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Using Cluster Analysis to Examine the Combinations of Motivation Regulations of Physical Education Students

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According to self-determination theory, motivation is multidimensional, with motivation regulations lying along a continuum of self-determination (Ryan & Deci, 2007). Accounting for the different types of motivation in physical activity research presents a challenge. This study used cluster analysis to identify motivation regulation profiles and examined their utility by testing profile differences in relative levels of self-determination (i.e., self-determination index), and theoretical antecedents (i.e., competence, autonomy, relatedness) and consequences (i.e., enjoyment, worry, effort, value, physical activity) of physical education motivation. Students ($N = 386$) in 6th- through 8th-grade physical education classes completed questionnaires of the variables listed above. Five profiles emerged, including *average* ($n = 81$), *motivated* ($n = 82$), *self-determined* ($n = 91$), *low motivation* ($n = 73$), and *external* ($n = 59$). Group difference analyses showed that students with greater levels of self-determined forms of motivation, regardless of non-self-determined motivation levels, reported the most adaptive physical education experiences.

Keywords: self-determination theory, physical activity, adolescents

Students have different reasons for participating in physical education, ranging from the enjoyment of physical activity to the avoidance of disapproval from others. These different reasons for participation explain variation in students' physical activity-related beliefs and behaviors both within and outside of the physical education setting (Cox, Smith, & Williams, 2008; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Ntoumanis, 2005; Standage, Duda, & Ntoumanis, 2006). According to self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2000, 2007), different reasons for participation reflect regulatory styles or intrinsic motivation and types of extrinsic motivation that vary in their degree of self-determination.

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Intrinsic motivation is completely self-determined and is reflected in behavior performed for the enjoyment and stimulation of the activity itself (Ryan & Deci, 2000, 2007). Organismic integration theory (OIT), a mini-theory of SDT, more specifically outlines four forms of extrinsic motivation that vary in degree of self-determination or internalization. Beginning with the most self-determined, they are integrated (i.e., acting because the activity has been assimilated with one's sense of self), identified (i.e., acting because the activity is valued), introjected (i.e., acting to avoid guilt or gain pride) and external (i.e., acting to satisfy an external contingency) regulations. Integrated and identified regulations are self-determined or autonomous, whereas introjected and external regulations are non-self-determined because the reasons for participation have not been endorsed by the individual. Together with intrinsic motivation, these regulatory styles represent a continuum of self-determination, reflecting the extent to which a behavior has been internalized by the individual. In contrast to intrinsic and extrinsic motivation, amotivation refers to the absence of motivation and is reflected in unintentional behavior. Amotivation is often considered at the low end of the continuum of self-determination, though it is expected to have multiple sources that lead to different consequences (Ryan & Deci, 2007). Ryan and Connell's (1989) research in the academic setting has revealed that intrinsic motivation, and identified, introjected, and external regulations[1] are relevant reasons underlying achievement behaviors identified by children and adolescents.

According to SDT, the proximal antecedents of these motivation regulations are perceptions of competence, autonomy, and relatedness (Ryan & Deci, 2000, 2007). Individuals will experience more self-determined forms of motivation when they experience greater feelings of effectiveness (i.e., competence), volition (i.e., autonomy), and social connectedness (i.e., relatedness) within a particular context. In turn, greater self-determined motivation should be associated with more positive cognitive (e.g., value), affective (e.g., enjoyment), and behavioral (e.g., effort) consequences. A growing body of research has supported these relationships in the physical education setting (e.g., Cox, Smith, & Williams, 2008; Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003, 2005, 2006).

A challenge for researchers who have examined various antecedents and consequences of motivation regulations within the SDT framework has been how to represent motivation in a way that captures the multidimensionality of the construct and accurately represents the self-determination continuum. One approach has been to examine each type of motivation individually, thus allowing researchers to retain information about the magnitude of each type of motivation and test how each type relates independently to theoretically relevant antecedents and consequences. The results of this approach in the physical education setting have consistently shown that higher intrinsic motivation and identified regulation are associated with greater feelings of competence, autonomy, and relatedness and more adaptive consequences including more positive affect, greater concentration and preference for challenge, higher effort, and less negative affect (Ntoumanis, 2001; Standage et al., 2003, 2005). Introjected regulation has demonstrated similar associations; however, its relationships with consequences of motivation have not been supported when tested in multivariate structural models (Ntoumanis, 2001; Standage et al., 2003, 2005). Finally, external regulation has either been associated with lower perceptions of competence, autonomy, and relatedness and

less adaptive consequences or shown no relationship to these variables (Ntoumanis, 2001; Standage et al., 2005). Inconsistent support for the relationships of introjected and external regulations to theoretically relevant constructs may be due to examining regulation types in parallel rather than in combination. Considering the combination of motivation types that individuals possess is consistent with the proposition that students may endorse multiple reasons for participation (Ryan & Deci, 2007).

One way to address this issue has been the popular approach of representing motivation as an index of self-determination (or relative autonomy). A self-determination index (SDI) is calculated by subtracting students' weighted scores on the non-self-determined forms of motivation from the self-determined forms (see Standage et al., 2006; Vallerand, 2001). Research has consistently shown that students with higher SDI scores have more positive experiences in physical education (e.g., higher perceived competence, autonomy, and relatedness, more positive affect, lower negative affect, greater concentration), have greater intentions to participate in optional physical education in the future, and are more physically active both within and outside of the school setting (Cox et al., 2008; Goudas, Biddle, & Fox, 1994; Hagger et al., 2003; Ntoumanis, 2005; Standage et al., 2006). This approach is grounded in the assumption that there is a pattern of ordered correlations among the different types of motivation that reflects the self-determination continuum (Ryan & Connell, 1989). Ryan and Connell referred to this as a simplex pattern in which, "those [constructs] deemed more similar correlate more highly than those that are hypothetically more discrepant" (p. 750).

