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A longitudinal diary study of the effects of causality orientations on exercise-related affect

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Abstract

According to self-determination theory, a tendency to view causes of a behavior as autonomous, controlled, or impersonal can influence motivation, self-regulation, and experience. We propose that causality orientations for exercise may shape self-determined regulations for exercise by leading to more positive exercise-related affect, leading to greater internalization of exercise behavior and more self-determined regulations to exercise (e.g., regulation on the basis of inherent interest and personally-held values).

Methods—Participants (N = 104) kept an online diary for four weeks documenting exercise behavior and affect experienced during exercise. Exercise causality orientations were measured at baseline and exercise regulations were measured at follow-up. Analyses were performed using multilevel modeling and path analysis.

Results—Exercise-related affect was more positive for those with higher levels of the autonomy orientation and lower levels of the impersonal orientation. Exercise-related affect partially mediated the relationship between autonomy and impersonal orientations and self-determined regulations for exercise.

Conclusions—Affective responses to self-selected exercise were more positive for those who tend to perceive exercise opportunities as more autonomous, which in turn led to more self-determined regulations.

Keywords

Affective response; Intrinsic motivation; Physical activity; Self-determination theory

Physical inactivity is a modifiable lifestyle risk factor for a number of the world's leading causes of death (Mokdad, Marks, Stroup, & Gerberding, 2004), but most people fail to meet recommendations (Troiano et al., 2008). Encouraging regular physical activity is a critical public-health issue (Macera et al., 2005), and understanding the mechanisms by which people adopt and maintain regular exercise is a priority. As with many health behaviors, exercise is highly dependent upon effective self-regulation, and recent research has shown that the affective response to exercise may be a key component of exercise self-regulation

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(Kwan & Bryan, 2010; Schneider, Dunn, & Cooper, 2009; Williams et al., 2008). But the sources of positive exercise-related affect and its relationship to self-regulation are not well understood. Self-determination theory (SDT; Ryan & Deci, 2000) provides a framework for exploring this topic. In line with the focus of this special issue, we examine self-regulation in the context of health by exploring the degree to which exercise-related affect mediates the relationship between exercise causality orientations and self-determined regulation of exercise (e.g., regulation on the basis of inherent interest and personally-held values), as informed by SDT.

SDT research shows that effective self-regulation of exercise is a function of the internalization of exercise values and regulations and autonomous motivation to exercise (e.g., Fortier, Sweet, O'Sullivan, & Williams, 2007). SDT suggests that this process of internalization stems from both state-level aspects of the current social context (support for basic psychological needs), and a trait-level tendency to perceive one's behavior as autonomous, externally controlled, or impersonal (causality orientations; Ryan & Deci, 2002). The goal of this paper is to extend past research to explore whether a relatively more autonomous causality orientation can facilitate the internalization of exercise regulations via its influence on affective responses to exercise.

Psychological Needs Satisfaction and Exercise Motivation and Self-regulation

According to SDT, behaviors that satisfy psychological needs for autonomy (feeling that behavior originates from within the self), competence (feeling effective and capable), and relatedness (feeling connected with others) facilitate internalization of behavioral regulations (Ryan & Deci, 2002). Through interaction with needs supportive social contexts, behaviors initially regulated by external sources can be internalized and integrated into one's sense of self if they consistently satisfy these basic psychological needs. Ideally, this leads to more *self-determined* motivation and more effective self-regulation of behavior. There is extensive empirical support for this process in the context of exercise (e.g., Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Hagger, Chatzisarantis, Culverhouse & Biddle, 2003; Ntoumanis, 2005; Pelletier, Fortier, Vallerand, & Briere, 2001; Wilson & Rodgers, 2004).

