

Self-Determination Moderates the Effects of Perceived Competence on Intrinsic Motivation in an Exercise Setting

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According to Deci and Ryan's (1985) self-determination theory, perceptions of self-determination moderate the effects of perceived competence on intrinsic motivation, with perceived competence only positively influencing intrinsic motivation under conditions of some self-determination. Vallerand's (1997) hierarchical model of intrinsic and extrinsic motivation suggests that self-determination and competence have only independent effects on intrinsic motivation. The aim of this study was to test these competing models. Women aerobics participants ($n = 146$) completed measures of self-determination, perceived competence, and intrinsic motivation for exercise. Moderated hierarchical regression revealed a significant interactive effect of self-determination and perceived competence. A plot of the regression of intrinsic motivation on perceived competence under conditions of high and low self-determination, however, showed that the interaction did not take the expected form. Variations in perceived competence positively influenced intrinsic motivation only under conditions of low self-determination. This suggests that it is particularly important to foster perceptions of competence among individuals low in self-determination.

Key words: self-determination, perceived competence, intrinsic motivation, exercise

Because of the well-documented potential benefits of regular exercise on physical and psychological well-being, and the high dropout rates among those who begin an exercise program (Dishman, 1988), an understanding of how individuals might be motivated to adopt and maintain a physically active lifestyle represents a significant challenge to exercise psychology. It has often been argued that although initial involvement in exercise might be prompted by extrinsic factors such as perceived health and fitness benefits, long-term participation more likely depends on the development of intrinsic motivation for exercise (Dishman, 1987; Ingledew, Markland, & Medley, 1998; McAuley, Wraith, & Duncan, 1991; Wankel, 1993). Intrinsically motivated behavior has been defined as engagement

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in an activity in the absence of extrinsic rewards (Deci & Ryan, 1985, 1990). When intrinsically motivated, individuals take part in an activity primarily for the enjoyment and satisfaction gained from participation itself. Because of this emphasis on intrinsic motivation for exercise, a popular theoretical approach in exercise motivation research is Deci and Ryan's (1985) cognitive evaluation theory, which is concerned with how events enhance or undermine intrinsic motivation for an activity.

Cognitive evaluation theory is the most fully developed and researched aspect of the broader self-determination theory and has been presented as four formal propositions (Deci & Ryan, 1985). The first two propositions concern the ways in which events influence intrinsic motivation through their effects on self-determination and perceived competence. The self-determination construct is principally concerned with the perception of choice in engaging in a behavior (Deci & Ryan, 1985; Deci, Vallerand, Pelletier, & Ryan, 1991), whereas perceived competence concerns perceptions of ability to deal effectively with one's environment (Deci & Ryan, 1985). The theory holds that events that enhance perceptions of self-determination and competence will facilitate intrinsic motivation. It is important that the second proposition also states that events that enhance perceptions of competence will only positively influence intrinsic motivation in the context of some self-determination. Thus, self-determination is held by the theory to moderate the effects of perceived competence on intrinsic motivation (Hardy, Jones, & Gould, 1996; Markland & Hardy, 1997).

To date, however, the majority of research examining these relationships has only considered the independent effects of either self-determination or perceived competence on intrinsic motivation. For example, studies have examined the effects of manipulating choice (and, by inference, self-determination) on intrinsic motivation for drawing among children (Swann & Pittman, 1977) and on puzzle-solving activities (Anderson & Rodin, 1989; Zuckerman, Porac, Lathin, Smith, & Deci, 1978). In an exercise context, Dwyer (1995) found that perceived choice of music accompanying an aerobics video enhanced intrinsic motivation in comparison with a no-choice condition. The effects of enhanced perceptions of choice have also been shown to positively influence exercise adherence. Thompson and Wankel (1980) demonstrated significantly greater exercise program attendance and intentions to continue to attend among participants who were led to believe that their preferred activities had been taken into account in designing the program.

