Effects of an Autonomy-Supportive Exercise Instructing Style on Exercise Motivation, Psychological Well-Being, and Exercise Attendance in Middle-Age Women

Frederiki C. Moustaka, Symeon P. Vlachopoulos, Chris Kabitsis, and Yannis Theodorakis

Background: The present study evaluated the effectiveness of an autonomy-supportive intervention based on self-determination theory in influencing perceptions of autonomy support, basic psychological needs, behavioral regulations, subjective vitality, and exercise behavior. Methods: 35 female exercise participants age 30 to 58 years who enrolled to an 8-week exercise program attended 24 exercise classes that were taught using either an autonomy-supportive (n = 19) or a lack of autonomy support (n = 16) instructing style. Results: The experimental group reported an increase in perceived autonomy support, the fulfillment of the needs for autonomy and competence, identified regulation, intrinsic motivation, and subjective vitality. They also reported higher attendance rates during the program and greater participation to moderate and/or mild nonstructured exercise during 5 weeks after the end of the program. The control group reported a decrease in perceived autonomy support, the needs for autonomy and competence, intrinsic motivation, and subjective vitality. Conclusion: The results supported tenets of self-determination theory and highlighted the motivational and psychological benefits of an autonomy-supportive exercise instructing style among middle-age women.

Keywords: self-determination theory, teaching style, autonomy-support, behavioral regulations, subjective vitality, physical activity

The links between regular physical activity and physical and psychological health are now well documented. However, despite the well known advantages associated with regular exercise, two-thirds of the adult population in the European region are physically inactive. Physical inactivity is a major public health concern which has been linked to reduced levels of quality of life. Therefore, a better understanding of how to facilitate regular exercise involvement becomes of great importance. To achieve this aim the motivational determinants of exercise participation need to be further delineated.

One popular theory with potential to facilitate a better understanding of this important health behavior is Self-Determination Theory (SDT). The most central distinction in SDT is between self-determined motivation and controlled motivation. Self-determined motivation involves people behaving with a full sense of volition, choice, and self-endorsement of their actions. It comprises both intrinsic motivation and the types of extrinsic motivation in which people have identified with an activity’s value (ie, identified regulation) and have integrated it into their sense of self (ie, integrated regulation). In contrast, controlled motivation involves behaving with a pressure to think and act in a specific way toward outcomes external to the self. It consists of both external regulation in which people’s behavior is a function of either external pressures, or gaining a reward or avoiding punishment and introjected regulation in which the regulation of action has been partially internalized and is energized by factors such as an acceptance motive, avoidance of shame and guilt, and ego-involvements. Both self-determined and controlled motivations energize and direct behavior, and they stand far from amotivation which refers to a complete absence of intention and motivation. These 4 types of extrinsic motivation running from the least to the most self-determined (ie, external regulation → introjected regulation → identified regulation → integrated regulation) are theoretically placed on a self-determination continuum where higher levels of self-determination reflect a greater degree of internalization and integration of the behavior with the true self and correspond with more adaptive cognitive, affective and behavioral outcomes.

SDT proposes 3 basic psychological needs, the fulfillment of which is essential for effective functioning and psychological health, postulating also a direct effect of the fulfillment of these needs on indices of psychological

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health. These are the needs for autonomy, competence, and relatedness. Autonomy reflects a desire to experience a sense of choice and being the origin of one’s behavior. Competence refers to individuals’ need to interact effectively with their environment and to experience a sense of effectiveness in producing desired outcomes. Relatedness is the need to feel connected to and be accepted by others in a social milieu. Part of SDT is also the construct of vitality which is described as energy available to the self and it is considered a significant indicator of health and motivation. Subjective vitality is a feeling of aliveness and energy that arises from a sense of freedom, autonomy support and intrinsic motivation.

Although the relationship of basic psychological needs and self-determined behavioral regulations with positive psychological and behavioral outcomes has been confirmed in several correlational studies in exercise, intervention studies have been fewer, thus highlighting the need for further research using an experimental design.

