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Anies Al-Hroub & Malak Krayem

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OVEREXCITABILITIES

Overexcitabilities and ADHD in Gifted Adolescents in Jordan: Empirical Evidence

Anies Al-Hroub and Malak Krayem

ABSTRACT
There is no empirical evidence in Jordan that addresses the overlap and coexistence of overexcitability (OE) and attention deficit hyperactivity disorder (ADHD) in gifted students. This study aims to investigate (a) the relationship between characteristics of OE forms and ADHD subtypes and (b) the gender differences in OE profiles among gifted students in Jordan. The participants included 265 gifted adolescents from the Jubilee Institute. They were administered the Jordanian version of the Overexcitability Questionnaire-Two (OEQII) and the Conners ADHD/DSM-V Scales-Adolescent scale. The Canonical Correlation Analysis (CCA) revealed a noteworthy collective relationship between OE and ADHD constructs, and another noteworthy relationship in relation to the gender of gifted adolescents. The findings also revealed small, significant positive correlations between (a) Psychomotor OE and hyperactive-impulsive ADHD, (b) Imaginational OE and ADHD subtypes, and (c) a small significant negative correlation between Intellectual OE and inattentive ADHD scores. Additionally, there was a significant gender difference in the Psychomotor OE in favor of boys and significant differences in the Emotional, Sensual, and Imaginational OEs in favor of girls. No significant gender differences were found in the Intellectual OEs of the participants.

KEYWORDS
ADHD; canonical correlation analysis; Conners; emotional; gender difference; gifted adolescents; hyperactivity; imaginational; inattention; intellectual; psychomotor; sensual

For decades, the failure to properly recognize gifted students has been shown to directly cause problems regarding a gifted child's behavior at school. Consequently, children whose giftedness remains unrecognized face social problems, attention deficits, academic underachievement, oppositional behavior, hyperactivity, and depressive behaviors that can easily be mistaken for common symptoms of neurodevelopmental and psychological disorders (Al-Hroub, 2007, 2010; El Khoury & Al-Hroub, 2018). According to a Berri and Al-Hroub (2016b) study conducted in Lebanon, many students are referred for therapy for impulsivity, hyperactivity, or the inability to sustain attention, often leading to a misdiagnosis of attention-deficit hyperactivity disorder (ADHD). The literature presents the analogous behaviors associated with both giftedness and ADHD (Hartnett et al., 2004; Rinn & Nelson, 2009; Webb, 2016).

Gender biases accompany the detection of a gifted child with ADHD, especially in the school setting (Maniadaki et al., 2003). Boys with ADHD typically exhibit high levels of hyperactivity, cause problems, and show aggressiveness and other externalizing symptoms, which teachers perceive as disruptive and stressful (Sciutto et al., 2004). However, girls with ADHD tend to exhibit lower levels of disruptive behavior and higher levels of inattentiveness, internalizing symptoms, and social impairment (Sciutto et al., 2004). Therefore, teachers' perceptions of students with these features vary, and it is thus difficult to diagnose ADHD.

When a gifted individual is assessed for ADHD, their tendency to be overexcitable should also be considered. It is difficult to distinguish a gifted child's overexcitability (OE) from ADHD symptoms. Because several of the characteristics and behaviors of gifted students mirror the characteristics of special education students, multiple instances of misdiagnoses have occurred. Gifted students might have more than one, if not many, forms of OE (Alias et al., 2013). For instance, Psychomotor OE may be mistakenly labeled as hyperactivity if the individual displays excessive energy or experiences excitability of the neuromuscular system.

There is potentially considerable overlap between ADHD and OE (Kyuman Chae et al., 2003). This is a concern for educators when such overlap interferes with the topography of the behavior but not necessarily with its function. Although most characteristics sound remarkably like hyperactivity of ADHD, the difference in the function appears to be that individuals with hyperactivity *cannot stop moving*.

In contrast, individuals with Psychomotor OE *love to move* (Flint, 2001). This is particularly important for explaining that ADHD, unlike Psychomotor OE, is a recognized DSM-IV disorder for which intervention and behavior management, including medication, is recommended (Berri & Al-Hroub, 2016c). Therefore, it

CONTACT Anies Al-Hroub aa111@aub.edu.lb; anies.al_hroub@uconn.edu Department of Education, American University of Beirut (AUB), P.O. Box 11-0236, Beirut, Lebanon.

is critical to differentiate symptoms of ADHD from OE characteristics in gifted individuals (Kyuman Chae et al., 2003), especially when a learner is in a position to receive an educational intervention or medication.

The lack of empirical research in the Middle East may provide a rationale for some initial exploratory data to draw a correlation between OE and ADHD characteristics among the gifted. Thus, the current study intends to set a goal to achieve the accurate diagnosis of ADHD in gifted children and extends what is known about the diagnostic decision-making processes of educators and school stakeholders, namely teachers, counselors, special education teachers, and diagnosticians. It will also raise awareness among both parents and teachers, enabling them to identify and deal with overexcitable students and minimize conflict among gifted students and their peers, teachers, and parents. Being able to assess better and identify such students requires all the necessary assessment tools to determine a student as OE or ADHD, while simultaneously considering cultural differences.

Attention Deficit Hyperactivity Disorder (ADHD)

ADHD is a term used to describe children, adolescents, and some adults who show hyperactive, impulsive, and/or inattentive behavior. Population surveys show that ADHD occurs in most societies, in approximately 5% of children and nearly 2.5% of adults. ADHD is more common in males than females in the general population, with a ratio of approximately 2:1 in children and 1.6:1 in adults (American Psychiatric Association, 2013). Farah et al. (2009) reviewed all the epidemiological studies about ADHD in the Arab world. The use of rating scales in school settings among Arab students showed that the rate of ADHD symptoms ranged from 5.1% to 14.9%. On the other hand, the rate of ADHD diagnosis using structured interviews ranged between 0.5% in the school setting and 0.9% in the community.

Alkhateeb and Alhadidi (2016) reviewed 26 prevalence studies, and two epidemiological studies about ADHD carried out in 11 Arab countries. The prevalence rates reported varied dramatically across the studies, ranging from 1.3% to 34.5%.

