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Profiles of intrinsic and extrinsic motivations: A person-centered approach to motivation and achievement in middle school

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Abstract The present study was designed to identify and evaluate naturally-occurring combinations of intrinsic and extrinsic motivations. Cluster analysis revealed four distinct motivational profiles based on a sample of middle-school students ($N = 343$): those with high levels of both intrinsic and extrinsic motivations (*high quantity*), low levels of both types of motivation (*low quantity*), high intrinsic coupled with low extrinsic motivation (*good quality*) and low intrinsic coupled with high extrinsic motivation (*poor quality*). Across two time points, students in the *good quality* cluster received higher grades than their peers in other clusters with poorer quality motivation, even if that motivation was present in high quantities. An examination of shifts in motivational profiles over the course of a school year revealed an intriguing balance of stability and change. Consistent with variable-centered research, movement tended to be away from the *good quality* and *high quantity* clusters and toward the *poor quality* and *low quantity* clusters.

Keywords Intrinsic motivation · Extrinsic motivation · Motivational change · Cluster analysis · Academic achievement

Introduction

The distinction between intrinsic and extrinsic motivations is one of long-standing interest in education. *Intrinsic motivation* refers to engaging in a task for its own inherent rewards whereas *extrinsic motivation* refers to engaging in a task in order to attain some separable outcome—such as approval from authority figures or special privileges in the classroom. Researchers have often operationalized these two constructs as mutually exclusive, such that an individual high in intrinsic motivation would necessarily be low in extrinsic motivation. However, recent studies suggest that these two types of motivation can, in fact, coexist and perhaps even work together to motivate task engagement (see Harter 1981; Gillet et al. 2009; Lepper et al. 2005; Ryan et al. 1995). An essential direction for research, then, is to identify naturally-occurring combinations of intrinsic and extrinsic motivations and their academic consequences. For instance, is it optimal for students to have high levels of both types of motivation, or are they better served by a pattern of high intrinsic motivation coupled with low extrinsic motivation? Understanding how different types of motivation may operate in tandem is a critical issue not only for motivational theorists but also practitioners, who must respond to the complexities of individual students.

Addressing these issues among middle school populations may be especially revealing because the transition to middle school is associated with more rigid rule structures and less support for student autonomy (see Eccles and Midgley 1989; Eccles et al. 1993). Extrinsic concerns may take on new significance at this stage of schooling, perhaps contributing to the oft-cited decline in academic engagement at the middle school level (Anderman and Maehr 1994; Anderman and Midgley 1997; Eccles et al. 1998; Harter et al. 1992; Simmons and Blyth 1987). Unfortunately, the study of how different types of motivation combine into distinct profiles among middle school students has been largely neglected, in part due to measurement issues. Harter's (1981) widely-used scale, for

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example, forces students to choose *either* an intrinsic or an extrinsic reason for their classroom behaviors, which does not allow for the possibility that both reasons might be at work simultaneously.

In addition, the analysis of intrinsic and extrinsic motivational profiles requires a shift from variable-centered approaches to person-centered approaches, which are rare in motivation research and psychology as a whole (Bergman and El-Khouri 1999; Nurmi and Aunola 2005; Roeser and Galloway 2002). Person-centered approaches provide an important perspective because they reflect the relationships among constructs at the level of the individual, which is useful for tailoring intervention efforts to the needs of unique groups of students (Roeser et al. 1998). In other words, such approaches focus on particular *combinations of* motivational variables as they exist within individuals or groups of students, rather than taking each variable itself as the focal point. Moreover, person-centered approaches sometimes reveal substantively different findings than those uncovered using variable-centered approaches. For example, Meece and colleagues analyzed the same dataset on students' goal orientations using both variable-centered and person-centered approaches. Although the variable-centered analyses suggested that it may be optimal for students to have some extrinsic concerns, the person-centered analyses revealed that it was actually more adaptive when such concerns were minimized (see Meece et al. 1988; Meece and Holt 1993).

A person-centered approach to intrinsic and extrinsic motivations

A key goal of the present study, therefore, was to evaluate the adaptive value of various motivational profiles among middle school students. Previous researchers have addressed this issue to some extent by measuring intrinsic and extrinsic motivations separately and breaking the sample into discrete groups of students. In one such study, Harter (1992) pulled apart her original scale to create separate intrinsic and extrinsic items, and classified middle school students into four distinct groups based on whether they scored high or low on each of the two scales. She found that students with high intrinsic and low extrinsic motivations had the highest perceived competence, most adaptive affective reactions to performance, and highest perceived teacher acceptance, followed by the students with high scores on both dimensions. In a second study, Lin et al. (2003) found that college students who reported high intrinsic motivation and moderate levels of extrinsic motivation exhibited more adaptive school behaviors and better performance than their peers who reported high intrinsic motivation coupled with either high or low extrinsic motivation. Taken together, these studies suggest that a pattern of high intrinsic motivation coupled with low to moderate extrinsic motivation may be optimal.

