Longitudinal Associations Between Exercise Identity and Exercise Motivation: A Multilevel Growth Curve Model Approach

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Abstract

Objectives: Past work linking exercise identity and exercise motivation has been cross-sectional. This is the first study to model the relations between different types of exercise identity and exercise motivation longitudinally. Understanding the dynamic associations between these sets of variables has implications for theory development and applied research.

Design: Longitudinal survey study.

Methods: Participants were 180 exercisers (79 men, 101 women) from Greece, who were recruited from fitness centres and were asked to complete questionnaires assessing exercise identity (exercise beliefs and role identity) and exercise motivation (intrinsic, identified, introjected, external motivation, and amotivation) three times within a six month period.

Results: Multilevel growth curve modelling examined the role of motivational regulations as within- and between-level predictors of exercise identity, and a model in which exercise identity predicted exercise motivation at the within-and between-person levels. Results showed that within-person changes in intrinsic motivation, introjected, and identified regulations were positively and reciprocally related to within-person changes in exercise beliefs; intrinsic motivation was also a positive predictor of within-person changes in role-identity, but not vice versa. Between-person differences in the means of predictor variables were predictive of initial levels and average rates of change in the outcome variables.

Conclusions: The findings show support to the proposition that a strong exercise identity (particularly exercise beliefs) can foster motivation for behaviours that reinforce this identity. We also demonstrate that such relations can be reciprocal over time and can depend on the type of motivation in question as well as between-person differences in absolute levels of these variables.

Keywords: motivational regulations, physical activity, longitudinal, self-determination theory

Introduction

Two factors that have been shown in the exercise psychology literature to be influential in terms of levels of exercise/physical activity (PA) participation are exercise identity and exercise motivation. Exercise identity refers to the extent to which one holds the role of "exerciser" as core aspect of one's identity.[1] Exercise motivation refers to the different reasons one identifies for engaging in exercise.[2] There is ample evidence to suggest that high levels of exercise identity and certain types of exercise motivation predict higher levels of PA, either directly or via mediating mechanisms.[3,4] What is less known is whether exercise identity and exercise motivation change over time, the extent to which such changes are reciprocally linked, and whether they differ across individuals. In this paper we address all these issues. This is a worthwhile pursuit for two reasons. First, all previous work linking exercise identity and motivation has been cross-sectional. Second, understanding the dynamic associations between these two sets of variables has implications for theory development as well as directing the focus of intervention research.

According to identity theory, the more salient one's identity is, the more likely it is that an individual will engage in behaviours associated with that identity.[1] In terms of exercise identity, research has shown that individuals with a more salient identity are more physically active and have greater fitness.[3,4] Such findings are not moderated by gender or age[5]. Exercise identity has also been linked with different types of exercise motivation, drawing from self-determination theory[6] (SDT), to explain why individuals will engage in behaviours that reinforce their identity. According to SDT, motivation for engagement in any type of behaviour varies along a continuum of self-determination. At the most self-determined end of this continuum is intrinsic motivation, which reflects activity engagement due to enjoyment or personal interest. Other types of motivation also high in self-determination are integrated regulation (motivation based on the fact that the activity represents one's core set of values) and identified regulation (motivation stemming from the personal importance and benefit of the behaviour). Intrinsic motivation, identified and integrated regulations are considered high self-determined types of motivation and have been linked with a variety of adaptive outcomes in the health domain[7] (e.g., treatment adherence, well-being). According to SDT, behaviour can also be motivated by introjected regulation (i.e., feelings of guilt and other types of internal control, such as contingent self-worth) and external regulation (e.g., external pressures or rewards, efforts to gain approval by others). Both introjected and external regulations are considered low in self-determination, with the latter lying on the lowest end of the self-determination continuum. Both regulations have been linked with maladaptive outcomes such as ill-being and low levels of behavioural engagement.[7] In the SDT literature, amotivation is also proposed as a non-self-determined factor reflecting lack of motivation to engage in a particular activity.

