do you intend to be physically active in the following week?" The participants were asked to consider again only moderate and strenuous physical activity.

Perceived self-efficacy was measured with two items, such as "I am certain that I can be physically active, even if it is difficult for me." The intercorrelation of the two items was $r = .89$. The measurement of self-efficacy in the domain of physical activity has been validated in numerous previous studies (e.g., Lippke et al., 2010; Scholz, Sniehotta, & Schwarzer, 2005).

Self-reported *planning* was assessed with regard to the when and how of activity. The wording of the two items was "I have already planned [when and how long] I will be physically active" ($r = .74$). This validated planning assessment has been frequently found to predict behavior change (Lippke, Ziegelmann, Schwarzer, & Velicer, 2009, Scholz et al., 2008).

Response formats for planning and self-efficacy were 6-point Likert-type scales, ranging from *totally disagree* (1) to *totally agree* (6). Example items are translations from German (Table 1).

Table 1. Means, Standard Deviations, and Intercorrelations for Intention, Planning, Self-Efficacy, and Physical Activity

Measure	2	3	4	5	*M*	*SD*
1. Intention T1[a]	.18**	.15*	.51**	.44**	3.74	1.42
2. Planning T2	—	.34**	−0.03	.27**	4.57	1.01
3. Self-efficacy T3		—	.13*	.35**	4.69	0.94
4. Baseline physical activity T1[a]			—	.37**	2.21	1.68
5. Physical activity T3[a]				—	2.70	1.68

Note. T1 = Time 1; T2 = Time 2 (3 weeks after baseline); T3 = Time 3 (6 weeks after baseline).
a. Frequency per week.
*$p < .05$. **$p < .01$.

Analytical Procedure

A moderated mediation model to predict T3 physical activity was specified with baseline physical activity and sex as covariates, using the MODMED macro by Preacher et al. (2007). Moderated mediation is expressed by an interaction between self-efficacy (T3) and planning (T2) (moderator × mediator) on behavior, which affects the mediation process (MacKinnon, 2008). Self-efficacy was measured at T3 because we examine an interaction between the mediator (planning) and self-efficacy on physical activity. The use of three measurement points in time is in line with the MacArthur approach (Kraemer, Stice, Kazdin, & Kupfer, 2001). In addition, we applied an extension of the Johnson–Neyman technique (Johnson & Neyman, 1936) to moderated mediation. This technique tests the significance of the indirect effect within the observed range of values of the moderator until the value of the moderator is identified, for which the conditional indirect effect is just statistically significant at a set level (here, α = .05). Values of the moderator for which the mediation effect is significant constitute the region of significance.

Results

Moderated Mediation: Self-Efficacy Moderates the Planning–Behavior Relationship

Regression analyses with standardized variables tested the moderated mediation hypothesis. First, intentions (T1) predicted planning (T2), $\beta = .18$, $p < .01$, which is a requirement for planning to be established as a mediator in the model. Subsequently, physical activity (T3) was jointly predicted by intention (T1), $\beta = .38$, $p < .01$, planning (T2), $\beta = .14$, $p < .05$, self-efficacy (T2), $\beta = .25$, $p < .01$, and the self-efficacy × planning interaction (Moderator × Mediator), $\beta = .08$, $p < .05$, accounting for 16% of the behavioral variance. The significant interaction effect supported the assumption of moderated mediation. Planning partially mediated the