In a school-based intervention program, SDT was used to promote exercise participation in an Asian sport. The study revealed that autonomy-supportive environments enhanced pupils’ effort, perceptions of autonomy support, self-determined motivation, performance ($\eta^2 = .64$), and persistence to the exercise activity ($\eta^2 = .87$). Further, the efficacy of an SDT intervention in a physical activity context was tested in a randomized clinical trial. Primary care patients received either brief (2–4 min), or intensive (6 sessions in a period of 3 months) autonomy-supportive physical activity counseling. Results revealed that 13 weeks later, patients who received intense autonomy-supportive counseling reported greater levels of autonomy support, short-term self-determined motivation and greater participation to physical activity compared with the brief-intervention patients. Another study evaluated the effectiveness of a school-based intervention to promote pupils’ leisure-time physical activity. Results indicated that pupils who were taught by autonomy-supportive teachers reported stronger self-determined motivational orientations, greater intention to exercise during leisure time and participated more frequently in leisure-time activities. More recently, in a randomized controlled trial women received a weight control intervention with 30 face-to-face contacts covering health-related topics in an autonomy supportive environment, for 1 year. Results showed that participants in the experimental group showed an increase in weight loss and levels of physical activity compared with the control group with large effect sizes (Cohen’s $d$ between 0.80–0.90). Another study examined the effect of an autonomy-supportive exercise instructing style intervention on exercise participants’ psychological need fulfillment, motivational regulations, exercise behavior, intention, and affect. Participants were in majority university students who took part either in a self-determined exercise condition or a typical exercise condition during 10 weeks. It was found that participants in the autonomy-supportive condition reported greater levels of psychological need fulfillment, positive affect, and exercise adherence demonstrating a medium effect size (Cohen’s $d = 0.54$) compared with those in the typical exercise condition.

Most of these experimental studies have revealed the role of SDT concepts as mediators of health behavior change. Specifically, self-determined motivation appears to play a mediating role in exercise adherence and self-reported physical activity participation and similarly both self-determined forms of exercise regulations and intrinsic motivation a mediating role in exercise adherence.

Despite that previous exercise-related research has examined the motivational effects of an autonomy-supportive instructing style in 2 studies being conducted in a school context and 1 study in an exercise context, no information exists on the extent to which such effects are maintained after termination of the intervention. Maintenance of the effects of an autonomy-supportive intervention will provide evidence for the validity of the relatively stable nature of the SDT motivational regulations and the efficacy of such an intervention to cause relatively long-term changes in individuals’ outlook toward exercise and possibly exercise behavior. Further, given that the only experimental study testing SDT principles in exercise has been conducted with university students, the need exists to further the evidence base replicating such an intervention with middle-age adults, a population for which the health benefits of regular exercise are equally important. Moreover, given that previous studies have not examined the effects of an autonomy-supportive exercise intervention on participants’ subjective vitality which is the central marker of well-being in SDT, the need exists for such effects to be examined.

Therefore, the aim of the study was (a) to test the effectiveness of an autonomy-supportive exercise-instructing style versus an exercise-instructing style that lacked autonomy support in positively influencing participants’ perceptions of autonomy support, basic psychological need fulfillment, self-determined motivation, subjective vitality, and persistence to exercise among middle-age women; and (b) to examine the extent to which possible effects of the autonomy-supportive intervention are maintained after termination of the intervention.

It was hypothesized that participants in the autonomy-supportive condition compared with those in the lack of autonomy support exercise condition will report (a) an increase in perceptions of autonomy support (PAS), (b) greater fulfillment of the needs for autonomy, competence, and relatedness, (c) an increase in self-determined exercise motivation, (d) an increase in levels of subjective vitality, (e) higher attendance rates during the exercise program, and (f) higher weekly frequency of participation in either strenuous or moderate or mild exercise during 5 weeks after the end of the intervention. The SDT psychological mechanism through which the autonomy supportive intervention may affect levels of vitality and exercise behavior is depicted in Figure 1.
Figure 1 — SDT variables depicting the psychological mechanism through which the autonomy-supportive intervention affects vitality and exercise attendance.
Materials and Methods

Participants

Participants were 35 Greek women age 30 to 58 years (mean = 44.26 ± 7.40) partaking in a community-based exercise program free of charge. Sixteen of them (45.7%) were university graduates whereas 19 (54.3%) had reached senior high school. The experimental group (autonomy-supportive instructing style) consisted of 19 females age 30 to 58 years (mean = 46.21 ± 7.74) with 2 to 20 years of exercise experience (mean = 11.32 ± 4.58), while the control group (lack of autonomy-support instructing style) consisted of 16 females age 30 to 50 (mean = 41.94 ± 6.45) with 1 to 20 years of exercise experience (mean = 10.31 ± 5.22) (see Figure 2 for participant flowchart). Given that there was no capability to randomly allocate the participants to the control/experimental group because they had already been exercising in this program before the initiation of the intervention, a quasi-experimental design was used. These 2 groups were randomly selected to represent the control and the experimental group (see Figure 2).

Figure 2 — Participant flowchart.
Measures

Perceived autonomy support (PAS) by the exercise instructor was measured using an exercise-specific version of the Health Care Climate Questionnaire. In the current study the term “my health care provider” was replaced with “my exercise instructor.” Sample items included “I feel that my exercise instructor provides me with choices and options.” Exercise participants responded to a 7-point Likert-type scale ranging from 1 (“strongly disagree”) to 7 (“strongly agree”).