In a study conducted by Nafi and Shaheen (2010) to determine the prevalence of ADHD symptoms among 4,374 school-aged children in Jordan, the findings revealed that by using the modified Arabic version of the DSM-IV criteria for ADHD, 273 cases were positive, showing a prevalence of 6.24%. Furthermore, the prevalence was 9% among schoolboys and 3.7% among school girls, with a male to female ratio of 2.4 boys for every girl.

Manifesting in childhood, ADHD is described as a permanent pattern of inattention and/or hyperactivity-impulsivity that interferes with normal functioning or development. ADHD must be observed in more than one setting (e.g., home, school, or work) before proceeding with a diagnosis (American Psychiatric Association, 2013). The culture fostered by the teachers and family plays a pivotal role in the diagnoses and treatment of ADHD, resulting in the varied prevalence as expressed in percentages. According to Berri and Al-Hroub's study (2016c), cultural differences play a significant role in the family and teachers' perceptions. It has also been found that boys are three to six times more likely to be affected by such perceptions (Millichap, 2010).

Overexcitability (OE)

The concept of OE stems from Dąbrowski's (1964) Theory of Positive Disintegration (TPD), which is based on personality development. Overexcitability is a translation of a Polish term that means the capacity for stronger neurological reactions (Falk et al., 1994). Dąbrowski used this term to emphasize a person's maximized mental activity as well as the differential types of responses as characteristic forms of expressions of emotional tension (Piechowski, 1986; Piechowski & Colangelo, 1984), which he initially noted to be more prevalent in gifted and creative learners in a school for art in Poland (Dąbrowski, 1972). Dąbrowski believed that individuals with innate ability and one or more of the OEs had the potential for greater personal development. Further, "gifted" children may be more predisposed to OEs, but this does not mean that other (nonidentified) children do not also experience them. There is a debate in the literature on whether OE is a valid construct, and if gifted children have more prevalence than nongifted. Furthermore, research revealed that not all gifted individuals display high OEs, although many of the gifted positively do display such high OEs (Vuyk et al., 2016; Winkler & Voight, 2016).

The five different forms of OE in Dąbrowski's (1972) theory are the following:

1. *Psychomotor OE*: a surplus of energy and unusual physical response to stimulation. A person with Psychomotor OE may exhibit traits such as compulsive talking, pressure for action, restlessness, competitiveness, and sleeplessness
2. *Sensual OE*: heightened sensory awareness such as sights, smells, tastes, textures, and sounds. A person with Sensual OE exhibits several traits, such as appreciation of beautiful objects, music, nature,

sensitivity to foods and pollutants, tactile sensitivity, and craving for pleasure;

3. *Intellectual OE*: curiosity, deep level of concentration, theoretical and analytical thinking, questioning, introspection, love of learning and problem-solving, moral concern, a wide variety of interests, and the capacity for sustained intellectual effort;
4. *Imaginational OE*: vivid and creative imagination, inventiveness, a vibrant and active fantasy life, superb visual memory, elaborate dreams, day-dreams, love of poetry, music and drama, fears of the unknown, great sense of humor; and
5. *Emotional OE*: multifaceted responses including emotional sensitivity, empathy, fear of death, sensitivity in relationships, strong memory for feelings, difficulty adjusting to change, fears and anxieties, inhibition, timidity, shyness, self-judgment, feelings of inadequacy and inferiority, heightened awareness of injustice and hypocrisy, and care for others' feelings (Dweck, 2008; Piechowski, 1975, 1979).

According to Dąbrowski, personalized attention resulting from the identification of OEs helps learners cope better with their behaviors and emotions (Daniels & Piechowski, 2009).

Overexcitability among the gifted

Research has indicated partial support that more OEs are prevalent in the gifted rather than in non-identified or nongifted learners (Mendaglio & Tillier, 2006). Bouchard (2004), for example, developed an OE Likert-scaled observation checklist designed for use by teachers to identify OEs in gifted elementary students. The findings revealed that the tool, named ElemenOE, classified 76% of gifted children and 42% of non-identified children as having similar OE profiles. These findings indicate that the ElemenOE was useful in identifying gifted children who were unidentified by traditional identification protocol. Interestingly, the findings indicated that the two groups differed significantly only on Psychomotor and Intellectual OE scores in favor of the gifted group, with gifted students earning significantly lower Psychomotor OE scores and significantly higher Intellectual OE scores than non-identified gifted. Similar to Bouchard's study, a study done by Ackerman (1997) revealed that only Psychomotor OE contributed to distinguishing between the gifted and non-identified groups except that the gifted group had significantly higher Psychomotor OE scores.

Another theme that emerged from the research was that intellectually-gifted adult learners tend to have higher Emotional, Imaginational, and Intellectual OE profiles (big three) than their nongifted adult peers (e.g., Bouchet & Falk, 2001; Miller et al., 1994; Piechowski & Cunningham, 1985), providing different levels of partial support.

In concluding their analyses, several researchers (e.g., Alias et al., 2013; Bouchard, 2004; Daniels & Piechowski, 2009) suggest that gifted students, who are often considered difficult because of their extreme behaviors, ought to be assisted in recognizing and handling their OEs. This would help them control and manage their concentration and sensitivity in a positive and significant way. As mentioned earlier, being aware of the various forms of OE enables teachers and parents to identify and deal with students with OE and also allows the minimization of conflict among gifted students and their peers, teachers, or parents. Additionally, it tends to suggest that behavioral interventions are effective in managing undesired behaviors. Thus, teachers, students, and parents need preparation in the area of behavior and self-management.

The coexistence of OE and ADHD

To be identified with any type of ADHD, six or more symptoms of either inattention or hyperactivity-impulsivity, as outlined in DSM-5, must be present for at least six months in two or more settings (e.g., school, home, extracurricular activities). The onset of most of these symptoms must occur before the age of 7. Consequently, the characteristics of OE and the symptoms of ADHD are strikingly similar and may be indistinguishable to the untrained observer when they overlap (Nelson et al., 2006; Rinn & Nelson, 2009; Rinn & Reynolds, 2012). Thus, it is necessary to be familiar with the symptoms of each before making a diagnosis. In their study, Leroux and Levitt-Perlman (2000) noted that gifted learners with ADHD demonstrate several behavioral characteristics that may also be present in those who have high Psychomotor, Emotional, and Imaginational OEs.