Self-determined motivation is characterized by a sense that one is acting under one's own volition and choice, whereas non-self-determined motivation is characterized by acting under external pressure and demand (Deci & Ryan, 2008). According to organismic integration theory, an SDT mini-theory, as a behavior becomes increasingly integrated into the self-concept, behavioral motivations and regulations are increasingly self-determined. The most self-determined is intrinsic regulation, by which an individual regulates behavior on the basis of inherent interest, pleasure and enjoyment. Conversely, extrinsic motivation is characterized by regulation of behavior on the basis of external contingencies and varies along a continuum in level of self-determination. The least self-determined form of extrinsic motivation is *external regulation*, in which an individual regulates behavior strictly on the basis of external reward and punishment. Increasing levels of self-determination are

reflected in *introjected regulation* (regulation by feelings of guilt or shame), *identified regulation* (regulation by desire to gain personally valuable benefits like fitness), and *integrated regulation* (behavior has become integrated into an individual's self-concept; regulation by self-consistency). Someone can also be *amotivated*, reflecting a lack of motivation and non-regulation.

Causality Orientations and Affect

Compared to the plethora of exercise research on social contextual factors in self-determined motivation, little SDT-based research in exercise has concerned individuals' general tendency to perceive their own behavior as autonomous, controlled, or impersonal (Wilson, Mack, & Grattan, 2008). In SDT, these general tendencies are referred to as causality orientations—individual differences in people's understanding of the nature of causality of their behavior (Deci, 1980). For example, presented with the opportunity to exercise, someone with higher levels of the autonomy orientation might perceive a chance to express personal choice and pursue personal goals, while someone with higher levels of the controlled orientation might perceive it as pressure to fulfill an obligation or to gain an extrinsic reward. The impersonal orientation might result in the perception of a chance for failure, or to demonstrate incompetence. It has been demonstrated that exercise-specific causality orientations are associated with behavioral regulations for exercise, with the autonomy orientation exhibiting a strong positive correlation with intrinsic regulation (Rose, Parfitt, & Williams, 2005).

Some individuals (those with higher levels of the autonomy orientation) are therefore more inclined than are others to interpret a situation as being needs supportive. Appraisal theories of emotion suggest that affect can be the result of appraisals of the degree to which goals, needs and motives have been satisfied (Ellsworth & Scherer, 2003). Therefore, we expect that causality orientations account for variability in the affective response to exercise. For example, there are interoceptive (i.e., physiological) factors (e.g., increased heart rate and blood lactate, muscle soreness and fatigue) associated with exercise that may be interpreted differently depending on causality orientation. Someone with higher levels of the autonomy orientation might interpret increases in blood lactate during exercise and associated muscle soreness as an indication that they are challenging themselves (high perceived competence) and thereby experience increased positive affect. In contrast, someone with an impersonal orientation might interpret this same physiological response as indicative of poor fitness (low perceived competence) leading to more negative affective response.

Exercise-related Affect and the Internalization of Exercise Regulations

SDT is said to be a theory of experience (Ryan & Deci, 2008), such that needs support and self-determined motivation are associated with more positive psychological well-being (e.g., Sheldon, Ryan, Deci, & Kasser, 2004) and more positive domain-specific affect (including exercise-related affect, e.g., Edmunds, Ntoumanis, & Duda, 2008; Lutz, Lochbaum, & Turnbow, 2003; Ntoumanis, 2005; Wilson, Mack, Blanchard, & Gray, 2009). Positive affect is thus a desirable consequence of self-determination and needs satisfaction. We propose that positive exercise-related affect is not only a *consequence* of self-determination, but is also a

facilitator of the process of internalizing exercise values and regulations. Importantly, "it is typically people's feelings, beliefs, motives, and goals, and the *perceived* environment within which these feelings, beliefs, motives, and goals arise, that organize subsequent behavior" (Ryan & Deci, 2008, p. 655, italics original). That is, *feelings are functional*: affect is part of the *mechanism of self-regulation* of behavior and not just a consequence (Baumeister, Vohs, DeWall, & Zhang, 2007). Positive affect during exercise could foster the integration of exercise into one's behavioral self-schemas, and is likely a determining factor of intrinsic interest in exercise and thus intrinsic motivation to exercise (the most self-determined form of motivation). We therefore suggest that the acute situational experience of positive exercise-related affect subsequently leads to the internalization of exercise regulations and values and more self-determined motivation to exercise.

