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# Examining the Relationship Between the Overexcitabilities and Self-Concepts of Gifted Adolescents via Multivariate Cluster Analysis

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## Abstract

The purpose of this study was to explore the relationship between gifted adolescents' forms of overexcitabilities and self-concepts. Clusters of adolescents were formed on the basis of their overexcitabilities, and these clusters of adolescents were then compared with regard to their self-concept scores. Gender differences were also examined. The sample consisted of 379 gifted adolescents, ranging in age from 11 to 16 years of age. Forms of overexcitabilities were measured using the Overexcitabilities Questionnaire–II, and various facets of self-concept were measured using the Self-Description Questionnaire–II. Using cluster analysis, multivariate analysis of variance, and chi-square analysis, results suggested a distinct four-cluster solution, as well as differences between clusters in self-concept and gender.

## Putting the Research to Use

Within this research, four distinct clusters of adolescents were found, namely a Low Imaginational group, a High Intellectual group, a Low Imaginational/High Psychomotor group, and a Low Psychomotor group. Differences in self-concept were found to center on the Low Psychomotor group, such that this group scored significantly lower than the three other groups with regard to various facets of self-concept. Females significantly outnumbered males in the Low Psychomotor group. Thus, gifted adolescent females with a low psychomotor overexcitability score may be more prone to a lowered self-concept and may need intervention, counseling, or special activities/accommodations to buffer the potential self-concept deficits they may face.

## Keywords

self-concept, overexcitabilities, adolescents

*Self-concept* is one of several "self" terms (i.e., *self-efficacy*, *self-esteem*) used to describe an individual's perceptions of the quality of his or her skills (e.g., math ability), characteristics (e.g., physical appearance), and behaviors (e.g., relationships with others). Although closely related to self-esteem and self-efficacy (Valentine, DuBois, & Cooper, 2004), self-concept is specifically defined as "a person's self-perceptions formed through experience with and interpretations of his or her environment" (Marsh & Hattie, 1996, p. 58).

Research supports a hierarchical model of self-concept, where perceptions of the self in academic and nonacademic domains fall within a broader view of the self (i.e., general or global self-concept; Marsh & Craven, 2006). Within the academic and nonacademic domains, there are more specific subdomains. For example, academic subdomains include verbal and math self-concept, and the nonacademic subdomains capture social, physical, and emotional self-concept, such as emotional stability and same-sex peer relations (Byrne & Shavelson, 1996).

An individual's self-concept in each domain develops through internal and external frames of reference (Marsh, 1986). Specifically, according to Marsh's internal/external frame of reference model, an individual's self-concept emerges through both internal comparisons (i.e., *my* academic competence vs. *my* physical ability) and external comparisons (i.e., *my*

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academic competence vs. my *friend's* academic competence), allowing for different levels of self-concept within the same individual, depending on the domain (Harter, 2006; Hoge & McSheffrey, 1991; Marsh, 1986; Plucker & Stocking, 2001).

Self-concept has been widely linked to academic and behavioral outcomes (De Fraine, Van Damme, & Onghena, 2007; Harter, 2006; Marsh, Trautwein, Ludtke, Koller, & Baumert, 2005; Pajares, 1996; Valentine et al., 2004). In their meta-analysis examining relations between self-beliefs and academic achievement in 55 research reports, Valentine et al. (2004) found that self-beliefs (operationalized as self-concept, self-efficacy, and self-esteem) had a small, positive effect on academic achievement. Similarly, Marsh et al.'s (2005) examination of relationships between academic self-concept and academic achievement provided strong support for the notion that academic self-concept predicts future academic achievement. In addition, there is evidence that academic self-concept predicts course taking (Ozturk & Singh, 2006). Ozturk and Singh found that math self-concept was surpassed only by math achievement in predicting students' advanced math course taking in high school.

Self-concept also has been found to relate to a wide range of nonacademic outcomes. For example, in a sample of 11- to 13-year-olds, athletic self-concept was negatively related to emotional and behavior problems (Donaldson & Ronan, 2006). Similarly, physical self-concept has been negatively related to body dissatisfaction in college women (Cook-Cottone & Phelps, 2003) and fear of failure in girls of 8 to 18 years (Conroy, Coatsworth, & Kaye, 2007). In her review of self-concept literature, Harter (2006) suggests that self-concept is an important predictor of mental health and adjustment. Collectively, this evidence points to the importance of understanding the factors that influence self-concept. One such factor may be an individual's form of overexcitabilities.

## Forms of Overexcitabilities

The notion of *overexcitabilities* stems from Dabrowski's (1964) theory of positive disintegration, which is a theory of personality development where an individual moves from an egocentric approach to life to an altruistic one. In the theory of positive disintegration, personality growth hinges on what Dabrowski calls developmental potential, which includes three components: special talents and abilities (including a high level of intelligence), motivation, and a physiological response to external stimuli called overexcitabilities (Mendaglio & Pyryt, 2004). Thus, the theory suggests that one's developmental potential is an important factor in determining the course of personality growth and overexcitabilities are influential to the acquisition of developmental potential. The overexcitabilities may lead to a series of developmental crises (i.e., positive disintegrations) and challenges that culminate in the emergence of an autonomous, self-crafted personality, marked by altruistic life goals and self-acceptance.

There are five forms of overexcitabilities, each of which may lead to different outcomes. For a thorough description of Dabrowski's ideas and the theory of positive disintegration, the reader is referred to Dabrowski (1937, 1964, 1970, 1972) and Mendaglio (2008). The five forms of overexcitabilities can be described as follows: A *psychomotor overexcitability* refers to a surplus of energy and may include such behaviors as extreme enthusiasm, rapid speech, impulsive actions, acting competitively, exhibiting anxious behaviors, and acting compulsively. A *sensual overexcitability* is marked by the pursuit of pleasure through senses such as tastes and smell. One might experience *enhancing stimuli,* such as through seeking to become the focus of attention or binge eating, or one might remove oneself from stimuli, such as by taking the tags out of one's clothes or wearing earplugs. An *intellectual overexcitability* is associated with striving for knowledge and truth through questioning, discovering, and analyzing. An *imaginational overexcitability* is characterized by daydreaming, fantasizing, dramatization, and the use of imagery and metaphors. An *emotional overexcitability* is marked by the intensified level of interpersonal relations to people, things, and places and compassionate feelings for others (Ackerman, 1997; Bouchet & Falk, 2001; Dabrowski & Piechowski, 1977; Piechowski, 1979; Piechowski & Colangelo, 1984).

