OPENNESS TO EXPERIENCE RATHER THAN OVEREXCITABILITIES

BY

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ABSTRACT

In the theory of positive disintegration (TPD), Dabrowski (1967) describes manifestations of inner energy that serve a developmental purpose and might be more frequently found in gifted individuals, called overexcitabilities (OEs). Most studies present OEs outside of the context of the original theory (Mendaglio, 2012). Atheoretically conceptualized, OEs seem to define the personality trait of openness to experience as each OE can be matched with a specific facet of openness. Descriptions of each facet of openness and its matching OE are very alike. In this paper I argue that they are conceptually equivalent and that current research on openness and OE supports this. The study examined the similarity of OEs to corresponding openness to experience facets via competing models in multigroup confirmatory factor analysis, given their conceptual similarity. O2: Aesthetics and sensual OE, and O5: Ideas and intellectual OE were represented by a single underlying latent construct. High correlations emerged among O1: Fantasy and imaginational OE, O2: Aesthetics and sensual OE, O3: Feelings and emotional OE, and O5: Ideas and intellectual OE; O4: Actions and psychomotor OE had a small positive correlation; and O6: Values had a small negative correlation to emotional OE. Openness to experience seems to encompass OEs; thus, giftedness researchers and practitioners should align with well-researched psychological theories such as the five-factor model of personality (Costa & McCrae, 1992; Goldberg. 1999) and begin to talk about openness rather than OEs.

Key words: openness to experience, overexcitability, five-factor model of personality

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Abstract

In the theory of positive disintegration (TPD), Dabrowski (1967) describes manifestations of inner energy that serve a developmental purpose and might be more frequently found in gifted individuals, called overexcitabilities (OEs). Most studies present OEs outside of the context of the original theory (Mendaglio, 2012). Atheoretically conceptualized, OEs seem to define the personality trait of openness to experience as each OE can be matched with a specific facet of openness. Descriptions of each facet of openness and its matching OE are very alike. In this paper I argue that they are conceptually equivalent and that current research on openness and OE supports this assertion. The five-factor model of personality is the model with the most research support and TPD lacks empirical support; therefore, gifted education should shift its way of explaining these tendencies by framing them as the personality trait of openness to experience rather than OEs.

Key words: openness to experience, overexcitability, five-factor model of personality

CHAPTER 1

Openness to Experience Rather Than Overexcitabilities: A Review

Counseling services for gifted students have gained popularity, with resource sites such as Hoagies Gifted (2015) maintaining lists of psychologists who are proficient in working with gifted individuals. However, part of this popularity might arise from the idea that gifted students have vulnerabilities due to the intensity of their personalities. This idea is preeminent among people who believe that giftedness indicates a qualitative difference from the rest of the general population. These vulnerabilities supposedly place gifted individuals at risk.

Counseling psychology is in a unique place to become involved in this issue for several reasons. First, psychologists in general have studied personality using empirical methods and have replicated studies across the globe (e.g., McCrae, Terracciano, et al., 2005). Well-researched personality theories must have a way of explaining these vulnerabilities in gifted students based on the behaviors they manifest. Second, counseling psychologists focus on normal development of individuals, with an emphasis on strengths and optimal development (Brown & Lent, 2008). Therefore, it is an ideal framework to study both normal development and variations of normal. Third, gifted education is the discipline that has mostly studied these vulnerabilities. However, gifted education's body of knowledge appears to be disjointed rather than unified by agreed-upon understandings of concepts (Dai & Chen, 2013, 2014). Practices in gifted education seem to revolve around armchair philosophies rather than being evidence-based, with longstanding divides among researchers and practitioners (Callahan & Moon, 2007). Subotnik, Olszewski-Kubilius, and Worrell (2011) urged both researchers and practitioners in gifted education alike to align with constructs well-studied in psychological science, as those

were insufficiently represented in the gifted education literature. Psychological science has much to offer and could help settle certain controversies in the field.

One of those controversies involves these previously mentioned vulnerabilities, also called overexcitabilities (OEs), a supposed personality construct only discussed in gifted education. OEs might be described as intensities and sensitivities that theoretically represent heightened nervous system activity (Mendaglio & Tillier, 2006; Mendaglio, 2012). Nevertheless, identical behaviors and predispositions can be found in other personality theories such as the five-factor model of personality, which is the leading personality theory in psychology based on its strong generalization across cultures and ages (McCrae, Terracciano, et al., 2005; McCrae, 2010) and provide a more parsimonious explanation of those behaviors than OEs do. In this paper, I will argue that OEs can be better explained as the personality trait of openness to experience and its underlying facets, rather than as independent constructs.

OEs and Paradigms in Gifted Education

To contextualize the longstanding controversy of OEs in gifted individuals for counseling psychology, it would be useful to revisit gifted education paradigms. The questions of What, Why, Who and How determine different existing paradigms in gifted education, and one of these divides pertains to the definition of giftedness and to traits that gifted individuals possess (Dai & Chen, 2013, 2014). OEs comprise the definition of giftedness, for one paradigm, while they are hardly acknowledged by a different paradigm.

The *gifted child paradigm*, the oldest one in the field, defends the existence of qualitative differences among gifted individuals and the general population, as opposed to quantitative differences situated on a continuum (Dai & Chen, 2013, 2014). Perhaps the most extreme of such

qualitative differences is exposed in the definition of giftedness coined by the Columbus Group (1991):

> Giftedness is asynchronous development in which advanced cognitive abilities and heightened intensity combine to create inner experiences and awareness that are qualitatively different from the norm. This asynchrony increases with higher intellectual capacity. The uniqueness of the gifted renders them particularly vulnerable and requires modifications in parenting, teaching and counseling in order for them to develop optimally.

Using this definition, proponents of the gifted child paradigm suggest that gifted individuals have nervous systems that qualitatively differ from the rest of the population because of this heightened intensity or OE (Piechowski, 2006). No support has been found in the literature for this assertion. Furthermore, such views might lead to believing that existing theories that describe normal human development such as personality, motivation, and intelligence theories might not apply to gifted individuals. The few studies that have attempted to describe a qualitatively distinct gifted personality hint at the possibility of higher openness to experience (Cross, Speirs Neumeister, & Cassady, 2007; Sak, 2004; Zeidner & Shani-Zinovich, 2011), thereby replicating patterns seen in the general population relating to intelligence and openness to experience (Ackerman & Heggestad, 1997) and thus would not support the hypothesis of qualitative differences.

The *talent development paradigm* grew exponentially in the 1990s out of an increasing dissatisfaction with the limitations of the gifted child paradigm (Dai & Chen, 2013, 2014). In this paradigm, the focus is removed from who is gifted to how to nurture talent (Dai & Chen, 2013, 2014). Practices are more inclusive as they pertain to a larger pool of students who could benefit

from interventions. Talent is seen through a lens that emphasizes its changing and evolving nature, rather than a static sense of being. Specificity of domains allows talents to be conceptualized as belonging to any area of human activity rather than focusing on general intelligence. Additionally, the talent development paradigm emphasizes psychosocial elements such as support and motivation. The most comprehensive definition of giftedness based on the talent development paradigm comes from the seminal paper by Subotnik et al. (2011):

> Giftedness is the manifestation of performance or production that is clearly at the upper end of the distribution in a talent domain even relative to that of other high-functioning individuals in that domain. Further, giftedness can be viewed as developmental, in that in the beginning stages, potential is the key variable; in later stages, achievement is the measure of giftedness; and in fully developed talents, eminence is the basis on which this label is granted. Psychosocial variables play an essential role in the manifestation of giftedness at every developmental stage. Both cognitive and psychosocial variables are malleable and need to be deliberately cultivated. (p. 7).

The talent development paradigm consistently uses well-researched psychological theories to describe and explain how gifts and talents manifest in individuals and how they can be best nurtured (Subotnik et al., 2011). Personality as defined in psychology is among the psychosocial variables listed as playing an essential role, yet OE is not listed. Proponents of this paradigm place differences on a continuum rather than an either-or approach. With these strong discrepancies among paradigms it is not surprising that multiple controversies exist in the research literature, and the existence and importance of OEs might be one of the most prevalent debates.

OEs and the Theory of Positive Disintegration

OEs or heightened intensity gained a prominent place in gifted education with multiple books published on the topic for teachers and parents. A Google search with the key terms "overexcitabilities + gifted" yielded 25,600 hits including pages from prominent organizations such as SENG – Social and Emotional Needs of the Gifted, the Davidson Institute, and the Duke Talent Identification Program or Duke TIP, as well as the popular resource site Hoagies Gifted. A Google Scholar search with identical key terms yielded 804 results, most of which contained reviews or mentions of OEs rather than original research.

Articles on OEs on popular websites described above such as Duke TIP (Rinn, 2009), SENG (Lind, 2000), or the Davidson Institute (Lind, 2000) do not mention Dabrowski's theory of positive disintegration (TPD), where OEs were originally described. In TPD, OEs represent manifestations of inner energy that show potential for advanced moral and emotional development and might be more frequently found in gifted individuals (Dabrowski, Kawczak, & Piechowski, 1970). Instead, popular websites merely describe behaviors associated with OEs and coping mechanisms for certain difficulties these behaviors might cause.

Some proponents of the gifted child paradigm believe OEs might be the Holy Grail of identification, which qualitatively separates the gifted from the non-gifted (Carman, 2011; Columbus Group, 1991), though such identification strategies are unsupported in the literature (Carman, 2011; Dai & Chen, 2014; Subotnik et al., 2011; Wirthwein & Rost, 2011; Rost, Wirthwein, & Steinmayr, 2014). This assertion is problematic because the most widely used measure of OEs failed to discriminate among gifted and non-gifted individuals in the two studies conducted for that purpose (Carman, 2011; Wirthwein & Rost, 2011), while the other measure reviewed by Carman is only intended for use in research with groups. Even TPD proponents

disagree with this identification procedure using a questionnaire as it might lead to misapplications of the theory; for positive disintegration and its subsequent advanced development, all five OEs must be present, rather than none or some (Mendaglio, 2012).

Problems with OE. OEs seem to be misused as they belong in the context of a theory, in which they have a specific function (Tillier, 2009a, 2009b, 2009c) rather than being standalone traits that merely serve to describe individuals. In TPD (Dabrowski, 1967; Dabrowski et al., 1970) a fully developed personality implies high emotional and moral awareness. Dabrowski (1967) believed that those who experience life in a singular and intense way by responding to more and different stimuli than other individuals had higher potential for advanced moral development. However, confounding giftedness with moral prowess is beyond the realm of intelligence, creativity, or giftedness theories, and does not serve gifted students (Kerr, 2011). Valorizing a group of individuals above others poses a challenge as it implies individuals who are not gifted are of lesser worth to society.

Later, Piechowski (1979, 2006), who was a student of Dabrowski, described five areas of heightened sensitivity or OEs that represented developmental potential and could lead to this advanced development. Unfortunately in many cases symptoms of psychological disorders might be assumed to be a manifestation of an OE and thus the individual might not receive adequate and validated treatment (Kerr, 2011). Misdiagnosis in gifted individuals is a problem, but its opposite of underdiagnosis also happens (Kerr, 2011).

OEs were hypothesized to appear more frequently in individuals with high ability (Dabrowski et al., 1970), though this affirmation was only based on observational studies with fewer than 300 gifted individuals (Tillier, 2009a). Still, OEs are not supposed to be normally distributed in the population, not even among a population of high ability (Mendaglio, 2012).

Piechowski (1979) promoted this idea of gifted individuals exhibiting more OEs. Again, Kerr (2011) warned against the dangers of a theory that becomes popular because of individual promotion rather than because of sound science supporting its tenets.

Public debates among followers of Dabrowski visited the role of OEs in his theory and fiercely disagreed on certain interpretations of the theory (e.g., Piechowski, 2009; Tillier, 2009a, 2009b, 2009c). A particular problem has been the excessive emphasis placed on OEs at the expense of other parts of the theory deemed more important, such as positive disintegration and the different stages in which this happens before a person achieves their full moral and emotional potential (Mendaglio, 2012; Tillier, 2009a, 2009b, 2009c). Misrepresentations of any theory are of no good to a field and in this case could even cause harm by ignoring the purposes of OEs in TPD.

While typically giftedness is seen as synonymous with high intelligence or advanced cognitive abilities, proponents of the gifted child paradigm believe it is not merely high intelligence. The definition of the Columbus Group (1991) describes giftedness as asynchronicity and includes heightened intensity plus advanced cognitive abilities as a requirement for giftedness; thus, an individual *must* exhibit OEs to be considered gifted. This circular argument prevents agreement among proponents of the various gifted education paradigms and provides an essentialist view. Given the absence of empirical support for other parts of TPD (Mendaglio, 2012), this circular definition becomes particularly tricky.

The circular definition of giftedness presented by the Columbus Group (1991) is strongly essentialist in its view of gifted individuals being qualitatively different from the general population. Essentialism has proved detrimental to racial and gender relations by oppressing a group and valorizing another based upon their supposed innate differences, while in reality such

paradigms are socially constructed (Glenn, 2000). It would be logical that essentialism could be equally detrimental to individuals based on giftedness; after all, giftedness is not a real and objective entity but a social construction that is inferred from other sources (Kerr, 2011).

Intelligence, giftedness, and OE. Studies on OE mostly compare groups of high intelligence with groups of average or above-average intelligence (Mendaglio, 2012). Many studies are underpowered and rely on questionable comparisons among groups (Winkler, 2014). Results have been mixed in researchers' attempts to identify a profile of gifted individuals for specific OEs (Winkler, 2014). In TPD, all five OEs are necessary to advance through one's developmental potential (Mendaglio, 2012). Ackerman (1997), Siu (2010), and Tucker and Hafenstein (1997) found in their studies that all five OEs were higher in students identified as gifted from elementary to high school compared to non-gifted peers, yet other studies had disparaging results.

Mendaglio and Tillier (2006) called imaginational, intellectual and emotional OEs the *Big Three* based on Dabrowski et al.'s (1970) claim that these OEs combined can indicate the early emergence of talents and interests and thereby might be a valid screen for giftedness. These *Big Three* OEs differentiated among gifted and non-gifted in studies with 24 children (Gallagher, 1986) and 59 adolescents and adults (Piechowski & Colangelo, 1984). A discriminant analysis showed that instead, psychomotor, intellectual, and emotional OEs composed a profile that could differentiate gifted from non-gifted and challenged the importance of the *Big Three* (Ackerman, 1997). Thus, the so-called *Big Three* do not appear to have a consistent discriminant function that can differentiate gifted individuals from others.