Other studies have investigated the effects of enhancing perceived competence on, for example, intrinsic motivation for puzzle-solving tasks (e.g., Deci, 1971) and a stabilometer task (Vallerand & Reid, 1984). In an exercise setting, intrinsic motivation for fitness testing among adolescents was shown to be enhanced by feedback that increased perceptions of competence (Whitehead & Corbin, 1991). Markland and Hardy (1997) examined the effects of both self-determination and perceived competence on intrinsic motivation in an exercise context, using structural equation modeling. They found that perceived competence had only weak effects on intrinsic motivation in comparison with strong effects found for self-determination and that a model in which self-determination mediated the effects of perceived competence on intrinsic motivation gave the best fit to their data. They did not, however, test for an interaction between self-determination and perceived competence. To date, only one study has tested the moderating effect of self-determination on the relationship between perceived competence and intrinsic

motivation. In an organizational setting, Fisher (1978) found a significant correlation between perceived competence and intrinsic motivation when participants felt that their behavior was self-determined, but no correlation when the behavior was perceived as externally constrained.

Vallerand (1997) recently presented a new hierarchical model of intrinsic and extrinsic motivation that extends self-determination theory and seeks to clarify the relationships between the determinants and consequences of intrinsic and extrinsic motivation at three levels of generality: a global (personality) level, a contextual (life domain) level, and a situational (state) level. Vallerand argued that at each of these levels social or environmental factors influence perceptions of self-determination (labeled autonomy in this model) and competence to determine levels of intrinsic and extrinsic motivation. Thus, increases in perceptions of self-determination and competence are held by his model to enhance intrinsic motivation. In contrast to Deci and Ryan's approach, however, the model predicts that perceptions of self-determination and competence have only independent effects on motivation and do not interact. Vallerand does discuss the comparative impact of these determinants of motivation, arguing that the relative strength of their effects depends on the circumstances in which the behavior takes place.

The present study was designed to determine whether self-determination moderates the effects of perceived competence on intrinsic motivation or whether self-determination and perceived competence have only independent effects in the context of aerobic dance classes for women. I predicted that when perceptions of self-determination were low, perceived competence would have no effect on intrinsic motivation, whereas when self-determination was high, intrinsic motivation would be greater when perceived competence levels were also high. This is a substantial issue for both theoretical and applied reasons. From the Deci and Ryan (1985) perspective, self-determination plays a pivotal role in determining levels of intrinsic motivation. If it were shown that the effects of perceived competence are moderated by perceptions of self-determination, then researchers in this area would be well advised to take this into account in testing theory-driven models of exercise motivation. From an applied perspective, it would suggest that interventions designed to enhance intrinsic motivation by increasing perceptions of competence might not be effective if they do not take place in a self-determining context. If the model of independent effects is supported, however, a more important theoretical and applied concern would be to determine under what circumstances either self-determination or perceived competence has the stronger influence on motivation.

Method

Participants and Procedure

Participants were 146 women members of four community-based aerobics classes (mean age = 31.51 years, $SD = 9.26$). Classes were held three or four times per week, each lasting 1 hr, and were led by qualified aerobics instructors. Participants reported having attended aerobics classes for a mean of 9.81 months ($SD = 12.9$). The mean frequency of attendance was 1.85 classes per week ($SD = 0.72$). After obtaining permission from class instructors, I approached potential participants at the start of an aerobics class and asked them to take part in a study of peoples' feelings about exercise, and I sought informed consent. Participants then

completed the questionnaire measures (see below) before leaving the exercise facilities.

Measures

Intrinsic Motivation. I operationalized intrinsic motivation for exercise using a version of the interest/enjoyment scale of the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989; McAuley et al., 1991). Specifically, I employed the four-item version of the scale used by Markland and Hardy (1997), which was drawn from McAuley et al.'s (1991) aerobic dance version of the IMI. Markland and Hardy reported an acceptable alpha reliability coefficient of .91 for the scale in a sample similar to that used in this study. Responses were scored on a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with high scores indicating high levels of interest/enjoyment.