Several researchers have noted gender differences with regard to the forms of overexcitabilities in adolescent and adult samples. For example, in their study of intellectually gifted adolescents, Gross, Rinn, and Jamieson (2007) found that females reported higher sensual, imaginational, and emotional overexcitability subscale scores than males. Bouchet and Falk (2001) examined the relationship between gender and overexcitabilities among university students and found that intellectually gifted males scored higher than intellectually gifted females on intellectual, imaginational, and psychomotor overexcitabilities, whereas intellectually gifted females scored higher than intellectually gifted males on emotional and sensual overexcitabilities. Tieso (2007a) also found that females scored higher than males on the emotional and sensual overexcitabilities in a sample of gifted children and adolescents and their parents. In their study of adults, Miller, Silverman, and Falk (1994) found that females scored higher on emotional overexcitability, whereas males scored higher on intellectual overexcitability.

Although not designed as a theory to identify intellectually gifted students, multiple researchers have found that gifted individuals tend to score higher than the nongifted on some forms of the overexcitabilities. Piechowski and Colangelo (1984) examined the overexcitabilities of intellectually gifted adolescents, intellectually gifted adults, artists, and average-ability graduate students. Results indicate that both gifted adolescents and gifted adults were characterized by higher intellectual, emotional, and imaginational overexcitabilities. Gallagher (1986) found that gifted 6th-grade students also reported higher intellectual, emotional, and

imaginational overexcitability scores than a random sample of average-ability 6-grade students. In a study of 10th- and 11th-grade students, gifted students had higher intellectual, emotional, and psychomotor overexcitabilities than average ability students (Ackerman, 1997), and Bouchet and Falk (2001) found gifted college students to score higher than average-ability college students on measures of intellectual and emotional overexcitabilities.

With overexcitability, though, comes what mainstream psychology considers symptoms of disorders or psychopathology. In Dabrowski's theory, such "symptoms" are recast as signs of development. For example, Dabrowski (1970) reported that, in a nonclinical sample of 170 children attending public school in Warsaw, ". . . 85% of the subjects with IQ from 120–150 have various symptoms of nervousness and slight neurosis, such as mild anxiety, depression, phobias, inhibitions, slight tics and various forms of overexcitability" (p. 18). In another sample of 80 gifted youth (IQ of 126-146) ranging in age from 8 to 23 years, Dabrowski (1967) reported that every participant showed considerable levels of all five forms of overexcitability. The sample also manifested various forms of symptoms: "[I]t turned out that these children also showed sets of nervousness, neuroses, and psychoneuroses of various kinds and degrees of intensity, from light vegetative symptoms, or anxiety symptoms, to distinctly and highly intensive psychasthenic or hysterical sets" (p. 253).

Dabrowski noted that different clusters of overexcitabilities might lead to different outcomes. For example, he was quite explicit that the higher forms of overexcitability—imaginational, intellectual, and emotional—were essential for advanced development. When only psychomotor and/or sensual forms were found in ambitious, narcissistic individuals, these lower forms of overexcitability were associated with psychopathology such as sociopathy (Dabrowski, 1972). The presence of the higher forms of overexcitability served to transform the psychomotor and sensual overexcitabilities into positive forms.

A hallmark of the theory of positive disintegration is the reframing of typical concepts in psychology. For example, one's personality is not a guaranteed outcome based on one's achievements (Dabrowski, 1967). Similarly, our notions of self-concept need reconsideration. Advanced personality development, for which the five forms of overexcitability are one prerequisite, is fraught with intense negative emotions that are typically associated with poor self-concepts or low self-esteem in traditional psychology. However, these same negative emotions could lead to the highest forms of development, according to Dabrowski. For example, an emotional overexcitability, which may manifest as neurosis, can promote positive development through magnified empathy. Thus, as poor self-concept may naturally coincide with the initial formation of one's personality development, we are left to wonder how the forms of overexcitability may be related to various facets of self-concept, if at all. Although low self-concept is traditionally seen as a negative characteristic in psychology and education, it is considered a positive characteristic in Dabrowski's theory. As the relationship between overexcitabilities and self-concept among the gifted is relatively unknown, and given the potential for reframing our notion of "self-concept" in the theory of positive disintegration, analyzing these variables in combination may provide necessary insight.

## Current Study

The purpose of the current study was to explore the relationship between intellectually gifted adolescents' overexcitabilities and self-concepts via cluster analysis. *Cluster analysis* is an umbrella term used for a number of multivariate statistical classification procedures, the purpose of which is to empirically form groups of homogeneous objects by classifying previously undefined cases in such a way that objects in the same class are similar to one another (Aldenderfer & Blashfield, 1984; Everitt, 1979; SAS Institute, 2003). In the current study, clusters of adolescents were formed on the basis of their overexcitabilities, and those clusters of adolescents were then compared with regard to their self-concept scores. Gender differences were also analyzed.

Because gifted individuals tend to score higher than the nongifted on some forms of the overexcitabilities, and because a high level of intelligence is a necessary condition for advanced development, according to Dabrowski (see Mendaglio & Pyryt, 2004), an examination of the gifted is warranted. Dabrowski (1972) himself categorized the overexcitabilities into "higher" and "lower" forms, whereby the higher forms (imaginational, intellectual, and emotional) were more likely to lead to advanced development. As such, categorizing, or clustering, gifted adolescents by their forms of overexcitabilities is useful. However, although Dabrowski classified the overexcitabilities into higher and lower forms, with subsequent ramifications for self-concept development in each of the forms, we did not force an examination of the higher and lower forms of overexcitabilities. As this is an exploratory study with a sample of gifted adolescents, who have not been examined often in this area, and because this study is based on research conducted at least four decades ago, specific hypotheses were not formed.

As one's self-concept becomes more differentiated with age (Bryne & Shavelson, 1996), early adolescence may well be the time period when perceptions of the self are becoming entrenched. This study will offer insight into the initial stage of gifted adolescent self-concept formation as well as how overexcitabilities may be related to the formation of self-concept. As previously mentioned, low self-concept is traditionally seen as a negative characteristic in psychology and education, but it is considered a positive characteristic in Dabrowski's theory. As such, the relationship between overexcitabilities and self-concept becomes even more important as we consider the socioemotional development of gifted adolescents.

## Method

### Participants

Participants were recruited from two summer programs for intellectually gifted students held at a comprehensive university in the South. These particular summer programs have been in operation for more than 20 years. The first summer program is a 2-week, largely residential program[1] for gifted students entering the seventh, eighth, or ninth grades the following school year. To qualify for participation in this summer program, students must show (a) high interest and/or achievement in one or more content areas; (b) be eligible for services as a gifted child or have an IQ score of 125 or above; (c) score at or above the 90th percentile on the total battery, or at or above the 95th percentile on the total mathematics or language/reading section, of the most recent achievement test or have scored at the proficient or distinguished level on performance assessment measures; and (d) be nominated by a teacher, counselor, or principal. This summer program involves 6 hours of class per day, 5 days a week, for 2 weeks. The students have a variety of courses from which to choose (e.g., acting, geography, science), and they enroll in four courses. The students also engage in various social activities (e.g., board games, athletic activities, a talent show) after class each day and on weekends.