The Basic Psychological Needs in Exercise Scale (BPNES) developed with Greek exercise participants, was used to assess the degree to which the needs for autonomy, competence, and relatedness were fulfilled during exercise. The BPNES comprises 12 items (4 per subscale). Items follow the stem “In the present exercise setting . . .” and include for autonomy, “The exercise program I follow is highly compatible with my choices and interests”; for competence, “I feel I have been making a huge progress with regard to the end result I pursue”; and for relatedness, “I feel that I associate with the other exercise participants in a very friendly way.” Participants were asked to report their agreement with 12 statements by providing their responses on a 5-point Likert-type scale ranging from 1 (“do not agree at all”) to 5 (“very strongly agree”).

The Behavioral Regulation in Exercise Questionnaire—Greek exercise participants was used to assess behavioral regulations in exercise. The scale comprises 5 subscales: amotivation (4 items: eg, “I don’t see why I should have to exercise”), external regulation (4 items: eg, “I exercise because other people say I should”), introjected regulation (3 items: eg, “I feel guilty when I don’t exercise”), identified regulation (4 items: eg, “I value the benefits of exercise”), and intrinsic motivation (4 items: eg, “I exercise because it’s fun”). Responses were provided on a 5-point Likert-type scale ranging from 1 (“strongly disagree”) to 7 (“very strongly agree”).

Participants’ levels of vitality were assessed via the Subjective Vitality Scale, a 7-item scale assessing feelings of aliveness and energy in general, at the trait level (eg, “I feel alive and vital”) on a 7-point Likert-type scale ranging from 1 (“not at all”) to 7 (“very much”). Self-reported frequency of exercise behavior was assessed using the Godin Leisure Time Exercise Questionnaire (GLTEQ). Participants responded to 3 questions assessing the frequency of strenuous, moderate, and mild exercise performed for a minimum of 15 min in a typical week. Scores were calculated by multiplying the weekly frequency of strenuous (running, vigorous swimming), moderate (easy cycling), and mild (easy walking) activity by 9, 5, and 3 METS (units of metabolic equivalence), respectively.

Participants’ perceived exertion was assessed immediately after the end of every class via Borg’s Scale of Perceived Exertion. Responses were provided to the question: “How intense did you find the exercise today?” Responses ranged from 6 (“not at all intense”) to 20 (“maximum intensity”). Borg’s scale was used to examine whether participants in both groups perceived the exercise program as equally difficult to ensure that possible differences on the outcome variables are not attributable to perceived exertion differences between the groups.

The effectiveness of the intervention was evaluated by distributing at the end of every single exercise class a scale comprising 6 items of the Health Care Climate Questionnaire. The items were selected to evaluate the extent to which the participants became aware of the autonomy-supportive strategies used by the exercise instructor in each group. The scale was phrased at the situational level of generality and was used as the manipulation check of the intervention. Sample items included, “In today’s class I felt that the exercise instructor was providing me choices and options” and “In today’s class the exercise instructor was encouraging me to ask questions.” Responses were provided on a 7-point Likert-type scale ranging from 1 (“strongly disagree”) to 7 (“strongly agree”).

Further, persistence to exercise was measured via monitoring the participants’ exercise attendance during the intervention.

Procedure

Verbal permission to conduct the study was granted by the managing committee of the community fitness center. The exercise classes were held 3 times per week (on Monday, Wednesday, and Friday) during evening times (experimental group 5 PM to 6 PM and control group 6 PM to 7 PM) for a total of 8 weeks. In total, each group attended 25 exercise sessions (the intervention was applied during the 24 exercise sessions starting from session 2). The exercise program in both conditions was almost identical and it comprised dance aerobic exercises during the first part (for about 35 minutes) and pilates-based strengthening exercises during the second part of the class (for about 20 minutes with 5 minutes of stretching/cool down at the end). Classes in both conditions were run by the same
exercise instructor (a female professional with 12 years of exercise-instructing experience) who was familiar with SDT and the principles of autonomy-supportive instructing practices. The classes were held in the same location and at the same time of the day and lasted for 60 minutes in total. The participants provided written informed consent for participation in the study while the conduct of the study followed the Aristotle University’s research regulations.