Other studies found inconsistent patterns of OEs higher in gifted individuals, as evidenced by the systematic review conducted by Winkler (2014). Turkish students with high

intelligence, motivation, and leadership scored higher in imaginational and intellectual OEs than students with low or average scores in those traits (Yakmaci-Guzel & Akarsu, 2006). Gifted adolescents from Korea scored higher than their US counterparts in psychomotor OE and lower in imaginational OE (Piirto, Montgomery, & May, 2008). Gifted adults in Germany scored higher than adults of average intelligence in intellectual OE with only by a small effect size of d = .42 (Wirthwein, Becker, Loehr, & Rost, 2011).

Intelligence as measured by *g* had a small correlation of r = .16 with intellectual OE in a German study with over 700 adolescents (Rost et al., 2014). Small correlations appeared between intellectual OE and school grades in mathematics, German, and music; sensual OE and grades in German, arts, and music; and emotional OE and German, arts, and music. In a Belgian study, adolescents scoring higher than the 80th percentile on a nonverbal fluid reasoning test scored higher on intellectual and sensual OE than adolescents scoring lower than the 60th percentile on the same test (Van den Broeck, Hofmans, Cooremans, & Staels, 2013). Unfortunately, Van den Broeck et al. created two ability groups instead of using all the information available; by comparing distributions in ability and OE they could have empirically tested Mendaglio's (2012) assertion that OEs are not normally distributed and not linearly correlated with cognitive ability. Lastly, a study in France found no correlations among any of the five OEs and a nonverbal ability measure (Botella et al., 2015).

Creativity and OE. Creativity is a part of the federal definition of giftedness (Elementary and Secondary Education Act, 2002). Thus, it should be examined when conducting studies on gifted individuals. Even fewer studies compare OEs in creative populations; these tend to have problems such as low sample sizes and no peer review process.

Studies with creative individuals appear more consistent in their results than studies conducted with intellectually gifted individuals. Turkish adolescents with high creativity scored higher in all five OEs (Yakmaci-Guzel & Akarsu, 2006). A study in Mexico compared creative individuals to psychiatric outpatients and found that the creative group scored higher in all OEs than the psychiatric population (Falk, Yakmaci-Guzel, Chang, Pardo de Santayana Sanz, & Chavez-Eakle, 2008) though it was published in a book and not peer-reviewed. Schiever (1985) found that elementary students with high creativity scored higher on imaginational, intellectual, and emotional OEs than their low creativity counterparts, yet this study had an insufficient total sample size of 21 students. Gallagher (1986) found no relationship among creativity and OEs in a very small sample of 24 students. While it might be that creative individuals score higher on OEs, the research base it at present not conclusive.

Openness to Experience and the Five-Factor Model of Personality

A different theory might provide an alternative explanation for these behaviors that represent OEs. The five-factor model of personality encompasses, as its name states, five personality factors, which are extraversion (E), neuroticism (N), openness to experience or openness/intellect (O), agreeableness (A), and conscientiousness (C). Since its inception, the five-factor model has gained acceptance, received criticism, and become established as the main model for personality theory in the psychology field (Block, 2010; McCrae, 2010). Thousands of studies across ages and cultures have found support for this conceptualization of personality as a combination of dispositions (McCrae, Terracciano, et al., 2005; McCrae, 2010). The Cybernetic Big Five theory (CB5T; DeYoung, 2014) describes the five personality domains as serving a function in the human cybernetic system of activating goals, selecting a strategy, moving to action, interpreting the outcome of the action, and compare goals. The five-factor model is

generalizable and parsimonious, and therefore is preferred when compared to other alternatives. Even researchers in gifted education such as Subotnik et al. (2011) and Kerr (2011) urged the field to adopt the five-factor model as the standard to conceptualize personality.

Openness to experience is the personality domain or factor that appears equivalent to OEs when comparing conceptual descriptions. In the CB5T, openness represents "cognitive exploration and engagement with information" (DeYoung, 2014, p. 10). This factor is also called Openness/Intellect by several researchers to adequately describe the subfactors that most closely represent it (DeYoung, 2014), after a lengthy debate in the past as to whether the factor should be labeled Openness to Experience, Intellect, Openness to Ideas, Openness to Aesthetics, Culture, or Creative Mentality (McCrae, 1994; Johnson, 1994). While I ascribe to the openness/intellect model as I believe it is the soundest description of the domain, throughout this paper I will stick to openness to experience or openness, the name chosen by Costa and McCrae (1992), for the purpose of simplicity.

Intelligence, giftedness, and openness to experience. A meta-analysis of intelligence and personality factors conducted by Ackerman and Heggestad (1997) found a positive association between openness to experience and intelligence measures, with estimated population correlations of .33 for general intelligence and .30 for crystallized intelligence in samples of average ability and personality traits. Ackerman and Heggestad acknowledged that further studies would be needed to extend their findings to samples located on the extremes of ability and personality traits.

Later studies demonstrated similar findings. Gignac, Stough, and Loukomitis (2004) found that a composite factor formed by the openness facets of actions, ideas, and values correlated with general intelligence as measured by two editions of the Wechsler intelligence

tests. Harris (2004) found that a composite factor formed by several facets of openness in three instruments correlated with a general intelligence factor. Openness to experience predicted general intelligence (β = .12) and the facets of openness to ideas (r = .20) and actions (r = .07) had positive correlations with general intelligence (Moutafi, Furnham, & Crump, 2006). In a study with two distinct samples by DeYoung, Quilty, Peterson, and Gray (2014), the subdomain of intellect was correlated with general intelligence (r = .32 - .35), verbal intelligence (r = .29 - .30), and nonverbal intelligence (r = .24 - .25). Openness on the NEO and Intuition on the MBTI predicted general intelligence across three measures (β ranging between .11 and .32); when examined by facets, Ideas was the only significant predictor (Moutafi, Furnham, & Crump, 2003). A study with several samples found correlations among general ability and openness (r = .34 and .35; Austin et al., 2002). The study found only linear relationships among measures, thereby not supporting quadratic relationships of a geometrical increase and larger variability of openness with high ability, a relationship previously found by Austin, Deary, and Gibson (1997).

Results with gifted samples are similar to results with regular samples. A research synthesis of 14 studies using the MBTI showed that gifted adolescents have a strong preference of 71.6% for intuition over sensory information, compared to 31.9% in the normative group (Sak, 2004). This preference for intuition relates to openness to experience (Costa & McCrae, 1992). Later, Cross et al. (2007) replicated these findings as 70% of gifted adolescents in their sample had a preference for intuition. Zeidner and Shani-Zinovich (2011) compared gifted and nongifted Israeli adolescents on the five-factor model of personality and found gifted adolescents scored higher in openness to experience with a medium effect size.

Perhaps the most complete study on personality and giftedness conducted to date is the one performed by Altaras Dimitrijević (2012) with three different samples of gifted students in

high school and college. Students completed test batteries measuring intellectual ability and the upper 20 percent of students in each sample was categorized as gifted. Altaras Dimitrijević reviewed the existent literature on personality and giftedness, regardless of personality theory represented by each study. She converted all personality traits supposedly ascribed to the gifted in those studies to the five-factor model of personality. Based on the literature, she hypothesized two models to differentiate among gifted and non-gifted students, both based on the five-factor personality theory. One model included the openness and agreeableness domains and one model included 14 facets corresponding to various personality domains. Those discriminant models were tested across samples and inconsistent facets were removed, leaving a seven-facet discriminant function that was constant across the samples. This final discriminant function included three facets of openness: Ideas, Fantasy, and Aesthetics (Altaras Dimitrijević, 2012). Thus, openness was the domain that was the strongest predictor of giftedness, consistent with previous studies.

Creativity and openness to experience. Openness to experience is the hallmark trait of creative individuals as evidenced by multiple studies. A meta-analysis found that creative people in the arts and the sciences have relatively similar personality patterns, scoring high on openness to experience (Feist, 1998). When using a profiling technique to recruit creative adolescents, openness to experience was their highest personality score (Kerr & McKay, 2013). Openness to experience and intellectual curiosity were among the traits that discriminated between creative and noncreative people (Ivcevic & Mayer, 2007). In a study of scientific creativity, openness was the only significant predictor among other personality factors based on the five-factor model and Eysenck's three factors; openness predicted number of citations received by a scientist, their *h*-index, their Soler creativity index (which takes into account citations of a paper, references cited

in that paper, number of authors per paper, and total publications by one author), and an overall score including the aforementioned criteria plus number of lifetime publications (Gorman & Feist, 2014).

Openness to experience was the strongest predictor of ideational behavior, a part of creativity, over other personality factors or intelligence measures (Batey, Chamorro-Premuzic, & Furnham, 2010). Similarly, openness was the strongest predictor of total creativity, creative story ratings, and creative hobbies in a German sample (Wolfradt & Pretz, 2001). Openness predicted self-rated creativity in an adult sample (Hughes, Furnham, & Batey, 2013) and an undergraduate sample of art and science students (Furnham, Batey, Booth, Patel, & Lozinskaya, 2011). Structural equation models found that openness was the strongest predictor of creative behaviors and self-rated creativity in models including other personality factors and psychopathology measures (Furnham, Hughes, & Marshall, 2013). Kaufman (2013) found that openness to experience was related to real-life creative achievement; in particular, affective engagement and aesthetic engagement were related to creativity in the arts, while intellectual engagement and explicit cognitive ability were related to creativity in the sciences.

Openness and OEs

Neuroscience. Brain imaging studies on openness to experience found several areas of action. An important one appears to be Brodmann's Area (BA) 40, which is the inferior section of the parietal lobe (DeYoung et al., 2010) and related to creativity (Bechtereva et al., 2004). Other sections related to openness were BA 18, the lingual gyrus, and BA 37, the middle temporal gyrus (DeYoung et al., 2010) as well as the posterior medial frontal cortex (DeYoung, 2010). Openness was related to resting-state functional connectivity among the midline centers of the default mode network, a brain system activated when individuals integrate information

about themselves and the environment, as well as the dorsolateral prefrontal cortex; those areas are related to cognitive flexibility, fantasy, curiosity, and exploration (Adelstein et al., 2011).

One brain imaging study on OEs has been conducted in Taiwan by Kuo et al. (2012, as cited in Chang & Kuo, 2013). They correlated OEs with brain volume measured with magnetic resonance imaging (MRI) and found areas related to each OE. Among those, BA 40 appeared as a significant area for imaginational OE and intellectual OE. The left superior temporal gyrus, BA 22, was positively related to sensual OE and intellectual OE, yet negatively related to emotional OE (Kuo et al., 2012, as cited in Chang & Kuo, 2013). The involvement of BA 40 in both openness and OEs seems to be robustly represented in studies, with other potential areas of involvement for both openness and OEs in the superior-middle areas of the temporal gyrus. Thus, brain imaging studies seem to support the hypothesis that OEs are representing facets of openness to experience.

Correlational studies. One non-peer-reviewed book chapter (Gallagher, 2012) and several new studies have investigated the relationship among openness to experience and OEs, either as the main aim of the study (Limont, Dreszer-Drogorób, Bedyńska, Śliwińska, & Jastrzębska, 2014) or in the context of instrument validation (Botella et al., 2015; Rost et al., 2014) and found that openness was related to most OEs. Limont et al. (2014) found that general correlations among openness and OEs were significant; r = .53 with sensual OE, r = .45 with imaginational OE, r = 34 with intellectual OE, and r = .31 with emotional OE. In their path models, sensual OE and imaginational OE could predict openness scores; they also found an interesting interaction effect in which the relationship between sensual OE and openness was stronger for the group labeled as gifted, defined as the upper 20% in a nonverbal reasoning task (Limont et al., 2014). In a French study to validate a version of the OEQ-II, Botella et al. (2015)

found correlations among openness and imaginational OE (r = .41), intellectual OE (r = .38), emotional OE (r = .20), and sensual OE (r = .20). Also, in a German study to validate a version of the OEQ-II, Rost et al. (2014) found significant correlations among openness and sensual OE (r = .60), intellectual OE (r = .52), emotional OE (r = .26), and imaginational OE (r = .24). However, these studies do not show the entire picture as they only correlate openness at the domain level instead of using facet scales.

Conceptual Comparison of Openness Facets and OEs

In personality tests, domain scales refer to each of the five personality factors; facet scales are subscales of each factor which serve to go into detail in a more delicate analysis of the person. In the case of openness, facet scales indicate the aspects of life in which the person is open to new experiences. An empirical study attempting to show the relationship between openness to experience and OEs should correlate these at the facet level. In the next section I will describe combinations of an openness facet and an OE that corresponds with the openness facet to highlight the conceptual similarity.

Fantasy and imagination. This openness/OE combination is, perhaps, one of the most related combinations. The openness facet is *O1: Fantasy*. High scorers have very active imaginations, fantasize constantly, and believe imagination contributes to fuller lives. They daydream frequently, not so much as an attempt to escape everyday life but more as a way of experiencing a very rich inner world, in which they create elaborate details (Costa & McCrae, 1992). *Imaginational OE* refers to the power to feel vividly things in the mind as real. When freed from restrictions, their imagination unleashes a powerful ability to visualize and use metaphors. They daydream, fantasize, create, and make up vivid stories, perhaps to the extent that they may prefer to live in their imaginative minds (Piechowski, 1979, 2006). Both

descriptions use the same words and discuss similar experiences, and are likely labeling the same construct with different words.

Aesthetics and sensory pleasures. Artistic interests and enjoyment appears in *O2: Aesthetics* and in *sensual OE.* People who score high in O2: Aesthetics are deeply moved by beauty. They appreciate art and have a great capacity for getting absorbed and carried away by music, poetry, theater, or visual arts. Artistic talent is not necessary to score high on this scale, nor is conformity with mainstream beauty standards (Costa & McCrae, 1992). Sensual OE or intense enjoyment through the senses and active pleasure-seeking could resemble shallowness and hedonism. People with sensual OE place high importance in pleasures they receive from their sense experience. When individuals feel anxious or tense, they may vent their emotions through their senses. They love attention, physical appearance and beauty, touching, tasting and smelling delightful things (Piechowski, 1979, 2006). The importance placed on sensorial input and enjoyment of beauty seems to be common to both descriptions.