Hypotheses

In line with SDT (Deci & Ryan, 1985) and consistent with prior research (Kowal & Fortier, 2000; Vlachopoulos, Karageorghis, & Terry, 2001), we posited that an autonomy orientation, compared to controlled and impersonal orientations, would prospectively predict more positive affect during exercise and more self-determined regulations for exercise. We expected that exercise-related affect would mediate the relationship between autonomous exercise causality orientations and self-determined regulations, with affect facilitating internalization of exercise values and regulations. To test our hypotheses we conducted a longitudinal diary study of affective experiences during self-selected, non-laboratory exercise. In the spirit of SDT and supporting psychological needs for autonomy, competence, and relatedness, participants were encouraged to set their own specific exercise goals (How often would they exercise? What kind of exercise?). They recorded exercise and affect in a daily online diary for one month.

Method

Participants

Participants were first-year undergraduate students at a large US state university (60 women, 44 men, M_{age} = 18.23, age range: 18–27 years, 91.3% White) recruited with flyers posted around campus, e-mail bulletins, and a booth at freshman orientation. Baseline data for one participant were lost due to technical difficulty. Eligible participants were over 18, not pregnant, and not elite or professional athletes or members of college sports teams. They had to have positive intentions to exercise in the next month (a value of four or higher on a scale from 1 to 7), and report exercising on average 1 to 5 days per week in the previous 3 months (M = 2.96, SD = 1.56). These criteria were chosen to maximize the likelihood that participants would engage in at least some exercise during the course of the study in order to provide diary data on affective experiences related to exercise, while reducing recruitment of trained athletes. The research was IRB-approved.

Measures

Previous exercise—Past aerobic exercise was assessed with three items (e.g., Kwan & Bryan, 2010). Participants read a definition of aerobic exercise and then reported: (1)

Frequency of aerobic exercise in the past three months (1 = *never* to 7 = *often*); (2) Average number of days per week of aerobic exercise in the past three months (0 to 7 days); and (3) Days of aerobic exercise in the past week (0 to 7 days). An index was created by standardizing and averaging these items (α = .92).

Intentions—Six items assessed intentions to exercise, e.g., "I intend to do aerobic exercise regularly in the next month", on 7-point scales (1 = *disagree strongly* to 7 = *agree strongly*; α = .82).

Exercise causality orientations—The Exercise Causality Orientations Scale (ECOS; Rose, Markland, & Parfitt, 2001) was administered at baseline. The ECOS presents seven scenarios concerning common exercise situations, with three possible ways of responding (one each corresponding to the autonomy, controlled, or impersonal orientation). Respondents indicate how likely they would be to respond in each way (1 = *very unlikely* to 7 = *very likely*). For example, one scenario describes the situation in which: "You are beginning a new exercise program." Possible responses are: (a) Attend a structured exercise class where an exercise leader is telling you what to do (controlled); (b) Attend a gym where you decide for yourself which exercises to complete (autonomy); and (c) Tag along with your friends and do what they do (impersonal). A score for each orientation consisted of the mean of responses for that orientation. Due to somewhat tentative validity and reliability (Rose et al., 2001), a factor analysis was conducted, revealing several items with very low (<.15) communality estimates. Eliminating these items led to the expected three-factor structure. However, reliability for each of the subscales was similar with and without the deleted items, and the results were essentially unchanged. Therefore the results presented here include the full scales for autonomy (α = .64), controlled (α = .65), and impersonal (α = .64) orientations.

Behavioral regulations for exercise—The Behavioral Regulations for Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004), administered at follow-up, is a validated 19-item scale designed to assess degree of self-determined motivation to exercise. Respondents indicated the degree to which each of several reasons for exercising were true for them (e.g., fun, feelings of guilt, valued benefits, etc.) on a 7-point scale (1 = *not at all true*, 7 = *very true*). The BREQ-2 has five subscales measuring intrinsic regulations (α = .94), identified regulations (α = .79), introjected regulations (α = .84), external regulations (α = .88), and amotivation (α = .97). An overall index of self-determined motivation (Relative Autonomy Index, RAI; Vallerand & Ratelle, 2002) was calculated for each participant according to the following formula:

$$3 \times (\text{Intrinsic}) + 2 \times (\text{Identified}) - 1 \times (\text{Introjected}) - 2 \times (\text{External}) - 3 \times (\text{Amotivation}).$$

Affective experience of exercise—Exercise-related affect was measured using the Feeling Scale (FS; Hardy & Rejeski, 1989), a single-item scale that assesses basic affect during exercise, consistent with the valence dimension of affect. On days they successfully exercised, participants reported: "While you were exercising today, how good or bad did you feel?" on an 11-point scale (from −5 = *very bad* to + 5 = *very good*). The FS is a valid

measure of the affective response to exercise (Ekkekakis & Petruzzello, 2002), is theoretically supported by Russell's (1980) circumplex model of affect, and as a single-item measure is well-suited for daily diary assessment.