Before the first class of the exercise program participants were informed that they would take part in a study which would last for about 2 months. In both conditions the investigators informed the participants that the study aimed to examine reasons for exercise participation and their attitudes about exercise in general. All the exercise participants from both conditions agreed to participate in the study. Then, they took part in the first class in which the exercise instructor followed a typical instructing style—the same for both groups. After the end of the first class, participants were asked to provide written informed consent for participation in the study and they got assured about the confidentiality and anonymity of their responses. Before the beginning of the second class they completed the initial questionnaire packet (measuring demographic variables, PAS, need fulfillment, their behavioral regulations, subjective vitality, and basic psychological need satisfaction in their life in general). In the first part of the questionnaire participants were asked to provide their name initials and date of birth to match their data across repeated assessments. The first questionnaire packet was distributed before the beginning of the second exercise class and not during the first class so that participants in the experimental group would be able to compare the exercise instructing style used in the first class before initiation of the intervention with the autonomy-supportive instructing style used after initiation of the intervention in the second class. Experience with the new instructor and the new exercise regimen during the first class was essential to provide meaningful responses on such a comparison.

**Content of the Intervention**

In the autonomy-supportive condition (experimental group), the exercise instructor adopted an autonomy-supportive interpersonal style in her interaction with the participants. An autonomy-supportive environment satisfies the need for autonomy by providing a meaningful rationale, opportunities for choice and positive feedback, by acknowledging the difficulties and by using neutral language during interpersonal communication. Thus, the exercise leader provided a meaningful rationale for the exercise activities using meaningful arguments pointing to the health benefits and the mood-enhancing effects of exercise. Moreover, the structure of the class was such that at the first part of the class participants could choose the music they preferred from 3 different styles of music (modern dance, disco '80s, and Latin) and therefore the style of the choreography. Within this part of the class, exercises were allowed to slightly deviate from the instructors’ style to be performed based on the participants’ personal style. For the second part of the class, participants had the opportunity to choose the exercise they preferred from a list of 2 to 3 exercises for every group of muscles and/or 2 to 3 difficulty levels. Furthermore, the exercise leader used neutral language (eg, used “may” and “could” rather than “must” and “should”) and provided positive feedback related to participants’ effort rather than performance. Also, the exercise leader was acknowledging the difficulties and minimized any pressure resulting from the expectation to perform the exercises in the ideal form.

In the control condition which we have labeled “lack of autonomy support,” the exercise instructor followed an instructing style characterized by a lack of an emphasis on autonomy supportive practices. According to SDT an environment is controlling when people in positions of authority (eg, exercise instructors) do not provide meaningful rationales and choice for the activities and use pressuring language. In the current study, the exercise instructor did not provide rationales and did not allow choices but she used neutral and not pressuring language. In a recent study in the sport context, the authors proposed 5 dimensions of a controlling interpersonal environment: 1) controlling use of rewards, 2) negative conditional regard, 3) intimidation, 4) excessive personal control, and 5) judging and devaluing. In the current study and in line with the above criteria, the exercise instructor did not use a controlling instructing style in the control group. However, she was expecting to see the ideal way of performing the exercises and she was correcting all exercises not performed in an ideal form.

The effectiveness of the delivery of the intervention was examined via a manipulation check using a short questionnaire that the participants were requested to complete at the end of every single exercise class. This short questionnaire was initially distributed in the second class in which the intervention was initiated. That questionnaire assessed participants’ perceptions of the extent to which the exercise instructor displayed a number of specific autonomy-supportive behaviors (eg, providing choices, encouraging questions, answering to questions, trying to understand how participants see things) and also levels of participants’ perceived exertion via Borg’s scale of perceived exertion.

The participants completed the main questionnaire packet 4 times in total [ie, before initiation of the second exercise class (1st week—time 1), in the middle of the intervention (4th week—time 2), after termination of the intervention (8th week—time 3), and 5 weeks after termination of the intervention (time 4)] during which the participants did not take part in any structured exercise program because the fitness center was closed due to holiday. Responses were always provided at the...
contextual level of assessment and before initiation of that day’s exercise class. Frequency of attendance in nonstructured strenuous, moderate, and mild exercise was measured once, 5 weeks after termination of the intervention.

Statistical Analysis

Data normality was examined using the Kolmogorov—Smirnov test, while Mauchly’s test of sphericity was also used to ensure that the variability of the changes between the different measurement time points was constant. Where Mauchly’s test suggested that this was not the case and that a conventional F-test would be biased, the Greenhouse-Geisser correction to the F-test was used to remove the bias. A repeated measures MANOVA (2 × 4) was computed to examine the multivariate interaction between the 2 groups (experimental and control) and measurements over time (measure 1, measure 2, measure 3, and follow up) for behavioral regulations and subjective vitality. In addition, a series of 2 × 3 repeated-measures ANOVA and MANOVA were computed between the 2 groups (experimental and control) and measurements over time (measure 1, measure 2, and measure 3) using as dependent variables the scores of PAS by the exercise instructor and the psychological needs for autonomy, competence and relatedness, respectively. Given statistically significant multivariate interaction group by time terms, post hoc tests were used to examine the between-group and the within-group mean differences. A 2 × 4 design was used for the behavioral regulations and trait subjective vitality given the postulated relatively stable nature of these constructs when assessed at the contextual level of generality in measurement. With respect to the subjective vitality analyses, participants’ scores on the satisfaction of the basic psychological needs in general in one’s life were used as covariates to more accurately evaluate the changes in trait subjective vitality attributable to the autonomy-supportive intervention alone. Further, independent samples t tests were used to compare frequency of exercise attendance during the program and possible exercise participation during the follow up period.