However, these studies are limited by the use of median- and tertile-splits to create profiles of students. Though this form of analysis is easy to implement, its disadvantages include artificiality, reduced power, discarded data, and biases that make statistical predictions unreliable (see Maxwell and Delaney 1993). A better person-centered approach may be cluster analysis, which takes into account both the actual level of each variable and the relative level of one variable to another to form homogeneous groups of participants, providing a precise method of classification without discarding moderate scores (Bergman 1998). And instead of imposing a final structure in advance, cluster analysis allows for a comparison of multiple solutions in terms of variance explained, cluster distinctiveness and theoretical relevance (Aldenderfer and Blashfield 1984; Bergman 1998). Indeed, recent work in the self-determination tradition has used cluster analysis or other grouping procedures to identify naturally-occurring combinations of intrinsic and extrinsic motivations (e.g., Boiche et al. 2008; Gillet et al. 2009; Ratelle et al. 2007; Vansteenkiste et al. 2009; Vlachopoulos et al. 2000). Self-determination theory proposes a continuum of motives based on the degree of autonomy endorsed, rather than two broad classes of intrinsic and extrinsic motivations (see Deci and Ryan 1985; Ryan and Deci 2000, 2002; Ryan and Connell 1989). Some person-centered studies in this tradition utilize the entire continuum of motives in their grouping procedures (e.g., Boiche et al. 2008; Ratelle et al. 2007) whereas others combine the more freely-chosen motives on the continuum into a single index of "autonomous" motivation and the less freely-chosen motives on the continuum into a single index of "controlled" motivation (e.g., Gillet et al. 2009; Vansteenkiste et al. 2009). In all cases, a key theoretical interest is whether more autonomous forms of motivation are complemented or thwarted by more controlled forms of motivation.

Although most of the person-centered research in this tradition has focused on the domain of sports, two studies have used group-based approaches to identify motivational profiles in the achievement domain. In the first of these studies, Ratelle and colleagues (2007) found that nearly all of their high school students across two studies reported levels of intrinsic and extrinsic motivations that were roughly equivalent in magnitude; it was only in a college sample that the theoretically important cluster of students with high intrinsic but low extrinsic motivations emerged. By contrast, Vansteenkiste et al. (2009) found a substantial group of students reporting high autonomous coupled with low controlled motivation at both the high school and college levels—a profile they referred to as representing *good quality* motivation because of the favorable ratio of

autonomous to controlled motivation. This good quality profile was one of four distinct groups that emerged from their data, largely analogous to those imposed on the data by Harter's (1992) earlier analysis: high quantity motivation (high autonomous, high controlled), low quantity motivation (low autonomous, low controlled), and poor quality motivation (low autonomous, high controlled). Drawing upon self-determination theory (Deci and Ryan 1985; Ryan and Deci 2000), Vansteenkiste et al. argued that the sheer amount of motivation is less important than the quality of that motivation. Indeed, students with good quality motivation reported less procrastination and test anxiety than those with high quantity motivation, and fared better on all measures of self-regulation than those with poor quality motivation. Taken together, these studies suggest that good quality motivation may be optimal provided that such motivation actually exists. Extending this line of investigation to younger age groups may shed light on the prevalence of a truly intrinsic motivational profile.

The present study assessed the motivational orientations of middle school students using the independent scales of intrinsic and extrinsic motivations from Lepper et al. (2005). We used this instrument because it derives from the earlier work of Harter (1981, 1992), which has been prominent in developmental analyses and research on child populations (e.g., Corpus et al. 2009; Guay et al. 2001; Tzuriel 1989, Wong et al. 2002). Although the scale does not differentiate between more and less self-determined forms of extrinsic motivation, a less nuanced approach may resonate more with the daily experiences of younger populations and, therefore, serve as a more reliable basis for forming profiles (see Corpus et al. 2009). Due to concerns raised by split-based analyses, we used cluster analysis to form groups of students with distinct motivational profiles. Based on Vansteenkiste et al.'s (2009) findings, which were grounded strongly in motivation theory, we tentatively expected to find four clusters that varied meaningfully along the dimensions of motivation quality (i.e., ratio of intrinsic to extrinsic motivations) and motivation quantity (i.e., total amount of intrinsic and extrinsic motivations).

Motivation and achievement

Presumably one goal of motivation research as a whole is to determine how different types of motivation affect the learning process and resulting achievement. Past research has demonstrated a positive relationship between intrinsic motivation and academic achievement (Boggiano 1998; Burton et al. 2006; Gottfried 1985; Lepper et al. 2005; Pintrich and DeGroot 1990). Extrinsic motivation, however, has been negatively associated with achievement in variable-centered analyses (Lepper et al. 2005; Wolters et al. 1996). The relationship between profiles of intrinsic and extrinsic motivations and achievement has been given relatively little attention, and the research that does exist is not entirely consistent. Recall that Harter's (1992) split-based study with middle school students showed the combination of high intrinsic and low extrinsic motivations to be most adaptive, although it did not include objective measures of achievement. Among Vansteenkiste et al.'s (2009) high school students, those with good quality motivation reported higher academic performance than their peers in any of the other clusters, including the high quantity profile. By contrast, Ratelle et al. (2007) found that achievement did not differ when comparing college students with high levels of both types of motivation to those with high intrinsic but low extrinsic motivations (cf. Gillet et al. 2009)—both groups outperformed those with lower levels of motivation. Those with the more autonomous profile did, however, demonstrate greater academic persistence.

We anticipated that students in the present study with relatively high intrinsic but low extrinsic motivations (i.e., good quality motivation) would have the highest achievement in school. This prediction is grounded in theory and research showing that those students who are free from concerns external to the academic task at hand will be the most self-directed, persistent and engaged with their work (Deci and Ryan 2002; Harter 1992; Lepper et al. 1973; Vansteenkiste et al. 2009). In short, we expected that the quality of motivation would be more directly related to achievement than the quantity of motivation—a hypothesis largely based on Vansteenkiste et al.'s (2009) findings and conceptualization rooted in self-determination theory (Deci and Ryan 1985; Ryan and Deci 2000). Of course, it is unclear whether cluster analytic findings with high school and college students would replicate with middle school students who are distinct in terms of both their developmental needs and the environmental supports provided by the instructional context. It seems possible, however, that good quality motivation might matter even more for younger populations who have more recently been introduced to normative grading structures, between-class tracking, and other competitive, outcome-oriented practices (Wigfield and Eccles 2002; see Midgley et al. 2001).