The IMI comprises five scales altogether, assessing effort/importance, pressure/tension, and perceived choice, in addition to interest/enjoyment and perceived competence. McAuley et al. (1989, 1991) proposed, on the basis of hierarchical confirmatory factor analyses, that the scales can be combined to form an overall intrinsic motivation score. Markland and Hardy (1997), however, argued that this recommendation is inappropriate on both statistical and conceptual grounds. In particular, they suggested that the results reported by McAuley et al. (1989, 1991) actually indicated a poor fit of the hierarchical model to the data and that because perceived competence is theoretically an antecedent of intrinsic motivation, it should not be included in the measurement of intrinsic motivation. Similarly, Vallerand and Fortier (1998, p. 91) questioned the adequacy of the factorial validity of the IMI and argued that it taps antecedents (e.g., perceived competence) and consequences (e.g., effort) of intrinsic motivation, as well as intrinsic motivation per se. Deci (1987) and Markland and Hardy (1997) have pointed out the dangers of using self-reports of persistence (effort/importance) as indicators of intrinsic motivation, because it is clear that individuals often persevere at an activity in order to obtain extrinsic rewards. Furthermore, the perceived choice scale of the IMI has repeatedly been shown to be low in reliability (Dwyer, 1995; McAuley et al., 1991; Oman & McAuley, 1993). Some concern has also been expressed about the reliability of the pressure/tension scale (Vallerand & Fortier, 1998). Consequently, for the present study only the interest/enjoyment scale of the IMI was used as an indicator of intrinsic motivation.

Perceived Competence. I assessed perceived competence using McAuley et al.'s (1991) three-item aerobic dance version of the perceived competence scale of the IMI. McAuley et al. (1991) and Markland and Hardy (1997) reported acceptable alpha reliability coefficients for the scale (.83 and .81, respectively). Responses were scored on a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with high scores indicating high levels of perceived competence.

Self-Determination. I operationalized self-determination using Markland and Hardy's (1997) Locus of Causality for Exercise Scale (LCE). This three-item scale was developed using exploratory and confirmatory factor analyses and indicates the extent to which respondents feel that they choose to exercise rather than feeling that they have to exercise. According to Deci and Ryan (1985, 1990), a central feature of self-determination is the perception of choice, whereas the construct of perceived locus of causality is concerned with the source of the initiation

Table 1 Items for Interest/Enjoyment, Perceived Competence, and Self-Determination (Locus of Causality for Exercise Scale)

Interest/enjoyment

I enjoy participating in this aerobics class very much.

This aerobics class is fun to do.

I think this aerobics class is boring.

I think this aerobics class is quite enjoyable.

Perceived competence

I think I am pretty good at aerobics.

I think I do pretty well in this aerobics class, compared to other people.

I am pretty skilled at the level of aerobics presented in this class.

Self-determination

I exercise because I like to rather than because I feel I have to.

Exercising is not necessarily something I would choose to do; rather it is something that I feel I ought to do.

Having to exercise is a bit of a bind, but it has to be done.

of behavior. When individuals feel that their behavior is controlled by an external event such as being told that they must comply, they are said to have an external perceived locus of causality. An internal perceived locus of causality is evident when an individual feels that he or she is engaging in a behavior freely and with no sense of coercion. Thus, although the constructs of self-determination and perceived locus of causality are not entirely synonymous, individuals feel more self-determined when the perceived locus of causality is internal and less self-determined when it is external. Responses to the LCE are scored on a Likert-type scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*), with high scores indicating more, and low scores less, self-determination. Markland and Hardy reported alpha reliability coefficients of .83 and .82 in two studies using the LCE and showed it to be a strong predictor of intrinsic motivation. The interest/enjoyment, perceived competence, and LCE items are shown in Table 1.

Data Analysis

I used moderated hierarchical regression analysis to test for the independent and interactive effects of self-determination and perceived competence on intrinsic motivation. Moderated hierarchical regression has been advocated as the method of choice for testing interactive effects when the independent variables are continuous (Cohen & Cohen, 1983). Alternative approaches are to dichotomize the proposed moderator variable and then to compare the correlations between the predictor and criterion variables for subgroups high and low on the moderator or, more commonly, to dichotomize both independent variables and then perform a two-factor ANOVA. It has been shown that forcing continuous variables into this categorical framework leads to a considerable loss of information (Cohen, 1983; Schutz & Gessaroli, 1993), which can be avoided by using a regression approach. In the present study, I adopted the procedures described by Jaccard, Turrissi, and

Wan (1990). I standardized all variables before the analysis to provide a common metric, facilitating the interpretation of the interaction term (Finney, Mitchell, Cronkite, & Moos, 1984), and computed the product of perceived competence and self-determination scores. I first entered perceived competence into the analysis; in the second model I added self-determination; in the final model I added the product term. A moderating effect of self-determination would be indicated by a significant increment in R^2 when the product term was entered. I used unstandardized regression coefficients in interpreting the results because the standardized regression coefficients are adversely influenced by differences in variances across levels of the moderator variable (Baron & Kenny, 1986). I assessed the form of the interaction by substituting low (1 *SD* below the mean) and high (1 *SD* above the mean) values for the independent variables into the final regression equation and plotting the resultant slopes for perceived competence against interest/enjoyment when self-determination was low and high, respectively. This allows one to determine how the regression of interest/enjoyment on perceived competence differs under conditions of low and high self-determination.