Emotions and values. Ranges of feelings and importance attributed to personal values and beliefs appear in two openness facets, *O3: Feelings* and *O6: Values*, and in *emotional OE*. O3: Feelings describes the person's openness to their own feelings and their tendency to have a wide range of emotional experiences, both in depth and in variety. People who score high on this facet feel all emotions with more intensity than others. They are receptive to emotions and believe that these are a very important part of life (Costa & McCrae, 1992). High scores in O6: Values describe individuals who do not have a particularly high regard for authority or tradition; they are willing to revise social, political and religious values when needed, and as such are a perfect opposite of dogmatism (Costa & McCrae, 1992). Emotional OE creates emotional experiences that are intense in both variety and depth. Individuals with intense feelings have a

high awareness of their emotions. Either extremely inhibited and shy or too excited and enthusiastic, these individuals may alternate between these extremes. Emotions experienced in the past are retained as powerful and poignant feelings which may indicate extraordinary affective memory. Their loneliness, guilt, and frequent thoughts about death could seem like depression or an exaggeration of feelings. However, they have high empathy, a fervent desire to love, and a strong capacity for justice (Piechowski, 1979, 2006). Both descriptions encompass the variety and depth of feelings as well as the importance placed on them.

Actions and movement. Comprised of *O4: Actions* and *psychomotor OE,* this is the openness/OE combination that appears to have the lowest conceptual match. However, one can still argue for their likeness. In O4: Actions, high scorers enjoy novelty and variety in their pursuits. They need to be moved to action. They are willing to step out of their comfort zone just for the fun of it. They dislike routines and might feel trapped in those (Costa & McCrae, 1992). People with psychomotor OE need to move and may appear restless. Pressure to act appears in their high energy and excitation. A person might use excess energy to gesticulate, make vivid facial expressions, and talk quickly (Piechowski, 1979, 2006). The need to take action and the energy of such actions are described by both O4: Actions and psychomotor OE.

Ideas and intellect. Perhaps the most common experience of openness to experience in gifted individuals is the love of learning and the strong curiosity, evidenced in *O5: Ideas* and in *intellectual OE*. People who score high in O5: Ideas show unusual degrees of intellectual curiosity. They want to know new things and need to understand underlying mechanisms. They are willing to consider new and unconventional ideas, keeping an open mind about them. Also, they enjoy philosophy and debates that challenge their brains (Costa & McCrae, 1992). Intellectual OE refers to an innate curiosity and eagerness for learning. These minds work

quickly and undertake complicated tasks. They strive for mastery of a mental task as well as understanding all the steps leading to its completion. In their quest for truth, these individuals will expend great energy in perplexing questions to satisfy their intellectual curiosity. Step by step analysis and harsh observations may characterize these independent thinkers who create theories and generate ideas (Piechowski, 1979, 2006). Descriptions use similar words to address curiosity and a strong need for knowledge.

Conclusion

Conceptual comparisons of facets of openness to experience and a corresponding OE show that those appear to be similar as many use identical words in their definitions. Those combinations of openness facets and an OE are O1: Fantasy and imaginational OE, O2: Aesthetics and sensual OE, O3: Feelings and emotional OE, O4: Actions and psychomotor OE, O5: Ideas and intellectual OE, and O6: Values and emotional OE as well. Up until now, though, no studies in the literature empirically tested the relationship among openness facets and OEs; thus, we can only infer the relationship from the seeming conceptual similarity and other tangential research on openness or OEs.

Studies of openness to experience and OEs show analogous patterns across individuals of average intelligence, high intelligence, and high creativity. In peer-reviewed studies with adequate sample sizes, openness and OE have high correlations with creativity (Batey et al., 2010; Feist, 1998; Furnham et al., 2011; Furnham et al., 2013; Gorman & Feist, 2014; Hughes et al., 2013; Ivcevic & Mayer, 2007; Kerr & McKay, 2013; Wolfradt & Pretz, 2001; Yakmaci-Guzel & Akarsu, 2006) and moderate correlations with intelligence in samples of all ability levels (Ackerman & Heggestad, 1997; Austin et al., 1997; Austin et al., 2002; Cross et al., 2007; Gignac et al., 2004; Harris, 2004; Moutafi et al., 2003; Moutafi et al., 2006; Sak, 2004; Zeidner

& Shani-Zinovich, 2011). Brain imaging studies show that openness and OEs seem to be largely represented in the same brain area, BA 40 (Adelstein et al., 2011; Chang & Kuo, 2013; DeYoung, 2010; DeYoung et al., 2010). Openness and OEs also correlate with each other (Rost et al., 2014; Botella et al., 2015), although all studies reviewed used openness as a domain instead of correlating each openness facet to the corresponding OE.

Perhaps parents, teachers, and gifted children themselves rely on OEs as those seem to be the only constructs they can find in the literature that explain certain observed behaviors. Books and popular articles on OEs are plentiful in gifted education, yet openness to experience is less known as it is mostly discussed in the field of psychology. At present, research is on OEs rather than TPD as a whole. As described before, OEs without theory basically reflect the personality trait of openness to experience.

An alternative conceptualization for behaviors related to OEs or openness might expand individuals' ability to explain these behaviors and give them an acceptable name. It would be preferable to name these traits using constructs that are strongly supported in the literature, like openness to experience, rather than talking about them as OEs which lack empirical support. Wirthwein et al. (2011) hypothesized OEs might simply be "old wine in new bottles" (p. 150). Rost et al. (2014) took this assertion a step further and stated that given empirical results, the OE construct was not useful; it did not serve as a giftedness identification tool, and it did not describe any new behaviors that could not be explained by other sources. Thus, it is a redundant construct. Practice should be based on sound science and in this case the science behind OEs is not sound.

Personality is rather stable yet susceptible to external influences and follows a developmental trajectory (Costa & McCrae, 1992) just like other factors in the talent

development paradigm (Subotnik et al., 2011). This is opposed to OEs, presented as an innate trait with negligible environmental influence (Mendaglio, 2012) with no empirical evidence for this posture. Therefore, a conceptual change from OEs to openness to experience would reflect the shift from a static and essentialist conception of giftedness to a talent development perspective.

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CHAPTER 2

Abstract

This study examined the similarity of OEs to corresponding openness to experience facets in a sample of 149 creative adolescents and adults, and a comparison sample of 312 adults from the general populations. Multigroup confirmatory factor analysis tested competing two-factor and one-factor models and measurement invariance across samples. O2: Aesthetics and sensual OE, and O5: Ideas and intellectual OE, were equally represented as one single factor or two factors; in the two-factor model they showed strong latent correlations. O1: Fantasy and imaginational OE, and O3: Feelings and emotional OE, were best represented by a two-factor model and had strong latent correlations. O4: Actions and psychomotor OE were best represented by a two-factor model and had a small positive latent correlation, and O6: Values and emotional OE were best represented by a two-factor model and had a small negative latent correlation. Based on the high correlations among most openness facets and OEs, openness to experience seems to encompass OEs. Thus, giftedness researchers and practitioners should align with well-researched psychological theories such as the five-factor model of personality (Costa & McCrae, 1992; Goldberg. 1999) and begin to talk about openness rather than OEs.

Key words: openness to experience, overexcitability, five-factor model of personality

CHAPTER 2

Openness to Experience Rather Than Overexcitabilities: Study

A controversy exists in gifted education regarding certain personality traits that appear to be related to giftedness, yet when describing those traits the literature does not use known personality theories. Psychology can provide an answer to this problem with the five-factor model of personality. This is a well-researched and generalizable personality model that is valid across ages and cultures (McCrae, 2010; McCrae, Terracciano, et al., 2005).

Overexcitabilities (OEs) supposedly describe heightened intensity and sensitivity in five areas, namely imaginational, sensual, emotional, psychomotor, and intellectual, that supposedly indicate a heightened activity of the nervous system (Mendaglio & Tillier, 2006; Mendaglio, 2012) and might lead to advanced moral and emotional development (Piechowski, 1979, 2006). Openness to experience, one of the personality factors in the five-factor model, most likely explains OEs. According to Costa and McCrae (1992), individuals who are open to new experiences enjoy both outer and inner worlds, are curious, and hold novel ideas. They have high aesthetic sensitivity, intellectual curiosity, vivid imagination, and evolving value systems. This description appears extraordinarily analogous to descriptions of OEs. The paucity of OE research appears to be atheoretical, thus misrepresenting the original theory and making it more plausible to say that the behaviors being called OE are in reality openness to experience. In this study, I will explore the potential connection between OEs and facets of openness to experience, suggesting that they represent similar or equivalent constructs.

The few empirical studies focus primarily on OEs without connecting them to the larger theory and the role they play in achieving one's developmental potential (Mendaglio, 2012). Despite the popularity of OEs, empirical evidence supporting their existence is poor; patterns in

gifted individuals are inconsistent (Mendaglio, 2012), many studies have low sample sizes (e.g., Gallagher, 1986; Schiever, 1985), and not all studies are published in peer-reviewed journals (e.g., Falk, Yakmaci-Guzel, Chang, Pardo de Santayana Sanz, & Chavez-Eakle, 2008). Despite these problems the OE literature continues to cite them. Certain proponents of OEs even go as far as to say that personality-based measures, especially ones based on OEs, should be at the basis of identification for giftedness (Carman, 2011). However, the empirical evidence does not support this (Mendaglio, 2012; Wirthwein & Rost, 2011) and the usefulness or even existence of the construct is debated (Rost, Wirthwein, & Steinmayr, 2014).

Recently, researchers have begun to review the relationship between openness to experience and OEs. In various studies, correlations were significant between openness and imaginational OE with *r* between .24-.45, sensual OE with *r* between .20-.60, intellectual OE with *r* between .34-.52, and emotional OE *r* between .20-.31 (Limont, Dreszer-Drogorób, Bedyńska, Śliwińska, & Jastrzębska, 2014; Botella et al., 2015; Rost et al., 2014). Limont et al. (2014) found using path models that both sensual OE and imaginational OE predicted openness scores. Also, in Limont et al.'s study, sensual OE showed an interaction effect with giftedness, where the group labeled as gifted (upper 20% in a nonverbal ability test) had a strong correlation among sensual OE and openness whereas the correlation in the non-gifted group was merely moderate. The problem with these correlations is that openness is used as a whole domain rather than each facet to the corresponding OE.

Openness facets, according to Costa and McCrae (1992) encompass fantasy, aesthetics, feelings, actions, ideas, and values as areas in which the person is open to new experiences. Each of those facets closely matches an OE, which are imaginational, sensual, emotional, psychomotor, and intellectual. A detailed comparison among openness facets and OEs was

presented by Gallagher (2012) albeit in a non-peer-reviewed format and merely theoretical. Empirical evidence of these relationships is still lacking in the literature.

The Present Study

Openness facets and their corresponding OEs are as follows: *O1: Fantasy* and imaginational OE, *O2: Aesthetics* and sensual OE, *O3: Feelings* and emotional OE, *O4: Actions* and psychomotor OE, *O5: Ideas* and intellectual OE, and *O6: Values* matching as well with emotional OE. Two hypothesized models tested the hypothesis that openness facets and their corresponding OEs represent the same latent constructs. In the two-factor or O/OE model, indicators of OEs and indicators of openness facets were modeled as two separate constructs expected to show a very strong correlation (see Figure 1). Different personality tests measuring the same constructs have correlations ranging between .70 and .80 (Goldberg, 1999). Therefore, if OEs show similar correlations with openness facets, it could be assumed they are measuring very similar or equivalent constructs. The one-factor model or O only made this hypothesized relationship more explicit by having all openness and OE items load into one single latent variable (see Figure 2).

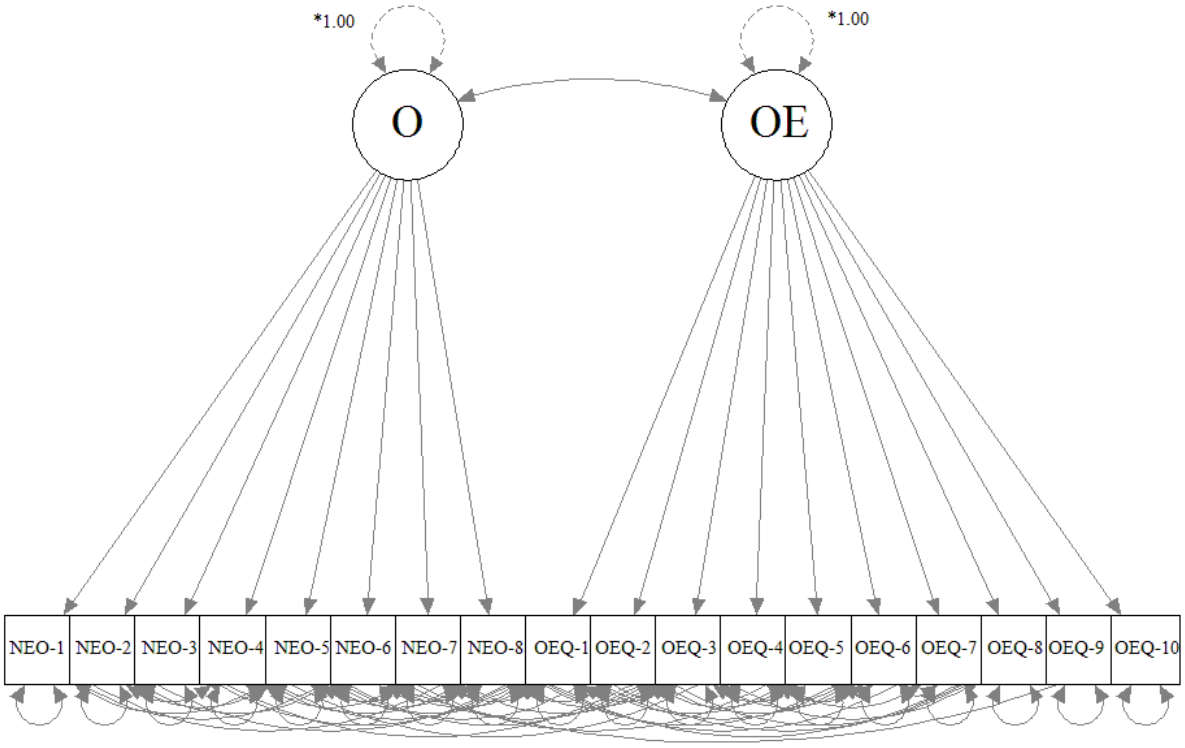

Figure 1. Two-factor O/OE sample model with an openness facet and its corresponding OE represented as correlated constructs. Latent constructs are shown in circles. Squares represent items pertaining to openness and OE.