Longitudinal markers of ontogenetic change

A final concern of the present study was the stability of motivational profiles over time. Because whole students—rather than variables in isolation—evolve over time, adopting a person-centered approach to the study of motivational change has been recognized as a crucial next

step (Ratelle et al. 2007; cf. Gillet et al. 2009). In order to address this gap in the literature, the present study assessed intrinsic and extrinsic motivations both in the fall and in the spring of a single academic year.

Several questions were of special interest. First, how stable are profiles of intrinsic and extrinsic motivations? Past research has shown mean-level decreases in motivational variables over the course of a single school year (Meece and Miller 2001; Pajares and Graham 1999), but little is known about individual differences in motivational change—especially regarding the patterns of change as intrinsic and extrinsic motivations shift simultaneously (cf. Harter et al. 1992). Based on variable-centered studies of change, we expected at least some movement over the course of the year in cluster membership. Second, are some motivational states more transient than others—i.e., more likely to be shifted away from over the year? Variable-centered research has documented a clear pattern of losses over time to intrinsic motivation, leading us to expect shifts away from both the good quality and high quantity profiles (e.g., Bouffard et al. 2003; Gottfried et al. 2001; Otis et al. 2005; Spinath and Steinmayr 2008). Movement away from the high quantity profile might also be expected based on studies showing losses to extrinsic motivation over time (Otis et al. 2005; Ratelle et al. 2004), which could have implications for the precarious nature of that profile. Third, are there consistent patterns of movement between clusters, such as a tendency to shift towards clusters that maintain a similar quality or quantity of motivation? Such patterns would inform our understanding of motivational change, but their particular form was difficult to anticipate given the dearth of relevant research.

In summary, the present study was designed to examine individual profiles of intrinsic and extrinsic motivations. Using cluster analysis, we identified motivational profiles among middle school students and explored the significance of these profiles by relating them to academic achievement at two time points. Finally, we examined the stability of profiles over the course of an academic year in order to better understand the dynamic nature of these motivational constructs.

Method

Participants

Participants were 388 6th-, 7th- and 8th-grade students (60% female) from a public middle school that served a largely working class population in Portland, Oregon. This school was one of several included in a large-scale research project assessing developmental change in motivational processes.[1] It used a traditional instructional approach with students divided into academic tracks and recognized by an honor roll system. The entire student body was invited to participate in the study; parental consent forms were received from 58% of the students. Forty-five participants were subsequently dropped from the study due to absences and school transfers, leaving a final sample of 343 students with data from both time points. Data from the first time point were available for 36 of the 45 students who were dropped; they did not differ from the final sample in their levels of either intrinsic or extrinsic motivations, $ts(377) < 1.53$, ns. Self-reported ethnicity in the final sample was as follows: 63% Caucasian, 21% Hispanic/Latin American, 17% Asian or Pacific Islander, 10% African American, 7% Native American, and 1% Other. There was a sizable population of Eastern European immigrants in the school community, with 35% of the overall sample speaking a language other than English at home.

Measures

The full survey included the measures described below as well as items unrelated to the present study.

Intrinsic and extrinsic motivations

The motivational constructs were measured with two scales from Lepper et al. (2005), which students responded to using five-point Likert scales ranging from *not like me at all* (1) to *exactly like me* (5). Intrinsic motivation was assessed with 17 items tapping students' curiosity-driven engagement, preference for challenging work, and inclination to master material independently. Averaged together, these items formed an internally consistent ($\alpha = .90$) composite scale of intrinsic motivation. Extrinsic motivation was assessed with 16 items tapping students' focus on pleasing authority figures, preference for easy schoolwork, and dependence on the teacher. Averaged together, these items formed an internally consistent ($\alpha = .83$) composite scale of extrinsic motivation. Additional information on scale reliability and validity can be found in Lepper et al. (2005); confirmatory factor analyses with the present sample are reported in Corpus et al. (2009).

[1] The sample for the present study was a subset of that reported in Corpus et al. (2009), which focused on patterns of change in third- through eighth-grade students' intrinsic and extrinsic motivations using a variable-centered approach. The present study is distinct in that it uses a person-centered framework to explore motivational profiles and their correlates.

Academic achievement

Letter grades were collected from school records for the first and fourth quarters of the academic year to correspond to the two time points at which the motivational constructs were measured. Because not all parents gave permission to access records, there was a slightly smaller group of students for whom achievement data were available ($N = 295$, 86% of the sample). These students did not differ in their levels of intrinsic or extrinsic motivations from those whose parents denied access, $ts(341) < 1.31$, ns. Grade-point averages (GPAs) at each time point were computed by averaging the numerical equivalent of the letter grades following the standard 4-point scale (i.e., $A = 4.0$, $A- = 3.7$, $B+ = 3.3$, etc.). Only the grades from core academic classes—language arts, math, science and social studies—were used in these calculations.

Procedure

The survey was administered once in the fall and once in the spring to groups of approximately 20 students gathered in the school cafeteria. Students were separated by small barriers to alleviate concerns that they would alter their responses based on judgment from classmates. Confidentiality was ensured and students were given sample questions to practice using the response scale. Questions were then read aloud by a research assistant, and students were encouraged to follow along instead of working ahead. Two to three additional research assistants floated around the room to answer questions as needed. The entire session lasted approximately 20 min.