Mika (2006) criticized the findings of Hartnett et al's., study (2004). The authors had asserted the misdiagnosis of gifted children with ADHD, although there was no indication that gifted children were often being misdiagnosed as having ADHD. According to Mika, Hartnett, and the other authors suggested that there exists an overlap between gifted children and children with ADHD concerning the occurrence of these two behavioral qualities; however, no practical records were presented to support this hypothesis. It is challenging to avoid confusion between behaviors that are marks of both giftedness and ADHD (Mika, 2006).

To support their contention of a possibility of misdiagnosis between ADHD and giftedness, Hartnett et al. (2004) brought in the concept of OE, where they proposed an apparent discrepancy between Psychomotor OE and the hyperactivity of ADHD. Kennedy et al. (2011) referenced psychologist Laura Honos-Webb in claiming that positive attributes of ADHD parallel many of Dąbrowski's OE forms. Honos-Webb, however, did not equate these attributes with giftedness.

Rinn and Reynolds (2012) have examined this overlap between OE and ADHD. Their study investigated the association between features of OE and indications of ADHD among the gifted. The results indicated a significant relationship between the following: Psychomotor OE scores and the DSM-IV hyperactive-impulsive subscale scores; between the Sensual OE scores and the Conners ADHD Index subscale scores; and between the Imaginational OE scores and the Conners ADHD Index subscale scores. Significant relationships were also attained from the inattentive subscale scores, the DSM-IV hyperactive-impulsive subscale scores, and the DSM-IV Total subscale scores. These relationships indicate that there is a potential relationship between the characteristics of OE and symptoms of ADHD.

Gender differences in ADHD and OE among gifted children

Research indicates that there are about 2.5 boys for every girl with ADHD and about six boys for every girl with ADHD referred to clinics in the United States (Ohan & Visser, 2009). A similar gender gap for ADHD also exists in Jordan, where the prevalence was 9% among boys and 3.7% among girls, with a ratio of 2.4 boys for every girl (Nafi & Shaheen, 2010).

As for gender difference in OE students, studies have found that gifted males showed stronger Psychomotor, Intellectual, and Imaginational OEs than gifted females, whereas gifted females demonstrated stronger Emotional and Sensual OEs (Bouchet & Falk, 2001; Siu, 2010; Tieso, 2007; Treat, 2006). However, some research did not report any gender difference among OEs (Bouchet & Fusun, 2006; Gallagher, 1985).

The current research

The purpose of this study is twofold: (a) to examine the relationship between characteristics of OE and symptoms of ADHD among gifted adolescents in Jordan, and (b) to explore the gender differences in levels of OE among those students. The research questions that guided this study were as follows:

1. What is the relationship between the characteristics of OE and ADHD among gifted Jordanian adolescent students?
2. What are the gender differences in levels of OE among gifted adolescents in Jordan?

Research method

Participants and setting

Participants included 265 (91 girls, 174 boys) gifted students at the secondary level from grades 9 to 11 from Jubilee School, the only school for gifted students in Jordan. All of the students from grades 9 to 12 were invited to participate in the study; however, the school administration informed us that it was difficult to conduct the surveys with students in grade 12 because it was their final year, and they were busy in several projects and examinations. Parental consent was required and obtained for students to participate. The school and parents granted their approval for this study. Participants' ages ranged between 14 and 18 years.

The study was conducted at the *Jubilee School for Gifted and Talented Students*, known as the "Jubilee Institute" in Jordan. The Jubilee Institute disseminates national and local educational standards through the extension of advanced curricula as well as training programs for public and private school teachers in Jordan and other Arab countries (Issa, 2013). The teaching staff consists of 64 teachers, with most of them working full-time and others working part-time at the school. The teacher/student ratio is 1:8. There are around 517 students with geographical and socioeconomic diversity distributed over grades 9–12 at the school. As noted earlier, the Jubilee Institute applies a rigorous multiple-criteria system for admission. These criteria (Jubilee Institute, 2019) include the following: (a) academic distinction over the last three semesters, and high intellectual functioning on the Jordanian version of the Stanford-Binet Intelligence Scale (30%); (b) the highest scores in the Jubilee Scholastic Aptitude Test (JSAT), which measures verbal, mathematical, and logical reasoning abilities (30%); (c) passing the Evaluation of Potential Creativity—EPoC test (20%); (d) meeting the behavioral characteristics of gifted individuals (10%); and (f) passing a personal interview (10%).

Data collection procedures

Ethical approval was obtained from the Institutional Review Board (IRB) at the American University of Beirut, and then permission to conduct the study was obtained from the school director. Informed consent was obtained from the parents of participating students.

They were given a full explanation of the study and were assured of the anonymity and confidentiality of all data collected. After obtaining their parent's approval, adolescents were given the choice of whether they would like to participate in the study. Data collection took place at the Jubilee Institute. Participants were administered the OE Questionnaire (OEQII) and the Conners Third Edition Self-Report Scale (ADHD/DSM-V) in Arabic. To gather information about the participants, they were also given a demographic questionnaire to complete. Using both the OEQII and the Conners scale allowed for the investigation of the possible co-occurrence of OEs and ADHD behaviors in gifted adolescent students in Jordan. The scales were administered in the students' classrooms and lasted approximately 35 mins.

Instruments

Overexcitability Questionnaire (OEQII). This tool was developed by Falk et al., (1999). A Jordanian version of the self-rating OEQII containing 50 items was administered to the students. The questionnaire (Al-Onizat, 2013; Bouchet & Falk, 2001) measures OE using a 5-point Likert scale with responses ranging from 1 (*not at all like me*) to 5 (*very much like me*). It is designed to measure the five forms of OE: Psychomotor, Sensual, Imaginational, Intellectual, and Emotional (10 items randomly distributed that assess each of the five types of OE). For instance, the Psychomotor OE score is obtained by adding items 2, 7, 10, 15, 18, 21, 29, 39, 42, and 50 and dividing the score by 10. Al-Onizat's study (2013) reveals that the Jordanian version of the OEQII is a valid and reliable tool.