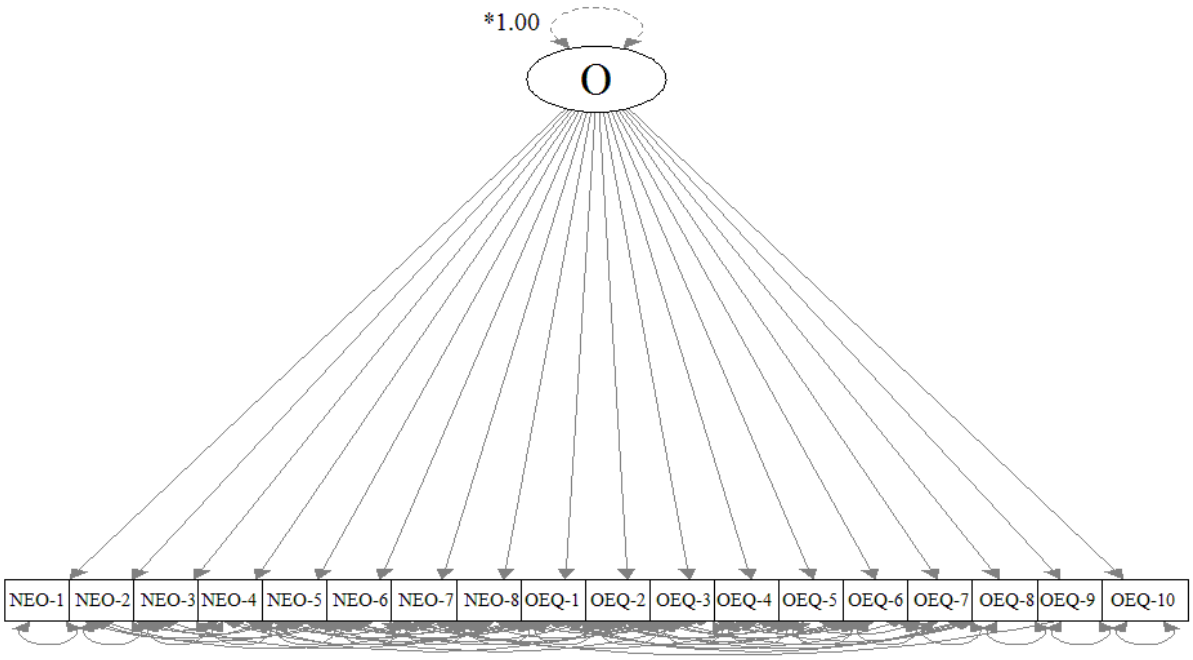

Figure 2. One-factor O only sample model with an openness facet and its corresponding OE represented as a single construct. The latent construct is shown in a circle. Squares represent items pertaining to openness and OE.

Method

Participants

Two distinct samples were recruited for this study. This was to ensure the inclusion of the population of interest, creative individuals, yet prevent restriction of range due to their expected high scores on openness to experience facets and OEs. Therefore, another sample comprised of adults from the regular population was included. According to five-factor model theorists, personality traits are normally distributed in the population (DeYoung, 2014; McCrae, Terracciano, et al., 2005) yet OEs are not supposed to be normally distributed (Mendaglio, 2012). Including two samples expected to have a wide range of scores on openness and OEs will allow testing for normal distributions.

The decision of selecting highly creative individuals was based on the literature reviewed, where creatively gifted individuals generally scored higher than the regular population on OEs (Falk et al., 2008; Yakmaci-Guzel & Akarsu, 2006), while intellectually gifted individuals showed an inconsistent pattern of scores. Both creatively gifted and intellectually gifted are covered under the umbrella of the federal giftedness definition (Elementary and Secondary Education Act, 2002) and thus represent the population that is considered pertinent to proponents of OE.

Sample 1: Creative adolescents and adults. Participants in the first sample were 149 creatively and intellectually gifted adolescents and adults from the Midwest identified via a profiling technique developed by Kerr and McKay (2013). They were recruited via invitations to high schools and their gifted programs, as well as creative programs at universities (e.g. arts, creative writing, graphic and industrial design). Schools received profiles that described eminent adults who achieved high creativity in their domains when they were younger, and school

personnel selected students who fit the profiles. Previous research indicated the promise of this identification method as many of these adolescents and adults already had creative accomplishments and their personalities resembled those of creative individuals (Kerr & McKay, 2013).

Participants were 55.7% female, 41.6% male, and 2.7% other, self-reported as 1.35% "non-binary" and 1.35% female-to-male transgender. Age ranged from 13 to 53 with a mean of 17.12 and a standard deviation of 4.83. They reported their race/ethnicity as 2.7% African or African American, 3.4% Asian or Asian American, 2.7% Latino/Hispanic, 2.0% Native American, 6.1% Multiracial or Other, and 83.1% Caucasian. Regarding education levels, 89.9% was attending high school, 9.4% was attending college, and 0.7% had a previous master's degree.

Sample 2: Adults from the general population. The second sample included 312 adults recruited from Amazon Mechanical Turk or MTurk, a crowdsourcing platform, by posting a request for completion of the study via a screener survey with demographic information and a follow-up survey with the assessments. MTurk only allows adults to use its services and no other prerequisite for participation was requested. First, 472 potential participants completed a screener survey with the information statement and demographics, for which they were paid $0.02. Instructions to the screener survey listed in detail the procedure used for compensation and information about the assessments. Those 472 potential participants received a $0.01 bonus with a custom link to the tests on the online platform Qualtrics. In total, 312 participants completed the instruments on Qualtrics. Upon completion, these 312 participants received a $1.97 bonus thereby earning $2.00 as full payment for completing the instruments. MTurk has shown reliability and validity coefficients similar to those obtained in college and community

samples, and thus is gaining acceptance in behavioral sciences research (Shapiro, Chandler, & Mueller, 2013).

Participants were 46.2% female, 53.2% male, and 0.6% other, self-reported as "gender fluid" and "I use a male body here, but I have no gender." Age ranged from 20 to 71 with a mean of 35.92 and a standard deviation of 10.88. They reported their race/ethnicity as 3.2% African or African American, 32.7% Asian or Asian American, 1.9% Latino/Hispanic, 1.0% Native American, 2.6% Multiracial or Other, and 58.7% Caucasian. The majority of participants lived in the United States (70.5%), followed by India (27.9%) and other countries (1.6%) such as Canada, Romania, Russia, and the United Kingdom. Education levels varied; 11.9% had a high school/GED diploma, 19.4% attended some college or technical training, 8.1% graduated from a two-year college, 41.9% graduated from a four-year college, 17.4% had a master's degree, and 1.3% had a doctorate or professional degree.

Instruments

NEO Personality Inventory-3. The NEO Personality Inventory-3 (NEO PI-3; McCrae, Costa, & Martin, 2005) is a 240-item measure based on the five-factor model of personality. Five domain scales of 60 items, each corresponding to a personality trait, include six facet subscales of 10 items in each scale. The facet scales for openness to experience are openness to fantasy, aesthetics, feelings, actions, ideas, and values. Copyright reasons prevent the inclusion of sample items. Results are presented as raw scores which can be converted to *T* scores to compare one's results to the suitable norming group. The normative sample of the NEO PI-3 included an adolescent sample and improved readability compared to previous iterations of the NEO PI (McCrae, Costa, et al., 2005). Test-retest reliability for the NEO PI was high in both short-term (weeks) and long-term (seven years) with reliabilities ranging from .63 to .92 in multiple studies.

Validity evidence based on relations with other variables supports the NEO PI as a sound instrument as domains of the NEO PI correlate positively with analogous constructs in other measures (Costa & McCrae, 1992).

Overexcitabilities Questionnaire-Two. The Overexcitabilities Questionnaire-Two (OEQ-II; Falk, Lind, Miller, Piechowski, & Silverman, 1999) is at present the only quantitative instrument available to assess OEs in individuals. The OEQ-II measures psychomotor, sensual, imaginational, intellectual and emotional OEs on a 5-point Likert scale (50 items) for group comparison purposes but not individual diagnoses. Representative items of these five factors are: "I am a competitive person," "The varieties of sound and color are delightful," "I like to daydream," "I am an independent thinker," and "It makes me sad to see a lonely person in a group" (Falk et al., 1999). A reliability generalization study found good reliability in 16 additional studies using the OEQ-II (Warne, 2011a). While one published CFA found that OE models did not fit and did not hold measurement invariance across genders (Warne, 2011b), a later study using exploratory structural equation modeling within a CFA framework (ESEM-within-CFA or EWC; Morin, Marsh, & Nagergast, 2013) found acceptable fit and partial measurement invariance across genders (Van den Broeck, Hofmans, Cooremans, & Staels, 2013).

Procedure

Data collection for the first sample took place in the context of a larger project approved by the KU HSCL in 2007. An amendment included the OEQ-II among the existing measures. Recruitment of participants and completion of questionnaires occurred between February 2014 and May 2015.

For the second sample, HSCL approval was secured first. Both questionnaires were set up in Qualtrics. A Human Intelligence Task (HIT) was posted on MTurk with a request for completion of the study, the information statement, and a screener survey asking for demographic information. Potential participants completed the screener survey for which they received a payment of $0.02. After the researcher approved the screener survey, potential participants received a $0.01 bonus payment with an embedded custom link to the assessments in Qualtrics via a private message. This custom link was related to that MTurk Worker ID and was a one-time use link. The researcher checked which participants completed the assessments in Qualtrics using the custom links and paid those participants an additional bonus of $1.97, for a total payment for $2.00. These additional steps were part of the license agreement for online use of the NEO PI-3. Recruitment of participants and completion of questionnaires occurred in March 2015.

Data Analysis

Instead of using the original 0-4 Likert scale in the NEO PI-3, items were converted to a 1-5 Likert scale as used by the OEQ-II for ease of interpretability. Data were screened with normality tests. Measurement models were designed including each openness/OE combination as separate latent factors or as a single latent factor. Those models were tested using confirmatory factor analysis (CFA) with robust maximum likelihood estimation as data were ordinal. Both models were contrasted before proceeding.

Description of models. Two competing models indicated the possible relationships among each openness/OE combination. In the two-factor O/OE model exemplified in Figure 1, each openness facet and each OE were represented as latent variables, with indicators corresponding to test items of each openness facet and OE. To be able to observe correlations

among constructs, the fixed factor method set the scale. In the one-factor O only model observed in Figure 2, each openness facet/OE combination represented a single construct. Again, the scale setting method fixed the factor variance. Model fit statistics followed Hu and Bentler's (1999) and Little's (2013) suggestions of acceptable fit if CFI/TLI > .90, RMSEA < .08, and SRMR < .11, or very good fit if CFI/TLI > .95, RMSEA < .05, and SRMR < .06, following their combinational rules based on SRMR and other fit indices' rejection rate of Type I and Type II errors. The combination rules of RMSEA and SRMR presented by Hu and Bentler indicate that with a sample size close to 500, the combination of RMSEA between .05 and .08 and SRMR between .06 and .11 yield an acceptable ratio of Type I and Type II errors and thus can be used to select useful models.

Separate models for openness facets and their corresponding OEs were chosen for two main reasons. First, the only published CFA model of the OEQ-II (Warne, 2011b) used this approach of five separate models based on the manner in which the OEQ-II was developed. Second, personality tests based on the five-factor model typically have fit problems in CFA models due to cross-loadings and correlated residuals, and as such it is preferable to model them individually (Gignac, Bates, & Jang, 2007). Since this study attempts to find the relationship among openness facets and OEs rather than testing the fit of each instrument, having separate models for each openness/OE combination seemed to be a better option.

Adding to the difficulty of fitting CFA models to personality instruments, this study had the extra challenge of needing to fit in the same model two personality instruments hypothesized to measure the same constructs. Meaningful correlations among residuals were expected based on the hypothesis, thus model modifications were anticipated. To determine an acceptable base model, text of the items were inspected and modification indices (MI) were checked. Items with

MI above 10 were permitted to have correlated residuals if there was a plausible theoretical explanation. For example, in the O1: Fantasy and imaginational OE models, multiple items related to "daydreaming" and were allowed to have correlated residuals; items related to "fantasy life" were also permitted to have modeled residual correlations. Ideally, models should not need any modifications, yet personality inventories are notorious for lacking the simple structure required for CFA and typically need modifications (Gignac et al., 2007). The same correlated residuals allowed in the two-factor models were imposed onto the one-factor models so they would be nested. Typically, one-factor models have more difficulty for proper fit (Slocum-Gori, Zumbo, Michalos, & Diener, 2009) and thus selecting correlated residuals based on one-factor models would have led to a higher proportion of error.

Multigroup confirmatory factor analyses. Next, multigroup confirmatory factor analyses (MGCFAs) conducted in the R package lavaan (Rosseel, 2012) and MPlus 7.1.3 (Muthén & Muthén, 2013) using the Robust Maximum Likelihood (MLR) estimator checked the similarity of openness to experience and OEs. Kline (2010) stated that CFA and other structural equation modeling studies could be advantageous to gifted education research to test relationships among hypothetical constructs such as openness or OEs. Models in CFA, also called measurement models, define constructs with multiple indicators thereby correcting for measurement error, and can establish the content validity of these indicators by separating reliable and unreliable indicators (Little, 2013). Population parameters estimated in structural equation models are unbiased and thus more exact and generalizable. Therefore, this approach increases internal and external validity compared to classical statistical models.

Multigroup tests are used when one or more groups are included in analyses to test for measurement invariance. Measurement invariance testing takes a stepwise approach in which

nested models are tested with increasing constraints in every step (Little, 2013). Configural invariance testing, the first step, runs the models separately for each group but without any additional constraints. If model fit is appropriate based on conventions for fit indices, weak invariance is tested by constraining factor loadings in each group. Again, if model fit remains appropriate, assessed by a nonsignificant test for the difference in chi-square or a change of < .01 in CFI (Cheung & Rensvold, 2002) then the next model is tested. Chi-square difference tests can be extremely sensitive to sample size and on occasions yield a significantly worse fit even when other fit indices do not show important changes; in those cases, the CFI change rule will be preferred based on the measurement invariance simulation studies of Cheung and Rensvold (2002). Strong invariance is tested by constraining the intercepts across groups. A higher level is called scalar invariance, in which residuals are constrained across groups to check for equal reliability among items.