Stringent tests of the simplex pattern have been rare (e.g., Ryan & Connell, 1989; Li & Harmer, 1996) and most sport and physical education research has supported the self-determination continuum through visual inspection of the correlations among motivation regulations (e.g., Goudas et al., 1994; Ntoumanis, 2001, 2005; Standage et al., 2003, 2006). Generally, these studies have demonstrated that the correlations among regulations get weaker and/or shift from positive to negative the farther apart they are on the continuum. However, there are differences in the magnitude and direction of correlations across these studies with diverse patterns of correlations and various deviations accepted as representing the simplex pattern. Given the range of correlation patterns considered supportive of the simplex pattern, it is not clear exactly when it is *in*appropriate to use the SDI.

Although the SDI provides a parsimonious way to represent motivation, the absence of unique information about the magnitude of students' scores on each type of motivation in addition to diverse support for the simplex pattern represents limitations. In fact, recent evidence shows that some groups of students deviate from the simplex pattern by reporting similar scores on all four types of motivation (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008; Ntoumanis, 2002). Such a pattern of motivation is not well understood. For example, what does it mean for someone to report high levels of inherent interest and external pressure to achieve? When the SDI is employed with these types of students, the weights of the self-determined and non-self-determined types of motivation cancel each other out, resulting in a moderate score. An alternative perspective is that such a combination of motivation types may serve an additive function, or be more beneficial than only having high self-determined motivation (Lepper & Henderlong,

2000). Thus, considering combinations of motivation types and their respective magnitudes may reveal important information regarding the relationships among motivation types and whether they may operate in an additive fashion.

A profile approach provides an alternative way of representing students' motivation by including information about combinations of multiple constructs and the constructs' respective magnitudes. Cluster analysis can be used to identify naturally occurring profiles or groups of students within a sample that have similar patterns of scores on the four types of motivation regulation. These profiles can then be used to examine how students with different combinations of motivation scores differ in their physical education experiences. Several studies have now attempted to identify adaptive and maladaptive motivation profiles in youth physical activity settings (e.g., Boiché et al., 2008; Chian & Wang, 2008; Ntoumanis, 2002; Wang & Biddle, 2001). However, these studies have typically included other variables in addition to the different motivation regulations when identifying profiles (e.g., goal orientations, motivational climate, perceived competence, effort, enjoyment). For example, Ntoumanis (2002) identified self-determined, moderate motivation, and controlling/amotivation profiles with 14- to 16-year-old physical education students using cluster analysis with the following constructs: amotivation, external regulation, introjected regulation, identified regulation, intrinsic motivation, effort, enjoyment, boredom, cooperation, and unequal recognition.

Few studies have attempted to identify profiles based solely on motivation regulations. In a sample of adult sport participants, Vlachopoulos, Karageorghis, and Terry (2000) identified two motivation profiles and found that those who were relatively high on all forms of motivation experienced greater enjoyment and put forth more effort compared with those who were relatively high on self-determined forms and low on non-self-determined forms of motivation. This study supports the additive function of motivation types (Lepper & Henderlong, 2000), suggesting that being relatively high on all types of motivation may lead to the most adaptive consequences.

More recently, Boiché and colleagues (2008) attempted to replicate the three clusters identified by Ntoumanis (2002) using only motivation regulations within a prospective design. They confirmed the three hypothesized clusters (i.e., self-determined, non-self-determined, and moderate) in a sample of French youth, where the self-determined profile generally predicted the highest achievement, but with similar levels of effort to the moderate profile. The authors suggest that the moderate profile represents an additive function of motivation types (Lepper & Henderlong, 2000), whereas the self-determined and non-self-determined profiles correspond with a pattern reflecting the self-determination continuum, with profiles oriented at either end of the continuum (see Pelletier & Sarrazin, 2007; Vallerand & Fortier, 1998).

Exploring the different combinations of motivation regulations that exist in real-world settings has been especially limited (e.g., Boiché et al., 2008). Given the current interest in the self-determination perspective (see Hagger & Chatzisarantis, 2007), further examination of whether the combinations of motivation types support a continuum, or additive view of motivation, *or both* is relevant and important. The purpose of the current study was to use cluster analysis to explore naturally occurring combinations of motivation regulations within a U.S. sample

of physical education students. A second aim was to examine the utility of the profile approach for understanding and explaining students' experiences in physical education. Whereas Boiché and colleagues took a confirmatory approach, limiting their examination of motivation profiles to three groups based on previous work that included constructs (e.g., enjoyment, boredom) beyond motivation types (i.e., Ntoumanis, 2002), we took a more exploratory approach by considering a range of potential profiles that emerged from a hierarchical cluster analysis. Subsequently, the profiles that emerged were examined to determine if they differed on relative levels of self-determination (i.e., SDI scores), or on theoretically relevant constructs representing antecedents (i.e., competence, autonomy, relatedness) or consequences (i.e., enjoyment, worry, effort, value, overall physical activity) of motivation. Exploring these profile differences extends Boiché and colleagues' work that examined group differences on individual motivation regulations and achievement outcomes only. The exploratory nature of this study precludes specific hypotheses; however, profiles characterized by greater levels of self-determined motivation were expected to have higher perceptions of competence, autonomy, and relatedness; greater enjoyment, effort, value, and physical activity; and lower levels of worry.

Method

Participants and Procedure

Students in 6th- through 8th-grade physical education classes in a junior high school in the Midwest region of the United States were invited to participate in this study after approval was received from the institutional review board and appropriate school personnel. Students were sent home with a parental consent form and letter describing the study to share with their parents. Students with parental consent (62%) reported to the school's computer laboratory during regularly scheduled physical education classes. All of these students provided assent for participation by completing an online questionnaire including measures of all study variables. After initial instructions, students completed the questionnaire at their own pace. At least one research assistant was present to address student questions and provide periodic instructions. The sample included 386 students representing grades six through eight (M_{age} = 12.78; SD_{age} = .94). Students were mostly Caucasian (86%) and 57% female. Students participated in physical education classes throughout the school year for approximately 40 min every other school day.