One of the authors established its validity by translation and back-translation of the English language version into Arabic, followed by an examination of content validity using expert judgment and a pilot study using items in Arabic. Ten experts at the University of Jordan and the Amman Arab University then reviewed the translated Jordanian version of the questionnaire. Factorial validity showed that the correlation coefficients ranged between (a) 0.30 and 0.69 for the Imaginational OE, (b) 0.48 and 0.69 for the Intellectual OE, (c) 0.34 and 0.67 for the Sensual OE, (d) 0.46 and 0.78 for the Psychomotor OE, and (e) 0.37 and 0.60 for the Emotional OE (Al-Onizat, 2013). The reliability of the questionnaire has been examined in terms of internal consistency (Cronbach-alpha), and test-retest reliability coefficients ranged from 0.73 for Psychomotor OE to 0.85 for Imaginational OE. The internal consistency coefficients ranged from 0.74 for Psychomotor OE to 0.84 for Intellectual OE. All outcomes suggest that the questionnaire is valid and reliable in the Jordanian context (Al-Onizat, 2013). Since all these values are acceptable, the questionnaire is considered a valid instrument for implementation in this study.

Conners 3rd Edition Self-Report Scale. Conners 3 (ADHD/DSM-V) is the most recent scale for Conners. It is a 99-item self-report scale aimed to measure ADHD and its most common co-morbid problems in children and adolescents aged 8 to 18 years. A 4-point Likert scale is used with responses ranging from 0 (*not true at all, never, seldom*) to 3 (*very much true, very often, very frequent)* and results in four subscale scores—Conners ADHD Index; DSM-V: Inattentive; DSM-V: Hyperactive-Impulsive; and DSM-V: Total—combined the inattentive and hyperactive type (Conners, 2008). High results on the Conners self-report scale might indicate the need for special education. The scale has established a reliable and dependable tool capable of supporting teachers, counselors, and psychiatrists in the diagnostic and identification process. Internal consistency coefficients (Cronbach's alpha) for the total normative sample of 3,400 youth ranged from .77 to .97. The Conners 3 provides separate scores for ADHD-Hyperactivity-Impulsivity and ADHD-Inattention. Cronbach's alpha for these two scale scores were 0.86 and 0.89 on the self-report version (Conners, 2008; Gallant, 2008). Conners ADHD/DSM-V Adolescent scale was translated to Arabic since it is only available in English. The authors established its validity by translation and back-translation of the English language version into Arabic, followed by the examination of content validity using three expert judgments and a pilot study using items in Arabic with 10 gifted adolescent students in the Jubilee Institute before commencing the study.

Data analysis

To assess for a possible violation of the normality assumption of the study sample, we calculated skewness (degree of symmetry) and kurtosis (degree of peakedness) for all OE and ADHD symptom scales. To analyze students' responses to the research questions, descriptive analysis, independent sample *t*-tests, and canonical correlational analyses (CCA) were conducted.

To answer the first research question "What is the relationship between the characteristics of OE and ADHD among gifted Jordanian adolescent students?" the canonical correlation analysis (CCA) was used to measure the extent to which OE and ADHD symptoms co-vary (between both, since gifted students may exhibit ADHD symptoms). There are several advantages of using CCA in this study. First, CCA is a multivariate technique that limits the probability of committing Type I error as compared to other techniques (e.g., multiple correlation or multiple regression) because it allows simultaneous comparisons among the variables rather than requiring many statistical tests (or correlations) to be conducted (Sherry & Henson, 2005; Thompson, 1991, 2000).

Second, CCA is a statistical technique that is theoretically consistent with the purpose of our research study so that important multivariate relationships (e.g., OEs traits and ADHD types) will not be missed as compared with the data if examined by univariate methods (Sherry & Henson, 2005). Third, it analyzes latent variables that are not directly observed to represent multiple variables that are directly found. Finally, although CCA examines the correlation between a synthetic predictor variable (independent), and a synthetic criterion variable (dependent) that weighted based on the relationships between the variables within the sets, this analysis can be conceptualized as a simple Pearson correlation coefficient r between the two synthetic variables (Thompson, 1991) as also presented in the findings.

In further analysis, CCA was conducted to measure the overall relationship and magnitude between OE and ADHD constructs in relation to the gender of gifted students. To interpret CCA, structure coefficients (R_s) greater than |.45|, and communality coefficients (h^2), greater than 45% were considered noteworthy. Also, a Pearson correlation (r) of 0.5 or above, or a 25% covariance was considered a positive correlation between ADHD and OE in students. As to the second research question, "What are the gender differences in levels of OE among gifted adolescents in Jordan?" descriptive statistics and independent t-tests were used.

Research findings

Normality

The data were first tested for normality. Table 1 shows that the distribution was approximately symmetrical across all scale scores (skewness values −0.42–0.22), which was supported by the small Kurtosis values (−0.72–0.00). The visual examination of histograms also revealed the dominant pattern of symmetrical distribution for each symptom scale scores. Therefore, we treat the study sample as normally distributed for all OEs and ADHD symptom scales, which explains the use of a less conservative p-value of .05, in addition to .01, to interpret significant research findings. Normality is particularly vital for making accurate inferences regarding significant canonical variate pairs.

Relationship between OEs and ADHD

To address research question one "What is the relationship between characteristics of OE and ADHD among gifted Jordanian adolescent students?" the canonical correlation analysis (CCA) and Pearson correlation coefficient (r) were used. Intercorrelations of all variables are shown in Table 2. Small significant correlations were found between Psychomotor OE and hyperactive-impulsive ADHD scores (r = 0.27). A small significant negative correlation was found between Intellectual OE and inattentive ADHD scores (r = −0.22). A small significant positive correlation was found between Imaginational OE and inattentive ADHD scores (r = 0.19), and Imaginational OE and hyperactive-impulsive ADHD scores (r = 0.23). No significant correlation was found between Sensual OE or Emotional OE and the three subtypes of ADHD.

On the other hand, on examining whether a correlation exists between the different forms of OE, a noteworthy finding is the moderately significant correlation between Imaginational OE and Intellectual OE (r = .42), as well as Imaginational OE and Sensual OE (r = .40). In addition, there is a moderately significant correlation between Sensual OE and Intellectual OE (r = .43). Furthermore, a moderately significant correlation was found between Emotional OE and Sensual OE (r = .45), and finally, between Emotional OE and Imaginational OE (r = .45).