The fixed alignment method (Asparouhov & Muthén, 2014) was used to estimate approximate measurement invariance and find noninvariant loadings and intercepts, which would facilitate weak and strong partial invariance testing. With the estimates provided by the alignment method, the traditional stepwise strategy of freeing one parameter at a time based on modification indices would not be necessary. Instead, all estimated noninvariant loadings and intercepts can be incorporated in one step to establish partial invariance at the weak and strong levels. According to Byrne, Shavelson, and Muthén (1989) at least two factor loadings and two intercepts must be invariant to establish partial invariance at each level to be able to compare latent means.

For the purposes of this study weak invariance is needed, as factor loadings should be equal to be able to estimate the desired factor covariance parameter. However, strong invariance

would permit a comparison of latent means among the creative sample and the regular sample. In models where openness facets and OEs were estimated as two different latent factors, an extra constraint was added at the end in which the factor covariance was forced to be equal in both groups. Constraining the factor covariance across groups would control for possible interaction effects of significantly stronger correlations among OEs and openness in the creative group, based on findings of Limont et al. (2014).

Results

Initial Analyses

There were no missing data as all items required a response. All indicators in the models appeared normally distributed with skewness <|1.5| and kurtosis <|2|. To calculate descriptive statistics, item scores of openness facets and OEs on a Likert scale of 1-5 were added to create a subscale score. Reliability was good for all subscales with Cronbach's α above .7. Means, standard deviations, and Cronbach's α can be found in Table 1.

Table 1
Descriptive Statistics on Openness Facets and OEs

	Sample 1: Creative Adolescents and Adults (*n*=149)		Sample 2: Regular Adults (*n*=312)		Cronbach's
Measure	*M*	*SD*	*M*	*SD*	α
Openness Domain	180.03	20.01	165.84	20.36	.902
O1: Ideas	30.47	5.31	26.56	5.56	.815
Imaginational OE	31.39	8.11	26.59	8.00	.887
O2: Aesthetics	29.64	6.66	27.58	5.90	.839
Sensual OE	36.28	8.44	34.85	8.21	.905
O3: Feelings	30.32	4.74	28.76	4.79	.742
Emotional OE	35.54	7.30	32.51	6.80	.820
O4: Actions	24.77	4.64	23.49	4.55	.729
Psychomotor OE	30.96	8.25	28.28	8.30	.891
O5: Ideas	32.55	4.82	29.83	5.62	.831
Intellectual OE	38.61	5.85	36.81	7.31	.883
O6: Values	32.28	5.02	29.62	5.89	.831

MGCFAs and Correlations among Latent Variables

Separate MGCFAs with robust maximum likelihood estimation were conducted for each openness facet and OE combination, testing the two-factor O/OE models and the one-factor O only models. Indices showed discrepancy in goodness of fit of the model. However, the selected models worked with Hu and Bentler's (1999) combination rules for RMSEA and SRMR, as well

as Little's (2013) guidelines for acceptable fit indices. Table 2 shows latent correlations among openness facets and OEs in the two-factor models. Table 3 shows latent mean comparisons across groups for all final models. Tables 4 to 9 show fit indices for invariance testing for each model.

Table 2
Latent Correlations

	Value	*p*
O1: Fantasy and imaginational OE	.820	<.001
O2: Aesthetics and sensual OE	.928	<.001
O3: Feelings and emotional OE	.843	<.001
O4: Actions and psychomotor OE	.133	.026
O5: Ideas and intellectual OE	.885	<.001
O6: Values and emotional OE	-.195	.002

Table 3
Latent Mean Group Comparisons

	Sample 1: Creative Adolescents and Adults (*n*=149)	Sample 2: Regular Adults (*n*=312)	
Measure	*LM*	*LM*	*p*
O1: Fantasy	0.000	-0.624	<.001
Imaginational OE	0.000	-0.300	.005
O2: Aesthetics	0.000	-0.442	<.001
Sensual OE	0.000	-0.198	.064
O2: Aesthetics and sensual OE	0.000	-0.269	.014
O3: Feelings	0.000	-0.330	.007
Emotional OE (in O3 model)	0.000	-0.509	<.001
O4: Actions	0.000	-0.444	<.001
Psychomotor OE	0.000	-0.342	.002
O5: Ideas	0.000	-0.537	<.001
Intellectual OE	0.000	-0.248	.023
O5: Ideas and intellectual OE	0.000	-0.382	<.001
O6: Values	0.000	-0.655	<.001
Emotional OE (in O6 model)	0.000	-0.661	<.001

Note. Latent means for the creative sample were fixed at zero. Latent variance was fixed at one for both groups.

O1: Fantasy and imaginational OE. The base CFA for the two-factor model or O/OE, where O1: fantasy and imaginational OE were modeled as separate latent constructs without splitting participants in groups, had poor fit initially, yet had good fit after allowing correlated residuals based on theory and MI above 10 (see Table 4 for fit indices and difference tests of all models described in this section). The configural invariance CFA model for O/OE had acceptable fit. The weak invariance model for O/OE in CFA fit acceptably as well; constraining factor loadings to be equal did not make the model fit worse based on chi-square difference testing and the -.01 change in CFI guideline from Cheung and Rensvold (2002). Factor loadings were all significant. Strong invariance did not hold in this model based on either chi-square or CFI difference. The partial strong invariance model based on estimated noninvariant intercepts provided by the alignment method (items 1, 14, 28, and 34 on the OEQ-II) did not hold either based on either difference. MIs were examined and the intercepts for items 3, 63, and 123 on the NEO PI-3 had a value above 10. Thus, another partial strong invariance model was specified in which those intercepts would be freely estimated across groups, and invariance did hold for this model based on the CFI change guideline. The additional constraint of the latent factor covariance still fit the data well.

The CFA for the one-factor O only model for the total sample, with indicators loading on a single latent construct for the O1: Fantasy and imaginational OE combination, yielded poor fit. The correlated residuals previously determined for the O/OE model were added to have an O only model nested within the O/OE model. These corrections yielded a model with acceptable fit. The configural invariance CFA model for O only had acceptable fit. The weak invariance model for O only fit acceptably and invariance was maintained with significant factor loadings. Strong invariance did not hold in this model based on CFI change (Cheung & Rensvold, 2002),

even after testing for partial strong invariance based on the estimated noninvariant intercepts provided by the alignment method (OEQ-II items 1, 14, 28, and 34). Thus, items 3, 63, and 123 on the NEO PI-3 were allowed to have freely estimated intercepts across groups based on the partial strong invariance O/OE model. Still, this model showed worse fit than the weak invariance model based on CFI change and significance testing for chi-square difference.

Models O/OE and O only at the partial strong invariance level could be compared with chi-square difference tests as they were nested within each other. These tests indicated that the two-factor or O/OE model was a better fit and thus was the preferred option for the data. Based on the latent covariance invariance results, the correlation among O1: Fantasy and imaginational OE is equal for both samples, with a value of .820, $p < .001$ (see Table 2 for correlations among latent factors). Latent means could be compared among samples given partial strong invariance. The creative sample had significantly higher means on O1: Fantasy and imaginational OE (see Table 3 for a comparison of latent means).

Table 4
Goodness-of-Fit Indices of O1: Fantasy and Imaginational OE Models (N = *461)*

Model	df	χ^2	CFI	RMSEA	RMSEA 90% CI	SRMR	Comparison Model	ΔCFI	*p* $\Delta\chi^2$ Diff Test
Model 1 O/OE									
1.1.1 No groups, no correlated residuals	134	1111.48	.717	.126	.119-.132	.107			
1.1.1.1 No groups, correlated residuals	85	276.00	.945	.070	.061-.079	.063			
1.1.2 Configural invariance	170	401.09	.933	.077	.068-.086	.073			
1.1.3 Weak invariance	188	421.50	.932	.073	.064-.082	.080	1.1.2	-.001	.442
1.1.4 Strong invariance	204	604.80	.883	.092	.084-.101	.101	1.1.3	-.049	<.001
1.1.4.1 Partial strong invariance, alignment method	200	525.15	.905	.084	.076-.092	.092	1.1.3	-.027	<.001
1.1.4.2 Partial strong invariance, alignment method + free λ NEO 3, 63, 123	197	459.22	.924	.076	.067-.085	.085	1.1.3	-.008	<.001
1.1.5 Partial strong and latent covariance invariance	198	464.46	.922	.076	.068-.085	.086	1.1.4.2	-.002	.017
Model 2 O only									
1.2.1 No groups, no correlated residuals	135	1221.11	.686	.132	.126-.138	.106	1.1.1	-.031	<.001
1.2.1.1 No groups, correlated residuals	86	373.03	.917	.085	.077-.093	.072	1.1.1.1	-.028	<.001
1.2.2 Configural invariance	172	492.01	.907	.090	.081-.099	.080	1.1.2	-.026	<.001
1.2.3 Weak invariance	190	519.53	.904	.087	.078-.095	.088	1.2.2	-.003	.101
1.2.4 Strong invariance	207	711.15	.853	.103	.095-.111	.105	1.2.3	-.051	<.001
1.2.4.1 Partial strong invariance, alignment method	203	644.32	.871	.097	.089-.105	.098	1.2.3	-.033	<.001
1.2.4.2 Partial strong invariance, alignment method + free *λNEO 3, 63, 123*	200	622.88	.877	.096	.088-.104	.096	1.2.3	-.027	<.001
Partial strong invariance model comparison (1.1.4.2 vs 1.2.4.2)								-.045	<.001

O2: Aesthetics and sensual OE. The base two-factor O/OE model with no group division fit poorly before the addition of the correlated residuals based on theory and MI higher than 10, which made the model achieve good fit (see Table 5 for fit indices of all models in this section). Configural invariance and weak invariance held for this model with significant factor loadings. The strong invariance model did not hold; thus, I freed the noninvariant intercepts estimated by the alignment method (NEO PI-3 218, and OEQ-II 27, 46, and 48). That model did not hold either based on the chi-square significant test; however, CFI change was -.005, below the suggested change of -.01 (Cheung & Rensvold, 2001). Adding an extra constraint for latent covariance invariance held as well based on both CFI change and chi-square difference testing.

The one-factor O only, with all sensual OE and O2: Aesthetics items loading onto a single factor, fit poorly. Fit indices improved after allowing the same correlated residuals based on theory and MI above 10 that were allowed in the two-factor O/OE model. Constraints for configural invariance and weak invariance held based on the <.01 CFI change rule (Cheung & Rensvold, 2002). Factor loadings were significant. Strong invariance did not hold based on chi-square difference and CFI change. I freed approximate noninvariant intercepts provided by the alignment method in model O/OE to keep models nested, and this yielded good fit based on CFI change.

Comparing both partial strong invariance models resulted in a significant difference yet CFI change was below -.01, indicating that both models fit the data approximately equally. The latent correlation among O2: Aesthetics and sensual OE in the O/OE model was invariant for both groups with a value of .928, $p < .001$ (see Table 2 for latent covariances). Latent means were comparable given partial strong invariance. The creative sample scored significantly higher

on O2: Aesthetics on the two-factor O/OE model, and significantly higher on the one-factor O only model combining O2: Aesthetics and sensual OE (see Table 3 for latent means).

Table 5

*Goodness-of-Fit Indices of O2: Aesthetics and Sensual OE Models (*N = *461)*

Model	df	χ^2	CFI	RMSEA	RMSEA 90% CI	SRMR	Comparison Model	ΔCFI	*p* $\Delta\chi^2$ Diff Test
Model 1 O/OE									
2.1.1 No groups, no correlated residuals	134	758.22	.829	.101	.094-.107	.068			
2.1.1.1 No groups, correlated residuals	110	189.49	.978	.040	.031-.048	.033			
2.1.2 Configural invariance	220	365.53	.963	.054	.044-.063	.042			
2.1.3 Weak invariance	238	389.14	.961	.052	.043-.061	.057	2.1.2	-.002	.186
2.1.4 Strong invariance	254	493.22	.939	.064	.065-.072	.066	2.1.3	-.022	<.001
2.1.4.1 Partial strong invariance, alignment method	250	419.66	.956	.054	.046-.063	.059	2.1.3	-.005	.002
2.1.5 Partial strong and latent covariance invariance	251	420.69	.956	.054	.046-.063	.061	2.1.4.1	.000	.332
Model 2 O only									
2.2.1 No groups, no correlated residuals	135	859.67	.802	.108	.102-.114	.067	2.1.1	-.027	<.001
2.2.1.1 No groups, correlated residuals	111	209.91	.973	.044	.035-.052	.036	2.1.1.1	-.005	<.001
2.2.2 Configural invariance	216	350.478	.965	.052	.042-.061	.041	2.1.2	.002	.009
2.2.3 Weak invariance	240	407.80	.957	.055	.046-.064	.060	2.2.2	-.008	<.001
2.2.4 Strong invariance	257	517.68	.933	.066	.059-.074	.069	2.2.3	-.024	<.001
2.2.4.1 Partial strong invariance, alignment method	253	452.56	.949	.058	.050-.067	.063	2.2.3	.008	<.001
Partial strong invariance model comparison (2.1.4.1 vs 2.2.4.1)								-.007	<.001

O3: Feelings and emotional OE. The base O/OE two-factor model before separating the sample into groups did not fit the data adequately until after adding correlated residuals based on theory and MI above 10 (see Table 6 for model fit pertaining to this section). Configural and weak invariance models held and fit the data well, with all factor loadings being significant. Strong invariance did not yield adequate fit, thus the alignment method provided approximate noninvariant intercepts to free (item 43 on the NEO PI-3 and item 9 on the OEQ-II). That model did not fit the data either based on CFI change and chi-square difference testing. Checking MIs led to freeing three additional intercepts that were likely noninvariant. That model fit the data well and appeared to hold based on a CFI change of .01 (Cheung & Rensvold, 2002). Constraining the latent covariance across groups did not result in worse model fit according to CFI change and chi-square difference testing.

The base one-factor O only model for O3: Feelings and emotional OE also indicated poor fit before freeing correlated residuals based on theory and MI above 10 previously determined in the O/OE model, at which point it fit well. Additional constraints for configural and weak invariance held with significant factor loadings. Strong invariance did not hold based on CFI change rules and chi-square difference testing. Approximate noninvariant intercepts were freed across groups based on results of the alignment method, yet that model did not hold either. After freeing three additional intercepts previously allowed to be freely estimated in model O/OE, partial strong invariance still did not hold based on either CFI change or chi-square difference.