Measures

Motivation. A modified version of the Academic Self-Regulation Questionnaire (see Goudas et al., 1994) assessed motivation in the physical education setting (see also Ntoumanis, 2005; Standage et al., 2006). This scale includes subscales for intrinsic motivation as well as identified, introjected, and external regulations. Students responded to 16 items (4 items for each type of motivation) on a 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7). The scale begins with the stem, "I take part in PE class . . ." followed by different reasons for par-

ticipation that reflect the different types of motivation. Example items include, "because PE is fun" (intrinsic motivation), "because it is important for me to do well in PE" (identified regulation), "because I would feel bad about myself if I didn't" (introjected regulation), and "because I'll get into trouble if I don't" (external regulation). Physical education research has supported the reliability and validity of these motivation subscale scores (e.g., Standage et al., 2006). The means of the items from each motivation subscale were calculated to identify motivation regulation profiles and were used to calculate the self-determination index: [(2 × intrinsic motivation) + (identified regulation) − (introjected regulation) − (2 × external regulation)] (see Standage et al., 2006). Positive scores on the index reflect relatively self-determined motivation, whereas negative scores reflect relatively non-self-determined motivation.

Theoretical Antecedents. The key antecedents of self-determined motivation, perceived competence, autonomy, and relatedness, were assessed. The athletic competence subscale (6 items) of Harter's (1985) Self-Perception Profile for Children was modified (e.g., adding "in PE" to items) to assess perceived physical ability in physical education class. This scale utilizes a structured-alternative format (e.g., "Some kids do very well at all kinds of sports in P.E., BUT Other kids don't feel that they are very good when it comes to sports in P.E."—select one, then indicate *sort of* or *really* true) and items are scored from 1 to 4, with higher values representing higher perceived competence. Reliable and valid scores have been obtained with a similarly modified version of the measure (Ridgers, Fazey, & Fairclough, 2007).

Perceived autonomy was measured with six items developed by Hollembeak and Amorose (2005) to capture perceptions of choice and volition in a sport setting. These items were modified to refer to the physical education rather than the sport setting. Students responded to items (e.g., "I have a say in what I do when participating in PE") on a 5-point scale that ranged from *Not at all true for me* (1) to *Completely true for me* (5). Hollembeak and Amorose reported adequate internal consistency and validity of the scores from this scale in the sport setting.

Perceived relatedness to others within the physical education setting was assessed with a modified version of the Need for Relatedness Scale (Richer & Vallerand, 1998). Modified versions of this scale have been used extensively in physical activity settings including physical education (Standage et al., 2003, 2006). The stem was changed from the original to read, "In my PE class, I feel . . ." and the phrase "teacher and classmates" was substituted in items that referred to specific others. The stem was followed by 10 items (e.g., "supported," "listened to," and "valued") to which students responded on a 7-point scale ranging from *Strongly disagree* (1) to *Strongly agree* (7). Scores from this scale, when similarly modified, have received support for validity and reliability in the physical education setting with young adolescents (Standage et al., 2003, 2006).

Theoretical Consequences. The following consequences of motivation were assessed: enjoyment, value, worry, effort, and general physical activity levels. The Sport Enjoyment Scale (Scanlan, Carpenter, Schmidt, Simons, & Keeler, 1993) was modified to assess students' perceptions of having fun engaging in different activities in physical education (e.g., "Do you like playing games in PE?"). Students responded to four items on a 5-point scale ranging from *not at all* (1) to *very*

much (5). The validity and reliability of scale scores have been supported in the youth sport (Scanlan et al., 1993) and physical education (Cox et al., 2008) settings.

Value (attainment and utility) was captured in four items that Xiang, McBride, Guan, and Solmon (2003) modified for use with elementary physical education students. These items were derived from Eccles and colleagues' education research on the expectancy-value model (e.g., Eccles, Wigfield, Harold, & Blumenfeld, 1993). Students responded to items (e.g., "For me, being good at activities and games in PE is . . .", "In general, how useful is what you learn in PE?") on a 5-point scale that ranged from *Not very important* (or *Not useful at all*) (1) to *Very important* (or *Very useful*) (5). Xiang and colleagues demonstrated good internal consistency and validity of these 4 items.

The amount of worry students experienced before and during physical education was assessed with the worry subscale of the Sport-Anxiety Scale-2 (Smith, Smoll, Cumming, & Grossbard, 2006). The scale's five items were modified to refer to the physical education setting (e.g., "I worry that I will mess up during PE class"). Students responded to these items on a 4-point scale ranging from *Not at all* (1) to *Very much* (4). Smith and colleagues supported the reliability and validity of subscale scores for use with 10- to 14-year-old youth sport participants.

The amount of effort students put into their physical education class was assessed with the three effort-related items from the effort-importance subscale of the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989). Items were contextualized to physical education (e.g., "I try very hard in this PE class.") and responses ranged on a 7-point scale from *Strongly disagree* (1) to *Strongly agree* (7). Ntoumanis (2001) reported good reliability and validity of scores using all four items from the subscale, similarly modified for physical education.

Finally, students' levels of overall physical activity were measured with five items from the Physical Activity Questionnaire for Older Children (Kowalski, Crocker, & Faulkner, 1997). Items pertained to the amount of moderate-to-vigorous physical activity students engaged in over the past 7 days after school, in the evening, over the weekend, during all free time, and on each day of the week. Responses are scored on a 5-point scale, with higher scores indicating higher activity levels. These items have demonstrated acceptable reliability and validity in research with middle school physical education students (Cox et al., 2008).