A canonical correlation analysis was conducted using the five OEs variables as predictors of the two ADHD variables to evaluate the multivariate-shared relationship between the two variable sets. The analysis yielded two

Table 1. Score descriptions and normality tests.

				Skewness		Kurtosis	
Symptom Scale	N	Mean	Std. Deviation	Statistic	Std. Error	Statistic	Std. Error
Psychomotor OE	265	3.41	.71	−0.42	0.15	0.00	0.30
Intellectual OE	265	3.65	.71	−0.34	0.15	−0.51	0.30
Sensual OE	265	3.27	.74	−0.19	0.15	−0.54	0.30
Imaginational OE	265	3.05	.74	−0.06	0.15	−0.38	0.30
Emotional OE	265	3.35	.74	−0.24	0.15	−0.27	0.30
Inattention ADHD	260	3.66	2.18	0.22	0.15	−0.72	0.30
Hyp_Imp ADHD	260	4.53	2.09	0.05	0.15	−0.54	0.30

Note. "A general guideline for ***skewness*** is that if the number is greater than +1 or lower than −1, this is an indication of a substantially skewed distribution" (Hair et al., 2017, p. 61). If skewness is between −1 and −0.5 or between 0.5 and 1, the distribution is moderately skewed. If skewness is between −0.5 and 0.5, the distribution is approximately symmetric. For ***kurtosis***, the values between −2 and +2 are considered acceptable in order to prove normal distribution (George & Mallery, 2010).

Table 2. Relationship between the different types of OE and characteristics of ADHD.

	Psyc. OE	Intel. OE	Sens. OE	Imag. OE	Emot. OE	Inattention ADHD	Hyp.-Imp. ADHD
Psychomotor OE							
Intellectual OE	.28**						
Sensual OE	.20**	.43**					
Imaginational OE	.11	.42**	.40**				
Emotional OE	.07	.21**	.45**	.45**			
Inattention ADHD	−.06	−.22	−.12	.19**	.07		
Hyp-Imp ADHD	.27**	.03	−.02	.23**	.04	.37**	

*Significant at level $p < .05$. ** Significant at level $p < .01$.

functions with squared canonical correlations (R_c^2) of .169 and .116 for each successive function. Collectively, the full model across all functions was statistically significant using the Wilks's λ (U value) = .734 criterion, [$F(10, 506) = 8.445$, $p < .001$]. Because Wilks's λ represents the variance unexplained by the model, 1 − λ yields the full model effect size in an r^2 metric. Thus, for the set of two canonical functions, the r^2 type effect size was .266, which indicates that the full model explained a noteworthy portion, about 26.6%, of the variance shared between the variable sets.

The dimension reduction analysis was conducted to test the hierarchal arrangement of functions for statistical significance. As noted, the full model (Functions 1 to 2) was statistically significant, [$F(10, 506) = 8.445$, $p < .001$]. Function 2, which was tested in isolation, also showed a statistically significant amount of shared variance between the variable sets, [$F(4, 254) = 8.327$, $p = .001$]. Given the R_c^2 effects for each function, the two functions were considered noteworthy in the context of this study (16.9% and 11.6% of the shared variance, respectively).

Table 3 presents the standardized canonical function coefficients and structure coefficients R_s for Functions 1 and 2. The squared structure coefficients R_s^2 are also provided as well as the communalities (h^2) across the two functions for each variable. Considering Function 1 coefficients, one notices large relevant criterion variables for inattention ($R_s = .829$) and hyperactivity-impulsivity ($R_s = .827$). The conclusion was supported by the squared structure coefficient $R_s^{2,}$ as shown in the table. These ADHD types also tended to have larger canonical function coefficients.

Regarding the predictor variable set in Function 1 (the relationship between ADHD and OEs characteristics), the Imaginational OE ($R_s = .608$) variable was the primary contributor to the synthetic predictor variable. Because the structure coefficient for Imaginational OE was positive, it was negatively related to all of the OEs types except for Psychomotor OE. Imaginational OE was positively related to Inattention and Hyperactivity-Impulsivity ADHD types. These results were supportive of the theoretically expected relationships between ADHD and OE traits. Moving to Function 2 (OE types), the coefficients in Table 3 suggest the relevance of the two criterion variables Inattention ($R_s = −.559$) and hyperactivity-impulsivity ($R_s = −.563$). As for OEs, Psychomotor OE ($R_s = .873$), and Intellectual OE ($R_s = .646$) were now the dominant predictors. These variables were positively related. Looking at the structure coefficients for the entire function, we see that Psychometric and Intellectual OEs were positively related to hyperactivity-impulsivity, and negatively related to inattention.

Relationship between OEs and ADHD by gender

CCA was also conducted to examine the relationship between OE and ADHD symptom scales in relation to gender. The analysis yielded two functions with squared canonical correlations (R_c^2) of .170, and .123 for boys, and (R_c^2) of .243, and .094 for girls for each successive function. Collectively, the full model across all functions was statistically significant using the Wilks's λ (U value) = .728 criterion for boys, [$F(10, 334) = 5.750$,

Table 3. Canonical solution for OEs predicting ADHD types for functions 1 and 2 (N = 260).

		Canonical Function 1			*Canonical Function 2*			
		Coeff.	R_s	R_s^2 *(%)*	*Coeff.*	R_s	R_s^2 *(%)*	h^2 *(%)*
Predictor set (Covariate)	Inattention-ADHD	.606	**.829**	68.72	−.890	**−.559**	31.25	**99.97**
	Hyp_Imp ADHD	.602	**.827**	68.34	.893	**.563**	31.66	**100.00**
	R_s^2			16.93			11.59	
Criterion set (Dependent)	Psychomotor OE	.464	.313	09.80	.752	**.873**	76.21	**86.01**
	Intellectual OE	−.629	−.270	07.29	.514	**.646**	41.73	**49.02**
	Sensual OE	−.415	−.205	04.20	.0152	.256	06.55	10.75
	Imaginational OE	.989	**.608**	36.97	−.102	.112	01.25	38.22
	Emotional OE	−.008	−.155	02.40	−.204	−.090	00.81	3.21

Note. Structure coefficients (R_s) greater than |.45| are in bold type. Communality coefficients (h^2) greater than 45% are in bold type. Coeff. = standardized canonical function coefficient; R_s = structure coefficient; R_s^2 = squared structure coefficient or variance explained; h^2 = communality coefficient.