Exercise behavior—At the end of each day, participants indicated the type, intensity (moderate/vigorous), and duration of any exercise they completed that day. For the following analyses, exercise behavior was quantified as the average total minutes of moderate to vigorous exercise per day.

Procedure

Interested participants completed an eligibility screening either online or by telephone. Eligible participants attended a baseline session during which they learned about study requirements, gave informed consent, and completed the baseline survey using MediaLab software (Empirisoft Corp., New York, NY, USA). Participants were taught how to use the online diary (www.surveymonkey.com), and given a password to access the survey and a personal ID code to ensure confidentiality. They were asked to complete a diary entry each day during the next month, even if they did not exercise. The diary assessed actual exercise behavior that day, exercise-related affect that day, and additional measures not included in the current analysis (e.g., barriers to exercise) that followed the affect measure. Participants completed an online follow-up survey at the end of the month assessing behavioral regulations for exercise. Participants received $10 each for completing the baseline and follow-up session, $5 each week they completed at least five on-time (by midnight the following day) diary entries, and a bonus $10 for completing a total of 20 diary entries, up to $50 total.

Analytical Approach

Diary data are amenable to analysis using multilevel modeling (e.g., Dehart, Tennen, Armeli, Todd, & Mohr, 2009), with affect nested within individual (a level-1 analysis with random effects), and causality orientation between individual (a level-2 analysis with fixed effects). Individuals differed in the number of diary entries provided, and it is a benefit of multilevel modeling that it is able to account for missing data and provides unbiased estimates of the effects of causality orientations on exercise-related affect. The models we tested specified FS responses as the dependent variable and causality orientation as the independent variable, allowing FS responses to vary between and within individuals. Finally, we examined the indirect effects of causality orientations on motivation via mean affective (FS) response using a path model. Model fit was evaluated using overall chi-square tests, the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and variance explained in dependent variables. Analyses were conducted in SAS (Version 9.2) and AMOS (Version 17.0).

Results

Of 104 total participants, 102 completed the follow-up survey (98.0% follow-up rate). All participants completed at least one diary entry. On average, participants completed 20.25 diary entries (SD = 6.74, median = 22, range 1 to 29).

Univariate and Bivariate Analysis

Autonomy orientation predicted more positive affective response to exercise, more positive RAI scores (indicative of more self-determined motivation), and more positive intrinsic and identified regulations for exercise at follow-up (Table 1). Controlled orientation was negatively (though not significantly) associated with affective response, and predicted lower RAI scores (e.g., less self-determined motivation), and more external regulations for exercise at follow-up. Impersonal orientation predicted significantly less positive affective responses and RAI scores, less intrinsic and identified regulation, and more external regulations for exercise at follow-up. Minutes of moderate to vigorous exercise per day were positively associated with intrinsic regulation and affective responses and negatively associated with controlled orientation.

Effects of Causality Orientations on Exercise-related Affect

Multilevel modeling revealed that autonomy orientation was positively associated with affect, β = 0.70, 95% CI (0.17, 0.97), $F(1, 100) = 16.04$, $p<.001$. Neither general intentions (β = 0.22, $p = .18$) nor past exercise behavior (β = .00, $p = 1.00$) predicted affect over and above autonomy orientation, which remained significant in the multivariate model (β = 0.57, $p = .005$). Conversely, impersonal orientation was negatively associated with affect, β = −0.49, 95% CI (−0.77, −0.21), $F(1, 100) = 11.76$, $p<.001$. This effect was still significant, β = 0.39, 95% CI (−0.69, −0.10), $F(1,98) = 6.86$, $p = .01$, when controlling for general intentions, β = 0.32, 95% CI (0.01, 0.62), $F(1, 98) = 4.33$, $p = .04$, and past behavior (β = 0.02, $p = .88$). Controlled orientation was also negatively associated with affect, β = −0.20, 95% CI (−0.44, 0.05), $F(1, 100) = 2.50$, $p = .12$, but this effect was not significant. In this case, there was a significant effect of intentions, β = 0.41, 95% CI (0.11, 0.71), $F(1, 98) = 7.34$, $p = .008$, but not past behavior (β = 0.06, $p = .64$), on affect over and above controlled orientation. Next, autonomy, controlled, and impersonal orientations were entered simultaneously as predictors of exercise-related affect. Only autonomy, β = 0.58, 95% CI (0.23, 0.93), $F(1, 98) = 10.96$, $p = .001$, and impersonal orientation, β = −0.34, 95% CI (−0.66, −0.03), $F(1, 98) = 4.80$, $p = .03$, predicted affect. Again these effects were virtually identical when controlling for general intentions and past exercise.