Analysis strategy

The clustering procedure followed Bergman and El-Khouri's (1999) guidelines for I-States as Objects Analysis (ISOA), a technique that, following dynamic systems models, treats an individual's data from a single time point as a discrete unit—an i-state. In practice, this means that instead of organizing the data in terms of single participants with repeated-measures motivation data, the fall and spring motivational profiles from each participant were temporarily separated and treated as unrelated data points. Once the data were clustered and a final solution was chosen, the i-states were reorganized to represent individual participants across time.[2] Cluster membership in the fall and the spring was then related to academic achievement from the same time point. Finally, exploratory longitudinal work traced movement among clusters across the school year, assessing stability and change in motivational profiles. ISOA was chosen in part because of its appropriateness in studying short-term changes, such as motivational shifts over the course of the school year (Bergman and El-Khouri 1999; Nurmi and Aunola 2005). It also offers the most coherent account of movement between clusters. If participants had been classified with two clustering procedures—one in the fall and one in the spring—it could be unclear whether the shifts reflected differences in the motivational profiles per se, or differences in the cluster solutions (cf. Braten and Olaussen 2005).

Results

There was very little missing data in the self-report measures. When students left particular items blank (<1% of cases), composite variables were created based on the average of completed items for each measure. Due to the sensitivity of clustering procedures to anomalies in the data, eight data points were identified as outliers ($|X–M| > 2.5$ SD) and converted to less extreme values ($|X–M| = 2.5$ SD).

Overall descriptive statistics are presented in Table 1. Notably, the correlations between intrinsic and extrinsic motivations were small when significant, confirming Lepper and colleagues' (2005) finding that these constructs are relatively orthogonal. Consistent with previous variable-centered research, academic achievement was correlated positively with intrinsic motivation and negatively with extrinsic motivation.

Forming motivational profiles with ISOA

Clustering procedures

Clustering followed Bergman and El-Khouri's (1999) ISOA technique. In the present study, an i-state consisted of one student's intrinsic and extrinsic motivations at one time point, either the fall or the spring. The i-states from both time points were treated as one large group to form a single set of clusters. As such, the first step in the analysis was to reorganize the data in terms of i-states instead of participants. The data rows were changed from representing a single person to representing a single person at a single wave (see Nurmi and Aunola 2005). Once this step

[2] Although organizing data from single participants as representing different i-states may appear to violate concerns about independent observations, readers can be assured that clustering is a simple algorithm not subject to the same assumptions as statistical tests of significance. Hypothesis testing was only performed once the data were reorganized into multiple waves of data for individual participants, and only for one wave of i-states at a time.

Table 1 Descriptive statistics and correlations for motivation and achievement

Variable	2	3	4	5	6	*M*	SD
Motivation							
1. F intrinsic	.68**	−.04	−.14**	.16**	.16**	3.32	.70
2. S intrinsic	–	−.06	−.16**	.15*	.18**	3.08	.73
3. F extrinsic		–	.70**	−.22**	−.18**	3.24	.64
4. S extrinsic			–	−.22**	−.19**	3.18	.63
Achievement							
5. F GPA				–	.80**	2.97	1.00
6. S GPA					–	2.82	1.18

F, Fall; *S*, Spring

* $p < .05$, ** $p < .01$

was complete, agglomerative hierarchical clustering took place using Ward's procedure, with average squared Euclidean distance as the measure of similarity (see Aldenderfer and Blashfield 1984).

A final solution of four clusters was chosen following the criteria outlined by Bergman (1998), as well as concerns of parsimony. This solution explained 67% of the variance in intrinsic motivation, 54% of the variance in extrinsic motivation, and 61% of the total variance—all above the 50% threshold used by Vansteenkiste et al. (2009). More importantly, this solution captured theoretically meaningful variations along the dimensions of motivation quality and quantity, as described in greater detail below. A three-cluster solution was less favorable because it explained less variance (51% overall) and collapsed two theoretically distinct clusters (i.e., a high intrinsic-low extrinsic cluster combined with a cluster that represented low levels of both constructs). A five-cluster solution, on the other hand, explained more variance (69% overall) but the increased granularity did not reflect a distinct profile missing from the four-group solution. Hence, the four-cluster solution was favorable.

In order to optimize the homogeneity of the clusters and remove any effect the initial data order had on the Ward's cluster solution, a k-means clustering procedure was used to construct the final solution (see Bergman 1998). Specifically, the four clusters revealed by Ward's analysis were used as the initial partition in a k-means cluster analysis. This procedure in essence shuffled i-states among the four clusters to minimize the variance within each group (Aldenderfer and Blashfield 1984). Following the k-means procedure, the final solution of four clusters explained 66% of the total variance in intrinsic and extrinsic motivations (69% of intrinsic, 63% of extrinsic).

This final solution was subjected to a double-split cross-validation procedure in order to ensure that it was stable and replicable (Breckenridge 2000). First, the i-states were randomly split into two halves, and the two-step cluster