Data Analysis

Screening for univariate and multivariate normality and outliers was conducted. Internal consistency reliability (Cronbach's alpha) was assessed for each construct. Descriptive statistics, (i.e., means, standard deviations, and bivariate correlations) were calculated to provide a description of the sample. To identify motivation profiles, cluster analysis was conducted using the four motivation types of intrinsic motivation, identified regulation, introjected regulation, and external regulation. Owing to the data-driven nature of cluster analysis, two approaches were used to assess the stability of the emergent motivation profiles and are described in the results section. To examine the utility of motivation profiles, a

series of group difference analyses was conducted to test for profile differences. First, to explore whether the profile groups differed on the SDI, a one-way ANOVA was conducted using the profile groups as the independent variable and the self-determination index as the dependent variable. It should be noted that the same constructs were used to identify the independent variable (group membership) and dependent variable (SDI) and this analysis is conducted for descriptive purposes to provide a comparison with a popular way to conceptualize self-determined motivation (i.e., SDI). Next, a one-way MANOVA was conducted using profile groups as the independent variable and constructs representing motivation antecedents (i.e., perceived competence, autonomy, relatedness) as the dependent variables. A second one-way MANOVA was conducted using profile groups as the independent variable and constructs representing motivation consequences (i.e., enjoyment, value, worry, effort, physical activity) as the dependent variables. Significant multivariate effects were followed up with univariate tests. The terms *antecedent* and *consequence* are used to group constructs according to theory; however, the constructs were assessed at one time point and should not be interpreted to imply causal relationships. Analyses were completed with SPSS 15.0 (SPSS Inc., Chicago, IL).

Results

Descriptive Statistics

All constructs demonstrated good reliability (α = .81–.96; see Table 1). Data screening procedures did not identify any variables as non-normal (skewness/kurtosis > 2), there were no univariate outliers ($z > \pm 3.0$) and only three cases were identified as multivariate outliers (Mahalanobis D^2 meeting a $p < .001$ criterion). Outliers can have a significant impact on the results, particularly in cluster analysis (Hair, Anderson, Tatham, & Black, 1998); therefore, analyses were conducted with and without the outliers. As results were nearly identical, all cases were retained in the analyses, which is preferable because all portions of the sample are represented (Hair et al., 1998). Descriptive statistics for study variables appear in Table 1. Participants reported moderate levels of all four motivation regulations. The self-determination index indicated the sample was slightly more self determined than not in overall motivation. Participants reported moderate perceptions of competence, autonomy, and relatedness; moderate-to-high levels of enjoyment, effort, value, and physical activity; and moderate-to-low levels of worry. Bivariate correlations were in theoretically consistent directions and significant ($p < .01$), except for the correlations between introjected and external regulations ($p = .08$) worry and introjected regulation ($p = .09$) and between physical activity and external regulation ($p > .10$). The pattern of correlations among the motivation types was largely consistent with the simplex pattern (Ryan & Connell, 1989), with the exception of the correlation between introjected and external regulations; however, the correlation magnitude and direction (i.e., small, positive) approximates other physical education research (Ntoumanis, 2001, 2002; Standage et al., 2006).

Table 1 Descriptive Statistics for Study Variables

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Intrinsic Mot.	*.92*												
2	Identified Reg.	.87**	*.89*											
3	Introjected Reg.	.61**	.70**	*.80*										
4	External Reg.	–.31**	–.21**	.09	*.88*									
5	Competence	.49**	.42**	.26**	–.14**	*.81*								
6	Autonomy	.55**	.50**	.33**	–.38**	.31**	*.84*							
7	Relatedness	.71**	.61**	.47**	–.20**	.48**	.61**	*.96*						
8	Enjoyment	.78**	.72**	.47**	–.30**	.60**	.49**	.60**	*.94*					
9	Worry	–.22**	–.12*	.09	.18**	–.49**	–.21**	–.35**	–.33**	*.91*				
10	Effort	.60**	.60**	.44**	–.19**	.36**	.30**	.42**	.61**	–.15**	*.89*			
11	Value	.79**	.81**	.60**	–.25**	.41**	.51**	.61**	.67**	–.14**	.60**	*.91*		
12	Physical Activity	.36**	.35**	.24**	–.05	.45**	.20**	.37**	.38**	–.25**	.37**	.37**	*.89*	
13	Self-Deter. Index	.80**	.68**	.23**	–.79**	.39**	.56**	.55**	.67**	–.27**	.48**	.63**	.26**	—
	Possible Range	1–7	1–7	1–7	1–7	1–4	1–5	1–7	1–5	1–4	1–7	1–5	1–5	−18 to 18
	N	386	386	386	386	386	386	386	386	386	386	386	384	386
	M	4.72	4.74	3.92	4.35	2.88	2.95	4.62	3.89	1.77	5.31	3.29	3.63	1.57
	SD	1.87	1.79	1.69	1.86	0.74	.92	4.58	1.12	0.77	1.68	1.14	0.98	6.79

Note. Alpha values on diagonal, correlation values below diagonal.

*$p < .05$, **$p < .01$ (2-tailed). Correlations calculated using pairwise deletion of missing data.

Cluster Analyses

The four motivation regulations were standardized and *z* scores were used in the cluster analyses. Both hierarchical and nonhierarchical cluster analyses were conducted in an attempt to provide the most stable solution. A hierarchical approach using Ward's linkage method and squared Euclidean distance as the similarity measure was first taken to aid in assessing the most appropriate number of clusters represented in the data. Agglomeration coefficients from the hierarchical analysis were examined and the percentage change in coefficient indicated sizable change of similar magnitude for two, three, four, or five profiles. This suggested that a range of profiles would be appropriate and two-, three-, four-, or five-cluster solutions were explored. A three-cluster solution[2] replicated the self-determined, moderate, and non-self-determined clusters identified by Boiché and colleagues (2008). However, when considering the range of possible solutions, the five-cluster solution was preferred because it produced the maximum number of nonredundant profiles with good sample representation (15–24%) in each profile. Next, a nonhierarchical *k*-means cluster analysis using simple Euclidean distance as the similarity measure was conducted, specifying a five-cluster solution and the initial cluster centers that were generated from the hierarchical cluster analysis. This approach is recommended because it eliminates the case order effect that random cluster centers can produce (Hair et al., 1998). The *k*-means analysis was first conducted on a random selection of half of the cases and then repeated on the remainder of the sample. The results of the two analyses were highly consistent in both magnitude and pattern of final cluster centers, supporting the stability of the five profiles; therefore the full sample results are reported. For descriptive purposes, likelihood ratio chi-square analysis was conducted and confirmed that the profiles did not have an uneven representation of males and females, $\chi^2(4) = 9.29$, $p > .05$, and separate ANOVAs for grade, $F(2, 380) = 1.01$, $p > .05$, and age, $F(4, 378) = 1.52$, $p > .05$, confirmed no differences in the distribution of cluster membership by grade or age.[3]