A number of studies have examined the relations between exercise identity and different types of motivation. Given that those with strong exercise identity are more likely to engage in PA because this behaviour is congruent with their identity, it is likely that their motivation for PA is self-endorsed. Indeed, researchers[3,8] have hypothesised and found direct and positive relations between high exercise identity and more self-determined forms of motivation for PA, particularly with integrated and identified regulations. Both types of regulations reflect motivation stemming from a high degree of internalisation of behaviour as part of one's identity, values and belief system. Other studies[4,9] which separated between two related types of exercise identity (see Methods for more details) also reported similar patterns of relations between each type of exercise identity and self-determined types of motivation. Although there have been studies examining longitudinal changes in exercise motivation,[10] such studies in the exercise identity literature are scarce and limited to very small time frames (up to two weeks).[11] Reifsteck and colleagues[3] have argued that although identities are fairly stable, they can change over time. Such changes might affect the motivation to engage in behaviours that reinforce such identities. Indeed, Reifsteck and colleagues[3] identified the need for future research to examine longitudinally the relations between exercise identity and exercise motivation.

The aim of the present study is to respond to this recommendation. Specifically, we first modelled change in exercise identity and exercise motivation over a period of six months. In line with recent findings on longitudinal changes in exercise motivation[12] and the internalization processes proposed by SDT, we hypothesised an increase in the high self-determined types of motivation (i.e., intrinsic motivation, identified regulation) and a decrease in the low self-determined types of motivation (i.e., introjected and external regulation) and amotivation for the participants over time. Based on previous findings showing increases in exercise identity over a 14-week exercise class,[13] we hypothesized increases in exercise identity over the study period among the exercisers. We then examined the relations between exercise identity and exercise motivation over time. Given that exercise identity has been tested as a predictor of exercise motivation[3] and as an outcome of it,[9] we tested both types of models using multilevel growth curve modelling to examine their reciprocal associations over time. We did so in ways that separated within-person associations from between-person differences in exercise motivation and exercise identity.

For the model in which exercise identity predicted exercise motivation, we hypothesised that at the between-person level, higher exercise identity would predict higher initial levels of and increases over time in the more self-determined types of motivation, as well as lower initial levels of and decreases over time in low self-determined motivation and amotivation. At the within-person level we hypothesised that exercisers with higher exercise identity at a specific time point would report higher levels of self-determined types of motivation and lower levels of low self-determined motivation and amotivation.

For the model in which exercise motivation predicted exercise identity, we similarly hypothesised at the between-person level that the more self-determined types of motivation would predict higher initial levels of and increases over time in exercise identity, whereas low self-determined motivation and amotivation would predict lower initial levels and decreases in exercise identity over time. At the within-person level we expected that exercisers with higher levels of self-determined motivation at a specific time point would report higher exercise identity, whereas those with low self-determined motivation/amotivation at a specific time point would report lower exercise identity.

Method

A total of 180 regular exercisers (79 men, 101 women) from Greece, with a mean age of 30.1 (range 17-63 years, *SD* = 9.6), participated in this study. The participants exercised on average 3.9 times per week (range 1 to 10 times per week, *SD* = 1.3), with most participants (80.5%) reporting three to five exercise sessions per week. The participants reported a mix of group-based exercise classes (30.0%), weight training activities (48.9%), or a combination of both activities (21.1%) as primary type of exercise.

Participants completed the Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2). The BREQ-2 consists of 19 items that measure intrinsic motivation (e.g., “I exercise because it’s fun”), identified regulation (e.g., “I value the benefits of exercise”), introjected regulation (e.g., “I feel guilty when I don’t exercise”), external regulation (e.g., “I exercise because other people say I should”), and amotivation (e.g., “I don’t see why I should have to exercise”). Items are scored on a 5-point scale (0 = *not true for me*; 5 = *very true for me*). A 5-factor solution of the BREQ-2 had excellent model fit in confirmatory factor analyses,[14] including Greek samples.[15] Participants also completed the Exercise Identity Scale[1] (EIS). The EIS measures the degree to which exercise is a central part of one’s identity. Confirmatory factor analyses,[16] including with Greek samples,[4] showed that this scale consists of two factors that capture role-identity (3 items; e.g., “I consider myself an exerciser”) and exercise beliefs (e.g., 6 items; e.g., “I need to exercise to feel good about myself”). Items were rated on a 7-point scale (1 = *Strongly Disagree*; 7 = *Strongly Agree*).