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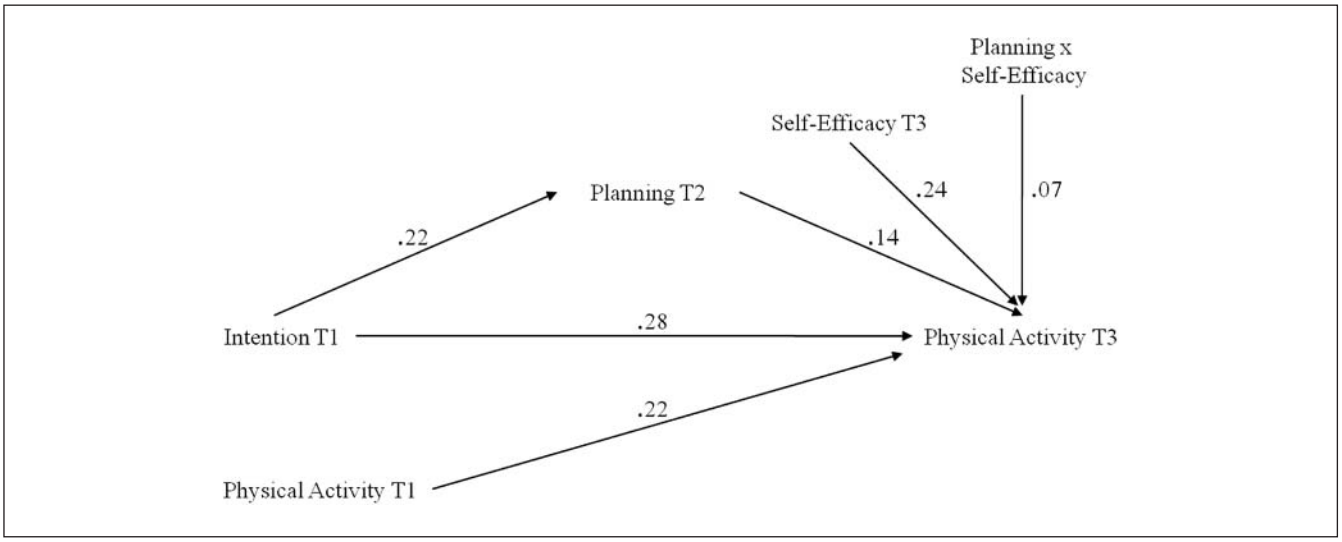

Figure 1. Mediation of the intention–activity relationship by planning, where self-efficacy, in addition, moderates the intention–planning–activity relationship, accounting for baseline physical activity (specified as a covariate)

intention–behavior relation, and perceived self-efficacy moderated this mediation.

Moderated Mediation Accounting for Baseline Physical Activity (T1 Self-Reported Behavior)

The previous analyses have demonstrated a partial mediation of the intention–behavior relationship by planning and the moderation of this mediation by levels of perceived self-efficacy.

To account for baseline behavior, the analysis has been replicated with an inclusion of T1 physical activity. For this purpose, the moderated mediation model was respecified with T1 physical activity as a covariate. In this model, T1 intention emerged as the best predictor of T3 physical activity, $\beta = .27$, $p < .01$, followed by self-efficacy, $\beta = .24$, $p < .01$, T1 physical activity, $\beta = .21$, $p < .01$, and planning, $\beta = .17$, $p < .01$. The effect of the interaction between planning and self-efficacy on physical activity was significant, $\beta = .08$, $p < .05$, indicating that self-efficacy moderates the mediation of planning between intention and changes in physical activity (see Figure 1). Because of the inclusion of baseline behavior, 28% of the criterion variance was accounted for.

This final analysis also corroborated the above-mentioned mediation effect, conditional on the value of self-efficacy. Planning mediated the effect of intentions on physical activity only if self-efficacy was higher than 4.1 on a scale from 1 to 6. This finding underscores that planning did not translate intentions into behavior within the subgroup of individuals who had lower levels of self-efficacy. Figure 2 shows the magnitude of the conditional indirect effect at all *z*-values of the moderator with a 95% confidence band.

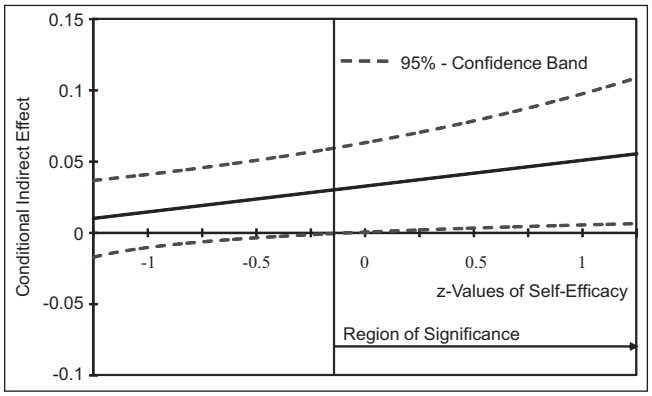

Figure 2. Illustration of the Johnson–Neyman technique reflecting the indirect effect of intentions via planning on physical activity, moderated by self-efficacy (95% confidence band)
Note. Left of the cutoff point on the x-axis is the area where no mediation takes place.