Table 2 contains means, standard deviations, and *z* scores for each of the profiles. Standardized scores of ±0.5 are used as criteria for identifying relatively high and low levels of each of the motivation regulations and are used to aid in interpretation and labeling of profiles. The labels are used to characterize the profiles relative to their counterparts and do not always correspond to high and low levels of motivation regulation in absolute terms, though the labels in most cases are an accurate representation of absolute levels of motivation. See Figure 1 for a representation of each profile using standardized scores.

The first profile was labeled as *average* ($n = 81$) as it was generally represented by motivation regulation scores that are neither characterized as relatively low or relatively high (i.e., for intrinsic motivation, identified regulation, and introjected regulation) though the external regulation scores were considered relatively high. The second profile was labeled *motivated* ($n = 82$) as all motivation regulations were characterized by relatively high scores. The third profile was labeled *self-determined* ($n = 91$) as it was characterized by relatively high scores on intrinsic motivation and identified regulation, an average level of introjected regulation, and relatively low level of external regulation. The fourth profile was labeled *low motivation* ($n = 73$) as this profile was characterized by relatively low

Table 2 Participant Numbers, Means, Standard Deviations, and Standardized Scores for Motivation Profiles Resulting from *k*-Means Cluster Analysis

		Intrinsic Motivation		Identified Regulation		Introjected Regulation		External Regulation	
Cluster	***n***	***M*(*SD*)**	***z***	***M*(*SD*)**	***z***	***M*(*SD*)**	***z***	***M*(*SD*)**	***z***
Average	81	4.19(0.89)	–0.28	4.46(0.87)	–0.16	4.02(0.94)	0.06	5.59(0.99)	0.66
Motivated	82	6.48(0.61)	0.94	6.57(0.55)	1.02	6.13(0.75)	1.31	5.27(1.23)	0.50
Self-Determined	91	6.38(0.67)	0.88	6.10(0.81)	0.76	3.93(1.25)	0.00	2.39(1.08)	–1.05
Low Motivation	73	3.51(1.05)	–0.65	3.43(0.99)	–0.74	2.90(0.99)	–0.60	2.86(0.99)	–0.80
External	59	1.95(0.92)	–1.48	2.15(0.92)	–1.45	1.95(1.04)	–1.17	6.22(0.92)	1.00

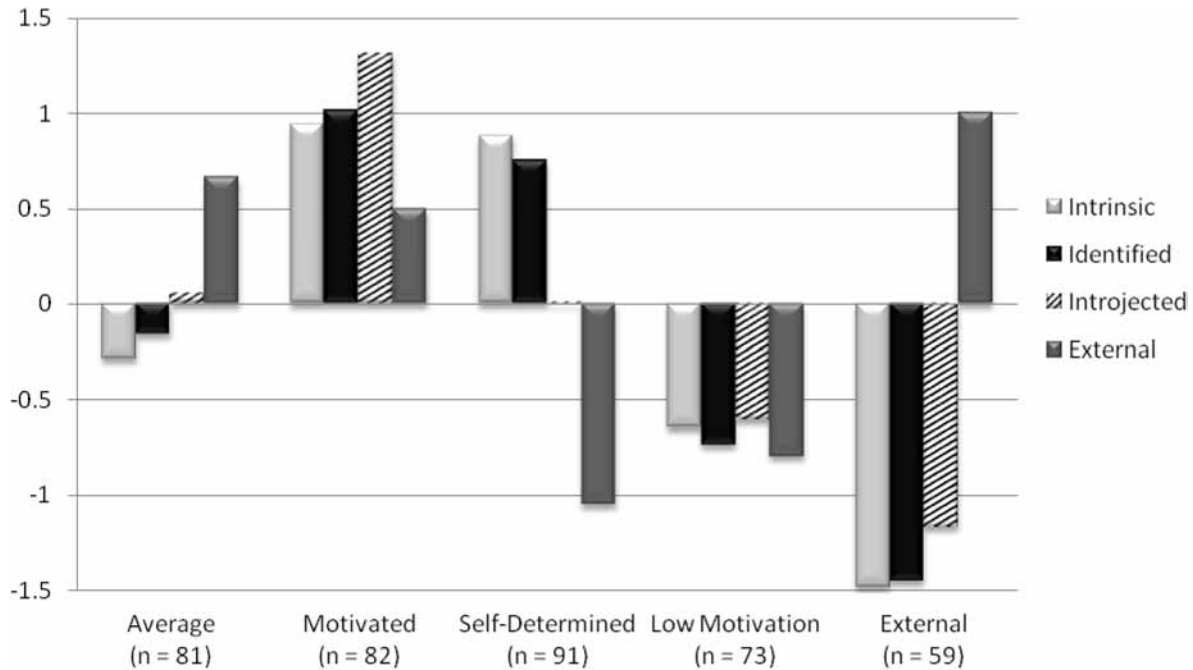

Figure 1 — Results of *k*-means cluster analysis ($N = 386$).

levels of all four motivation regulations. The fifth profile was labeled *external* (*n* = 59) as the profile was characterized by relatively low levels of intrinsic motivation, identified regulation, and introjected regulation, and a relatively high level of external regulation.