Direct and Indirect Effects of Causality Orientations on Self-determined Regulations Via Affect

A path analysis was estimated in which autonomy, controlled, and impersonal orientation scores were specified as exogenous variables, which predicted mean affect, which then predicted RAI scores (Figure 1). A full mediation model was not a good fit to the data, $\chi^2(N = 100, df = 3) = 28.55$, $p<.001$, $CFI = 0.72$, $RMSEA = .29$ (.20, .40), and only 18% of the variance in RAI scores was explained by mean affect.

Allowing for direct effects of causality orientations on self-determination (and eliminating the non-significant path from control to affective response to prevent a perfectly identified model) was a much better fit, $\chi^2(N = 100, df = 1) = 0.01$, $p = .94$, $CFI = 1.00$, $RMSEA = .00$ (.00, .06). In this model, autonomy orientation was positively associated with affect, while impersonal orientation was negatively associated with affect, explaining 20% of the variance in affect. Based on bootstrapped bias-corrected confidence intervals (90% confidence level),

there was a significant indirect effect of autonomy, *est* = 0.07, 95% CI (0.02, 0.13), $p = .004$, and impersonal, *est* = (0.05, 95% CI (−0.12, −0.01), $p = 0.01$, orientations on RAI scores via affect. However, there were also significant direct effects of impersonal, *est* = (0.36, 95% CI (−0.50, −0.15), $p = .002$, and autonomy orientations, *est* = 0.19, 95% CI (0.04, 0.33), $p = .04$, on RAI scores, with 38.2% of the variance in RAI scores jointly explained by affect and causality orientations. There were no effects of controlled orientation.

Discussion

Research has shown that positive affective responses to exercise predict more frequent exercise behavior (Kwan & Bryan, 2010; Schneider, Dunn, & Cooper, 2009; Williams et al., 2008). But what are the mechanisms by which affect influences the self-regulation of exercise behavior, and what factors contribute to the quality of the affective response to exercise? In this investigation, we attempted to address both questions in the context of SDT. We expected that an autonomy orientation for exercise behavior would lead to more positive exercise-related affect, which would subsequently lead to more self-determined regulations for exercise. Our hypothesis was supported, and is consistent with other SDT-based research. For instance, Edmunds et al. (2008) showed that, among aerobics class participants, identified regulations were associated with more positive exercise-related affect while external regulations and amotivation were associated with more negative exercise-related affect. Lutz et al. (2003) showed that post-exercise positive affect and energetic arousal were positively associated with more self-determined regulations and negatively associated with less self-determined regulations. Schneider and Kwan (2010) demonstrated that, among adolescents, the affective response to acute bouts of moderate exercise were associated with intrinsic regulations for exercise, both directly and indirectly via perceived needs satisfaction. Our data corroborate such a relationship between exercise-related affect and behavioral regulations, and add SDT-consistent evidence that affective responses to self-selected exercise are more positive for those with a more autonomous causality orientation towards exercise.

In the current study, autonomy and impersonal orientations influenced behavioral regulations both directly and indirectly, via affective responses to exercise. It appears that the relationship between causality orientations and self-determined motivation to exercise cannot be fully accounted for by affective responses to exercise. This may be due to either the limited information provided by our measurement of affect (a single-item scale) or the direct influence of cognition (e.g., perceived needs satisfaction) on self-reported exercise regulations.