Results

Descriptive statistics and Cronbach’s α values were computed for all variables at each measurement point for both conditions (Table 1). Internal consistency estimates were systematically greater than .70 except for introjected regulation and the assessment of the 3 needs in general in the first measurement occasion where the coefficients were slightly lower.

Variable Pairwise Correlations

Pairwise correlations between all variables were calculated for the first measurement time point (Table 2). The results showed that basic psychological needs displayed significant positive pairwise correlations. The behavioral regulations displayed the expected simplex-like pattern of correlations in line with the self-determination continuum. Trait subjective vitality displayed significant positive correlations with the psychological needs, identified regulation and intrinsic motivation and a negative correlation with amotivation. PAS displayed significant positive correlations with the psychological needs and vitality and negative correlations with external regulation and amotivation.

Manipulation Check

To determine whether the participants of the experimental group perceived the instructors’ behavior as more autonomy-supportive compared with the instructors’ behavior in the control group, independent samples t tests were computed for each exercise class separately. The 2 groups were compared on a composite score of the behaviors reflecting the construct of autonomy support (eg, provision of choice, providing rationales for the activities etc.). These behaviors are reported in detail in the description of the intervention. Descriptive statistics were computed for this composite score for every class (Figure 3). Independent samples t tests computed for every single class showed significant differences between the experimental and the control group (P < .001) in the expected direction for all classes (Figure 3). In regard to levels of perceived exertion during the exercise classes, the 2 groups did not differ statistically for 15 out of 24 classes.

Preliminary Analysis

An initial 1-way MANOVA showed no significant differences in the scores of PAS, basic psychological needs, behavioral regulations, and subjective vitality between the 2 groups for the first measure (time 1) providing evidence of equivalence of the groups in the dependent variables under investigation before initiation of the intervention.

Perceived Autonomy Support

A 2 × 3 repeated-measures ANOVA indicated significant differences for PAS [F(2, 66) = 174.60, P < .001, η² = .84] between the experimental and the control group. An eta squared value of .00 corresponds to a small effect size, a value of .05 to a medium effect size and a value of .13 to a large effect size.33 Post hoc tests showed significant differences (P < .001) between the group means for measures 2 and 3 with higher means for the experimental group. Within-group comparisons showed a significant increase (P < .001) in PAS means of the experimental group for measures 2 and 3 while a significant reduction (P < .001) was observed for the control group for measures 2 and 3 in comparison with the initial scores.

Basic Psychological Needs

The initial 2 × 3 MANOVA for basic psychological needs displayed a significant multivariate interaction term [Wilks’s λ = .003, F(9, 25) = 73.20, P < .001,
Table 1  Descriptive Statistics and Cronbach’s α Coefficients for Basic Psychological Needs, Behavioral Regulations, Subjective Vitality, Perceived Autonomy Support, and Basic Psychological Needs in General at Weeks 1, 4, 7, and Follow-Up

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<th>Week 7</th>
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<td>SDT</td>
<td>C</td>
<td>α</td>
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<td>C</td>
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<td>4.80 ± 0.42*4</td>
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<td>External regulation</td>
<td>.70</td>
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<td>0.84 ± 0.61</td>
<td>.91</td>
<td>0.56 ± 0.45*123</td>
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<td>2.86 ± 0.39*</td>
<td>1.73 ± 0.9223</td>
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<td>Identified regulation</td>
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<td>3.49 ± 0.43</td>
<td>3.33 ± 0.50</td>
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<td>Subjective vitality</td>
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<td>4.82 ± 1.12</td>
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<td>Perceived autonomy support</td>
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<td>3.84 ± 0.28</td>
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<td>6.05 ± 0.57*12</td>
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<td>General relatedness</td>
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<td>5.32 ± 0.96</td>
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<td>General competence</td>
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<td>5.23 ± 0.87</td>
<td>5.45 ± 0.87</td>
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Abbreviations: C, control group; SDT, autonomy-supportive condition.

Note. Subjective vitality differences were statistically corrected for global needs differences.