As the one-factor or O only partial strong invariance model did not fit the data the partial strong invariance two-factor O/OE model was selected; chi-square difference significance testing and CFI change established its superiority. O3: Feelings and emotional OE had a high correlation of .843 ($p < .001$) consistent across both samples, and both were significantly higher for the

creative sample than for the general adult sample (see Table 2 for latent correlations and Table 3 for latent means).

Table 6
*Goodness-of-Fit Indices of O3: Feelings and Emotional OE Models (*N = *461)*

Model	df	χ^2	CFI	RMSEA	RMSEA 90% CI	SRMR	Comparison Model	ΔCFI	*p* $\Delta\chi^2$ Diff Test
Model 1 O/OE									
3.1.1 No groups, no correlated residuals	134	709.50	.734	.097	.090-.103	.078			
3.1.1.1 No groups, correlated residuals	101	214.32	.956	.049	.040-.059	.043			
3.1.2 Configural invariance	202	327.81	.944	.052	.042-.062	.055			
3.1.3 Weak invariance	220	348.36	.943	.050	.040-.060	.064	3.1.2	-.001	.281
3.1.4 Strong invariance	236	460.99	.900	.064	.056-.073	.075	3.1.3	-.043	<.001
3.1.4.1 Partial strong invariance, alignment method	234	417.30	.919	.058	.049-.067	.070	3.1.3	-.024	<.001
3.1.4.2 Partial strong invariance, alignment method + free λ oeq35, 41, 44	231	382.28	.933	.053	.044-.062	.067	3.1.3	-.010	<.001
3.1.5 Partial strong and latent covariance invariance	232	382.63	.933	.053	.044-.062	.068	3.1.4.2	.000	.573
Model 2 O only									
3.2.1 No groups, no correlated residuals	135	747.81	.716	.099	.093-.106	.079	3.1.1	-.018	<.001
3.2.1.1 No groups, correlated residuals	102	236.27	.938	.053	.045-.062	.047	3.1.1.1	-.018	<.001
3.2.2 Configural invariance	204	375.72	.924	.060	.051-.070	.058	3.1.2	-.020	<.001
3.2.3 Weak invariance	222	394.37	.924	.058	.049-.067	.067	3.2.2	.000	.374
3.2.4 Strong invariance	239	507.95	.881	.070	.062-.078	.078	3.2.3	-.043	<.001
3.2.4.1 Partial strong invariance, alignment method	237	465.56	.899	.065	.056-.073	.073	3.2.3	-.025	<.001
3.2.4.2 Partial strong invariance, alignment method + free λ oeq 35, 41, 44	234	433.00	.912	.061	.052-.069	.070	3.2.3	-.012	<.001
Partial strong invariance model comparison (3.1.4.2 vs 3.2.4.2)								-.021	<.001

O4: Actions and psychomotor OE. The two-factor O/OE base model fit acceptably before making theory-based and MI-based modifications to achieve good fit for invariance testing (see Table 7 for fit indices of models mentioned in this section). Configural invariance held yet weak invariance did not; however, all factor loadings were significant. The alignment method did not show approximate noninvariant loadings, so MIs and differential loadings in the configural model were checked to free loadings across groups for partial weak invariance. After freeing loadings for NEO items 18 and 48, and OEQ items 2 and 42, partial weak invariance was reached. Full strong invariance was not able to be tested as full weak invariance was not achieved. Steenkamp and Baumgartner (1998) stated that in the case of partial weak invariance, researchers could move on to the next level of analysis and test partial strong invariance by freely estimating intercepts for the noninvariant loadings across groups. Thus, intercepts for the noninvariant loadings were unconstrained across groups which overlapped with suggestions from the alignment method. This model held based on CFI change rules given that CFI difference was below .01 (Cheung & Rensvold, 2002). Latent covariance invariance also held.

The one-factor base model or O only for O4: Actions and psychomotor OE had poor fit. Allowing previously determined residual correlations still resulted in a model that did not fit the data. Thus, the O only model that treated O4: Actions and psychomotor OE as one single factor was deemed to be inadequate leaving the O/OE two-factor model as the best fit for the data.

O4: Actions and psychomotor OE had a small latent correlation of .133 (p = .026). This correlation was consistent across both groups (see Table 2). The creative sample scored significantly higher on both O4: Actions and psychomotor OE when compared to the regular sample, yet this might be confounded as only partial weak invariance was achieved and the differential loadings could affect latent means (see Table 3).

Table 7
Goodness-of-Fit Indices of O4: Actions and Psychomotor OE Models (N = *461)*

Model	df	χ^2	CFI	RMSEA	RMSEA 90% CI	SRMR	Comparison Model	ΔCFI	*p* $\Delta\chi^2$ Diff Test
Model 1 O/OE									
4.1.1 No groups, no correlated residuals	134	401.63	.894	.066	.059-.073	.079			
4.1.1.1 No groups, correlated residuals	123	245.57	.951	.046	.038-.055	.072			
4.1.2 Configural invariance	246	431.28	.930	.057	.048-.066	.080			
4.1.3 Weak invariance	264	491.30	.914	.061	.053-.069	.093	4.1.2	-.016	<.001
4.1.3.1 Partial weak invariance, free Λ NEO 18, 48, oeq 2, 42	260	465.43	.923	.059	.050-.057	.088	4.1.2	-.007	.002
4.1.4.1 Partial strong invariance, alignment method	272	502.01	.913	.061	.052-.069	.090	4.1.3.1	-.010	<.001
4.1.5 Partial strong and latent covariance invariance	273	505.09	.912	.061	.053-.069	.091	4.1.4.1	-.001	.086
Model 2 O only									
4.2.1 No groups, no correlated residuals	135	819.69	.728	.105	.098-.112	.107	4.1.1	-.066	<.001
4.2.1.1 No groups, correlated residuals	124	525.88	.859	.084	.077-.091	.091	4.1.1.1	-.092	<.001

O5: Ideas and intellectual OE. The base model for O5: Ideas and intellectual OE as two separate factors had poor fit (see Table 8 for models pertaining to this section). MIs were checked and corrections were made to the model based on values above 10 that made theoretical sense. That model achieved good fit. Configural and weak invariance held based on CFI change and chi-square difference testing with significant factor loadings. Strong invariance did not hold based on CFI change or chi-square difference testing. The alignment method estimated all intercepts to be invariant, yet examination of MIs showed I could free one intercept which allowed partial strong invariance based on CFI change. Latent covariance invariance across groups also fit properly.

The one-factor model or O only model presented poor fit before controlling MIs and selecting items with values above 10 that could be allowed to have correlated residuals based on theory, at which point it achieved excellent fit. Configural invariance and weak invariance held based on the -.01 rule for CFI change (Cheung & Rensvold, 2002). Factor loadings were significant. Strong invariance did not hold based on chi-square difference and CFI change, thus I freed one intercept based on the partial strong invariance model for O/OE. This O only partial strong invariance model fit based on the CFI change rule.

Comparing the partial strong invariance model for O only and the partial strong invariance model for O/OE indicated that both models had adequate fit to the data based on CFI change rules, yet chi-square significance testing indicated an advantage for the two-factor O/OE model. The latent correlation among O5: Ideas and intellectual OE in the two-factor model was very high with a value of .885 ($p < .001$, see Table 2). The creative sample scored significantly higher on O5: Ideas and intellectual OE both as separate factors and as a combined factor (see Table 3).

Table 8

Goodness-of-Fit Indices of O5: Ideas and Intellectual OE Models (N = *461)*

Model	df	χ^2	CFI	RMSEA	RMSEA 90% CI	SRMR	Comparison Model	ΔCFI	*p* $\Delta\chi^2$ Diff Test
Model 1 O/OE									
5.1.1 No groups, no correlated residuals	134	813.03	.778	.105	.099-.111	.077			
5.1.1.2 No groups, correlated residuals	100	167.22	.978	.038	.029-.047	.036			
5.1.2 Configural invariance	200	282.89	.974	.042	.031-.053	.042			
5.1.3 Weak invariance	218	307.40	.971	.042	.031-.052	.094	5.1.2	-.003	.139
5.1.4 Strong invariance	234	389.77	.960	.054	.044-.063	.097	5.1.3	-.011	<.001
5.1.4.1 Partial strong invariance, free λ oeq16	233	378.80	.962	.052	.042-.061	.096	5.1.3	-.009	.008
5.1.5 Partial strong and latent covariance invariance	234	379.02	.962	.052	.042-.061	.098	5.1.4.1	.000	.640
Model 2 O only									
5.2.1 No groups, no correlated residuals	135	924.89	.742	.113	.106-.119	.082	5.1.1	-.036	<.001
5.2.1.2 No groups, correlated residuals	101	202.69	.967	.047	.038-.055	.040	5.1.1.2	-.011	<.001
5.2.2 Configural invariance	202	311.52	.965	.048	.038-.058	.046	5.1.2	-.009	<.001
5.2.3 Weak invariance	220	340.41	.962	.049	.039-.058	.097	5.2.2	-.003	.049
5.2.4 Strong invariance	237	392.66	.950	.053	.044-.062	.101	5.2.3	-.012	<.001
5.2.4.1 Partial strong invariance, free λ oeq16	236	386.62	.952	.053	.044-.061	.101	5.2.3	-.010	<.001
Partial strong invariance and strong invariance model comparison (5.1.4.1 vs 5.2.4.1)								-.010	<.001

O6: Values and emotional OE. The initial two-factor O/OE model fit the data poorly. After checking MIs and allowing theory-based and values above 10 to have correlated residuals, the model fit the data well. Configural invariance constraints held. However, weak invariance did not hold based on CFI change rules and chi-square significance testing. The alignment method estimated one noninvariant loading on NEO item 58, yet after that specification the model did not fit either. Checking MIs and loadings on the configural model led to free four factor loadings across groups, and this model fit the data based on CFI change rules. Factor loadings were all significant. As full weak invariance was not achieved, only partial strong invariance testing was possible (Steenkamp & Baumgartner, 1998). Partial strong invariance with free intercepts for the noninvariant loadings did not fit the data based on CFI and chi-square differences. Adding the approximate noninvariant intercept provided by the alignment method, OEQ-II item 9, still yielded worse fit based on CFI and chi-square differences. Next, MIs were checked and three additional intercepts were allowed to be freely estimated. This partial strong invariance plus latent covariance invariance model did not result in worse fit based on CFI change rules. Imposing an additional constraint on the latent invariance still held based on CFI difference.

The one-factor model or O only for O6: Values and emotional OE had extremely poor fit. Allowed residual correlations from model O/OE were added, yet fit remained poor. Therefore, the O only model for O6: Values and emotional OE was considered to not fit the data.

The latent correlation among O6: Values and emotional OE was small and negative, with a value of -.195 (p = .002). This value was consistent across both groups given latent covariance invariance (see Table 2). The creative sample scored significantly higher than the sample regular adults on O6: Values and on emotional OE; again, this could be confounded given that the differential loadings in partial weak invariance could affect latent means (see Table 3).

Table 9

*Goodness-of-Fit Indices of O6: Values and Emotional OE Models (*N = *461)*

Model	df	χ^2	CFI	RMSEA	RMSEA 90% CI	SRMR	Comparison Model	ΔCFI	*p* $\Delta\chi^2$ Diff Test
Model 1 O/OE									
6.1.1 No groups, no correlated residuals	134	573.27	.805	.084	.078-.091	.082			
6.1.1.2 No groups, correlated residuals	108	239.05	.942	.051	.043-.060	.067			
6.1.2 Configural invariance	216	372.12	.932	.056	.047-.065	.073			
6.1.3 Weak invariance	234	432.29	.916	.061	.052-.069	.093	6.1.2	-.016	<.001
6.1.3.1 Partial weak invariance, alignment method	233	419.95	.920	.059	.050-.068	.093	6.1.2	-.012	<.001
6.1.3.2 Partial weak invariance, alignment method + free Λ NEO 28, 178, 208	230	400.65	.927	.057	.048-.066	.085	6.1.2	-.005	.014
6.1.4.1 Partial strong invariance	242	503.04	.889	.068	.060-.077	.093	6.1.3.2	-.038	<.001
6.1.4.1 Partial strong invariance, alignment method	241	466.87	.904	.064	.055-.072	.089	6.1.3.2	-.023	<.001
6.1.4.2 Partial strong invariance, alignment method + free λ oeq35, 44, 49	238	428.08	.919	.059	.050-.067	.088	6.1.3.2	-.008	<.001
6.1.5 Partial strong and latent covariance invariance	239	438.03	.915	.060	.051-.069	.095	6.1.4.2	-.002	.003
Model 2 O only									
6.2.1 No groups, no correlated residuals	153	2407.94	.408	.147	.140-.153	.161	6.1.1	-.397	<.001
6.2.1.1 No groups, correlated residuals	109	793.28	.739	.117	.109-.224	.135	6.2.1.1	-.203	<.001

Discussion

Based on the results, openness to experience and OEs seem to represent largely the same construct. O1: Fantasy and imaginational OE, O2: Aesthetics and sensual OE, O3: Feelings and emotional OE, as well as O5: Ideas and intellectual OE appear to be equivalent to each other as they had very strong correlations. O4: Actions and psychomotor OE seem related yet not the same. O6: Values was negatively related to emotional OE. Considering these findings, four out of the five OEs can be entirely represented by a facet of openness and the remaining OE can be partially represented by an openness facet.

These results were obtained with two different samples; one of the samples was composed of creative individuals, and the other included individuals from the general population. Creative individuals were expected to score higher on openness and OEs based on previous research (Batey, Chamorro-Premuzic, & Furnham, 2010; Falk et al., 2008; Feist, 1998; Furnham, Batey, Booth, Patel, & Lozinskaya, 2011; Furnham, Hughes, & Marshall, 2013; Gorman & Feist, 2014; Ivcevic & Mayer, 2007; Kaufman, 2013; Kerr & McKay, 2013; Wolfradt & Pretz, 2001; Yakmaci-Guzel & Akarsu, 2006) and thus are a helpful criterion for studies such as this one. In this study, they did have higher scores than the general population sample. High correlations among openness and OEs were consistent for both samples; thus, openness and OEs seem to be related regardless of how open to new experiences people are.

Statistical Similarity

The correlations among the latent factors of openness facets and their corresponding OEs were strong, at a level that is typically found among different tests of the same construct. In fact, relationships at the same level exist among the openness facets on the NEO PI and the same openness facets on the International Personality Item Pool (IPIP; Goldberg, 1999), which ranged

between $r = .70$ and $r = .80$ and theoretically measure the same construct using different items. Based upon the psychometric difficulty of fitting one-factor solutions in confirmatory factor analysis even when they are essentially unidimensional (Slocum-Gori et al., 2009) it makes sense that a two-factor solution would show better fit to the data. However, taking into consideration the strength of relationships found in this study among openness and OEs, OEs can be thought as being the same construct as openness yet merely measured by a different test.