Implications

These findings inform our understanding of the sources of effective self-regulation of exercise, which may aid in the design of exercise interventions. While interventions are generally successful at encouraging increased physical activity initially, once the external structure and reinforcement of the intervention is removed, behavior often falls back to baseline (Bock, Marcus, Pinto, & Forsyth, 2001). Effective long-term behavior change requires a shift from regulation of one's behavior from external sources to self-regulation of

behavior on the basis of personally held interests, values, and goals (Ryan & Deci, 2002). Relatively more autonomous causality orientations help support this process. Our data suggest that this is in part due to how exercise causality orientations influence the affective response to exercise. Higher levels of an autonomy orientation appear to lead to more pleasurable affective experiences during exercise—which is a core component of intrinsic motivation (Schneider & Kwan, 2010). Ensuring psychological needs support in the context of an intervention may therefore be especially important for those with less autonomous causality orientations.

Limitations

Limitations of this study include suboptimal reliability of the ECOS, the correlational (albeit prospective) nature of the design, and the possibility that these findings may not generalize beyond the population studied or beyond self-selected exercise. In addition, affective response was in fact *remembered* affect during exercise and may not be indicative of the actual affective experience during exercise. As shown in research on emotion memory (e.g., Levine, 1997), how people remember feeling during exercise may be a function of *current* appraisals of goal states (perceived goal attainment at the time reports of past affect are made). The autonomy orientation may lead people to appraise their behavior and the outcomes of their behavior as more conducive to goal attainment. This does not diminish the validity of our findings, however, as such an explanation would still be consistent with systematic differences in affective experiences among the various causality orientations. Comparing experienced and remembered affect during exercise would be an intriguing area of future research.

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References

Baumeister RF, Vohs KD, DeWall CN, Zhang L. 2007; How emotion shapes behavior: Feedback, anticipation, and reflection, rather than direct causation. Personality and Social Psychology Review. 11(2):167–203. [PubMed: 18453461]

Bock BC, Marcus BH, Pinto BM, Forsyth LH. 2001; Maintenance of physical activity following an individualized motivationally tailored intervention. Annals of Behavioral Medicine. 23:79–87. [PubMed: 11394558]

Deci, EL. The psychology of self-determination. Lexington, MA: D. C. Heath; 1980.

Deci EL, Ryan RM. 1985; The General Causality Orientations Scale: Self-determination in personality. Journal of Research in Personality. 19:109–134.

Deci EL, Ryan RM. 2008; Facilitating optimal motivation and psychological well-being across life's domains. Canadian Psychology. 49(1):14–23.

Dehart T, Tennen H, Armeli S, Todd M, Mohr C. 2009; A diary study of implicit self-esteem, interpersonal interactions and alcohol consumption in college students. Journal of Experimental Social Psychology. 45:720–730. [PubMed: 20161219]

Edmunds J, Ntoumanis N, Duda JL. 2008; Testing a self-determination theory-based teaching style intervention in the exercise domain. European Journal of Social Psychology. 38:375–388.

Ekkekakis P, Petruzzello SJ. 2002; Analysis of the affect measurement conundrum in exercise psychology: IV. A conceptual case for the affect circumplex. Psychology of Sport & Exercise. 3:35–63.

Ellsworth, PC, Scherer, KR. Appraisal processes in emotion. In: Davidson, RJ, Scherer, KR, Goldsmith, HH, editors. Handbook of affective sciences. New York, NY: Oxford University Press; 2003. 572–595.

Fortier MS, Sweet SN, O'Sullivan TL, Williams GC. 2007; A self-determination process model of physical activity adoption in the context of a randomized controlled trial. Psychology of Sport and Exercise. 8(5):741–757.

Hagger MS, Chatzisarantis NLD, Barkoukis V, Wang CKJ, Baranowski J. 2005; Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. Journal of Educational Psychology. 97(3):376–390.

Hagger MS, Chatzisarantis NLD, Culverhouse T, Biddle SJH. 2003; The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: A trans-contextual model. Journal of Educational Psychology. 95(4):784–795.

Hardy CJ, Rejeski WJ. 1989; Not what, but how one feels: The measurement of affect during exercise. Journal of Sport and Exercise Psychology. 11:304–317.