Group Difference Analyses

The one-way ANOVA with the SDI score as the dependent variable was significant, $F(4, 381) = 339.53$, $p < .01$, $\eta_p^2 = .78$, and post hoc pairwise comparisons of the estimated marginal means indicated that all profiles differed on SDI scores except for the *motivated* and *low motivation* profiles (see Table 3). As expected the *self-determined* profile had the highest, and relatively self-determined, SDI score, whereas the *external* profile had the lowest, and relatively non-self-determined, SDI score.

The one-way MANOVA with perceived competence, autonomy, and relatedness as the dependent variables was significant (Pillai's trace = .53, $F(12, 1143) = 20.37$, $p < .01$, $\eta_p^2 = .18$), and follow-up univariate analyses indicated significant ($p < .01$) group differences of low-to-moderate magnitude on all dependent variables (see Table 4). Post hoc pairwise comparisons of the estimated marginal means indicated that the *motivated* and *self-determined* profiles did not differ from one another and had the highest perceptions of competence, autonomy, and relatedness. The *average* and *low motivation* profiles did not differ from one another on perceptions of competence, autonomy, or relatedness. The *external* profile had the lowest perceptions of competence, autonomy, and relatedness, although this group did not differ from the *low motivation* group on perceived competence. See Figure 2 for a graphic representation.

The one-way MANOVA with enjoyment, worry, effort, value, and physical activity behavior as the dependent variables was significant (Pillai's trace = .67, $F(20, 1512) = 15.26$, $p < .01$, $\eta_p^2 = .17$) and follow-up univariate analyses indicated significant ($p < .01$) group differences on all variables (see Table 5 and Figure 2). The effect sizes of the univarate follow-ups were of moderate magnitude with the exception of the worry (.04) and physical activity behavior (.10) constructs. Post hoc pairwise comparisons of the estimated marginal means were examined to identify group differences. The *motivated* and *self-determined* pro-

Table 3 Profile Means and Standard Deviations for SDI (*N* = 386)

Cluster	SDI	
	M	***SD***
Average[a]	–2.36	3.38
Motivated[b]	2.85	2.93
Self-Determined[c]	10.14	3.39
Low Motivation[b]	1.82	3.04
External[d]	–8.34	3.17

Note. Distinct subscripts represent significant group differences ($p < .01$).

Table 4 Univariate *F*, Effect Size, and Profile Means, Standard Deviations, and Standardized Scores for Motivation Antecedent Variables

			Cluster									
			Average (*n* = 81)		Motivated (*n* = 82)		Self-Determined (*n* = 91)		Low Motivation (*n* = 73)		External (*n* = 59)	
Variable	*F*(4, 381)	η_p^2	*M*(*SD*)	*z*	*M*(*SD*)	*z*	*M*(*SD*)	*z*	*M*(*SD*)	*z*	*M*(*SD*)	*z*
Competence	19.91**	.17	2.78(0.73)[a]	–.14	3.25(0.57)[b]	.49	3.15(0.64)[b]	.37	2.64(0.67)[ac]	–.32	2.40(0.79)[c]	–.66
Autonomy	43.11**	.31	2.75(0.80)[a]	–.22	3.29(0.86)[b]	.37	3.52(0.71)[b]	.62	2.91(0.73)[a]	–.05	1.95(0.69)[c]	−1.09
Relatedness	65.03**	.41	4.35(1.42)[a]	–.17	5.75(0.99)[b]	.72	5.53(1.07)[b]	.58	3.80(1.23)[a]	–.52	3.01(1.42)[c]	−1.02

Note. **$p<.01$; Cluster differences ($p<.05$) based on pairwise comparison of estimated marginal means are indicated by distinct superscripts. Analyses are based on participants with complete data ($n = 386$).