The relationship between openness and OEs existed both at low levels and high levels of both traits for both the creative sample and the sample from the general population as latent covariance invariance constraints held for all models. No interaction effect indicated stronger relationships among high scorers, as suggested by Limont et al. (2014) based on their findings that sensual OE and openness had a strong relationship among gifted individuals yet only moderate in the general population. Limont et al.'s findings only applied to that one OE and were not able to be replicated in this study. This lends further support to the normal distribution of openness in the population like any other personality trait. Mendaglio (2012) stated that OEs were not expected to have a normal distribution in the population. Conversely, personality traits—thus including openness—are normally distributed (DeYoung, 2014). Thus, if OEs appear to represent facets of openness, they should be normally distributed as well.

Conceptual Similarity

Openness to fantasy and imagination, which is measured in O1: Fantasy, seems to encompass construct measured by imaginational OE as evidenced by their conceptual descriptions and these results showing a strong correlation. Individuals open to fantasy are prone to daydreaming, which likely is of adaptive value to them and serves personal goals (McMillan, Kaufman, & Singer, 2014). Piechowski (2006) agreed that daydreaming and using imagination

in general opens a myriad of possibilities. Fantasy, along with aesthetics, feelings, and actions, is related to creative potential (Nusbaum & Silvia, 2011), creative achievement in the arts (Kaufman, 2013), and implicit learning (Kaufman, DeYoung, Gray, Jiménez, Brown, & Mackintosh, 2010).

Openness to sensory pleasures and aesthetic experiences is measured by O2: Aesthetics and sensual OE. From their conceptual descriptions to the actual results of this study, these two factors appear undifferentiated; models measuring O2: Aesthetics and sensual OE as separate factors and as one single factor fit the data. In the two-factor model, O2: Aesthetics and sensual OE had a very strong correlation, even though items in the NEO PI-3 focus more on enjoyment of the arts while items on the OEQ-II focus on everyday sensorial experiences. Aesthetics, just like fantasy, relates to implicit learning (Kaufman et al., 2010), and creativity (Kaufman, 2013; Nusbaum & Silvia, 2011). Individuals high in openness to aesthetic experiences tend to be strongly moved by beauty found in nature and in arts, and often experience aesthetic chills in their bodies in response to these stimuli (McCrae, 1997; Silvia & Nusbaum, 2011).

Regarding personal emotional life, O3: Feelings and emotional OE showed a strong correlation in this study. Both seem to describe the same openness to a wide variety and depth of feelings that individuals have. Again, it relates to creative achievement and potential (Kaufman, 2013; Nusbaum & Silvia, 2011) as well as to the experience of aesthetic chills (McCrae, 1997; Silvia & Nusbaum, 2011). Individuals who are open to feelings value emotions as an important part of life and are in tune with their emotional states; both their positive and negative emotional experiences are more intense than those of others (Costa & McCrae, 1992). Piechowski (2006) also describes extremes from ecstasy and emotional aliveness to fears and preoccupation with death. Even though one might think this wide gamut could render individuals vulnerable to mood

disorders, particularly bipolar types, openness to feelings does not predict either unipolar or bipolar mood disorders (Quilty, Pelletier, DeYoung, & Bagby, 2013).

Intellect is one of the most widely studied aspects of openness to experience, with many theorists calling the domain Openness/Intellect rather than simply openness (DeYoung, 2014). Both the two-factor model measuring O5: Ideas and intellectual OE separately, as well as the one-factor model measuring them as a single construct, fit the data. The correlation in the two-factor model was very high. O5: Ideas and intellectual OE appeared to describe the same construct of intellect, which has been previously linked with working memory (DeYoung, Shamosh, Green, Braver, & Gray, 2009), fluid intelligence (DeYoung, Peterson, & Higgins, 2005; Nusbaum & Silvia, 2011), and crystallized intelligence (DeYoung et al., 2005). Intellect serves as a predictor of creative achievement in the sciences (Kaufman, 2013).

Openness to revise one's values and conceptions of the world as measured by O6: Values was negatively related to emotional OE. Openness to values should theoretically relate in a positive way to OE descriptions of Piechowski (2006) about self-examination and moral awareness, which should be encompassed in the OEQ-II under the emotional OE subscale. Perhaps said items do not adequately capture the vastness of Piechowski's descriptions, or perhaps items that related to that construct were left out during the development of the OEQ-II. An alternative explanation would involve the findings of DeYoung et al. (2005). DeYoung and colleagues found that O6: Values and O5: Ideas closely related to fluid intelligence and dorsolateral prefrontal functions more than the other openness facets did, and explored a potential relationship between intellectual curiosity, intelligence, moral relativism, and rejection of dogmatic beliefs. In this case, O6: Values would be related to intellectual OE instead of

emotional OE, given that O5: Ideas and intellectual OE were practically indistinguishable in this study. Thus, further research is needed to empirically elucidate this question.

Lastly, O4: Actions and psychomotor OE had a small positive relationship that was consistent for both groups. Clearly they do not represent the same constructs, but they are related to a degree. O4: Actions describe an openness to change in general, adaptability to novel situations, and refusal of routines (Costa & McCrae, 1992). These individuals continuously revise their actions trying to find alternative ways of doing things (Costa & McCrae, 1992). O4: Actions negatively predicts depression (Quilty et al., 2013) likely due to the adaptability and willingness to change until satisfying alternatives emerge, and is less related to cognitive abilities than the other facets of openness (DeYoung et al., 2005). Psychomotor OE refers to increased general activity and expression through motor modes as well as an excess of physical energy (Piechowski, 2006). People who continually seek novel alternatives are probably in constant motion, yet these two can be mutually exclusive for some individuals.

Problems with OEs and TPD

Research on OEs and TPD has two elemental problems. According to Dabrowski's TPD OEs serve a purpose within a larger theory and are meaningless on their own (Dabrowski, 1967; Dabrowski, Kawczak, & Piechowski, 1970). TPD and OEs supporters seem to imply that the scarce OEs research validates the existence of OEs and therefore support TPD. However, this link is missing in the literature. One, OEs research is atheoretical and does not link OEs to the original theory (Mendaglio, 2012). Two, TPD presently lacks sufficient empirical support (Mendaglio, 2012). No studies have yet validated the assumptions of the overactive nervous systems, the different brain wirings, and the enhanced experiences attributed to people presenting with OEs. The only study that used brain imaging (Kuo et al., 2012, in Chang & Kuo, 2013)

found similar results as brain imaging studies of openness (Adelstein et al., 2011; DeYoung, 2010; DeYoung et al., 2010). Mendaglio (2012) suggested that assuming a normal distribution for OEs would be incongruent with TPD; however, all OE items and subscales had a fairly normal distribution in this study, which is more consistent with the five-factor model (Costa & McCrae, 1992). Thus, at present, OEs merely describe behaviors and cannot be linked to any biological etiology.

Parsimony tells us to avoid a complicated theory if a simple one provides better explanations for the phenomena studied. The relationships among OEs and openness indicate that they are the same underlying construct with different names. As Wirthwein et al. (2011) posited, OEs are possibly "old wine in new bottles" (p. 150) instead of a distinct and useful personality construct that can describe characteristics of gifted and creative individuals. Researchers such as Rost et al. (2014) and Winkler (2014) found that the relationship between giftedness and OEs is unclear and thus the usefulness of the construct is limited.

Limitations and Suggestions for Future Studies

Choice of instruments, sample size, and sample selection can still be improved. Self-report instruments rely on participants for accuracy of results, which is a major limitation. Studies with observers' reports of personality such as the NEO PI-3 Observer Rating Forms (McCrae et al., 2005) will add to these findings. Inspecting both instruments showed that the NEO PI-3 had overall longer items than the OEQ-II. This might be a purely psychometric reason that could differentiate among openness facets and OEs that would not relate to the constructs themselves, but would be an artifact of measurement tools. Additionally, if the relationship of openness to OEs is robust it should hold with different personality instruments such as the IPIP (Goldberg, 1999). While the sample size in this study was adequate for the models tested, it

would not be enough to assess larger models. Future studies could include large-scale samples to be able to estimate larger models, such as all openness facets and OEs in the same model. Different analyses such as exploratory structural equation modeling (ESEM) or ESEM-within-CFA can help confirm these results.

Samples in this study had a disparity in age; means in one sample did not overlap with the other sample's range. It was not possible to find comparable samples of the same age for this study. Even though sample comparison was not the main aim in this study, they still yielded important information. Covarying age would be particularly important in studies where the main focus is to establish comparisons among samples. Future studies could include age as a covariate in a multiple indicators multiple causes or MIMIC model in structural equation modeling, to prevent any spurious effects due to the age difference.

Replications of this same study in other samples will help further generalization. This study included a creatively gifted sample as a criterion sample as creative individuals tend to score highest on openness to experience, and used a comparison of adults from the regular population. However, OE research has largely focused on intellectually gifted adults. Thus, the inclusion of intellectually gifted individuals as a separate group would be advantageous. If proponents of OEs continue to believe that OEs and openness to experience are separate constructs, then it will be their responsibility to conduct future studies to clarify the conceptual similarities in deeper detail, as well as empirically support Dabrowski's TPD.

Conclusion

Since openness facets and OEs appear to represent the same construct, then the giftedness field would benefit from discussing the construct as the personality trait of openness to experience. The five-factor model is the personality model with the strongest research support

and professional acceptance in the present day (Costa & McCrae, 1992; Goldberg, 1999). In their seminal paper, Subotnik, Olszweski-Kubilius, and Worrell (2011) urged gifted education to use the vast body of psychological research to inform practices.

The reason for this change from OEs to openness to experience goes beyond a mere change in names; the change will positively impact interpretation of behaviors. OEs have a place in a theory, TPD, which has insufficient empirical support. When reading about OEs, parents and practitioners can gravitate toward the theory and make assumptions that go beyond the description of openness- or OE-related behaviors. Such a leap is dangerous as it might present individuals who are open to experience as more moral and more valuable to society (Kerr, 2011) and those assumptions are not rooted in science. The leap becomes even more dangerous when OE is presented as an identification tool for giftedness, when studies have consistently shown that intelligence and openness have correlations in the .20 - .40 range (Ackerman & Heggestad, 1997; Austin, Deary, & Gibson, 1997; Austin et al., 2002; Moutafi, Furnham, & Crump, 2003; Moutafi, Furnham, & Crump, 2006; Zeidner & Shani-Zinovich, 2011).

Instead of attempting to fix problems with OE and TPD research, gifted education researchers and practitioners would benefit from the adoption of the five-factor model of personality as used by psychologists across the globe. The five-factor model of personality is a better option as it will permit meta-analyses and further generalization of findings. In addition, it will allow practitioners and parents to have shared vocabulary with other sciences to describe a personality trait commonly seen in the field such as openness to experience.

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APPENDICES

Appendix A

Informed Consent for Sample 1

CLEOS Project Parent Information and Consent Form
Department of Psychology and Research in Education
University of Kansas

Dear Parent,

For creatively gifted young people, the path to the fulfillment of their talents is often a mystery. Unlike more traditional careers, vocations in such fields as the fine and performing arts, invention, and creative entrepreneurship and service don't have clear career ladders. On behalf of the University of Kansas Department of Psychology and Research in Education, we would like to introduce the CLEOS Project (Counseling Laboratory for the Exploration of Optimal States). Creativity has been identified as a characteristic that seems to be related to optimal development. Currently, we are sponsoring a research through service program to study the career development and performance needs of creatively gifted high school students.

Your high school-age child has been identified by the co-ordinator of gifted education at your school as a student who may benefit from our program. We would like to invite your child to participate in a creativity workshop at the University of Kansas School of Education. The workshop will include individual assessments and interpretation of interests, personality characteristics and values; individualized counseling for academic and career planning, activities for identifying and overcoming barriers to goals and dreams such as procrastination and performance anxiety, and personal goal-setting. The techniques used will be based on research on guidance of talented people. The staff consists of masters- and doctoral-level counselors from KU's Counseling Psychology program, led by faculty psychologists.

The date that your child's school will attend the CLEOS Project has been selected, and we require parental consent for students to participate. The details of the project and form for your consent to allow your child to participate are enclosed with this letter. The cost of the computerized test interpretation and materials is $35 per student, although a sliding scale is available upon request to me at the below email address. Students will eat lunch on campus, with an average cost of $5 to $7.

Please read the enclosed guardian informed consent form, sign, date, and return it to the gifted program coordinator at your child's school.

We are looking forward to working your child! If you have questions, we can be reached by email (info@cleoslab.org) or by telephone (785.864.9762)

Sincerely,

Barbara Kerr, Ph.D.

CLEOS Project Director
Psychology and Research in Education
The University of Kansas
bkerr@ku.edu

GUARDIAN INFORMED CONSENT STATEMENT
Project Name: Counseling Laboratory for the Exploration of Optimal States
(CLEOS Project)

INTRODUCTION
The Department of Psychology and Research in Education at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish your child to participate in the present study. You may refuse to sign this form and not allow your child to participate in this study. You should be aware that even if you agree to allow your child to participate, you are free to withdraw at any time. If you do withdraw your child from this study, it will not affect your relationship with this unit, the services it may provide to you, or the University of Kansas.

PURPOSE OF THE STUDY
This is a research through service project, meaning that we provide academic and career counseling at the same time as observing and evaluating what we are learning in order to improve our understanding of creatively gifted people. We want to learn about performance blocks and paths to academic and career development in creatively gifted high school students.

PROCEDURES
The project will take place at the University of Kansas in Lawrence at the Center for Psychoeducational Services, located on the first floor of Joseph R. Pearson Hall (1122 West Campus Road). Your child's school will provide transportation and a chaperone. The workshop will take place during a school day and will require your child to be dismissed from school in order to attend. The cost of the workshop is $35, which will be paid either by your child's school or by the parent or guardian. The schedule of events for the workshop is provided in Appendix 1.