Kowal J, Fortier MS. 2000; Testing relationships from the hierarchical model of intrinsic and extrinsic motivation using flow as a motivational consequence. Research Quarterly for Exercise & Sport. 71:171–181. [PubMed: 10925814]

Kwan BM, Bryan AD. 2010; In-task and post-task affective response to exercise: Translating exercise intentions into behavior. British Journal of Health Psychology. 15:115–131. [PubMed: 19397847]

Levine LJ. 1997; Reconstructing memory for emotions. Journal of Experimental Psychology. 126(2): 165–177.

Lutz R, Lochbaum M, Turnbow K. 2003; The role of relative autonomy in post-exercise affect responding. Journal of Sport Behavior. 26(2):137–154.

Macera CA, Ham SA, Yore MM, Jones DA, Ainsworth BE, Kimsey CD, et al. 2005; Prevalence of physical activity in the United States: Behavioral Risk Factor Surveillance System, 2001. Preventing Chronic Disease. 2(2):A17.

Markland D, Tobin V. 2004; A modification to the Behavioural Regulation in Exercise Questionnaire to include an assessment of amotivation. Journal of Sport & Exercise Psychology. 26(2):191–196.

Mokdad AH, Marks JS, Stroup DF, Gerberding JL. 2004; Actual causes of death in the United States, 2000. Journal of the American Medical Association. 291(10):1238–1245. [PubMed: 15010446]

Ntoumanis N. 2005; A prospective study of participation in optional school physical education using a self-determination theory framework. Journal of Educational Psychology. 97(3):444–453.

Pelletier LG, Fortier MS, Vallerand RJ, Briere NM. 2001; Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. Motivation and Emotion. 25:279–306.

Rose EA, Markland D, Parfitt G. 2001; The development and initial validation of the Exercise Causality Orientation Scale. Journal of Sport Sciences. 19:445–462.

Rose EA, Parfitt G, Williams S. 2005; Exercise causality orientations, behavioral regulation for exercise and stage of change for exercise: Exploring their relationships. Psychology of Sport & Exercise. 6:399–414.

Russell JA. 1980; A circumplex model of affect. Journal of Personality & Social Psychology. 39:1161–1178.

Ryan RM, Deci EL. 2000; Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist. 55(1):68–78. [PubMed: 11392867]

Ryan, RM, Deci, EL. Overview of self-determination theory: An organismic dialectical perspective. In: Deci, EL, Ryan, RM, editors. Handbook of self-determination research. Rochester NY: University of Rochester Press; 2002. 3–33.

Ryan, RM, Deci, EL. Self-determination theory and the role of basic psychological needs in personality and the organization of behavior. In: John, OP, Robbins, RW, Pervin, LA, editors. Handbook of personality: Theory and research. New York, NY: Guilford Press; 2008. 654–678.

Schneider M, Dunn A, Cooper D. 2009; Affect, exercise, and physical activity among healthy adolescents. Journal of Sport and Exercise Psychology. 31:706–723. [PubMed: 20384008]

Schneider M, Kwan BM. 2010Psychological need satisfaction, intrinsic motivation and affective response to exercise in adolescents. Psychology of Sport & Exercise.

Sheldon KM, Ryan RM, Deci EL, Kasser T. 2004; The independent effects of goal contents and motives on well-being: It's both what you pursue and why you pursue it. Personality and Social Psychology Bulletin. 30:475–486. [PubMed: 15070476]

Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M. 2008; Physical activity in the United States measured by accelerometer. Medicine & Science in Sports & Exercise. 40(1):181–188. [PubMed: 18091006]

Vallerand, RJ, Ratelle, CF. Intrinsic and extrinsic motivation: A hierarchical model. In: Deci, EL, Ryan, RM, editors. Handbook of self-determination research. Rochester NY: University of Rochester Press; 2002. 37–63.

Vlachopoulos SP, Karageorghis CI, Terry PC. 2001; Motivation profiles in sport: A Self-determination theory perspective. Research Quarterly for Exercise and Sport. 71(4):387–397.