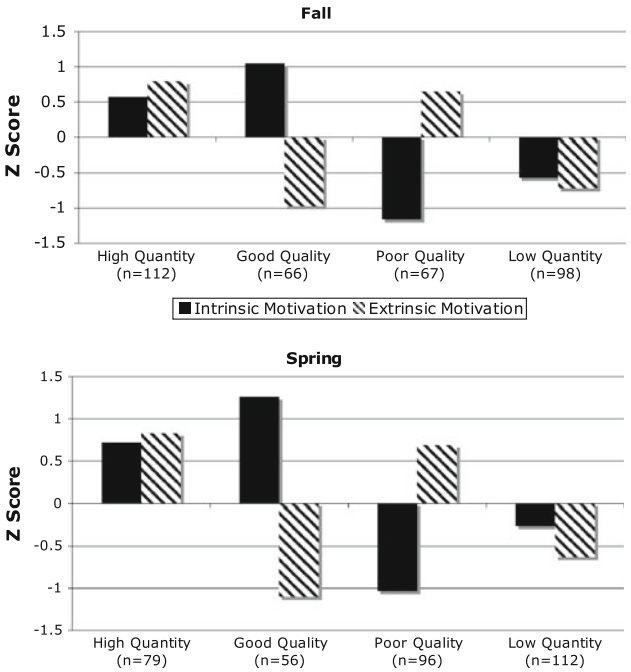

Fig. 1 Z scores by cluster for fall and spring

procedure performed on each half. Data points from each half were then reclassified based on the cluster to which their nearest neighbor in the other half belonged. The original and reclassified cluster assignments were then compared by means of Cohen's kappa. The average kappa value for the two halves was .88, far above the .60 threshold of acceptability (Asendorpf et al. 2001).

Description of the final solution

The final four-cluster solution closely resembled that of Vansteenkiste et al. (2009); it included a "high quantity" group that reported high levels of both intrinsic and extrinsic motivations (191 i-states), a "good quality" group with high intrinsic motivation but low extrinsic motivation (122 i-states), a "poor quality" group with low intrinsic motivation but high extrinsic motivation (163 i-states), and a "low quantity" group with low levels of both constructs (210 i-states). Figure 1 presents the *z* scores of intrinsic and extrinsic motivations for each cluster in the fall (top graph) and spring (bottom graph). The four groups were clearly distinct from one another and deviated considerably from the mean in their levels of intrinsic and extrinsic motivations. Moreover, the quantity and quality labels were appropriate at both time points, although it is notable that the low quantity group was also of relatively good quality, particularly in the spring (cf. Vansteenkiste et al. 2009). In order to verify that the four-cluster solution was appropriate for both fall and spring data, we repeated the double-split cross-validation procedure with the fall and spring

samples as the two halves. The average kappa value was .63, providing further evidence that the cluster solution was replicable.

Preliminary analyses

The fall and spring motivational clusters were analyzed separately for systematic variations in gender and grade distribution. Chi-square tests of independence examining gender across the clusters were not significant χ^2s(3, $N = 343$) < 6.08, ns. There were, however, significant differences in the percentage of students from each grade among the clusters, χ^2s(6, $N = 343$) > 18.66, ps < .01. In the high quantity group, 6th-grade students were overrepresented and 7th-grade students underrepresented. In the good quality group, 7th-grade students were overrepresented and 8th-grade students underrepresented. Because grade was also systematically related to GPA at each timepoint, Fs(2, 292) > 5.32, ps < .01, we used it as a covariate in subsequent analyses on the relationship between cluster membership and GPA.

Motivational profiles and academic achievement

Fall

An analysis of covariance (ANCOVA) revealed a significant effect of cluster membership on first-quarter GPA, controlling for grade level, $F(3, 290) = 6.13$, $p < .001$, $\eta_p^2 = .08$.[3] Planned comparisons showed that students in the good quality group achieved significantly higher grades ($M = 3.43$, SE = .13) than their peers in the other three clusters: high quantity ($M = 2.78$, SE = .10), poor quality ($M = 2.77$, SE = .13), or low quantity ($M = 2.98$, SE = .11) groups. Figure 2 depicts the apparently adaptive value of motivation quality.

Spring

An ANCOVA revealed a significant effect of cluster membership on fourth-quarter GPA, controlling for grade level, $F(3, 290) = 6.02$, $p < .001$, $\eta_p^2 = .06$. As shown in Fig. 2, there was a similar pattern of relationships to that of the fall. Planned comparisons showed that students in the good quality group again achieved higher grades ($M = 3.23$, SE = .17) than those in the high quantity ($M = 2.77$, SE = .14) and poor quality ($M = 2.42$, SE = .13) groups, but not significantly higher than those in the low quantity group ($M = 2.99$, SE = .12). Thus, the two clusters with the highest ratio of intrinsic to extrinsic motivations (i.e., good quality, low quantity) appeared most adaptive in terms of academic achievement. The least adaptive cluster, by contrast, was the poor quality group representing the lowest ratio of intrinsic to extrinsic motivation. Once again the quality of motivation was critical.

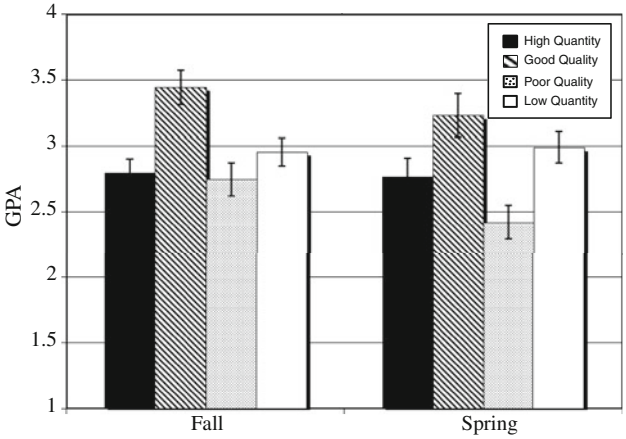

Fig. 2 Mean GPA (+SEs), adjusted for grade level, in the fall and spring by cluster

Changes in cluster membership over the year

Changes in cluster membership are presented in Table 2. To study longitudinal changes, we first identified all the pathways from fall clusters to spring clusters present in the sample. In order to ease interpretability as well as maximize the validity of the patterns that emerged, we considered a meaningful shift to be one that involved 10% or more of a fall cluster, as displayed in Fig. 3. Overall, the clusters were moderately stable while still showing plenty of variability. Although the majority of students from each fall cluster remained in their initial cluster, 43% of the sample changed cluster membership.