Discussion

The purpose of our study was to analyze whether planning mediates the effect of intentions on self-reported physical activity as a function of the underlying level of self-efficacy. It was hypothesized in line with Bandura (1997) that perceived self-efficacy may be a necessary precondition for the putative mediation process. Individuals who are self-efficacious are optimistic about their capability to resume their exercise regimen after a break, which might help them to enact their plans. In other words, planning would not translate intentions into behavior if people harbor self-doubts. We assumed that the moderator operates on the planning–behavior

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relation, which is statistically reflected by an interaction between planning and perceived self-efficacy.

This study replicates studies on physical activity in Germany, China, and Poland that have found similar results (Lippke, Wiedemann, et al., 2009; Luszczynska et al., 2010) in a different sample. Study participants of the previous studies were adolescents and younger adults than in the present study. Beyond that, the present analyses also extend the results of those studies as the measurement points in time are increased up to three and the interval between baseline assessment and the follow-ups is expanded to 6 weeks.

Mediation obviously does not apply to everyone in the same way. There are subgroups of people for whom a putative causal chain mechanism does not hold true. In the present case, this is the subgroup of poorly self-efficacious individuals, but other research has found other relevant moderators, such as gender and age (Hankonen et al., 2010; Renner et al., 2007).

Some limitations are to be mentioned. The data of our study are based on online self-reports. Online studies have the advantage that researchers can reach large samples of individuals with different age, socioeconomic status, and from different geographic regions (Birnbaum, 1999; Gosling, Vazire, Srivastava, & John, 2004). Although the validity of self-reports appears to be satisfactory (e.g., Armitage & Conner, 2001; Godin & Shephard, 1985; Miller, Freedson, & Kline, 1994), supplementation by more objective measures of physical activity is desirable (e.g., using pedometers or accelerometers). Even though one has to bear in mind that both self-report and objective data have limitations and tap different facets of the phenomenon being measured (Prince et al., 2008), using only one method (self-report measures) might inflate the explained variance because of shared method variance (Feldman & Lynn, 1988).

Another limitation concerns the voluntariness of the study participation, the attrition rate, and the selective dropout in terms of sex and baseline physical activity. Owing to the attrition rate (only 14% of the study participants completed all three questionnaires), the study results probably hold true for highly motivated and already active women. Therefore, generalizations to unmotivated or inactive individuals and to men should be made cautiously. Furthermore, the data are nonexperimental and therefore do not allow for causal inferences. Experimental causal chain designs are more suitable to examine the intention–behavior mediation by planning (Reuter, Ziegelmann, Wiedemann, & Lippke, 2007).

There are also conceptual limitations that should be considered in the design of future studies. We did not make a distinction between action planning and coping planning although there has been a great deal of evidence in favor of such a distinction (e.g., Sniehotta, Schwarzer, Scholz, & Schüz, 2005). We argue for a separation of the construct in future studies, as coping planning might be more relevant than action planning because it includes the anticipation of barriers to physical exercise. Another conceptual limitation lies in the use of a generic self-efficacy item although there is accumulating evidence that the nature of self-efficacy changes as people move through stages of health behavior change; future studies should assess self-efficacy at different points in time, making a distinction between task self-efficacy, coping self-efficacy, and recovery self-efficacy (Luszczynska, Mazurkiewicz, Ziegelmann, & Schwarzer, 2007).

However, the present results are innovative because they extend the well-known mediator model by adding moderating processes. Changes in levels of physical activity operate along the common intention–planning–behavior chain unless individuals do not feel confident to make such a change. This study can be an example for future research that varies the kinds and numbers of such moderators, which would help accumulate further evidence on the mechanisms of health behavior change.

The main contribution of our study is the confirmation of the moderated mediation model over a period of 6 weeks with three measurement points in time and its replication with baseline behavior as covariate.

The present results have implications for the design of interventions. Individuals with low self-efficacy beliefs are less likely to adopt health behaviors. Planning alone might not be beneficial for them. In addition to planning an exercise regimen, individuals need to be confident in their own resources to change or maintain it even when barriers emerge (Bandura, 1997). Therefore, interventions should not only encourage individuals to plan their physical activity but also foster self-efficacy beliefs. Bandura (1997) suggests using mastery experience, role modeling, and verbal persuasion to increase an individual's self-efficacy.

This study might also be helpful for researchers and practitioners analyzing activity change. It might stimulate further research on the mechanisms that are involved in behavior change. Further research might examine whether the mediation is moderated at the first step (between predictor and mediator) or at the second step (between mediator and criterion) of the mediation. Moreover, testing moderated mediation effects of planning and self-efficacy in other behavioral domains, such as smoking cessation or dietary behaviors, might help generalize the evidence about the studied mechanism.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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