$p < .001$], and Wilks's λ (U value) = .686 criterion for girls, [$F(10, 158) = 3.281$, $p < .001$]. Because Wilks's λ represents the variance unexplained by the model, 1 – λ yields the full model effect size in an r^2 metric. Thus, for the set of two canonical functions, the r^2 type effect sizes were .272 for boys and .314 for girls, which indicates that the full model explained a noteworthy portion, about 27.2% and 31.4% for boys and girls respectively, of the variance shared between the variable sets.

The dimension reduction analysis was conducted to test the hierarchal arrangement of functions for statistical significance. As noted, the full model (Functions 1 to 2) was statistically significant for boys, [$F(10, 334) = 5.750$, $p < .001$], and girls, [$F(10, 158) = 3.281$, $p < .001$]. Function 2, which was tested in isolation, also showed statistically significant amounts of shared variance between the variable sets for boys, [$F(4, 168) = 5.872$, $p = .001$], and for girls, [$F(4, 80) = 2.081$, $p = .001$]. Given the R_c^2 effects for each function, the two functions were considered noteworthy in the context of this study (17% and 12.3% of the shared variance for boys, and 24.3% and 9.4% for girls, respectively).

Table 4 presents the standardized canonical function coefficients and structure coefficients R_s for Functions 1 and 2. The squared structure coefficients R_s^2 are also provided as well as the communalities (h^2) across the two functions for each variable. Considering Function 1 coefficients, one notices large relevant criterion variables for Inattention ($R_s = .971$ for boys), and girls ($R_s = -.732$ for girls), and Hyperactivity-Impulsivity ($R_s = -.907$ only for girls). The conclusion was supported by the squared structure coefficient $R_s^{2,}$ as shown in the table. These ADHD types also tended to have larger canonical function coefficients.

Regarding the predictor variable set in Function 1 (the relationship between ADHD and OEs characteristics), the Imaginational OE ($R_s = -.710$) variable was the primary contributor to the synthetic predictor variable for girls. Because the structure coefficient for Imaginational OE was negative for girls, it was positively related to all of the OEs types except for Intellectual OE. Imaginational OE was positively related to Inattention and Hyperactivity-Impulsivity ADHD types. In contrast, Intellectual OE ($R_s = -.639$), and Sensual OE ($R_s = -.449$) were the two contributors to the synthetic predictor variable for boys, and both were negatively related to Inattention-ADHD type. Moving to Function 2 (OE symptom scales), the coefficients in Table 4 suggest the relevance of the two criterion variables Inattention for girls ($R_s = .681$) and Hyperactivity-Impulsivity for boys ($R_s = .991$). As for OEs, Psychomotor OE for boys and girls ($R_s = .821$ and $-.825$ respectively), and Intellectual OE for girls ($R_s = -.507$) were now the dominant predictors. These variables were positively related to boys, but negatively related to girls. Looking at the structure coefficients for the entire function, we see that Psychometric OE was positively related to Hyperactivity-Impulsivity for boys, and Psychometric and Intellectual OEs were negatively related to Inattention for girls.

Gender differences in OEs in gifted adolescents in Jordan

To address research question two, "What are the gender differences in levels of OE among gifted adolescents in Jordan?" descriptive statistics and independent sample *t*-tests were deployed. Descriptive statistics were employed to report the OE profiles of 265 gifted Jordanian adolescents: 91 females and 174 males (Table 5). The mean of each OE was compared, demonstrating that intensities are higher in Intellectual OE ($M = 3.65$, $SD = .71$) and Psychomotor OE ($M = 3.50$, $SD = .71$), followed by Emotional ($M = 3.35$, $SD = .74$), Sensual ($M = 3.27$, $SD = .74$), and Imaginational ($M = 3.05$, $SD = .74$) OEs. As for gender, differences were found in the OEs' rank ordering. Boys showed a pattern of OEs (*Intellectual > Psychomotor > Emotional*

Table 4. Canonical solution for OEs predicting ADHD types for functions 1 and 2 (Males = 174, Females = 86).

		Canonical Function 1						*Canonical Function 2*							
		Coeff.		R_s		R_s^2 (%)		*Coeff.*		R_s		R_s^2 (%)		h^2 (%)	
		Boy	*Girl*	*Boy*	*Girl*	*Boy*	*Girl*	*Boy*	*Girl*	*Boy*	*Girl*	*Boy*	*Girl*	*Boy*	*Girl*
Predictor set (Covariate)	In-ADHD	1.064	−.455	**.971**	**−.732**	94.28	53.58	−.142	.978	.238	**.682**	5.66	46.51	**99.96**	**99.59**
	Hyp_Imp ADHD	−.256	−.736	.132	**−.907**	1.74	82.2	1.043	−.789	**.991**	−.422	98.20	17.8	**99.94**	**100.00**
	R_s^2					17.04	24.30					12.27	9.42		
Criterion set (Dependent)	Psyc_OE	−.155	−.373	−.373	−.347	13.91	6.86	.886	−.801	**.821**	**−.825**	67.40	68.06	**81.31**	**76.66**
	Intel_OE	−.719	.689	**−.639**	.206	40.83	4.24	−.083	−.622	.284	**−.507**	8.06	25.71	**48.89**	29.95
	Sens-OE	−.439	.165	**−.449**	−.021	24.90	0.04	−.289	.453	.102	.051	1.04	0.26	25.94	.66
	Imagin_OE	.608	−1.014	.307	**−.710**	9.42	50.41	.659	.222	**.536**	−.027	28.73	0.07	38.15	**50.48**
	Emot_OE	.349	−.047	.285	−.262	8.12	6.86	−.192	−.068	.142	−.107	2.01	1.15	10.13	7.21

Note. Structure coefficients (R_s) greater than |.45| are in bold type. Communality coefficients (h^2) greater than 45% are in bold type. Coeff. = standardized canonical function coefficient; R_s = structure coefficient; R_s^2 = squared structure coefficient or variance explained; h^2 = communality coefficient.