Ethics approval was obtained by a university ethics committee in northern Greece. Data were collected from six private fitness centres and one community fitness centre in January, March, and June of the same year. Data were collected by a trained research assistant. Participants were told that there were no right or wrong answers and that they could choose not to participate in the study if they did not want to do so. A code based on name and surname initials along with date of birth was developed to match responses of the same individuals across the three time points.

We used Mplus[17] version 7.4 and the robust full information maximum likelihood estimator (MLR) to estimate multilevel growth curve models (MGM).[18] The robust ML estimator provides standard errors and a chi-square test statistic that are robust to non-normality; we used this estimator as some of the variables we measured displayed high kurtosis and/or skewness.[16] MGM are useful for handling nested data structures, for example, repeated measures nested within people.[19] It has been shown[20] that a sample of 50 or more is needed at level 2 to avoid biased estimates, particularly standard errors; our sample at level 2 was much larger (i.e., 180 individuals). Manifest scale mean scores were used in the analyses. First, random intercept models were estimated separately for each of the five behavioural regulations and the two exercise identity variables to explore the degree of variance attributable to the between- and within-person levels, and to calculate intra-class correlation coefficients (ICCs). A larger ICC indicates more between-person variance whereas a smaller ICC indicates more within-person variance. Second, we estimated unconditional linear MGM for each of the five behavioural regulations and the two exercise identity variables to examine their change patterns over time. The number of random effects was kept at a maximum as long as no convergence problems were encountered.[21] Time was centred at the first measurement point in each model, hence, the intercept can be interpreted as the group mean at the first measurement point. Third, we tested separate conditional MGM models in which (a) the five behavioural regulations were between- and within-person level predictors of exercise beliefs and role-identity, and (b) exercise beliefs and role-identity were between- and within-person level predictors of the five behavioural regulations. At the between-person level the slope and intercept factors were regressed on the predictors to explain between-person differences at the first time point and in change over time in the outcome variables. At the within-person level the predictors were included as time-varying covariates[22] to predict the outcome variables at each time point. Because all variables in this study contained both between-person (i.e., person-to-person differences in mean levels across time points) and within-person (i.e., variation around a person's mean level at a given time) variation, they can in the multilevel model be considered as two variables instead of one.[18] Specifying covariates as between- and within-level predictors decomposes the within-level covariate into two uncorrelated latent variables, which can be viewed as an implicit latent group-mean centring of the within-level covariate.[23, 24]

Results

There was a small percentage of missing data at the scale score level (< 3%) across the three measurement points; this small percentage of missing data can be handled well using the robust full information maximum likelihood (FIML) estimation.[25] Bivariate correlations, descriptive statistics, ICCs, and internal consistency of all study variables are displayed in Supplementary Table 1. In general, the participants reported low levels of amotivation and external regulation towards exercise, introjected regulation scores were around the midpoint of the scale, and identified regulation and intrinsic motivation scores were above the midpoint of the scale. Participants also reported relatively high levels of role-identity and exercise beliefs, scoring five or higher on a seven-point scale. Omega coefficients ranged from 0.60 to 0.93, with almost all of them being in the region of 0.70 and above. The ICCs ranged from 0.07 to 0.71 indicating that between 7% and 71% of the variance in the study variables was attributable to the between-person level. Taken together, the ICCs indicate that variance existed at both the between- and within-person levels and it was therefore appropriate to consider a multilevel model to account for clustering effects.

We looked at the correlations between age, self-reported BMI, gender, and the behavioural regulations and the exercise identity variables at each time point; most of them were weak and not statistically significant. Given the pattern of these correlations, and mindful of the fact that the inclusion of these variables would increase model complexity with no concurrent benefit, we did not include these variables in the analyses. We first tested univariate MGM. As indicated by the statistically significant slope coefficients (see Table 1) the participants' amotivation, external regulation, and introjected regulation on average decreased, whereas their levels of identified regulation, intrinsic motivation, exercise beliefs, and role-identity increased over the six months study period. Furthermore, the slope variances were not statistically significant indicating a relatively homogenous change pattern among the participants. Except for amotivation and external regulation, all intercept variances were statistically significant indicating between-person differences in initial levels at the first measurement point.