A general trend toward poorer quality motivation dominated these shifts. Indeed, the cluster representing poor quality motivation had the highest stability (71.6%) and the highest ratio of new member gains to old member losses (2.53:1). By contrast, the cluster representing good quality motivation was less stable (56.1%) and had a much smaller ratio of new member gains to old member losses (.66:1). Figure 3 shows no substantial pathways leading into the good quality cluster for the spring. There was also a less pronounced trend toward lower quantity motivation over the course of the year. The high quantity group was the least stable (49.1%) with the fewest new member gains relative to old member losses (.42:1); the low quantity group, by contrast, had a much larger ratio of new member

[3] An ANCOVA using the cubic transformation of GPA as dependent variable was also conducted to address a violation of the homogeneity of variance assumption, $F(3, 290) = 9.10$, $p < .01$, $\eta_p^2 = .08$. Findings were identical to those using the raw GPA data.

Table 2 Longitudinal shifts in cluster membership

Fall cluster	Spring cluster				
	1	2	3	4	Total
1. High quantity	55 (49.1%)	11 (9.8%)	19 (17.0%)	27 (24.1%)	112 (100%)
2. Good quality	6 (9.1%)	37 (56.1%)	3 (4.5%)	20 (30.3%)	66 (100%)
3. Poor quality	8 (11.9%)	0 (0%)	48 (71.6%)	11 (16.4%)	67 (100%)
4. Low quantity	10 (10.2%)	8 (8.2%)	26 (26.5%)	54 (55.1%)	98 (100%)
Total	79	56	96	112	343

Values in parentheses are the percentages of each fall cluster that shift into the various spring clusters. *IM*, intrinsic motivation; *EM*, extrinsic motivation

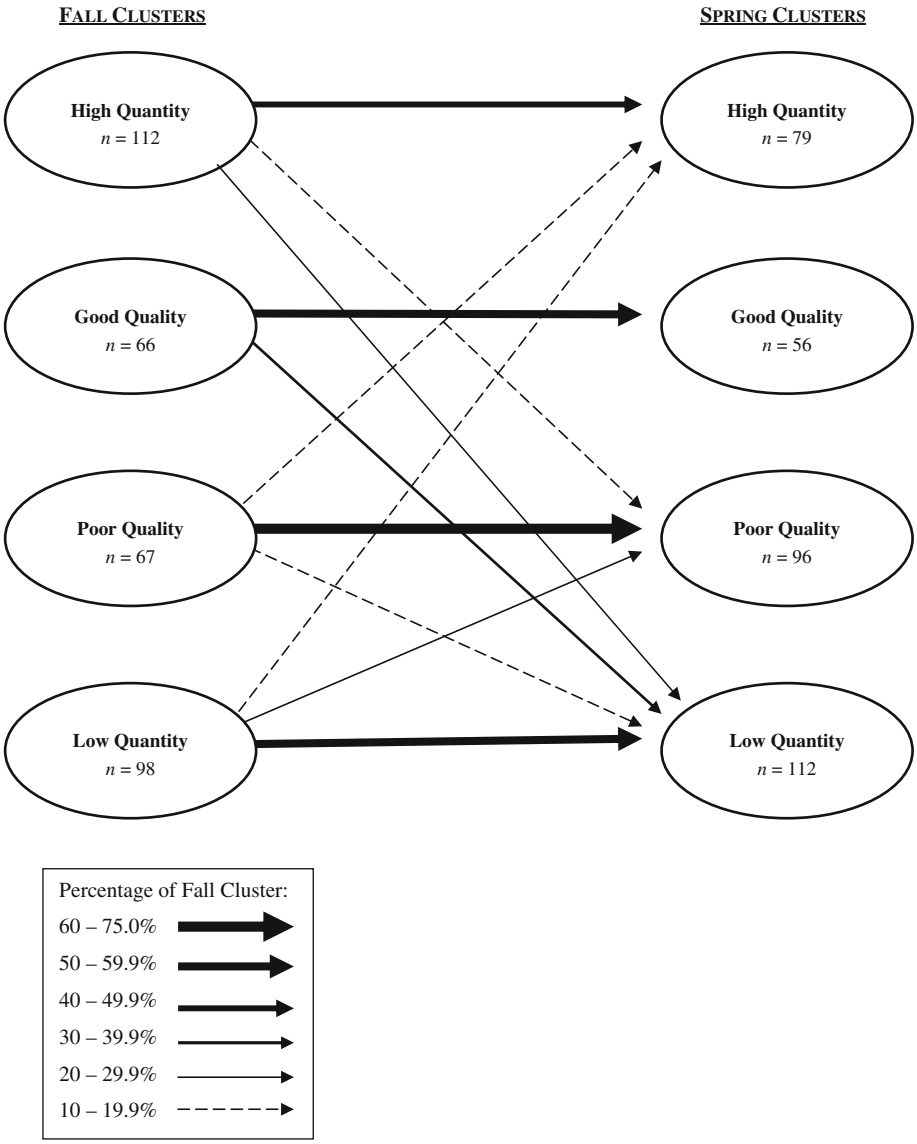

Fig. 3 Fall to spring shifts in cluster membership

gains to old member losses (1.32:1). In short, there was movement away from the good quality and high quantity clusters and toward the poor quality and low quantity clusters.