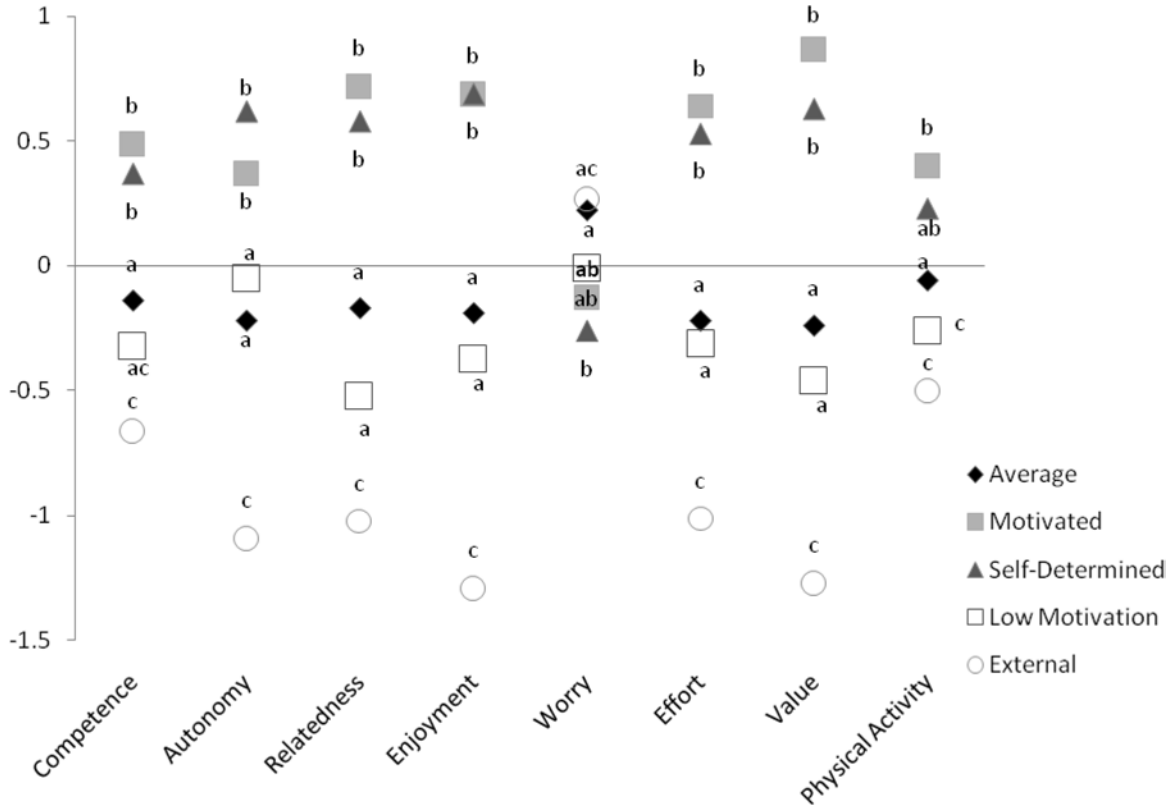

Figure 2 — Profile differences identified from the MANOVA analyses using standardized scores. Unique letters indicate significant group differences ($p < .05$).

Table 5 Univariate *F*, Effect Size, and Profile Means, Standard Deviations, and Standardized Scores for Motivation Consequence Variables

			Cluster									
			Average (n = 81)		Motivated (n = 80)		Self-Determined (n = 91)		Low Motivation (n = 73)		External (n = 59)	
Variable	$F(4, 379)$	η_p^2	$M(SD)$	z	$M(SD)$	z	$M(SD)$	z	$M(SD)$	z	$M(SD)$	z
Enjoyment	96.12**	.50	3.68(0.83)^{a}	–.19	4.67(0.56)^{b}	.69	4.66(0.48)^{b}	.69	3.48(0.96)^{a}	–.37	2.45(1.12)^{c}	–1.29
Worry	4.05**	.04	1.95(0.82)^{a}	.22	1.67(0.70)^{ab}	–.13	1.57(0.58)^{b}	–.26	1.76(0.72)^{ab}	–.01	1.98(1.04)^{ac}	.27
Effort	48.23**	.34	4.93(1.48)^{a}	–.22	6.39(0.83)^{b}	.64	6.19(1.09)^{b}	.53	4.79(1.52)^{a}	–.31	3.62(1.93)^{c}	–1.01
Value	116.58**	.55	3.02(0.88)^{a}	–.24	4.29(0.66)^{b}	.87	4.01(0.72)^{b}	.63	2.77(0.81)^{a}	–.46	1.85(0.76)^{c}	–1.27
Physical Activity	10.27**	.10	3.57(0.87)^{ac}	–.06	4.02(0.83)^{b}	.40	3.85(0.85)^{ab}	.23	3.37(1.01)^{c}	–.26	3.14(1.16)^{c}	–.50

Note. **$p < .01$; Cluster differences ($p < .05$) based on pairwise comparison of estimated marginal means are indicated by distinct superscripts. Analyses are based on participants with complete data (n = 384).

files did not differ from one another and represent the most adaptive profiles with the highest levels of enjoyment, effort, and value. The *average* and *low motivation* profiles did not differ from one another and generally fall between the highest and lowest scores on each outcome. The *external* profile appears to be the least adaptive overall, with the lowest levels of enjoyment, effort, and value. The worry and physical activity behavior variables were not well distinguished, with modest profile differences.

Discussion

The current study examined combinations of motivation regulations by exploring naturally occurring motivation profiles of a U.S. sample of physical education students and examined the utility of this approach for understanding and explaining students' experiences. Five distinct combinations of motivation regulations emerged from the analyses reflecting *self-determined*, *motivated*, *average*, *low motivation,* and *external* profiles. There were both similarities and differences in physical education experiences among the five profiles. The *self-determined* and *motivated* students did not differ from one another on key motivation antecedents and consequences and were the most adaptive motivation profiles, supporting the study hypothesis. The *average* and *low motivation* students were also similar on all variables except for physical activity behavior and reported less positive physical education experiences than the *self-determined* and *motivated* students. Finally, the *external* students generally represented the least adaptive group on the motivation-related constructs. Interestingly, differences in physical education experiences across profiles did not necessarily correspond with different SDI scores, and, conversely, similar physical education experiences sometimes corresponded with different SDI scores. Therefore, combinations of motivation regulations that retain information on the magnitude of each motivation regulation appear to provide unique information about which students are likely to have positive physical education experiences.

The results of this study suggest that students' relative levels of self-determination may not distinguish among physical education experiences for those with certain combinations of motivation regulations. Specifically, the *motivated* and *low motivation* students did not differ on the SDI, yet had significantly different physical education experiences. The *motivated* students felt more competent, autonomous, and socially related in physical education than the *low motivation* students. They also enjoyed and valued physical education more, put forth more effort during class and reported higher levels of physical activity than the *low motivation* students. Although the SDI scores suggest these students' experiences may be similar, the significant differences on motivationally relevant antecedents and consequences indicate otherwise. The similar index scores for these groups are a mathematical artifact that impacted a sizable portion of our sample (i.e., 40%). These results stimulate questions regarding how effective it is to use the SDI in cases where students score similarly on motivation regulations.

The results also showed that having different scores on the SDI do not necessarily reflect distinct physical education experiences. For instance, *self-determined* and *motivated* students did not differ in their experiences. Both reported moderate

to high perceptions of competence, autonomy and relatedness and high levels of enjoyment, effort and value, yet the *self-determined* students had higher SDI scores. Both groups of students had high levels of intrinsic motivation and identified regulation though they differed on levels of introjected and external regulation. Overall it appears that experiences were quite positive when students had high levels of intrinsic motivation and identified regulation, regardless of their non-self-determined motivation levels. These findings are consistent with research touting the benefit of the combination of high levels of both intrinsic motivation and identified regulation (Burton, Lydon, D'Alessandro, & Koestner, 2006; Koestner & Losier, 2002).