We then examined the role of the five behavioural regulations as between- and within-level predictors of exercise beliefs and role-identity (Table 2). At the between-person level, external regulation and identified regulation positively predicted exercise beliefs at the first measurement point. Intrinsic motivation positively predicted role-identity at the first measurement point. None of the behavioural regulations had a statistically significant association with average rate of change in exercise beliefs or role-identity over time. At the within-person level, introjected regulation, identified regulation, and intrinsic motivation positively predicted exercise beliefs, whereas only intrinsic motivation was a positive predictor of role-identity.

We finally examined the role of exercise beliefs and role-identity as between- and within-level predictors of the five behavioural regulations (Table 3). At the between-person level, exercise beliefs negatively predicted amotivation and positively predicted introjected regulation, identified regulation, and intrinsic motivation at the first measurement point, whereas role-identity negatively predicted introjected regulation at the first measurement point. Higher levels of exercise beliefs also predicted a lesser decrease in amotivation, a steeper decrease in introjected regulation, and a lesser increase in identified regulation (although not statistically significant) and intrinsic motivation across the three measurement points. Higher levels of role-identity predicted a lesser decrease in introjected regulation. At the within-person level, exercise beliefs were a positive predictor of introjected regulation, identified regulation, and intrinsic motivation.

Discussion

This is the first study to model the relations between different types of exercise identity and exercise motivation longitudinally, reciprocally, and by separating within-person associations from between-person differences in exercise motivation and exercise identity.

We used multilevel growth curve modelling to examine the role of motivational regulations as within- and between-level predictors of exercise identity, and vice versa. Overall, in alignment with past cross-sectional work[3,4] we found some support for our overall expectation that exercise identity will be reciprocally linked with self-determined motivation, but the findings varied as a function of the level of analysis and the type of exercise identity. Specifically, within-person changes in intrinsic motivation, introjected, and identified regulations were positively and reciprocally related to within-person changes in exercise beliefs; intrinsic motivation was also a positive predictor of within-person changes in role-identity, but not vice versa. Between-person differences in the means of some predictor variables were predictive of initial levels and average rates of change in some of the outcome variables, indicating inter-individual variability at the starting point and room for change in these variables. For example, individuals with higher exercise beliefs had lower amotivation and higher intrinsic motivation at the starting point, and hence less room for change, which explains why these individuals reported smaller decreases in amotivation and smaller increases in intrinsic motivation, compared to individuals with lower exercise beliefs.

Understanding changes in exercise motivation and exercise identity, as well as how these changes are related and can be dependent on between-person differences in these variables is important in terms of setting up effective interventions. Our findings provide a potential answer to calls for intervention ideas aiming to promote exercise identity.[11] We showed that within-person changes in exercise identity were positively and reciprocally related to changes in intrinsic motivation, identified regulation, and introjected regulation. Further, differences between individuals in the mean levels of these motivational variables did not predict changes in exercise identity, which indicates that what matters more for increases in exercise identity is not the absolute level of the three aforementioned motivational regulations, but the extent to which these regulations can change over time within persons. Hence, one way to promote exercise identity is to foster intrinsic motivation and identified regulation. Both types of motivation are self-determined in nature and have been shown to be amenable to change in situations in which the social context is supportive of exercisers' basic psychological needs for autonomy, competence, and relatedness.[26] However, introjected regulation, the third type of motivation that was shown to be reciprocally related to exercise identity in our study, is a maladaptive form of motivation, as it represents motivation to act due to internal pressures and contingencies (although in the short term this regulation has been found to be a positive predictor of behavioural engagement[12]). Such contingencies are also captured in some of the exercise beliefs items of EIS (e.g., "I need to exercise to feel good about myself"). In terms of theory and measurement refinement, future research on exercise identity should examine whether exercise beliefs (a component of exercise identity) require separation into a motivationally maladaptive component, such as the one above, and a component that is more motivation-conducive (e.g., "I have numerous goals relating to exercising"). Taking this a step further, one might test whether a motivationally maladaptive component represents exercise identity or if it is in fact a proxy measure of (low self-determined) motivation.