The second summer camp is a 3-week residential program for gifted students entering the 8th, 9th, 10th, or 11th grades the following school year. To qualify for participation in this summer program, students must have been eligible to attend talent search summer programs (e.g., through the Duke Talent Identification Program) within the past 4 years. This summer program involves 6 hours of class and 1 hour of study hall per day, 5 days a week, for 3 weeks. The students have a variety of courses from which to choose (e.g., humanities, genetics, theatre, mathematics), and they enroll in only one course. Similar to the other summer program, the students also engage in various social activities after class each day and on weekends.

A total of 569 cases were available for use across the 2-year data collection period. However, there were a number of missing scores within the original 569 cases likely because of attrition or aging out of the summer program, which resulted in an overall useable $N = 379$ cases that had scores for all overexcitabilities subscales and self-concept subscales. Of the 379 participants, 194 were male and 185 were female. The mean age of the participants was 13.4 ($SD$ = 1.3), with a range from 11 to 16. Slightly more than 78% of the participants were Caucasian ($n = 296$). Of the remaining 22%, approximately 8% were Asian or Pacific Islander ($n$ = 32), 4% were African American ($n = 14$), 1% were Hispanic ($n = 5$), and 0.5% were American Indian or Alaska Natives ($n = 2$). A total of 16 participants did not report information on ethnicity.

### Materials

*Demographic information.* Participants were given a demographic questionnaire to assess gender and age, among other information. Other data were gathered from participants' applications for summer camp participation, including ethnic background and grade level.

*Overexcitabilities.* The Overexcitabilities Questionnaire–II (OEQ-II) was designed to measure the five forms of overexcitabilities: psychomotor, sensual, imaginational, intellectual, and emotional (Falk, Lind, Miller, Piechowski, & Silverman, 1999). The OEQ-II includes 50 self-report items using a 5-point Likert-type scale with responses ranging from 1 (*not at all like me*) to 5 (*very much like me*). High scores indicate higher levels of overexcitabilities. Each overexcitability subscale is made up of 10 items. An example from the psychomotor overexcitability subscale is, "When I have a lot of energy, I want to do something really physical." A sample item for the sensual overexcitability subscale is, "Viewing art is a totally absorbing experience." The intellectual overexcitability scale includes items such as, "Theories get my mind going," whereas an example from the imaginational overexcitability subscale is, "Things that I picture in my mind are so vivid that they seem real to me." A sample item for the emotional overexcitability subscale is, "I can be so happy that I want to laugh and cry at the same time." From the normative sample, Cronbach's alpha was high for each form of overexcitability: psychomotor (.86), sensual (.89), imaginational (.85), intellectual (.89), and emotional (.84).

*Self-concept.* The Self-Description Questionnaire–II (SDQ-II) was designed to measure the self-concepts of young adolescents and is theoretically based on the notion that self-concept is multidimensional and hierarchically structured (Marsh, 1990; Shavelson, Hubner, & Stanton, 1976). The SDQ-II measures self-concept in the following areas via 11 subscales: mathematics, verbal, and physical abilities; physical appearance; same-sex peer relations; opposite-sex peer relations; parent relations; emotional stability; honesty-trustworthiness; general academic; and general self. The SDQ-II includes 102 self-report items using a 6-point Likert-type scale with responses ranging from 1 (*false*) to 6 (*true*). Higher scores indicate higher levels of self-concept. Extensive support for the reliability and validity of the SDQ-II has been reported in other research (see Gilman, Laughlin, & Huebner, 1999; Plucker, Taylor, Callahan, & Tomchin, 1997). See Table 1 for a description of each subscale, internal consistency scores for each subscale based on the normative sample, and factor loadings for each subscale based on the normative sample.

### Procedure

Parental consent was obtained prior to the start of the summer program. Adolescents whose parents gave consent were

**Table 1.** Information From the Normative Sample Regarding the Self-Description Questionnaire–II

| Subscales | Subscale Description | Reliability Estimate | Range of Factor Loadings |
|---|---|---|---|
| Mathematics | Ability, enjoyment, and interest in math and reasoning | .90 | .72-.80 |
| Verbal | Ability, enjoyment, and interest in English and reading | .86 | .53-.75 |
| Physical Abilities | Skills and interest in physical activities and sports. | .85 | .67-.78 |
| Physical Appearance | Physical attractiveness | .91 | .68-.76 |
| Same-Sex Peer Relations | Interactions with peers of the same sex | .86 | .57-.68 |
| Opposite-Sex Peer Relations | Interactions with peers of the opposite sex | .90 | .69-.78 |
| Parent Relations | Interactions with parents | .87 | .68-.77 |
| Emotional Stability | Emotional well-being and freedom from emotional dysfunction | .83 | .57-.66 |
| Honesty/Trustworthiness | Truthfulness and dependability | .84 | .61-.71 |
| General Academic | Interests and abilities in schoolwork | .87 | .48-.64 |
| General Self | Feelings of self-worth, self-confidence, and self-satisfaction | .88 | .49-.64 |

Note: Marsh (1990) uses item pairs in factor analysis, such that the 8 or 10 items from each subscale of the SDQ-II are divided into four- or five-item pairs. For more information, see Marsh and O'Neill (1984).

invited to take part in the study, but they were given the option to decline participation. Data were gathered at a single session during the first week of each summer program.

## Results

Clusters of adolescents were formed on the basis of their forms of overexcitabilities. These individuals in each cluster were then compared with regard to their self-concept scores using multivariate analysis of variance (MANOVA). Gender differences were also analyzed using chi-square analysis.

### *Cluster Analysis*

*Cluster analysis* is an umbrella term used for a number of multivariate statistical classification procedures, the purpose of which is to empirically form groups of homogeneous objects by classifying initially undefined cases in such a way that objects in the same class are similar to one another (Aldenderfer & Blashfield, 1984; Everitt, 1979; SAS Institute, 2003). More specifically, the goal is to form groups that maximize both intragroup similarities and intergroup dissimilarities (Campbell & Johnson, 1997).

An initial analysis was conducted to check for outliers and multicollinearity. In cluster analysis, outliers are likely to show up as clusters that contain only a few subjects. These tend to distort the functioning of many clustering algorithms (Anderberg, 1973). Examination of the frequency distributions identified no outliers. Multicollinearity is an issue in cluster analysis because variables that are multicollinear are implicitly weighted more heavily (see Hair, Anderson, Tatham, & Black, 1995; Hair & Black, 2000). To address the assumption of multicollinearity, correlations among all levels of overexcitabilities were obtained. Because the largest correlations were moderate (−0.43 or less) and the variables were conceptually distinct, all five overexcitability variables were retained for inclusion in the cluster analyses (Hair & Black, 2000).