A second trend in the inter-cluster shifts was the lack of radical movement along the quality dimension. While students certainly moved in and out of the good and poor quality clusters, they rarely switched from one extreme to

the other. Indeed, fewer than 5% of students with good quality motivation in the fall switched to the poor quality cluster in the spring; no students switched from poor to good quality motivation over the course of the year. It was much more common, however, to see even extreme changes along the quantity dimension. Of the students with high quantity motivation in the fall, a full 24% switched to the low quantity cluster in the spring; 10% of students initially in the low quantity cluster switched to the high quantity cluster over the course of the year. It appears, then, that students may fairly easily undergo changes in the amount of motivation they report, but that the ratio of intrinsic to extrinsic motivation is less likely to change in a radical fashion.

Discussion

Intrinsic and extrinsic motivations have long been studied as mutually exclusive constructs, and more recently as independent entities. In the present study, we attempted to move in a multidimensional and dynamic direction by studying various combinations of intrinsic and extrinsic motivations and their stability over time. Cluster analysis revealed four distinct motivational profiles that varied meaningfully along the dimensions of motivation quantity and quality and mapped quite closely onto those found in previous research with high school and college students (Vansteenkiste et al. 2009). These motivational profiles, in turn, were differentially associated with academic achievement.

A new look at achievement

Across both time points, students in the good quality cluster received higher grades than their peers in other clusters with poorer quality motivation, even if that motivation was present in high quantities. It appears that the ratio of intrinsic to extrinsic motivation is far more predictive of academic achievement than the sheer amount of motivation present. This is shown particularly well by the spring data in which the low quantity profile was associated with relatively good grades, arguably because it had a favorable ratio of intrinsic to extrinsic motivation. The importance of motivation quality is also reflected in the mediocre performance of students in the poor quality and high quantity profiles. Indeed, students with high quantity motivation did substantially worse than those with good quality motivation despite both groups having relatively high levels of intrinsic motivation, presumably because extrinsic motivation had an undermining function.

These findings are consistent with decades of theory and research documenting the benefits of intrinsic motivation and potential detriments of extrinsic motivation (Deci and Ryan 1985; Harter 1992; Lepper et al. 1973; Pintrich and DeGroot 1990). They are also consistent with our earlier variable-centered research that included the present sample (Corpus et al. 2009). This research revealed academic achievement to be correlated positively with intrinsic motivation but negatively with extrinsic motivation, which might suggest the adaptive value of good quality motivation. Importantly, though, the present cluster analytic approach made contributions beyond our variable-centered work: First, we found that high levels of intrinsic motivation alone were not enough to predict good performance; one must simultaneously consider levels of extrinsic motivation. Second, although our variable-centered analyses showed intrinsic and extrinsic motivations to be moderately negatively correlated, the present study revealed subgroups of students for whom these types of motivation appeared to co-exist quite readily—i.e., those in the high and low quantity clusters (see Lepper and Henderlong 2000). Person-centered approaches, therefore, are an important complement to the variable-centered research that dominates the field.

Finally, our findings on motivation and achievement echo claims by Vansteenkiste et al. (2009), who found that secondary students with good quality motivation fared best—and those with poor quality motivation fared worst—on a number of learning outcomes. Their high quantity group, however, outperformed their low quantity group—a pattern that was arguably reversed in the present study. It is notable that their high quantity group had a more favorable ratio of intrinsic to extrinsic motivation than their low quantity group and that the reverse was true in the present study. Once again, this suggests that the quality of motivation is critical. Of course comparisons across studies must be made cautiously given the different population ages, educational contexts, and motivational measures involved. Nonetheless, there appears to be converging evidence that a combination of high intrinsic and low extrinsic motivations is uniquely adaptive (cf. Boiche et al. 2008; Liu et al. 2009).

One might argue that the good quality group earned the highest grades because intrinsic motivation uniquely promotes deep task engagement and optimal learning—a causal pathway found in our previous variable-centered research (Corpus et al. 2009). However, the reverse causal sequence is also plausible. High achieving students may be accustomed to attaining positive reactions from authority figures quite easily, and thus have the luxury of focusing primarily on task enjoyment and challenge-seeking. Likewise, low achieving students may elicit controlling reactions from adults that would generally serve to increase extrinsic motivation—again, a causal pathway supported by Corpus et al. (2009). It is also possible that a third

variable (e.g., competence) could underlie the achievement differences instead of the motivational profiles themselves. Future research must probe these causal pathways with power and precision. Longitudinal approaches with much larger samples than that of the present study will be necessary because the effect sizes are known to be small (see Corpus et al. 2009) and the variability of the motivational predictor in a person-centered analysis is so limited. Given the amount of motivational change we observed over the course of the year, a relatively short period of time between motivation measures and achievement outcomes may be ideal for testing underlying causal processes (cf. Boiche et al. 2008). Greater precision might also be achieved by adopting a domain-specific approach. Measuring both motivation and achievement within particular content areas would arguably reveal stronger connections—and perhaps in a more accurate fashion—than is possible with a domain-general approach (Spinath and Steinmayr 2008; see Eccles 2005 for a thoughtful commentary on this and related issues).