* Significantly different from control group; 1 significantly different from measure 2 (experimental group); 2 significantly different from measure 3 (experimental group); 3 significantly different from measure 4 (experimental group); 4 significantly different from measure 3 (control group); 5 significantly different from measure 4 (control group).
### Table 2  Pairwise Pearson’s Correlations for the First Measurement Occasion

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<td>1. Competence</td>
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<td>.68**</td>
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<td>4. External regulation</td>
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<td>−.14</td>
<td>.16</td>
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<td>5. Introjected regulation</td>
<td>.57**</td>
<td>.42*</td>
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<td>−.33*</td>
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<td>6. Identified regulation</td>
<td>.53*</td>
<td>.34*</td>
<td>.21</td>
<td>−.42*</td>
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<td>7. Intrinsic motivation</td>
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<td>−.40*</td>
<td>.52**</td>
<td>.78**</td>
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<td>.50**</td>
<td>−.41*</td>
<td>−.53**</td>
<td>−.61**</td>
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<td>9. Subjective vitality</td>
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<td>.35*</td>
<td>−.29</td>
<td>.27</td>
<td>.43**</td>
<td>.45**</td>
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<td>11. Autonomy in general</td>
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<td>.45**</td>
<td>.39*</td>
<td>−.18</td>
<td>.03</td>
<td>.21</td>
<td>.23</td>
<td>−.34*</td>
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<td>.03</td>
<td>−.09</td>
<td>−.30</td>
<td>.08</td>
<td>−.06</td>
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<td>.40*</td>
<td>−.15</td>
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<td>13. Competence in general</td>
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<td>.17</td>
<td>−.02</td>
<td>−.05</td>
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<td>.39*</td>
<td>.06</td>
<td>.35*</td>
<td>.41*</td>
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*Note. N = 35; ** significant at the .001 level; * significant at the .05 level.*

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**Figure 3** — Perceived levels of autonomy-supportive exercise-instructing behaviors for the experimental (SDT group) and the control group for all exercise classes.
Further repeated-measures ANOVAs showed significant differences in the degree to which the needs for competence \([F(2, 66) = 17.46, P < .001, \eta^2 = .34]\) and autonomy \([F(2, 66) = 37.48, P < .001, \eta^2 = .53]\) were fulfilled between the 2 groups. Specifically, the experimental group displayed higher competence and autonomy means in measures 2 and 3 compared with the control group \((P < .001)\). Regarding the within-group comparisons for the experimental group, post hoc tests using the within error term showed significant increases in competence between measures 1 and 3 \((P < .001)\) and for autonomy between measures 1 and 2 \((P < .05)\), measures 1 and 3 \((P < .001)\) and measures 2 and 3 \((P < .05)\). Within group comparisons for the control group showed a significant decrease for competence between measures 1 and 3 \((P < .05)\) and for autonomy between measures 1 and 2 \((P < .05)\) and measures 1 and 3 \((P < .001)\). There were neither between-group nor within-group significant differences on the need for relatedness.

**Behavioral Regulations**

The initial \(2 \times 4\) MANOVA for behavioral regulations displayed a significant multivariate effect \([Wilks's \lambda = .02, F(20, 14) = 23.53, P < .001, \eta^2 = .97]\). Further repeated-measures ANOVAs showed significant mean differences for amotivation \([F(3, 99) = 12.64, P < .001, \eta^2 = .27]\) between the experimental and the control group, external regulation \([F(3, 99) = 25.42, P < .001, \eta^2 = .43]\), introjected regulation \([F(3, 99) = 10.11, P < .001, \eta^2 = .23]\), identified regulation \([F(3, 99) = 10.16, P < .001, \eta^2 = .23]\), and intrinsic motivation \([F(3, 99) = 25.27, P < .001, \eta^2 = .43]\).

Post hoc tests showed significant between-group differences in the hypothesized direction for external regulation \((measure 2, P < .05; measure 3 and follow-up measure, P < .001)\), identified regulation \((measure 2, P < .05; measure 3 and follow-up, P < .001)\), intrinsic motivation \((measures 2, 3 and follow-up, P < .001)\), and amotivation \((measure 3, P < .05 and follow-up, P < .001)\). With respect to introjected regulation, the post hoc tests showed greater means for the experimental group for measures 2, 3, and the follow-up \((P < .001)\). Within-group comparisons showed a significant decline in external regulation for the experimental group \((P < .001)\) from measure 1 to measures 3 and 4 and from measure 2 to measures 3 and 4 while no changes were observed for the control group. For introjected regulation no significant differences were observed across measurement points for both groups. Identified regulation and intrinsic motivation showed a significant increase \((P < .05)\) from measure 1 to measures 3 and 4 for the experimental group while no significant differences were observed for the control group. For intrinsic motivation, the control group means were significantly reduced \((P < .001)\) from measure 1 to measures 2, 3, and 4. Within-group comparisons for amotivation showed a significant reduction \((P < .05)\) in the experimental group for measures 2, 3, and 4 while no significant differences emerged for the control group.