To be able to validate the final cluster solution, the sample of 379 was randomly split into two groups. The cluster analyses were performed on 190 randomly selected cases and then validated on the remaining 189. Statistical analyses were performed using SPSS Version 15.0 for Windows. As the goal was to determine a cluster structure with a viable number of clusters, the hierarchical clustering procedure, Ward's method, was used to identify the number of clusters within the participants' scores on the five measures of overexcitability. In Monte Carlo studies of data with known cluster structures, Ward's method has been found to be superior in structure recovery (for a review, see Milligan, 1981). Lorr (1983) reports that Ward's method is most effective when a Euclidian distance measure is used. As such, squared Euclidian distance was used as the measure of proximity in these analyses.

An initial run of the cluster analysis resulted in a viable two-cluster structure where one cluster contained respondents who reported mostly high levels of all overexcitabilities and another cluster that included those that reported mostly low levels, which essentially identified groups according to their response style. This type of systematic pattern of responses to a set of items is known as *response-style effects* (Hair & Black, 2000). The goal here was not to simply identify groups according to their response style (e.g., low overexcitability or high overexcitability) but, rather, to examine the relative importance of one level of overexcitability to another. To put it another way, the objective was to find if clusters of respondents with similar patterns of overexcitability could be found in these data. To avoid these response-style effects, *row-centering standardization* was done on each overexcitability score. Row-centering standardization, or *within-case standardization* as it is sometimes called, was achieved by standardizing each overexcitability score to the respondent's

**Table 2.** Clustering Variable Mean Values From the Hierarchical Cluster Analysis of Row-Centered Standardized Scores

| Cluster | Psychomotor OE | Sensual OE | Imaginational OE | Intellectual OE | Emotional OE | Cluster Size |
|---|---|---|---|---|---|---|
| Two-cluster solution | | | | | | |
| 1 | 0.56 | −0.14 | −1.04 | 0.63 | 0.00 | 141 |
| 2 | −1.25 | 0.20 | 0.27 | 0.42 | 0.35 | 49 |
| Three-cluster solution | | | | | | |
| 1 | 0.15 | 0.70 | −1.41 | 0.58 | −0.02 | 42 |
| 2 | 0.73 | −0.50 | −0.88 | 0.65 | 0.00 | 99 |
| 3 | −1.25 | 0.20 | 0.27 | 0.42 | 0.35 | 49 |
| Four-luster solution | | | | | | |
| 1 | 0.15 | 0.70 | −1.41 | 0.48 | −0.21 | 42 |
| 2 | 0.48 | −0.55 | −0.78 | 1.12 | −0.27 | 60 |
| 3 | 1.11 | −0.42 | −1.04 | 0.08 | 0.42 | 39 |
| 4 | −1.25 | 0.20 | 0.27 | 0.42 | 0.35 | 49 |

Note: OE = overexcitability.

**Table 3.** Significance Testing of Differences Between Cluster Centers for the Hierarchical Cluster Analysis

| Variable | Cluster Mean Square | Degrees of Freedom | Error Mean Square | Degrees of Freedom | *F* Value |
|---|---|---|---|---|---|
| Two-cluster solution | | | | | |
| Psychomotor OE | 118.80 | 1 | .37 | 188 | 324.28** |
| Sensual OE | 4.39 | 1 | .54 | 188 | 8.09** |
| Imaginational OE | 62.55 | 1 | .32 | 188 | 196.87** |
| Intellectual OE | 1.59 | 1 | .50 | 188 | 3.15** |
| Emotional OE | 4.64 | 1 | .44 | 188 | 10.48** |
| Three-cluster solution | | | | | |
| Psychomotor OE | 64.30 | 2 | .32 | 187 | 203.58** |
| Sensual OE | 23.28 | 2 | .32 | 187 | 72.70** |
| Imaginational OE | 35.38 | 2 | .28 | 187 | 128.49** |
| Intellectual OE | 0.861 | 2 | .506 | 187 | 1.70** |
| Emotional OE | 2.33 | 2 | .445 | 187 | 5.23** |
| Four-cluster solution | | | | | |
| Psychomotor OE | 46.01 | 3 | .27 | 186 | 172.40** |
| Sensual OE | 15.60 | 3 | .43 | 186 | 48.99** |
| Imaginational OE | 24.13 | 3 | .27 | 186 | 89.90** |
| Intellectual OE | 11.85 | 3 | .33 | 186 | 36.29** |
| Emotional OE | 5.33 | 3 | .39 | 186 | 13.79** |

Note: OE = overexcitability.
**$p < .001$, two-tailed.

average of all their overexcitability scores. As such, this was a standardization by observation as opposed to a standardization by variables. Subtracting the respondent's average score of the five types of overexcitability from his or her raw score and then dividing by the standard deviation of his or her responses to the five types of overexcitability resulted in the row-centering standardized score.

The clustering agglomeration coefficient showed rather large increases in going from four to three clusters, three clusters to two, and two clusters to one. The largest increase in the clustering coefficient occurred in going from two to one cluster, whereas the increase from four to three clusters was essentially the same as the increase from three to four clusters. As such, the two-, three- and four-cluster solutions were examined.

An analysis of the cluster centroids was conducted to aid in interpretation of the clusters. Table 2 contains the values of the cluster centroids for the two-, three-, and four-cluster solutions, whereas Table 3 illustrates the results of the significance testing of the differences between cluster centers for the hierarchical cluster analysis. Inspection of the cluster coefficients implied that a four-cluster solution was retained and carried forward to a nonhierarchical analysis to obtain the final cluster solution.

A nonhierarchical K-means cluster analysis was conducted with the centroids from the Ward's method solution used as the seed points. The K-means procedure was done as an independent check on the stability of the cluster structure and as a way to optimize cluster membership. Convergence occurred in eight iterations. The centroid values, cluster sizes, univariate *F* ratios, and levels of significance comparing the differences between the cluster means are located in Table 4. In comparing the clustering variable means of the hierarchical and nonhierarchical methods, it can be seen that the profiles match well

**Table 4.** Significance Testing of Differences between Cluster Centers for the K-means Four-Cluster Solution

| Variable | Cluster Mean Square | Degrees of Freedom | Error Mean Square | Degrees of Freedom | *F* Value |
|---|---|---|---|---|---|
| Four-cluster solution | | | | | |
| Psychomotor OE | 46.76 | 3 | .26 | 186 | 183.49* |
| Sensual OE | 18.94 | 3 | .27 | 186 | 70.96* |
| Imaginational OE | 23.64 | 3 | .28 | 186 | 85.58* |
| Intellectual OE | 9.27 | 3 | .37 | 186 | 25.17* |
| Emotional OE | 8.75 | 3 | .33 | 186 | 26.44* |

Note: OE = overexcitability.
*$p < .001$, two-tailed.