One limitation of our study could be that we did not assess integrated regulation, as this was not part of the BREQ-2. This regulation has been shown to be most strongly associated with exercise identity in previous studies[3,4] that have included a modified BREQ-2 which includes items for integrated regulation. However, an inspection of the items of this scale shows strong content overlap with several EIS items (e.g., "I consider myself an exerciser"), thus questioning the discriminant validity of the two measures, hence our decision not to use the modified BREQ-2 in our study. We propose that future measures of exercise identity focus exclusively on the identity/schema aspects and remove items that capture reasons for exercise. Both exercise identity and exercise motivation have been extensively related to physical activity in cross-sectional and longitudinal studies.[7, 11] Future research could examine the temporal dynamics of exercise identity and exercise motivation by assessing these variables at different time periods to provide a test of temporal sequence. Further, future research could expand our models by examining how objective measures of physical activity change over time, and whether such changes are associated with changes in exercise identity and exercise motivational regulations in mediational multilevel growth models (for an example of testing such a model see Cheong et al.).[27]

Perspectives

Understanding how exercise motivation and exercise identity change over time within individuals is important for understanding how to best support behaviour change.[3] We found that the relation between certain types of exercise motivation and exercise identity is mutually reinforcing over time but can vary across individuals. One potential way to support increases in exercise identity over time within individuals might be to foster exercise motivation by focusing on enjoyment and personal benefits derived from exercise.[10]

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Table 1

Univariate Multilevel Growth Curve Models of the Behavioural Regulations, Exercise Beliefs, and Role-Identity

	Amotivation		External regulation		Introjected regulation		Identified regulation		Intrinsic motivation		Exercise beliefs		Role-identity	
Fixed effects	*Est (SE)*	*p*	*Est (SE)*	*p*	*Est (SE)*	*p*	*Est (SE)*	*p*	*Est (SE)*	*p*	*Est (SE)*	*p*	*Est (SE)*	*p*
Intercept	0.42 (0.04)	0.000	0.49 (0.04)	0.000	2.27 (0.07)	0.000	3.38 (0.04)	0.000	3.10 (0.05)	0.000	5.48 (0.07)	0.000	5.00 (0.10)	0.000
Slope	-0.07 (0.03)	0.007	-0.12 (0.03)	0.000	-0.15 (0.03)	0.000	0.11 (0.02)	0.000	0.20 (0.02)	0.000	0.07 (0.03)	0.011	0.23 (0.03)	0.000
Random effects														
Intercept	0.04 (0.07)	0.548	0.04 (0.07)	0.575	0.52 (0.10)	0.000	0.14 (0.04)	0.000	0.28 (0.07)	0.000	0.70 (0.11)	0.000	1.38 (0.16)	0.000
Slope	0.00 (0.07)	0.982	0.00 (0.07)	0.982	0.00 (0.04)	0.913	0.00 (0.01)	0.780	0.01 (0.03)	0.794	0.02 (0.02)	0.405	0.06 (0.04)	0.112
Intercept-slope covariance	-0.00 (0.06)	0.946	-0.01 (0.06)	0.939	-0.02 (0.05)	0.657	-0.02 (0.02)	0.264	-0.04 (0.04)	0.223	-0.05 (0.04)	0.197	-0.23 (0.07)	0.001
Residual variance (within-level)	0.32 (0.06)	0.000	0.33 (0.06)	0.000	0.46 (0.04)	0.000	0.13 (0.02)	0.000	0.18 (0.05)	0.000	0.25 (0.03)	0.000	0.28 (0.04)	0.000

Note. *Est* = unstandardized estimate, *SE* = standard error.

Table 2

Multilevel Growth Models with Between-Person and Within-Person Predictions of Exercise Beliefs and Role-Identity