Table 5. Gender difference in the OE forms of gifted adolescents.

Form of OE	N	*Mean*	*SD*	Gender	N	*Mean*	*SD*	Mean Difference	*Independent t*-test (df = 263)	*Sig. (2-tail)*	*Effect Size (Cohen d)*
Psy_OE	265	3.41	.71	Girl	91	3.25	.71	−.25	−2.80	.006**	0.357
				Boy	174	3.50	.69				
Intel_OE	265	3.65	.71	Girl	91	3.65	.72	−.005	−.06	.96	0.008
				Boy	174	3.65	.71				
Sens_OE	265	3.27	.74	Girl	91	3.58	.67	.47	5.18	.00**	0.690
				Boy	174	3.10	.72				
Imag_OE	265	3.05	.74	Girl	91	3.17	.72	.19	2.02	.045*	0.260
				Boy	174	2.98	.74				
Emot_OE	265	3.35	.74	Girl	91	3.81	.66	.70	8.19	.00**	1.064
				Boy	174	3.11	.66				

*Significant at level $p < .05$. ** Significant at level $p < .01$.
Note. Cohen d is calculated to show three levels of effect size thresholds when interpreting the effect of intervention: Small-S (.20), Medium-M (.50), Large-L (.80), Very Large-VL (1.30) (Cohen, 1988).

> *Sensual > Imaginational)* that is different from girls' OEs' pattern *(Emotional > Intellectual > Sensual > Psychomotor > Imaginational)*.

The gender differences in the OE forms were also compared using the independent t-test. Table 2 shows that there was a significant difference between boys and girls in the Psychomotor OE [$t(265) = -2.80$, $p < .01$] in favor of boys, with a moderate Cohen's effect size ($d = 0.36$), which indicates that the difference has moderate practical significance.

The findings also revealed large significant differences in favor of girls in the Emotional OE [$t(265) = 8.19$, $p < .01$], moderate in the Sensual OE [$t(265) = 5.18$, $p < .01$], and small in the Imaginational OE [$t(265) = 2.02$, $p < .05$] as supported by Cohen's effect sizes ($d = 1.06, 0.690$, and 0.26) respectively. No significant gender differences were found in terms of Intellectual OE.

Discussion and conclusions

This study initially demonstrated that empirical evidence regarding OEs in Jordan is quite limited compared to research conducted in other regions of the world, especially in North America and Europe.

Relationship between OE forms and ADHD symptoms in gifted adolescents

Canonical Correlation analyses (CCA) were used to study the relationship between OEs and ADHD. These results are generally and collectively supportive of the theoretically expected relationships between ADHD and OEs constructs. Specific findings revealed that the Imaginational OE variable was the primary contributor to the synthetic predictor variable (Function 1), followed by the Psychomotor and Intellectual OEs (Function 2). Imaginational, Psychomotor, and Intellectual OEs were found positively related to Hyperactivity-Impulsivity ADHD, suggesting that a high level of imagination and thinking skills among gifted adolescents lead to excessive physical energy that should not be confused with Hyperactivity-Impulsivity ADHD. The findings also revealed that Imaginational OE positively correlated with Inattention ADHD, which may create some confusion. This finding is supportive of previous work done by Al-Hroub and Krayem (2018).

Person Coefficient Correlations supported these results. Small positive significant correlations were found between Psychomotor OE and Hyperactive-Impulsive ADHD. The relationship between Psychomotor OE and ADHD scores (Hyperactive-Impulsive scores) is not surprising, especially since there is an overlap between characteristics of ADHD and Psychomotor OE, as also found in previous research (e.g., Hartnett et al., 2004; Leroux & Levitt-Perlman, 2000; Mika, 2006; Rinn & Reynolds, 2012), which suggests a possibility of misdiagnosis when no multidisciplinary assessment approach is used (Al-Hroub, 2013, 2011; Al-Hroub & Whitebread, 2019, 2008).

A small significant negative correlation was found between Intellectual OE and Inattentive ADHD scores, which means that gifted children with high Intellectual OEs are somewhat more attentive and vigilant. This finding is also consistent, to a large extent, with the signs of Intellectual OE, such as deep concentration and large capacity for sustained intellectual effort (Bailey, 2010; Dweck, 2008; Piechowski, 1975, p. 1979).

A small significant positive correlation was found between Imaginational OE and Inattentive ADHD scores, and Imaginational OE and Hyperactive-Impulsive ADHD. This suggests that gifted adolescents with an Imaginational OE may display characteristics of ADHD, which would, therefore, increase the likelihood of an ADHD misdiagnosis. This corresponds with previous research (e.g., Leroux & Levitt-Perlman, 2000) that gifted learners with ADHD demonstrate behaviors that may also be present as signs of Imaginational OEs.

No significant correlation was found between Sensual OE or Emotional OE and the three subtypes of ADHD.

Sensual OE did not show a significant correlation with the characteristics of ADHD. Although a student with ADHD might display sensitivity to fluorescent lights in the class, it still does not mean that there is a significant correlation between Sensual OE and ADHD subtypes. It is one of the characteristics that students with ADHD might display, but it is one of many. Thus, even if a child reacts strongly to a specific taste or texture of a particular food or displays any of the Sensual OE characteristics, it does not mean that it is correlated to characteristics of ADHD.

No significant correlation was found between Emotional OE and ADHD characteristics. Individuals with Emotional OE display noticeable and familiar expressions such as anxieties, fears, and feelings of guilt (Mendaglio & Tillier, 2006). A student displaying ADHD characteristics might have difficulty making and keeping friends or might have their feelings easily hurt. Still, these reasons did not suggest that they are related to Emotional OE or vice versa.

On the other hand, in examining whether there exists a correlation between the different forms of OEs, a noteworthy finding is the moderate significant correlation between Imaginational OE and Intellectual OE as well as Imaginational OE and Sensual OE. In addition, there is a moderately significant correlation between Sensual OE and Intellectual OE. Additionally, a moderately significant correlation was found between Emotional OE and Sensual OE, and finally, between Emotional OE and Imaginational OE. The significant positive correlation between Emotional, Intellectual, and Imaginational OEs is hypothesized by several researchers (e.g., Mofield & Parker Peters, 2015) to be linked to perfectionism among gifted students. The findings of this study show significant positive correlations between these three OEs, but this is not enough to claim that they predict perfectionism among gifted adolescents in Jordan. There is a need to use a scale for perfectionism to tests this hypothesis.