**Table 5.** Clustering Variable Mean Values From the K-Means Four-Cluster Solution of Row-Centered Standardized Scores on the Entire Sample of 379 Participants

| Cluster | Psychomotor OE | Sensual OE | Imaginational OE | Intellectual OE | Emotional OE | Cluster Size |
|---|---|---|---|---|---|---|
| 1. Low Imaginational | 0.03 | 0.65 | −1.39 | 0.55 | 0.15 | 109 |
| 2. High Intellectual | 0.47 | −0.60 | −0.60 | 1.19 | −0.54 | 93 |
| 3. Low Imaginational/High Psychomotor | 1.06 | −0.67 | −0.91 | 0.11 | 0.39 | 83 |
| 4. Low Psychomotor | −1.26 | 0.21 | 0.20 | 0.52 | 0.33 | 94 |

Note: OE = overexcitability

and that the cluster sizes are somewhat similar. As in the Ward's method four-cluster solution, all variables varied in a statistically significant manner in the K-means analysis. As a validity check on the stability of the cluster solution, a K-means cluster analysis was performed on the 189 participants that made up the validation half of the original sample of 379, using the same initial seed points that were used in the first K-means analysis. Both the cluster sizes and profiles were consistent indicating an acceptable level of stability in the four-cluster solution. These correspondences and the stability of the two solutions between the nonhierarchical and hierarchical methods confirmed the results subject to theoretical and practical acceptance (Hair & Black, 2000).

Information on the cluster centroids of the final four-cluster solution is provided in Table 5 and illustrated graphically in Figure 1. This information aided in the profiling and interpretation of the cluster solution. Imaginational overexcitability and sensual overexcitability are the most important variables in describing the individuals represented by the first cluster. Because the scores were row-center standardized, the metric of the centroids is in the individual respondents' standard deviation of all overexcitability scores. For example, the −1.39 centroid of imaginational overexcitability indicates that this cluster is represented in large part by students with an on average imaginational overexcitability score that is approximately 1.4 standard deviations below their other overexcitability scores. In other words, the Cluster 1 members reported particularly low levels of imaginational overexcitability relative to their other overexcitabilities. In this fashion, it can be seen that Cluster 1 comprises individuals who are

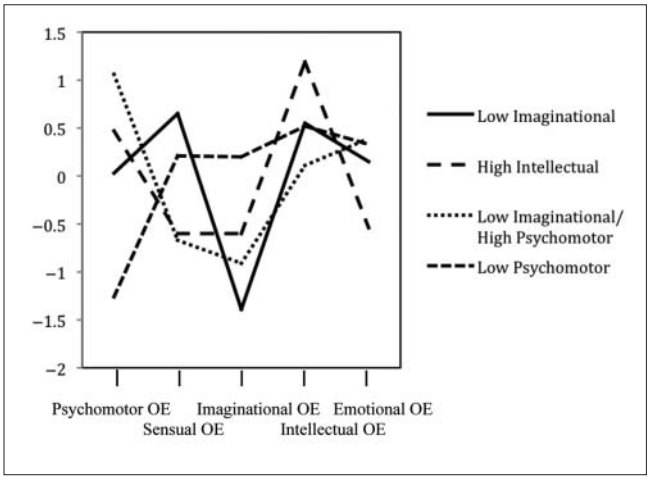


**Figure 1.** Graphical representation of the clustering variable means of the final cluster solution

primarily low imaginational overexcitability, with a bit of an influence of positive sensual and intellectual overexcitability, relative to the other types of overexcitability; emotional overexcitability is average. Cluster 2 membership is marked primarily by a considerably high intellectual overexcitability, with lesser positive psychomotor overexcitability, and low levels of imaginational, sensual, and emotional overexcitability. Cluster 3 individuals exhibit particularly high psychomotor and low imaginational overexcitability. Sensual is somewhat low and emotional somewhat high for these members. Finally, Cluster 4 members are primarily

**Table 6.** Distribution Information for the Measures of Self-Concept

| | Minimum | Maximum | Mean | Standard Deviation | Skew (*SE*) | Kurtosis (*SE*) |
|---|---|---|---|---|---|---|
| Honesty/trustworthiness | 1.39 | 6.00 | 5.00 | 0.85 | −1.36 (.13) | 2.02 (.25) |
| Verbal | 1.39 | 6.00 | 5.00 | 0.87 | −1.11 (−.13) | 1.03 (.25) |
| Opposite sex | 1.00 | 6.00 | 4.21 | 1.02 | −0.64 (.13) | 0.33 (.25) |
| Same sex | 1.20 | 6.00 | 5.21 | 0.81 | −1.77 (.13) | 4.36 (.25) |
| Physical ability | 1.00 | 6.00 | 4.43 | 1.26 | −0.82 (.13) | −0.19 (.25) |
| Physical appearance | 1.00 | 6.00 | 4.46 | 1.04 | −0.80 (.13) | 0.34 (.25) |
| Parent relations | 1.00 | 6.00 | 5.07 | 0.92 | −1.38 (.13) | 2.04 (.25) |
| Emotional | 1.10 | 6.00 | 4.31 | 1.03 | −0.65 (.13) | 0.05 (.25) |
| Math | 1.00 | 6.00 | 4.85 | 1.02 | −1.25 (.13) | 1.44 (.25) |
| General school | 3.00 | 6.00 | 5.39 | 0.50 | −1.85 (.13) | 4.59 (.25) |
| General self | 2.00 | 6.00 | 5.33 | 0.71 | −1.84 (.13) | 3.99 (.25) |

Note. *SE* = standard error of the statistic.

very low on psychomotor overexcitability and have a bit of the other four types. As a result, the clusters were named as follows: Cluster 1, Low Imaginational; Cluster 2, High Intellectual; Cluster 3, Low Imaginational/High Psychomotor; and Cluster 4, Low Psychomotor.

## *Gender Differences Among the Four Clusters*

A chi-square analysis was conducted to see if significant differences in the number of male and female members existed within the four clusters. The overall chi-square of the four clusters was significant ($\chi^2(3) = 53.09$, $p < .001$). To ascertain which specific clusters were significant, a series of follow-up chi-square analyses were performed. Because four comparisons were being made, a Bonferroni adjustment was made to the family-wise error rate of .05, which resulted in an $\alpha$ of .0125 for each comparison. Females significantly outnumbered males 63 to 31 ($\chi^2(1) = 16.58$, $p < .001$) in the Low Psychomotor cluster, whereas males significantly outnumbered females 77 to 16 ($\chi^2(1) = 49.28$, $p < .001$) in the High Intellectual cluster. Although females outnumbered males 62 to 47 in the Low Imaginational cluster and 44 to 39 in the Low Imaginational/High Psychomotor cluster, those differences were not statistically significant ($\chi^2(1) = 3.99$, $p = .046$ and $\chi^2(1) = 0.77$, $p = .386$, respectively; all tests were two-tailed).