	Exercise beliefs		Role-identity	
	Est (SE)	*p*	*Est (SE)*	*p*
Fixed effects				
Intercept	-3.68 (3.81)	0.334	-4.75 (4.59)	0.300
Slope	-0.39 (1.52)	0.799	0.85 (1.85)	0.645
Between-person level				
Intercept (DV)				
Amotivation	-4.37 (2.82)	0.121	1.87 (3.28)	0.568
External regulation	6.32 (2.88)	0.028	-0.49 (3.57)	0.890
Introjected regulation	-0.10 (0.21)	0.648	0.01 (0.35)	0.988
Identified regulation	2.11 (0.99)	0.032	1.67 (1.25)	0.183
Intrinsic motivation	0.36 (0.35)	0.297	1.06 (0.47)	0.022
Slope (DV)				
Amotivation	1.82 (2.02)	0.369	1.25 (1.98)	0.527
External regulation	-1.53 (1.96)	0.434	-0.93 (1.72)	0.588
Introjected regulation	0.12 (0.12)	0.321	0.14 (0.17)	0.431
Identified regulation	-0.13 (0.36)	0.723	-0.25 (0.46)	0.588
Intrinsic motivation	0.16 (0.18)	0.361	-0.06 (0.19)	0.771
Within-person level				
Amotivation	0.21 (0.13)	0.106	0.14 (0.15)	0.356
External regulation	-0.24 (0.14)	0.087	-0.12 (0.17)	0.499
Introjected regulation	0.22 (0.04)	0.000	0.09 (0.05)	0.068
Identified regulation	0.24 (0.08)	0.002	0.12 (0.11)	0.275
Intrinsic motivation	0.28 (0.07)	0.000	0.28 (0.09)	0.003
Random effects				
Intercept	0.18 (0.15)	0.249	0.93 (0.16)	0.000
Slope	0.03 (0.03)	0.408	0.07 (0.03)	0.039
Intercept-slope covariance	0.00 (0.06)	0.987	-0.18 (0.06)	0.000
Residual variance (within-level)	0.17 (0.02)	0.000	0.24 (0.03)	0.000

Note. *Est* = unstandardized estimate, *SE* = standard error, DV = dependent variable.

Table 3

Multilevel Growth Curve Models with Between-Person and Within-Person Predictions of the five Behavioural Regulations

	Amotivation		External regulation		Introjected regulation		Identified regulation		Intrinsic motivation	
	Est (SE)	*p*	*Est (SE)*	*p*	*Est (SE)*	*p*	*Est (SE)*	*p*	*Est (SE)*	*p*
Fixed effects										
Intercept	1.45 (0.37)	0.000	1.00 (0.34)	0.003	-0.81 (0.42)	0.057	1.58 (0.32)	0.000	0.58 (0.39)	0.134
Slope	-0.46 (0.21)	0.029	-0.35 (0.20)	0.086	0.01 (0.20)	0.973	0.50 (0.18)	0.005	0.68 (0.19)	0.000
Between-person level										
Intercept (DV)										
Exercise beliefs	-0.24 (0.10)	0.020	-0.03 (0.11)	0.778	0.94 (0.15)	0.000	0.35 (0.09)	0.000	0.50 (0.11)	0.000
Role-identity	0.05 (0.08)	0.512	-0.07 (0.09)	0.485	-0.41 (0.13)	0.002	-0.02 (0.06)	0.736	-0.04 (0.09)	0.650
Slope (DV)										
Exercise beliefs	0.10 (0.05)	0.040	0.04 (0.05)	0.405	-0.23 (0.08)	0.003	-0.10 (0.05)	0.065	-0.12 (0.05)	0.012
Role-identity	-0.03 (0.04)	0.491	0.00 (0.04)	0.987	0.21 (0.07)	0.002	0.02 (0.04)	0.54	0.032 (0.04)	0.449
Within-person level										
Exercise beliefs	-0.02 (0.09)	0.809	-0.07 (0.09)	0.430	0.39 (0.09)	0.000	0.18 (0.05)	0.000	0.20 (0.05)	0.000
Role-identity	-0.02 (0.08)	0.823	-0.02 (0.08)	0.814	0.03 (0.07)	0.616	0.031 (0.04)	0.484	0.08 (0.05)	0.119
Random effects										
Intercept	0.03 (0.07)	0.673	0.03 (0.07)	0.657	0.31 (0.08)	0.000	0.07 (0.02)	0.003	0.14 (0.05)	0.005
Slope	0.00 (0.08)	0.979	0.00 (0.08)	0.980	0.00 (0.04)	0.914	0.00 (0.01)	0.905	0.00 (0.03)	0.923
Intercept-slope covariance	0.00 (0.07)	0.998	-0.00 (0.07)	0.962	-0.01 (0.04)	0.891	-0.01 (0.01)	0.700	-0.01 (0.03)	0.695
Residual variance (within-level)	0.32 (0.06)	0.000	0.33 (0.06)	0.000	0.41 (0.04)	0.000	0.121 (0.02)	0.000	0.16 (0.04)	0.000

Note. *Est* = unstandardized estimate, *SE* = standard error, DV = dependent variable.