**Subjective Vitality**

A \(2 \times 4\) repeated measures ANCOVA was calculated with subjective vitality as the dependent variable and scores of the participants’ basic psychological needs in general as the covariates (i.e., autonomy, competence, relatedness). Results showed that the 2 groups differed significantly in subjective vitality \([F(3, 90) = 23.56, P < .001, \eta^2 = .38]\) and specifically in measures 2, 3, and the follow up. At within-group comparisons, the experimental group showed increased vitality means \((P < .001)\) during measurements 2, 3, and the follow up. In contrast, the control group displayed reduced vitality means from measure 1 to measure 3 and the follow up \((P < .05)\).

**Frequency of Exercise Class Attendance**

An independent samples \(t\) test showed that participants in the experimental group participated significantly more frequently during the exercise program than individuals in the control group \((t = 6.60, P < .001)\). More specifically, the experimental group participants \((mean = 19.26 \pm 1.45)\) attended the exercise classes more often than the control group participants \((mean = 16.19 \pm 1.28)\). Furthermore, independent samples \(t\) tests showed that the 2 groups differed in weekly frequency of moderate \((t = 2.52, P < .001)\) and mild \((t = 3.21, P < .05)\) exercise behavior during the 5 weeks after termination of the intervention with the experimental group participants reporting higher levels of exercise attendance in moderate \((mean = 0.63 \pm 0.60)\) and mild \((mean = 1.53 \pm 0.84)\) exercise behavior compared with the control group participants \((moderate exercise: mean = 0.19 \pm 0.40; mild exercise: mean = 0.63 \pm 0.81)\).

**Discussion**

The aim of the current study was to evaluate the effectiveness of an intervention based on SDT principles in positively influencing perceptions of autonomy support, basic psychological needs, behavioral regulations, subjective vitality, and exercise behavior among Greek female middle-age exercise participants. In support of the first hypothesis, participants in the experimental condition perceived greater levels of autonomy support by the exercise instructor. That is, the provision of a meaningful rationale, choices, and positive feedback as well as acknowledging difficulties and using neutral language enhanced participants’ perceptions of autonomy support. In contrast, participants in the control group (lack of autonomy support exercise condition) reported a decrease in PAS. Despite the use of neutral language—which is an autonomy-supportive behavior—in the control group condition, the decrease in PAS is linked to not providing any rationale, not allowing choices, expecting to see the ideal form of exercise performance, and correcting every wrong exercise performance that are behaviors postulated to create a controlling interpersonal environment. Hence, the present findings further support the validity and effectiveness of the instructor behaviors...
postulated by Deci and Ryan in creating corresponding perceptions and a differential viewpoint of the activity for the participants.

**Basic Psychological Needs**

In support of the second hypothesis, participants in the experimental group reported a significant increase in the fulfillment of the needs for autonomy and competence whereas participants in the control group reported a significant decrease for the same needs. Hence the findings support SDT tenets on the effectiveness of autonomy-supportive behaviors in positively influencing the fulfillment of the needs for autonomy and competence. In terms of the decrease of the need for competence satisfaction scores in the control group, such a phenomenon may be attributable to the fact that the exercise instructor did not systematically enacted specific behaviors targeted at satisfying participants’ need for competence. Thus, it seems that a systematic lack of such competence-supporting behaviors and consequently of information that may enhance the participants’ sense of competence might have lowered their scores on competence need satisfaction. It seems that a lack of such competence-enhancing instructing behaviors does not simply leave the perception of the need for competence unaffected but in the long term leads to the decrease of such perceptions. Therefore, future research may study more closely those exercise-instructing behaviors that may more efficiently enhance the participants’ need for competence. However, levels of relatedness did not change as a function of the intervention in any of the conditions. One explanation for this finding may be the lack of intervention component behaviors specifically tailored to enhance interpersonal relationships between the exercise participants. Previous SDT experimental research manipulating an autonomy-supportive interpersonal climate demonstrated a significant increase in competence and relatedness need satisfaction rather than autonomy. An alternative explanation may be the postulation that there are situations where relatedness plays a less central role to intrinsic motivation than autonomy and competence, and especially in behaviors in which people may engage in isolation. Exercise is such an example where a considerable number of participants do not participate out of pursuing the cultivation of social relationships but rather the attainment of physical fitness and an improved physique. Deci and Ryan have suggested that relational supports may not be necessary as proximal factors to maintain intrinsic motivation and this could be also the case for exercise participation. Thus, the need exists to further delineate the role of specific instructor behaviors in influencing each of the 3 psychological needs for competence, autonomy, and relatedness.