## *Overexcitability and Self-Concept*

A 4 (cluster) × 11 (types of self-concept) MANOVA was conducted in to assess the relationship between overexcitability cluster membership and self-concept. In looking at the univariate distributions of the types of self-concept, it was found that the assumption of multivariate normality had been violated. Examination of the distribution information for each type of self-concept in Table 6 will reveal an overall pattern of considerable negative skew and positive kurtosis for the majority of the self-concept variables. This indicates that, overall, most participants had relatively high levels of self-concept. Tabachnick and Fidel (2007) have suggested that MANOVA is reasonably robust to violations of multivariate normality in large samples. The correlations among the types of self-concept reveal that the highest correlation was $r(376) = .65$, indicating potential problems with multicollinearity. Because the issue at hand was to ascertain the nature of the relationship between the types of self-concept and the naturally occurring groups of overexcitabilities, it was essential that all dependent variables be kept in the analysis. Means, standard deviations, and cell size for the types of self-concept for each cluster can be found in Table 7.

The overall MANOVA was significant, $F = 6.83$, $p < .001$, two-tailed, $\Lambda = .54$, indicating systematic differences in the levels of self-concept among the different clusters of overexcitability. From a multivariate perspective, this indicates the presence of at least one linear combination of the types of self-concept that significantly discriminated among the different clusters of overexcitability. Wilks's lambda indicated that 46% of the variance in that linear combination was explained by cluster membership.

The follow-up of the significant MANOVA was twofold. First, a series of univariate ANOVAs was conducted to further explore the differences in the levels of types of self-concept across the four clusters of overexcitability. Second, a discriminant function analysis was performed to determine the nature of the multivariate relationship between self-concept and the clusters of overexcitability.

*ANOVAs.* In the univariate ANOVAs, Levene's tests indicated that the assumption of equality of variance had been violated for same sex, $F(3, 372) = 5.16$, $p = .002$; physical ability, $F(3, 372) = 13.04$, $p < .001$; parent relations, $F(3, 372) = 4.08$, $p = .007$; emotional, $F(3, 372) = 2.88$, $p = .036$; math, $F(3, 372) = 3.00$, $p = .031$; and general $F(3, 372) = 5.17$, $p = .002$, self-concepts. (All tests were two-tailed.) Results of the univariate ANOVAs can be found in Table 8. The Games-Howell test was used for the post hoc analyses because of the combination of unequal sample sizes and the presence of inequality of variances (Field, 2000).

The post hoc analyses revealed no significant differences between the four clusters with regard to honesty/trustworthiness, verbal, general academic, and parent relations self-concepts. The remaining significant differences in

**Table 7.** Mean Scores, Standard Deviations, and Group Size for Measures of Self-Concept as a Function of Cluster Membership

| | *M* | *SD* | *n* |
|---|---|---|---|
| Honesty/trustworthiness elf-concept | | | |
| Low imaginational group | 5.18 | 0.81 | 108 |
| High intellectual group | 5.06 | 0.94 | 92 |
| Low imaginational/high psychomotor group | 4.88 | 0.83 | 82 |
| Low psychomotor group | 4.88 | 0.89 | 94 |
| Verbal self-concept | | | |
| Low imaginational group | 4.91 | 0.98 | 108 |
| High intellectual group | 4.84 | 0.90 | 92 |
| Low imaginational/high psychomotor group | 5.15 | 0.77 | 82 |
| Low psychomotor group | 5.01 | 0.89 | 94 |
| Opposite sex self-concept | | | |
| Low imaginational group | 4.23 | 0.91 | 108 |
| High intellectual group | 4.26 | 1.04 | 92 |
| Low imaginational/high psychomotor group | 4.55 | 0.96 | 82 |
| Low psychomotor group | 3.83 | 1.06 | 94 |
| Same sex self-concept | | | |
| Low imaginational group | 5.33 | 0.73 | 108 |
| High intellectual group | 5.23 | 0.66 | 92 |
| Low imaginational/high psychomotor group | 5.45 | 0.65 | 82 |
| Low psychomotor group | 4.82 | 0.99 | 94 |
| Physical ability self-concept | | | |
| Low imaginational group | 4.65 | 0.99 | 108 |
| High intellectual group | 4.67 | 1.08 | 92 |
| Low imaginational/high psychomotor group | 5.26 | 0.64 | 82 |
| Low psychomotor group | 3.21 | 1.24 | 94 |
| Physical appearance self-concept | | | |
| Low imaginational group | 4.52 | 0.99 | 108 |
| High intellectual group | 4.53 | 0.97 | 92 |
| Low imaginational/high psychomotor group | 4.77 | 0.93 | 82 |
| Low psychomotor group | 4.05 | 1.13 | 94 |
| Parent relations self-concept | | | |
| Low imaginational group | 5.14 | 0.82 | 108 |
| High intellectual group | 5.14 | 1.01 | 92 |
| Low imaginational/high psychomotor group | 5.14 | 0.73 | 82 |
| Low psychomotor group | 4.84 | 1.05 | 94 |
| Emotional self-concept | | | |
| Low Imaginational Group | 4.53 | 0.88 | 108 |
| Intellectual Group | 4.20 | 1.05 | 92 |
| Low imaginational/high psychomotor group | 4.26 | 0.90 | 82 |
| Low psychomotor group | 3.78 | 1.07 | 94 |
| Math self-concept | | | |
| Low imaginational group | 4.89 | 1.00 | 108 |
| High Imaginational group | 5.17 | 0.93 | 92 |
| Low imaginational/high psychomotor group | 4.96 | 0.87 | 82 |
| Low psychomotor group | 4.54 | 1.16 | 94 |
| General school self-concept | | | |
| Low imaginational group | 5.46 | 0.59 | 108 |
| High imaginational group | 5.62 | 0.42 | 92 |
| Low imaginational/high psychomotor group | 5.58 | 0.41 | 82 |
| Low psychomotor group | 5.50 | 0.50 | 94 |
| General self-concept | | | |
| Low imaginational group | 5.34 | 0.67 | 108 |
| High imaginational group | 5.45 | 0.67 | 92 |
| Low imaginational/high psychomotor group | 5.48 | 0.51 | 82 |
| Low psychomotor group | 5.07 | 0.85 | 94 |