A similar pattern of results was illustrated by the *average* and *low motivation* student profiles. The *average* students had lower SDI scores than the *low motivation* students, yet the two groups did not differ on motivation-related constructs. Both groups of students had moderate perceptions of competence, autonomy, and relatedness, and moderate levels of enjoyment, effort, and value of physical education. These two profiles demonstrate that average-to-low levels of intrinsic motivation, identified regulation, and introjected regulation are associated with average physical education experiences, regardless of the level of external regulation. In all these examples, considering both the combination and magnitude of motivation regulations provides unique insight regarding how the combinations of motivation regulations correspond with students' physical education experiences. The information gained from using motivation profiles rather than examining each regulation individually may help explain why there is only weak support for the relationships of introjected and external regulations to relevant consequences in the physical education literature (Ntoumanis, 2001; Standage et al., 2003, 2005).

Overall, this study supports the general trend in the literature of more positive constructs representing theoretical antecedents and consequences experienced by individuals with more self-determined motivation (e.g., Cox et al., 2008; Hagger et al., 2003; Ntoumanis, 2005; Standage et al., 2006). An additional implication of the current results is that intrinsic and identified regulation may supersede non-self-determined forms of motivation in the physical education setting. Specifically, having high levels of extrinsic motivation was not maladaptive when combined with high levels of self-determined forms of motivation. In contrast, the *extrinsic* group appears to have the least adaptive experience in physical education, even compared with the *low motivation* group. One might interpret the *low motivation* group as being amotivated; however, low scores on all motivation types is theoretically distinct from amotivation, or perceiving a lack of intention. Ryan and Deci (2007) depict amotivation as being independent of the self-determination continuum per se (p. 8), which, according to organismic integration theory, ranges from regulatory styles that are highly autonomous to highly controlling. Amotivation appears to fall outside this scope because it identifies a state that can have different sources that lead to different consequences (Ryan & Deci, 2007). Since motivation research has largely included amotivation as part of the continuum, it appears important to further examine the role of this construct relative to the continuum as well as within real-world contexts (e.g., volitional vs. compulsory activities).

The number of profiles identified in the current study may be due to the more exploratory nature of this study. Whereas Boiché and colleagues (2008) set out to confirm three motivation profiles, we investigated a broader range of potential solutions in the cluster analysis. Results supported the existence of five nonredundant profiles in this sample of physical education students. The groups of students in this study who were identified as *self-determined*, *average,* and *external* are consistent with past physical education research (Boiché et al.; Ntoumanis, 2002). However, the results of this study departed from past research with the identification of the *motivated* and *low motivation* groups representing students who were relatively high or low on all types of motivation, respectively. The *motivated* profile supports research with adult sport participants (Vlachopoulos et al., 2000) in which they found a profile characterized by relatively high motivation across all regulations. Interestingly, they found this group of individuals was more adaptive in terms of motivational outcomes compared with a group that was relatively self-determined, supporting an additive function of motivation types. The current study fails to support an additive view of motivation inasmuch as being highly *motivated* across regulations was no more beneficial than being high only on *self-determined* regulations.

The results of these recent studies on motivation profiles raise questions regarding when it is appropriate to calculate the SDI and the advantages and disadvantages of using different methods of combining motivation regulations. The critical assumption that supports the creation of the SDI is that the relationships among the motivation regulations conform to a simplex-like pattern (Grolnick & Ryan, 1987). However, it is unclear how deviations or variations of the expected pattern impact the appropriateness or usefulness of the index. For example, the *low motivation* group in this study scored relatively low on all types of motivation and the correlations for this group revealed that external regulation had similar positive correlations with the other three motivation types. Other studies have also revealed motivation profiles in which participants score similarly across motivation regulations (Boiché et al., 2008; Ntoumanis, 2002; Vlachopoulos et al., 2000); however, the degree to which these types of scores represent a meaningful departure from the simplex pattern is currently not well understood.

Although students' responses in this study demonstrated good variability, the sample itself was quite narrow. Future research replicating motivation regulation profiles in different contexts and age groups is necessary to help corroborate the findings that emerged in the current study, particularly given the data-driven nature of cluster analysis. In addition, examining motivation regulation profiles across key transitions (e.g., elementary to middle school) would provide interesting insight into developmental change in motivational processes of youth physical activity participants. Researchers may also consider other motivation-related constructs to further examine the utility of motivation profiles. Such work could include more objective, or observable behaviors (e.g., teacher ratings of effort, physical fitness parameters), to demonstrate how self-report constructs relate to actual behavior (Anderson, McCullagh, & Wilson, 2007).

Motivation profiles provide unique information that cannot be gleaned from using either the SDI or examining the different types of regulations in parallel. Specifically, the differences among the profiles on motivation-related variables show that relative levels of self-determination provide different information than

the profile approach, which identifies unique combinations of motivation regulations while also retaining information about the magnitude of those regulations. It appears that when paired with self-determined reasons, having non-self-determined motives does not coincide with maladaptive patterns of beliefs and behaviors. In fact, different patterns of reasons for participation may be equally adaptive, as reflected in the *motivated* and *self-determined* profiles. Although the results illustrate the value in using the profile approach, we recognize that the different methods to assess motivation regulations can answer different research questions and provide valid ways of understanding motivational processes. Future research that explicitly tests the power of different approaches will shed further light on the most appropriate method to use under specific circumstances.

Notes

1. Integrated regulation and amotivation are not discussed further or examined in this study because they did not emerge as relevant reasons underlying achievement behaviors in Ryan & Connell's (1989) research with older children. Research has demonstrated that integrated reasons may not emerge until adulthood (Vallerand, 1997). In addition, amotivation was not examined because it represents the absence of motivation, and the purpose of this study was to identify profiles of motivation regulations (Ryan & Deci, 2007).

2. Contact the first author for results of the three-cluster solution.

3. Three sets of cluster analyses were conducted for 6th-, 7th-, and 8th-grade students, respectively. The pattern of the five clusters was confirmed with each grade. The same conclusions could be drawn from the subsequent MANOVAs for each grade. There were very minor deviations across these analyses.

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