Gender differences in levels of OEs in gifted adolescents in Jordan

The analysis revealed a noteworthy collective relationship between OE and ADHD constructs in relation to the gender of gifted adolescents (r^2 = .272 for boys and .314 for girls). These results are supportive of the theoretically proposed relationships between ADHD and OEs constructs in relation to gender.

The results of our study resonate with previous findings and conflict with others. For example, the findings are consistent with numerous research studies conducted (e.g., Bouchet & Falk, 2001; Tieso, 2007; Treat, 2006) where gifted males show stronger Psychomotor OE than gifted females, but conflict with the same studies regarding the Intellectual OE. With regard to Psychomotor OE, this is not a surprising finding because studies done in Jordan (e.g., Krayem & Al-Hroub, 2019) and the Middle Eastern context (Alkhateeb & Alhadidi, 2016; Berri & Al-Hroub, 2016c) consistently demonstrate that psychomotor activity/OE, or hyperactivity are more prevalent among boys than girls due to cultural reasons. This Middle Eastern culture tolerates psychomotor or hyperactive behaviors among boys more than girls (Berri & Al-Hroub, 2016c). Also, according to Silverman (2013), Intellectual OE and intelligence, though they are not identical, do overlap. In our study, the participants are gifted adolescents with high intellectual ability who also showed high Intellectual OE. However, the findings conflict with Tieso (2007) and Treat's (2006) studies in terms of Imaginational OE. The results revealed stronger Imaginational OE among gifted females compared to gifted males.

It is worth noting that Intellectual OE, followed by Psychomotor OE, ranked the highest of OEs in this study. In contrast, most studies reported in the literature that Emotional OE ranked the highest. Interestingly, Emotional OE ranked the highest of the OEs among gifted females. Since they comprise 1/3 of the entire sample, this unequal distribution of males and females might have influenced the results. However, it corresponds with a study done by Krayem and Al-Hroub (2019), which showed that female Jordanian teachers were considerably more capable of identifying Emotional OE in gifted adolescents than male teachers.

Apart from psychomotor OE, gifted females showed higher intensities than gifted males in Emotional, Imaginational, and Sensual OEs, whereas they showed the same intensity level in Intellectual OE. It is important to note that within Dąbrowski's TPD, collective heightened Emotional, Imaginational, and Intellectual OEs, are theorized to allow learners to have the capability to reach the highest levels of personality development (Dąbrowski, 1964). Jordanian gifted females seem to show higher levels of personality development. One explanation is that gifted females, in a conservative country like Jordan, are more eager to learn and develop their skills, when allowing flourishing and shining.

This study sheds light on and helps us understand that ADHD and OE characteristics overlap, which may be attributable to a tautology in the same setting, but one study is not enough. Research and speculation on this topic will and ought to continue. It is an essential step because many educators, counselors, and even parents are unfamiliar with these terms. Teachers, practitioners, and parents in Jordan are not familiar with OE. Research studies in Jordan (e.g., Krayem & Al-Hroub, 2019; Krayem & Al-Hroub, 2018) revealed that 61% of teachers for gifted students were able to identify Imaginational OE, followed by Emotional OE (52%), Intellectual OE (44%), Sensual OE (41%), and Psychomotor OE (26%). The findings also revealed that teachers were not able to differentiate between Hyperactivity and Psychomotor OE. Accordingly, both ADHD and OE characteristics need to be clarified by each culture, and culturally sensitive and relevant assessments should be developed.

Based on what the research demonstrates, many people might confuse the characteristics of ADHD with those of OEs. Educators with limited knowledge of OEs may mistakenly confuse gifted students' disruptive behaviors for disciplinary problems (Rotigel, 2003), which could lead to misdiagnosis, and mislabeling. Thus, we consider it essential that the Jubilee Institute and all other schools take account of these research findings to aid their gifted students.

Since this study has helped conceptualize the coexistence and overlap between OEs and ADHD in gifted students, the subsequent research studies could include more qualitative in-depth analyses of the identification procedures. Further study could benefit from teachers' and parents' perspectives as well, in addition to those of the other school stakeholders (e.g., counselors and principals). Also, further studies could target different school levels, for example, elementary and middle schools.

Limitations

There were certain limitations to this study. One limitation is that the study sample was taken from only one school catering to gifted adolescent students. Because of this limitation, the number of male students was more than that of females. Unequal distributions of males and females might have influenced the results. However, this was beyond our control, given that the Jubilee Institute is the only school designated for gifted students in Jordan. One more limitation is that we only focused on targeting the secondary level. Although it was stated earlier that the reason for including these students was because the Jubilee Institute is tailored to the needs of gifted students at the secondary level, it would be helpful to investigate students at the elementary and middle school levels in further research. Another limitation is related to the design of the study. While this correlational research can suggest that there is a relationship or overlap between OE and ADHD symptoms, it cannot explain that one variable (e.g., Psychomotor OE) causes a change in another variable (e.g., hyperactivity), and vice versa.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Notes on contributors

Dr. Anies Al-Hroub is an Associate Professor of Education Psychology and Special Education at the American University of Beirut (AUB). Currently, he is a Visiting Scholar at the Renzulli Center for Creativity, Talented Development and Gifted Education, University of Connecticut. Al-Hroub is an elected member of the executive committee for the World Council for Gifted and Talented Children (WCGTC). Al-Hroub's research interests focus on giftedness, creativity and talent development, twice-exceptionality, and psychometric and dynamic assessment. His publications appear in international gifted and special education journals. His latest book (with Mrs. El Khoury) is, *Giftedness in Lebanese Schools: Integrating Theory, Research, and Practice* (Springer, 2018). Email: aa111@aub.edu.lb; anies.al_hroub@uconn.edu

Ms. Malak Krayem is a PhD candidate majoring in Psychology at the Lebanese University. Krayem's research emphasizes children and adolescents. She also focuses on gifted children and adolescents, children diagnosed with ADHD and/or special needs. Krayem is currently working on research related to children experiencing trauma in Canada and Lebanon. Email: malak44@gmail.com