**Table 8.** One-Way Analyses of Variance for the Four Clusters on Types of Self-Concept

| Dependent Variable | Sum of Squares | Mean Square | $F(3, 374)$ |
|---|---|---|---|
| Honesty/trustworthiness self-concept | | | |
| Between | 6.62 | 2.21 | 2.96 |
| Within | 279.11 | 0.75 | |
| Verbal self-concept | | | |
| Between | 5.70 | 1.90 | 2.42 |
| Within | 293.19 | 0.78 | |
| Opposite sex self-concept | | | |
| Between | 23.23 | 7.74 | 7.90** |
| Within | 365.57 | 0.98 | |
| Same sex self-concept | | | |
| Between | 20.90 | 6.97 | 11.68** |
| Within | 222.49 | 0.50 | |
| Physical ability self-concept | | | |
| Between | 210.11 | 70.04 | 67.22** |
| Within | 388.62 | 1.04 | |
| Physical appearance self-concept | | | |
| Between | 24.78 | 8.26 | 8.15** |
| Within | 376.91 | 1.01 | |
| Parent relations self-concept | | | |
| Between | 6.48 | 2.16 | 2.60*** |
| Within | 310.63 | 0.83 | |
| Emotional self-concept | | | |
| Between | 41.38 | 13.79 | 14.36** |
| Within | 358.38 | 0.961 | |
| Math self-concept | | | |
| Between | 10.02 | 6.34 | 6.39** |
| Within | 91.04 | 0.243 | |
| General academic self-concept | | | |
| Between | 1.78 | 0.59 | 2.44 |
| Within | 177.31 | 0.48 | |
| General self-concept | | | |
| Between | 9.40 | 3.13 | 6.59** |
| Within | 177.31 | 0.48 | |

**$p < .001$, two-tailed.

self-concept largely centered on the Low Psychomotor group. The Low Psychomotor group scored significantly lower than all three of the other groups (Low Imaginational, High Intellectual, and Low Imaginational/High Psychomotor) with regard to each of the following facets of self-concept: opposite sex, same sex, physical ability, physical appearance, and emotional. With regard to the math self-concept and general self-concept, the Low Psychomotor group scored significantly lower than the Low Imaginational/High Psychomotor group and the High Intellectual group. The only other significant difference found was between the Low Imaginational/High Psychomotor group and each of the other three groups with regard to the physical ability self-concept, as the Low Imaginational/High Psychomotor group scored higher than the others. As mentioned previously, a complete list of the means and standard deviations for the types of self-concept for each cluster can be seen in Table 7.

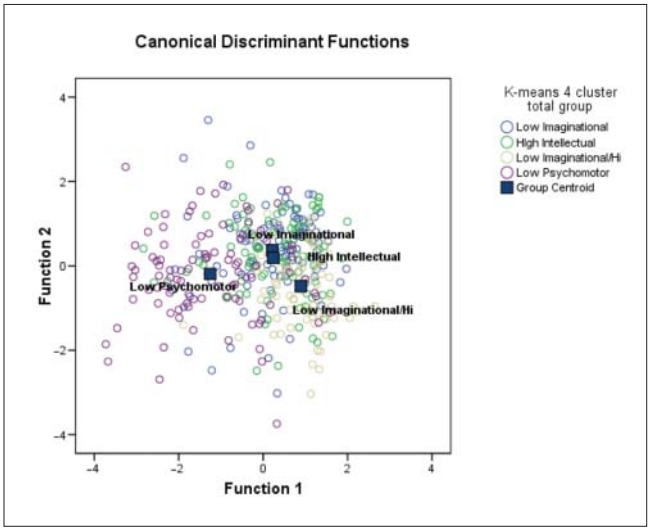


**Figure 2.** Graphical representation of the four cluster centroids on the two discriminant functions

*Discriminant function analysis.* To examine the multivariate relationship between self-concept and the clusters of overexcitability, a discriminant function analysis with the 11 types of self-concept predicting cluster membership was performed. Test of dimensionality for the discriminant analysis indicated that two of the three dimensions were significant. Specifically, Function 1 Wilks's $\Lambda = .54$, $p < .001$ and Function 2 $\Lambda = .866$, $p < .001$ (both tests were two-tailed). Function 1 had a canonical correlation of .61, whereas Function 2 had a correlation of was .31.

Table 9 lists both the function and structure coefficients of the two significant functions. Figure 2 provides a graphical representation of the four cluster centroids on the two discriminant functions.

The first discriminant function is primarily representing physical ability self-concept (.948). In Function 2, emotional self-concept is contributing the most (.654), with a secondary contribution from honesty/trustworthiness (.439). Function 1 appears to discriminate mostly between the Low Psychomotor group and everyone else. Function 2 discriminates the Low Imaginational/High Psychomotor from the other three groups.

## Discussion

The purpose of this study was to explore the relationship between gifted adolescents' overexcitabilities and self-concepts via cluster analysis, while incorporating gender into the analyses. Four distinct clusters were found, namely a Low Imaginational group, a High Intellectual group, a Low Imaginational/High Psychomotor group, and a Low Psychomotor group. Differences in self-concept were found to center on the Low Psychomotor group, such that

**Table 9.** Correlation of the Predictor Variables with Discriminant Functions (Function Structure Matrix) and Standardized Discriminant Function Coefficients for the Two Significant Discriminant Functions

| | Correlation With Discriminant Function | | Standardized Discriminant Function Coefficients | |
|---|---|---|---|---|
| Predictor Variable | Function 1 | Function 2 | Function 1 | Function 2 |
| Honesty/trustworthiness | .053 | .439 | −.072 | .587 |
| Verbal | −.151 | .158 | −.223 | .221 |
| Opposite sex | .321 | −.121 | −.040 | −.243 |
| Same sex | .391 | .117 | .069 | .122 |
| Physical ability | .948 | .041 | .990 | −.149 |
| Physical appearance | .330 | −.005 | .049 | −.150 |
| Parent relations | .174 | .149 | .044 | −.161 |
| Emotional | .322 | .654 | .044 | −.161 |
| Math | .238 | .210 | −.034 | .923 |
| General school | .076 | −.131 | −.155 | −.431 |
| General self | .284 | .046 | .024 | −.219 |

this group scored significantly lower than the three other groups with regard to opposite sex self-concept, same sex self-concept, physical ability self-concept, physical appearance self-concept, and emotional self-concept, and scored lower than the Low Imaginational/High Psychomotor and High Intellectual groups with regard to math self-concept and general self-concept. Females significantly outnumbered males (63 to 31) in the Low Psychomotor group.

In a similar study, Gross et al. (2007) correlated the forms of overexcitabilities with various facets of self-concept and found that adolescents' psychomotor overexcitability scores were more positively correlated with the majority of the self-concept subscale scores, namely the same sex peer relations, opposite sex peer relations, physical appearance, general school, general self, and physical abilities subscale scores, than the other overexcitability scores. Except for the general school self-concept score, all the positive correlations were with nonacademic self-concept subscale scores. Thus, findings from the current study are similar, as the adolescents with low psychomotor overexcitabilities scored lower on most of the self-concept subscales than students with differing clusters of overexcitabilities.