Results

Table 2 shows means, standard deviations, alpha reliability coefficients, and intercorrelations for the scales. Scale means were relatively high in absolute terms and marginally higher than those reported by Markland and Hardy (1997). However, the full range of possible scale scores was represented in the data (1–7 for interest/enjoyment and perceived competence and 1–6 for self-determination). Alpha reliabilities were acceptable for each scale. One-way ANOVAs showed that there were no significant differences in interest/enjoyment, perceived competence, or self-determination scores across the four different aerobics classes ($p > .05$), suggesting that it was acceptable to collapse the data from the four classes for the main analysis.

Table 3 shows the regression analysis results. The minimum tolerance when all the variables were entered into the analysis was .79, suggesting that multicollinearity among the independent variables was not a problem. For Model 1

Table 2 Scale *Ms*, *SDs*, Intercorrelations (standard errors of correlations in parentheses), and Alpha Reliability Coefficients (on the diagonal)

	1	2	3
1. Perceived competence	.81		
2. Interest/enjoyment	.49 (.07)	.80	
3. Self-determination	.45 (.07)	.69 (.06)	.87
<i>M</i>	4.27	5.75	4.20
<i>SD</i>	1.30	1.22	1.33

Table 3 Moderated Hierarchical Regression Analysis Results

Variables entered	R^2	F	df	R^2 change	b	SE	t
Model 1							
Perceived competence	.24	45.03**	1,144				
Model 2							
Perceived competence							
Self-determination	.52	77.21**	2,143	.28**			
Model 3							
Constant					.09	.06	1.47
Perceived competence					.20	.06	3.11*
Self-determination					.59	.06	9.30**
Product	.56	58.82**	3,142	.04*	-.20	.06	-3.36*

Note. Regression equation: $y = .09 + .20x_1 + .59x_2 - .20x_1x_2$, where x_1 = perceived competence and x_2 = self-determination. $N = 146$.

* $p < .01$. ** $p < .001$.

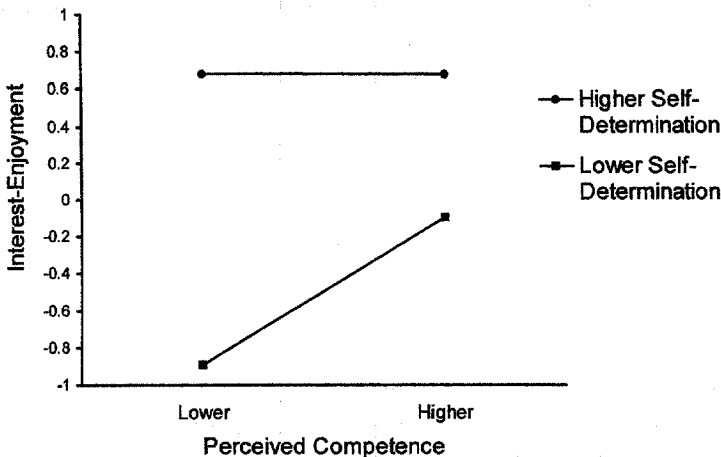


Figure 1 — Regression slopes for interest/enjoyment on perceived competence under conditions of higher and lower self-determination.

there was a significant effect for perceived competence on interest/enjoyment. In Model 2 there was a significant increase in R^2 when I entered self-determination. Model 3 showed a further small but significant increase in R^2 when I entered the product term, which indicates an interactive effect. In the final model 56% of the variance in interest/enjoyment was accounted for. Figure 1 shows the form of the interaction. Variations in perceived competence only had an influence on interest/enjoyment under conditions of lower self-determination. Specifically, when

self-determination was low, lower levels of perceived competence were related to lower levels of interest/enjoyment, whereas higher levels of perceived competence were related to higher levels of interest/enjoyment. When self-determination was high, however, interest/enjoyment levels were the same, regardless of the level of perceived competence.