**Behavioral Regulations**

In support of the third hypothesis, the experimental group reported a significant increase in levels of identified regulation and intrinsic motivation in contrast to the control group that reported a decrease in intrinsic motivation and no change in identified regulation. Moreover, the experimental group reported a decrease in external regulation and amotivation while the control group reported no change in these variables. These results compare favorably with previous SDT physical activity research. With respect to introjected regulation, the results showed an increase in favor of the SDT group participants over time. A probable explanation may be that motivation is composed of various dimensions simultaneously and it is the relative preponderance of some regulations over other (not any individual type alone) which may determine outcomes. Another explanation may be that some degree of covariance among regulations is expected. Previous research in the exercise context has found similar results in female samples. The increase of introjected regulation in female samples may be explained because females tend to be more concerned with their appearance and body image in general that often are heightened in exercise settings. Thus, the female exercise participants in the current study may have used social standards of physique increasingly so as the exercise program unfolded, to judge their self worth. Ego involvement and contingent other-referenced judgments of self worth are held to be contributors to greater introjections. Moreover, in another study in the exercise context it was found that introjected regulation was a positive predictor of several motivational consequences (such as more frequent exercise participation) only in female participants suggesting that females may experience a sense of pride associated with exercise or some degree of guilt if they don’t exercise. Thus, it is possible that in small class sizes led by 1 instructor (as in the current study) it would be more noticeable for a participant missing a class compared with classes with greater numbers of participants and multiple instructors. Thus, this increase in introjected regulation may be due to the participants’ feeling guilty about missing a class. Clearly, future research should take a closer look at the motivating role of this type of behavioral regulation.

**Subjective Vitality**

Support was further obtained for the fourth hypothesis concerning the reported increase of levels of trait subjective vitality in the experimental group. That is, in line with SDT assumptions, perceptions of an autonomy-supportive interpersonal environment may lead to increased feelings of perceived energy available to the self. As expected, the control group reported a decrease in subjective vitality supporting a cause-and-effect relationship between feeling more alive and full of energy when experiencing an autonomy-supportive interpersonal environment.

**Exercise Behavior**

In support of the fifth hypothesis, participants in the experimental group demonstrated greater levels of behavioral engagement in exercise. A significant difference in
the frequency of exercise attendance was observed with participants in the experimental condition attending the exercise program more regularly than their counterparts in the control condition. They were also more likely to exercise during leisure time than participants in the control group and self-reported greater moderate and mild exercise participation during 5 weeks after termination of the intervention in contrast to the control group that demonstrated poorer exercise engagement. These findings concur with previous studies that demonstrate that SDT-based interventions can enhance levels of exercise adherence.\textsuperscript{16,17,19,20} In addition, the results support the possibility of training exercise instructors to create a class environment marked by autonomy. These findings concur with prior research indicating that teachers and health-care professionals can be effectively trained to adopt a self-determination centered instructing style.\textsuperscript{16–18}

Overall, results suggest that a well-structured exercise class based on SDT principles enhances self-determined motivation, facilitates feelings of vitality and leads to greater persistence to exercise. The results are in line with previous findings in the health context suggesting that autonomy-supportiveness positively influences self-determined motivation.\textsuperscript{35,36} In addition, the results are in line with previous research showing that engaging in an autonomous and self-regulated activity can help maintain or enhance subjective vitality.\textsuperscript{37} In agreement with results from a previous study in the health context\textsuperscript{22} autonomy-support is found to play a key role in the commitment for exercise participation. Overall, the results of the current study highlight the benefits of an autonomy-supportive instructing style on middle-age women’s participation in exercise.

Limitations and Future Directions

The present findings are limited to Greek middle-age healthy women. Clearly the effectiveness of the present intervention should be reexamined not only with healthy middle-age men but also individuals with chronic disease or musculoskeletal disorders where exercise may be an important component of rehabilitation. Further, given the lack of a capability to randomly allocate the participants into the groups, future SDT studies should also improve on this aspect of the experimental design, and also replicate the current study using longer postintervention assessment time frames to more accurately examine the long term effects of such an intervention. In addition, future research should delineate the specific components of SDT-based interventions that may differentially influence each of the needs for autonomy, competence, and relatedness.

General Conclusion

Despite the low levels of exercise involvement among adults, autonomy-supportive instructing strategies in exercise may enhance exercise attendance by creating circumstances that may facilitate perseverance in exercise.

References


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