Williams DM, Dunsiger S, Ciccolo JT, Lewis BA, Albrecht AE, Marcus BH. 2008; Acute affective response to a moderate-intensity exercise stimulus predicts physical activity participation 6 and 12 months later. Psychology of Sport & Exercise. 9(3):231–245. [PubMed: 18496608]

Wilson PM, Mack DE, Blanchard CM, Gray CE. 2009; The role of perceived psychological need satisfaction in exercise-related affect. Hellenic Journal of Psychology. 6:183–206.

Wilson PM, Mack DE, Grattan KP. 2008; Understanding motivation for exercise: A self-determination theory perspective. Canadian Psychology. 49(3):250–256.

Wilson PM, Rodgers WM. 2004; The relationship between perceived autonomy support, exercise regulations and behavioral intentions in women. Psychology of Sport and Exercise. 5:229–242.

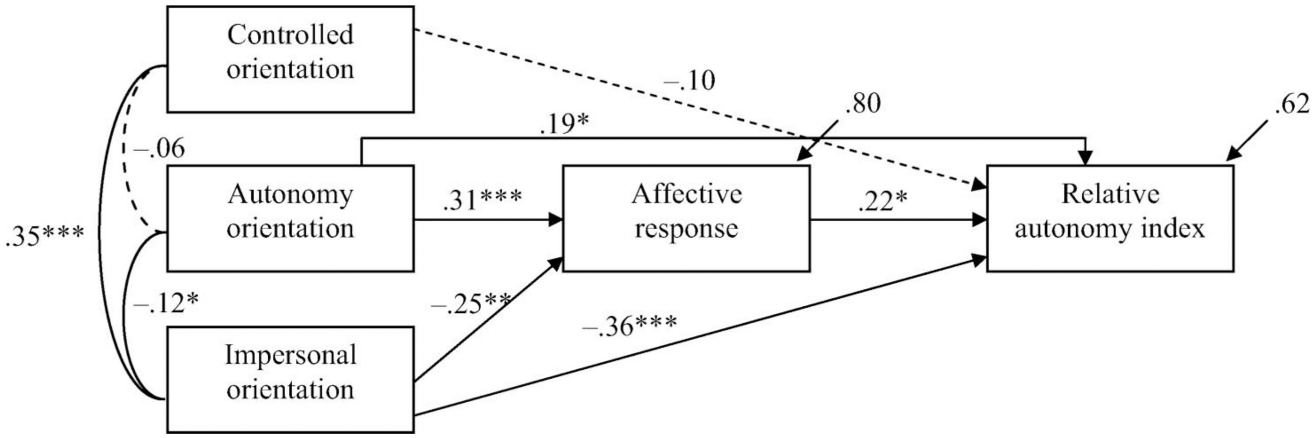

FIGURE 1.

Path analysis testing direct and indirect effects of causality orientations on self-determined motivation. *Note*: Standardized path coefficients are shown. Non-significant paths and covariances are shown as dashed lines. *p<.05; **p<.01; ***p<.001.

TABLE 1

Means, Standard Deviations, and Correlations between Causality Orientations, Exercise-related Affect and Motivation to Exercise

	M *(SD)*	1	2	3	4	5	6	7	8	9	10
1. Autonomy	5.62 (0.64)	–									
2. Controlled	4.04 (0.97)	−.09	–								
3. Impersonal	2.89 (0.82)	−.27**	.46***	–							
4. Exercise (min/day)	38.05 (24.15)	.06	−.28**	−.09	–						
5. Average FS response	2.78 (1.21)	.34***	−.17	−.32**	.22*	–					
6. Intrinsic regulation	5.16 (1.49)	.40***	−.17	−.38***	.26**	.48***	–				
7. Identified regulation	5.71 (1.08)	.44***	−.14	−.38***	.13	.28**	.76***	–			
8. Introjected regulation	4.25 (1.75)	.17	.06	.00	−.02	.01	.25*	.43***	–		
9. External regulation	2.62 (1.33)	−.04	.34***	.29**	.00	−.05	−.08	.01	.39***	–	
10. Amotivation	1.19 (0.58)	−.13	.17	.36***	−.03	−.11	−.10	−.15	.00	.21*	–
11. RAI	13.84 (7.50)	.37***	−.32**	−.53***	.19	.42***	.81***	.68***	−.10	−.54**	−.41***

* $p < .05$;

** $p < .01$;

*** $p < .001$.