Suppl. Table 1

Bivariate Correlations, Descriptive Statistics, Internal Consistency, and ICCs of all Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. T1Amot																					
2. T1EXT	.73*																				
3. T1IJ	-.16*	-.07																			
4. T1ID	-.45*	-.41*	.41*																		
5. T1IM	-.35*	-.28*	.33*	.52*																	
6. T1RI	-.28*	-.25*	17*	.39*	.47*																
7. T1EB	-.34*	-.27*	.45*	.56*	.58*	.66*															
8. T2Amot	.13	.14	-.12	-.15*	-.19*	.00	-.04														
9. T2EXT	.04	.07	-.05	-.08	-.09	.03	.07	.92*													
10. T2IJ	-.09	-.07	.42*	.30*	.28*	.30*	.34*	.13	.14												
11. T2ID	-.22*	-.26*	.30*	.41*	.28*	.21*	.23*	-.46*	-.49*	.27*											
12. T2IM	-.15*	-.14	.32*	.33*	.52*	.29*	.34*	-.28*	-.23*	.27*	.56*										
13. T2RI	-.17*	-.15*	.17*	.44*	.35*	.74*	.50*	-.03	-.06	.46*	.39*	.42*									
14. T2EB	-.25*	-.14	.31*	.45*	.43*	.64*	.64*	-.02	-.00	.45*	.38*	.46*	.80*								
15. T3Amot	.16*	.23*	-.12*	-.21*	-.16*	-.10	-.10	.05	.05	-.24*	-.22*	-.12	-.15*	-.11							
16. T3EXT	.09	.16	-.05	-.14*	-.11*	-.11	-.08	.04	.07	.23*	-.20*	-.12	-.16*	-.11	.90*						
17. T3IJ	-.06	-.02	.60*	.29*	.27*	.23*	.33*	-.21*	-.15*	.58*	.36*	.40*	.32*	.37*	.00	-.03					
18. T3ID	-.21*	-.28*	.31*	.50*	.33*	.26*	.29*	-.11	-.10	.34*	.41*	.30*	.34*	.33*	-.31*	-.28*	.33*				
19. T3IM	-.20*	-.28*	.31*	.41*	.54*	.32*	.35*	-.19*	-.15*	.27*	.33*	.55*	.31*	.33*	-.31*	-.29	.33*	.56*			
20. T3RI	-.11	-.12	.13	.32*	.37*	.75*	.51*	-.06	-.06	.32*	.19*	.30*	.81*	.69*	-.01	-.02	.31*	.27*	.31*		
21. T3EB	-.19*	-.17*	.39*	.44*	.47*	.59*	.66*	-.07	-.04	.37*	.28*	.42*	.67*	.84*	-.05	-.04	.46*	.35*	.41*	.73*	
M	0.39	0.48	2.37	3.42	3.13	4.97	5.55	0.41	0.41	1.91	3.40	3.23	5.26	5.43	0.25	0.24	2.08	3.64	3.53	5.42	5.70
SD	0.53	0.54	1.03	0.53	0.66	1.37	1.00	0.71	0.72	0.92	0.52	0.68	1.00	0.92	0.53	0.51	0.93	0.43	0.50	1.02	0.86
ω	.80	.78	.76	.72	.84	.84	.84	.91	.93	.78	.60	.85	.85	.82	.90	.90	.73	.72	.74	.87	.84
ICC	.10	.07	.49	.40	.45	.71	.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note. T1 = time point 1, T2 = time point 2, T3 = time point 3, Amot = amotivation, EXT = external regulation, IJ = introjected regulation, ID = identified regulation, IM = intrinsic motivation, RI = role-identity, EB = exercise beliefs, ω = Omega coefficient, ICC = intra-class correlation.

*$p < .05$