That the Low Psychomotor group scored lower than the other groups in five self-concept areas (opposite sex, same sex, physical ability, physical appearance, and emotional) and two other groups in two self-concept areas (math and general) may be an artifact of gender, as females outnumbered males about two to one in the Low Psychomotor group. Research on gender differences in the forms of overexcitabilities shows that males may have higher psychomotor overexcitabilities than females. For example, Bouchet and Falk (2001) found that gifted college-aged males scored higher than gifted college-aged females on intellectual, imaginational, and psychomotor overexcitabilities. Tieso (2007b) found that male elementary and middle school students had higher psychomotor overexcitability scores than females. Furthermore, research on gender differences in self-concept typically shows that females score lower than males beginning in early adolescence, particularly in the areas of physical appearance and physical ability (Worrell, Roth, & Gabelko, 1998). With a sample of gifted adolescents, Rudasill, Capper, Foust, Callahan, and Albaugh (2009) found lower self-concept among females in almost all dimensions of self-concept. However, some researchers argue gender differences in self-concept among adolescents are small and lack meaning (e.g., Crain & Bracken, 1994). Even so, these findings raise an important question: Why were so many girls in the Low Psychomotor group?

Because psychomotor overexcitabilities are indicative of individuals with high levels of energy, the Low Psychomotor group may have relatively low levels of energy. It follows that they would not be as physically active and, thus, they have lower physical ability and physical appearance self-concept scores, and perhaps lower opposite sex and same sex self-concept scores. Indeed, the only other significant difference found in the current study was between the Low Imaginational/High Psychomotor group and each of the other three groups with regard to the physical ability self-concept, with the Low Imaginational/High Psychomotor group scoring higher than the others. It is worth noting that this could be an artifact of the measurement process. The questionnaires that are designed to measure psychomotor overexcitability and physical ability self-concept are vaguely similar. For example, questions from the psychomotor overexcitability subscale of the OEQ-II include "When I have a lot of energy, I want to do something physical" and "The longer that I have to sit still, the more restless I get." Questions from the physical ability self-concept subscale of the SDQ-II include "I am good at things like sports, gym, and dance," "I try to get out of sports and physical education classes whenever I can," and "I can run a long way without stopping." Whereas the OEQ-II seems to measure whether or not

someone does something, the SDQ-II seems to measure preference for something as well as whether or not someone does something. As with the debate on academic achievement and academic self-concept with regard to which comes first (Hamachek, 1995; House, 2000), a similar argument could be made here: physical ability self-concept and psychomotor overexcitability could be reciprocal. Although research has not been conducted on this issue specifically, research has shown that adolescents who exercise have been found to have higher general self-esteem (Delaney & Lee, 1995; Jaffee & Manzer, 1992) and a higher physical ability self-concept (Jackson & Marsh, 1986) than adolescents who do not exercise. Ference (1999) examined the relationships between exercise, team sports, and multiple domains of self-concept in a study of 44 gifted females, 23 gifted males, 138 nongifted females, and 100 nongifted males, all of whom were in the eighth grade. For gifted females, in particular, participation in team sports was positively related to feelings of social acceptance and athletic competence. However, existing research is mixed regarding gender and exercise; on one hand, Dauber and Benbow (1990) and Bucknavage and Worrell (2005) that found gifted males were more likely to spend time engaged in sports than females, but Olszewski-Kubilius and Lee (2004) and Rinn and Wininger (2007) did not find any gender differences in the rates of sports participation among gifted students. As such, we have to focus solely on level of activity among both genders. If the Low Psychomotor group is a more sedentary group, it logically follows that they would score lower than the other groups in areas relating to physical and social self-concept.

Females with low psychomotor overexcitabilities might be at the greatest risk for low self-concept. However, psychomotor overexcitabilities are believed to be detrimental to positive development. Does it follow that females with low psychomotor overexcitabilities are the most likely to reach advanced development, according to the theory of positive development? In the application of the theory of positive development, we need to reconsider our views: The goal is not positive self-concept or high self-esteem but, rather, self-acceptance (Mendaglio & Pyryt, 2003). Personality development, for which the five forms of overexcitability are one prerequisite, is fraught with intense negative emotions that are typically associated with poor self-concepts or low self-esteem in traditional psychology. However, overcoming the negative emotions or engaging in the process of positive disintegration may lead to the highest forms of development (i.e., an altruistic life approach).

## Limitations and Directions for Future Research

As the current sample consisted of only gifted students from a summer program, replication of the current study in settings other than a summer program, such as in the regular classroom, as well as using a more diverse sample is suggested. Future research should include a comparison of average ability students and gifted students with regard to the clustering of the forms of overexcitabilities as well as an analysis of how the clusters among gifted and average-ability students relate to their self-concepts. In addition, the current study is limited because it focused solely on *intellectually* gifted adolescents. Replication of this study using students who are gifted in other areas (e.g., creativity, leadership, visual and performing arts) would be beneficial as some researchers have shown a distinction among types of giftedness and forms of overexcitabilities. Ely (1995) found differences between creatively gifted students and intellectually gifted students with regard to the emotional overexcitability and intellectual overexcitability scores. Yakmaci-Guzel and Akarsu (2006) found that highly creative Turkish tenth graders scored higher than students with low creativity on measures of psychomotor, sensual, imaginational, and intellectual overexcitabilities. In the same study, Yakmaci-Guzel and Akarsu that found students with high motivation and high leadership abilities scored higher on the imaginational and intellectual overexcitabilities than their peers.

Treat (2006) suggests that research should include sexual orientation, as well as gender, in the study of overexcitabilities among the gifted. Her research indicated a difference in overexcitabilities among gifted university students as a function of one's sexual orientation, such that non-heterosexual females scored significantly higher than heterosexual females in the intellectual overexcitability category, and heterosexual males scored significantly higher than nonheterosexual males in the psychomotor category.

Future research should explore psychomotor overexcitability in greater depth. Some researchers indicate that psychomotor overexcitability is most associated with giftedness (e.g., Ackerman, 1997; Bouchard, 2004; Tolan, 1994), but others find a lowered psychomotor overexcitability score more indicative of giftedness (see Mendaglio & Tillier, 2006, for a review). As the psychomotor overexcitability is often attributed to the misdiagnosis of ADHD and other disorders among the gifted (Hartnett, Nelson, & Rinn, 2004; Nelson, Rinn, & Hartnett, 2006; Webb et al., 2005) and a lower self-concept in a variety of facets in the current study (but perhaps a greater potential for advanced development), a closer examination is warranted.

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1. A nonresidential option is chosen by about 20% of participants.

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