Discussion

The aim of this study was to determine whether self-determination moderates the effects of perceived competence on intrinsic motivation for participating in aerobic dance classes. Of course, caution is warranted in interpreting the results as representing causal relationships, because of the cross-sectional nature of the data. Furthermore, generalizability is limited by the facts that only women were sampled and only one type of physical activity was examined.

Notwithstanding these limitations, and if one accepts the underlying theoretical premise that intrinsic motivation is caused by rather than a cause of self-determination and perceived competence, and also that interest/enjoyment is an acceptable indicator of intrinsic motivation, the results show that in the present context, self-determination moderates the effects of perceived competence on intrinsic motivation. Although the interaction only explained a further 4% of the variance in interest/enjoyment over and above the independent effects, it is well recognized that there are considerable difficulties in detecting interactive effects in field studies (McClelland & Judd, 1993), and effects rarely exceed 3% of the variance explained (Champoux & Peters, 1987; Chaplin, 1991). An examination of the regression of interest/enjoyment on perceived competence under low and high self-determination conditions, however, revealed that the form of the interaction was not as I had predicted. I had expected that perceived competence levels would only influence intrinsic motivation when self-determination was high. I found that, on the contrary, when self-determination was high, differences in perceived competence had no effect on intrinsic motivation. Only when self-determination was low did perceived competence levels have a positive relationship with intrinsic motivation. This is not as surprising as it might at first appear, however. The findings suggest that when individuals really feel that they are engaging in aerobics because they choose to, perceptions of competence are not an issue. They participate because they want to, and therefore it does not matter to them whether or not they feel that they are good at aerobics.

When self-determination is low, however, perceptions of competence appear to be very important as far as intrinsic motivation for aerobics is concerned. It is easy to see how if one feels one has to participate in an activity for some reason, then also feeling that one is not very competent at it is likely to be particularly detrimental to one's intrinsic motivation. This suggests that for those low in self-determination, it is vital to ensure that activities are structured in such a way as to foster perceptions of competence. This might be particularly important for those just beginning an exercise program, because at this point they might well be lacking a sense of self-determination. Mullan and Markland (1997) examined self-determination for exercise from a stages-of-change perspective and found that self-determination increased in a systematic way across the stages of change for exercise, with those in the early stages being particularly low in self-determination.

It should be noted that the present results also indicate the importance of the independent effect of self-determination. In the final model, the regression coefficient for self-determination was moderately strong compared with a rather weak coefficient for perceived competence, which was accompanied by a relatively large standard error. Furthermore, levels of interest/enjoyment were always higher, and approaching 1 *SD* above the mean, under conditions of high self-determination, regardless of the level of perceived competence. Therefore, it would seem advisable to always seek to create self-determining conditions for exercise class participants. Deci and Ryan (1985, 1990) described three dimensions of social situations that are relevant to the development of self-determined functioning: autonomy support, structure, and involvement. In autonomy-supporting contexts, choice is provided, pressure to engage in the behavior is minimized, and individuals are encouraged to initiate actions themselves. The structural dimension concerns the degree to which the relationships between the behavior and salient outcomes are understandable, expectations are clear, and positive feedback is provided. Involvement describes the extent to which individuals perceive that significant others (e.g., exercise class leaders) are genuinely interested in them and their well-being. All three of these dimensions are relevant in the context of exercise classes and give clear indications as to how such situations could be organized in a way that would maintain or enhance participants' self-determination.

In conclusion, the initial predictions of this study were only partly borne out. Although the interaction that was found supports the self-determination theory perspective, the nature of the moderating effect of self-determination was not as the theory predicts. One should be wary about generalizing this finding to other contexts, however. As pointed out earlier, Vallerand (1997) argued that the relative impact of self-determination and perceived competence differs in different circumstances. It might be that the nature of any interaction between these perceptions also differs in different circumstances or, indeed, that in some circumstances they do not interact. Future research could address this issue by determining the conditions under which self-determination and perceived competence interact and what form any such interaction might take under different conditions. A useful starting point might be to examine these relationships in more challenging interpersonal contexts than that of the present study, such as in a competitive sport setting. Given the fact that the present results neither supported the independent-effects model of Vallerand nor were entirely in line with the interactive prediction of cognitive evaluation theory, there is clearly considerable scope for further examination of the effects of self-determination and perceived competence on intrinsic motivation.

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