Longitudinal patterns and the mechanisms of change

A second and truly unique contribution of the present study was the exploration of stability and change in the motivational profiles. Just over half of the sample remained in the same cluster from fall to spring, which suggests a modest amount of stability. For those students who did shift clusters, two main trends emerged in the pattern of inter-cluster movements. First, it was far more common to see radical change along the dimension of motivation quantity (i.e., movement between the high/low groups) than the dimension of motivation quality (i.e., movement between the good/poor groups). Students with good quality motivation may not necessarily sustain their adaptive outlook over time but they appear quite unlikely to join their peers in the diametrically opposed—and far less adaptive—poor quality group. The quantity dimension, by contrast, was more malleable, which suggests that students may find it easier to alter the sheer force of their efforts than the nature of those efforts. This may be an important consideration for interventionists. The second broad pattern was a trend toward poorer quality motivation over time, which is consistent with variable-centered longitudinal work documenting losses to intrinsic motivation (Bouffard et al. 2003; Eccles et al. 1998; Ntoumanis et al. 2009; Otis et al. 2005). This was perhaps demonstrated most clearly by the high degree of stability in the poor quality cluster and the overall exodus from the two groups with high levels of intrinsic motivation (i.e., good quality, high quantity). The pattern of instability in the high quantity group, moreover, suggests that maintaining high levels of both intrinsic and extrinsic motivations may not be sustainable—a possibility that calls for further research.

What factors can help account for these shifts in motivation over the year? Previous research has implicated a variety of potential components. Perceived competence, for example, has been shown to drive changes in both autonomous and controlled forms of motivation over the middle school years (Ntoumanis et al. 2009; also see Harter et al. 1992). Aspects of the instructional context may also be critical given that shifts in students' perceptions of the school goal context predicted shifts in their levels of intrinsic and extrinsic motivations in our earlier variable-centered research (Corpus et al. 2009; cf. Ntoumanis et al. 2009). Likewise, Vansteenkiste et al. (2009) found teacher autonomy support to be highest in their good quality cluster and lowest in their poor quality cluster, although their study did not track change over time. Unstable motivational profiles may also relate to students' fluctuating sense of belonging (see Deci and Ryan 2002), sensitivity to classroom exams (Bong 2005), and the escalating pace and difficulty of academic material over the year. In short, the dynamic nature of these motivational profiles likely reflects students' ongoing adaptations to their ever-changing school lives. It will be important for future research to test these explanatory hypotheses with statistical approaches that are both sensitive and powerful. Latent transition analysis, for example, might fruitfully be employed to assess the probability of cluster movement given a set of underlying contextual and personal factors such as those listed above. Truly understanding the processes of motivational change will also require methods that allow for the integration of person-centered and variable-centered analyses (Muthen and Muthen 2000).

Implications for future research

The person-centered framework of the present study is relatively rare in motivation research and therefore calls for replication and extension in future work. The particular approach we took to clustering, for example, might be refined by using not only the factors of intrinsic and extrinsic motivations, but also their respective sub-scales. Although Lepper et al. (2005) found that intrinsic motivation clearly functioned best as a single higher-order factor, the component scales of extrinsic motivation (desire for easy work, focus on pleasing adults, dependence on the teacher) functioned somewhat independently. It would be interesting, therefore, to compare cluster solutions using only the higher-order extrinsic factor versus the three extrinsic subscales. Such analyses could more precisely identify the central goals motivating students in the high quantity and poor quality profiles, for example. Future research might also adopt a domain-specific approach

either by measuring motivation only in a single content area or by measuring motivation separately across a number of content areas. Although previous research on intrinsic and extrinsic motivations has primarily used a domain-general approach (e.g., Lepper et al. 2005; Murphy and Alexander 2000), there is some evidence that children show different patterns of motivation across content areas in person-centered research (Nurmi and Aunola 2005). Finally, it will be important to move beyond GPA to identify correlates that may further differentiate the clusters, such as emotional well-being, drop-out intentions, and self-protective behaviors. Ratelle et al. (2007) and Vansteenkiste et al. (2009) have begun to address some of these issues at the high school and college level; more work with younger populations is needed (cf. Liu et al. 2009).

In continuing this line of study, a developmental perspective may be especially fruitful. Research in the related area of goal theory has suggested different patterns of adaptiveness depending on age. For example, performance goals tend to relate positively to academic achievement among high school and college students (Church et al. 2001; Elliot and McGregor 2001; Harackiewicz et al. 2000; Wolters 2004), but may be linked to maladaptive outcomes among elementary students (see Midgley et al. 2001). Perhaps the relationship between profiles of intrinsic and extrinsic motivations and achievement would also differ for older versus younger students. In support of this hypothesis, the well-documented undermining effect of extrinsic rewards on intrinsic motivation has been shown to be more pronounced for children than for college students (Deci et al. 1999). This may be related to the distinct academic environments commonly found at different stages of the schooling process. Many high school and college classrooms reward students who comply with rules, develop effective test-taking strategies, and focus on tangible markers of success. In these contexts, one could imagine that high quantity motivation would accord benefits that are not present at the middle school level (Ratelle et al. 2007; cf. Vansteenkiste et al. 2009). Likewise, the benefits of good quality motivation may be even more pronounced at the elementary level, where rules are less rigid and student autonomy is promoted to a greater extent. It will be important for future studies to include both younger and older populations in order to determine whether the benefits of particular motivational profiles change as a function of age and educational context.

One final direction for future research involves the longitudinal shifts discussed earlier. The variety of inter-cluster movement is of particular interest as it could signify a high degree of malleability in motivation. Perhaps the dynamic nature of these motivational profiles indicates amenability to intervention efforts. Using a framework that encompasses the study of individual differences, examines interaction between students and their environments, and captures the fluid nature of motivational constructs can be a helpful step towards the ultimate goal of optimizing student motivation. Perhaps this endeavor will help enable all students to echo Mark Twain's (1889) sentiment that "Intellectual 'work' is misnamed; it is a pleasure, a dissipation, and is its own highest reward."

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