Approximately 1-2 weeks before your child attends the CLEOS project, he or she will complete a short survey online to assess how much your student is engaged in creative career and academic activities.
Your child will participate with 8 to 12 other students in a morning workshop, from 8.30 am until the afternoon. During the career workshop, students will engage the following activities:

- individual assessment of interests, personality characteristics, performance blocks, and decision making;;
- interpretation of assessments;
- individual counseling;
- a group activity aimed at identifying and overcoming barriers to goals and dreams

Approximately 1 week to 1 month later, your child will be contacted via telephone or email by a CLEOS Project research team member for a follow up interview. Your child will be asked several questions about his/her experience with the CLEOS Project. The interview will take approximately 20 to 30 minutes and responses will be entered into an electronic file with a number but no name attached to it.

If at any time, your child decides not to participate in an activity, he or she can withdraw and be allowed to work or read in the Learning Resource Center of the college under supervision.

The techniques used will be based on a National Science Foundation guidance program for career development of talented people and will be approved by institutional review. The staff will consist of masters- and doctoral-level student counselors from KU's Counseling Psychology program, supervised by faculty psychologists.

All sessions (including follow-up telephone interviews) will be videorecorded; however, video files will be not be labeled with your child's name, will not be accessible to anyone other than the researchers and counselors, and will be kept in a locked file in the CLEOS office, until the end of the project when they will be destroyed. In addition, all students will receive the results of their tests to take home and discuss with you; copies of the results, which will be identified by number and not by name, will be kept in a locked file as long as the CLEOS project exists.

RISKS

We have learned from previous counseling laboratories that there are few risks associated with our counseling program. If a student should feel uncomfortable as a result of his or her discussion with the counselor, we encourage the student to talk to his or her parents and offer the option of continuing counseling.

CLEOS Project counselors will encourage students to talk with their parents or guardians about their sessions, and will provide information about continued counseling if the participant and/or parent or guardian desires. In the event of an emergency, the parent or guardian will be contacted immediately.

Because some of the surveys are taken online, it is possible, however, with internet communications, that through intent or accident someone other than the intended recipient may see the responses.

The researchers will not share information about you/your child unless (a) it is required by law or university policy, or (b) you give written permission.

Career counseling such as the CLEOS project provides is unlikely to reveal any psychological emergency; however, in the circumstance in which a student threatens to harm himself/herself or others, we are bound by ethical and legal standards governing all psychologists and trainees at the University of Kansas with regard to limits to confidentiality and duty to warn. In addition, CLEOS Project personnel will follow the University of Kansas Center for Psychoeducational Services protocol for the assessment of risk and for informing parents by telephone on the day of the workshop.

BENEFITS
The benefits of the program, based on previous research on guidance laboratories, may be increased self-esteem; increased sense of self-efficacy in school; increased self-knowledge concerning interests and personality; increased knowledge of college and careers; increased discussion with parents, teachers, and peers concerning careers; increased sense of identity; and increased sense of purpose.

PAYMENT TO PARTICIPANTS
There will be no payment to participants.

PARTICIPANT CONFIDENTIALITY
Your child's name will not be associated in any way with the information collected about your child or with the research findings from this study. The researcher(s) will use a study number or a pseudonym instead of your child's name. The researchers will not share information about your child unless required by law or unless you give written permission.

Permission granted on this date to use and disclose your information remains in effect indefinitely. By signing this form you give permission for the use and disclosure of your child's information, excluding your child's name, for purposes of this study at any time in the future.

REFUSAL TO SIGN CONSENT AND AUTHORIZATION
You are not required to sign this Consent and Authorization form and you may refuse to do so without affecting your right to any services you are receiving or may receive from the University of Kansas or to participate in any programs or events of the University of Kansas. However, if you refuse to sign, your child cannot participate in this study.

CANCELLING THIS CONSENT AND AUTHORIZATION
You may withdraw your consent to allow participation of your child in this study at any time. You also have the right to cancel your permission to use and disclose information collected about your child, in writing, at any time, by sending your written request to: Barbara Kerr, 130Q JRP, University of Kansas, Lawrence, KS 66045. If you cancel permission to use your child's information, the researchers will stop collecting additional information about your child. However, the research team may use and disclose information that was gathered before they received your cancellation, as described above.

QUESTIONS ABOUT PARTICIPATION
Questions about procedures should be directed to the researcher(s) listed at the end of this consent form.

PARTICIPANT CERTIFICATION
I have read this Consent and Authorization form. I have had the opportunity to ask, and I have received answers to, any questions I had regarding the study. I understand that if I have any additional questions about my child's rights as a research participant, I may email irb@ku.edu or call (785) 864-7429 or (785) 864-7385 or write the Human Subjects Committee Lawrence Campus (HSCL), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7563.

I agree to allow my child to take part in this study as a research participant. By my signature I affirm that I have received a copy of this Consent and Authorization form.

_____ _____

Type/Print Participant's Name Date

_____

Parent/Guardian Signature

[If signed by a personal representative, a description of such representative's authority to act for the individual must also be provided, e.g. parent/guardian.]

Researcher Contact Information
Barbara Kerr, Ph.D. bkerr@ku.edu
Distinguished Professor of Counseling Psychology
130 Q Joseph R. Pearson Hall
University of Kansas Lawrence, KS 66045

Appendix 1
Guardian Informed Consent Statement
The CLEOS Project Schedule
University of Kansas Department of Psychology and Research in Education

SCHEDULE (Tentative)

8.30 – 9:30 Check in and group discussion on Flow with Dr. Kerr
9:30 -12:00 Individual counseling and Future Perfect Day
12.00-1.00 Lunch
1.00-2.00 EEG Brain Flowers at the Lawrence Creates Makerspace
2.00-3.00 Goal Setting / Wrap Up

DETAILS

Please make checks payable to: The University of Kansas/PRE or CLEOS and *put the date that your child will be at CLEOS.*

Lunch: Students will have lunch at the Kansas Union. The cost of lunch per person is usually between $5 and $7.

Arrive: Approximately 10-15 minutes before the beginning of the workshop to check in.

Location: Center for Psychological Services (CPS)
Joseph R. Pearson Hall, Room 130
1122 W. Campus Road
Lawrence, KS 66045-3101

Appendix B

Information Statement for Sample 2

Information Statement

The Department of Psychology and Research in Education at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

We are conducting this study to better understand aspects of personality. This will entail your completion of surveys. Your participation is expected to take approximately 10-20 minutes to complete. The content of the surveys should cause no more discomfort than you would experience in your everyday life.

Although participation may not benefit you directly, we believe that the information obtained from this study will help us gain a better understanding of the way that personality and vocational decision making interact. Your participation is solicited, although strictly voluntary. Your name will not be associated in any way with the research findings. Your identifiable information will not be shared unless (a) it is required by law or university policy, or (b) you give written permission. No personally identifying information will be gathered from you using the MTurk system. The information that we do gather will be kept on an encrypted flash drive that only the researchers will have access to. It is possible, however, with internet communications, that through intent or accident someone other than the intended recipient may see your response.

You will be paid $2.00 for your participation in this study. This payment to you will be submitted using the Mturk reimbursement system.

If you would like additional information concerning this study before or after it is completed, please feel free to contact us by phone or mail.

Completion of the survey indicates your willingness to take part in this study and that you are at least 18 years old. If you have any additional questions about your rights as a research participant, you may call (785) 864-7429 or write the Human Subjects Committee Lawrence Campus (HSCL), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7563, email irb@ku.edu.

Sincerely,

M. Alexandra Vuyk, M.S.
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Appendix C

Tables for Factor Loadings and Intercepts

Table 10

O1: Fantasy and Imaginational OE Factor Loadings and Intercepts

	Two-Factor Loadings (SE)			Two-Factor Intercepts (SE)		
Items	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2
O1: Fantasy						
O1-1	.585 (.041)			4.278 (.056)		
O1-2	.471 (.049)				3.504 (.095)	3.104 (.080)
O1-3	.786 (.042)			3.897 (.078)		
O1-4	.399 (.054)			3.821 (.070)		
O1-5	.861 (.047)				3.213 (.097)	3.810 (.107)
O1-6	.454 (.059)				3.626 (.079)	3.247 (.081)
O1-7	.279 (.059)			3.952 (.070)		
O1-8	.706 (.047)			3.655 (.086)		
Imaginational OE						
MOE-1	.693 (.054)				3.977 (.087)	3.262 (.090)
MOE-2	.981 (.047)			2.943 (.091)		
MOE-3	.665 (.052)				3.951 (.087)	3.317 (.085)
MOE-4	.694 (.055)			2.387 (.081)		
MOE-5	.863 (.043)			3.235 (.082)		
MOE-6	.900 (.049)			2.812 (.088)		
MOE-7	.640 (.053)				3.131 (.096)	2.467 (.080)
MOE-8	.640 (.055)			2.129 (.077)		
MOE-9	.682 (.050)				3.342 (.100)	2.910 (.084)
MOE-10	.958 (.041)			3.276 (.088)		

Note. All factor loadings and intercepts are significant at a $p < .001$ level and are based on the most constrained model. Items were renamed to protect copyrighted scoring keys for both instruments.

Table 11

O2: Aesthetics and Sensual OE Factor Loadings and Intercepts

	Two-Factor Loadings (SE)			One-Factor Loadings (SE)			Two-Factor Intercepts (SE)			One-Factor Intercepts (SE)		
Items	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2
O2: Aesthetics												
O2-1	.734 (.050)			.686 (.050)			4.156 (.082)			4.076 (.078)		
O2-2	.427 (.048)			.423 (.048)			4.160 (.061)			4.108 (.058)		
O2-3	.762 (.052)			.723 (.051)			3.449 (.089)			3.340 (.082)		
O2-4	.877 (.055)			.837 (.051)			3.639 (.096)			3.514 (.087)		
O2-5	.692 (.058)			.664 (.058)			3.236 (.086)			3.142 (.078)		
O2-6	.416 (.044)			.410 (.045)			4.084 (.057)			4.034 (.054)		
O2-7	.732 (.049)			.722 (.046)			3.936 (.077)			3.871 (.075)		
O2-8	.748 (.057)			.702 (.053)				2.989 (.103)	3.338 (.094)		2.922 (.099)	3.215 (.082)
Sensual OE												
SOE-1	.722 (.041)			.715 (.041)			3.993 (.070)			4.022 (.071)		
SOE-2	.927 (.044)			.929 (.044)			3.301 (.089)			3.350 (.092)		
SOE-3	.893 (.043)			.890 (.043)			3.543 (.083)			3.587 (.084)		
SOE-4	.697 (.055)			.702 (.055)				3.920 (.087)	3.281 (.084)		3.901 (.088)	3.341 (.087)
SOE-5	.979 (.038)			.968 (.038)			3.351 (.094)			3.395 (.095)		
SOE-6	.667 (.047)			.667 (.047)			3.898 (.068)			3.934 (.069)		
SOE-7	.751 (.051)			.747 (.051)			3.815 (.077)			3.845 (.077)		
SOE-8	.890 (.041)			.868 (.042)			3.602 (.083)			3.639 (.083)		
SOE-9	.648 (.048)			.644 (.049)				3.309 (.092)	3.667 (.073)		3.309 (.092)	3.712 (.071)
SOE-10	.611 (.050)			.610 (.050)				3.789 (.080)	3.927 (.069)		3.808 (.083)	3.967 (.110)

Note. All factor loadings are significant at a $p <= .001$ level and are based on the most constrained models. One-factor model loadings and intercepts are reported because the final model was deemed satisfactory. Items were renamed to protect copyrighted scoring keys for both instruments.

Table 12

O3: Feelings and Emotional OE Factor Loadings and Intercepts

	Two-Factor Loadings (SE)			Two-Factor Intercepts (SE)		
Items	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2
O3: Feelings						
O3-1	.609 (.045)			3.994 (.065)		
O3-2	.578 (.057)				3.905 (.085)	3.599 (.081)
O3-3	.512 (.054)			3.654 (.064)		
O3-4	.387 (.053)			3.520 (.059)		
O3-5	.586 (.055)			3.537 (.071)		
O3-6	.364 (.055)			3.675 (.060)		
O3-7	.536 (.058)			3.851 (.065)		
O3-8	.337 (.038)			4.210 (.044)		
Emotional OE						
EOE-1	.599 (.055)			3.846 (.069)		
EOE-2	.241 (.076)				3.683 (.098)	2.874 (.087)
EOE-3	.458 (.056)			3.679 (.066)		
EOE-4	.761 (.053)			3.053 (.092)		
EOE-5	.785 (.046)			3.591 (.089)		
EOE-6	.551 (.047)			3.751 (.067)		
EOE-7	.859 (.049)				2.981 (.106)	3.306 (.109)
EOE-8	.577 (.049)				3.857 (.081)	3.612 (.082)
EOE-9	.745 (.053)				3.895 (.088)	4.323 (.099)
EOE-10	.568 (.052)			3.462 (.071)		

Note. All factor loadings and intercepts are significant at a $p < .001$ level and are based on the most constrained model. Items were renamed to protect copyrighted scoring keys for both instruments. Emotional OE was included twice as it was part of two O/OE combinations.

Table 13

O4: Actions and Psychomotor OE Factor Loadings and Intercepts

	Two-Factor Loadings (SE)			Two-Factor Intercepts (SE)		
Items	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2
O4: Actions						
O4-1		.195 (.094)	.439 (.061)		2.558 (.080)	2.626 (.070)
O4-2		.437 (.073)	.236 (.066)		3.740 (.066)	3.750 (.053)
O4-3	.668 (.053)			3.072 (.076)		
O4-4	.399 (.067)			3.429 (.066)		
O4-5	.727 (.049)			2.554 (.078)		
O4-6	.165 (.042)			4.124 (.038)		
O4-7	.456 (.055)			2.831 (.060)		
O4-8	.595 (.055)			2.643 (.067)		
Psychomotor OE						
POE-1		.344 (.096)	.694 (.066)		3.651 (.095)	3.289 (.088)
POE-2	.743 (.048)			3.217 (.079)		
POE-3	.884 (.036)			3.325 (.083)		
POE-4	.822 (.044)			3.450 (.082)		
POE-5	.912 (.043)			3.047 (.086)		
POE-6	.555 (.051)			3.164 (.072)		
POE-7	.817 (.040)			2.734 (.078)		
POE-8	.550 (.056)			2.842 (.071)		
POE-9		.737 (.079)	.980 (.052)		2.879 (.092)	3.243 (.103)
POE-10	.967 (.045)			2.745 (.096)		

Note. All factor loadings and intercepts are significant at a $p = .05$ level and are based on the most constrained model. Items were renamed to protect copyrighted scoring keys for both instruments.

Table 14

O5: Ideas and Intellectual OE Factor Loadings and Intercepts

	Two-Factor Loadings (SE)			One-Factor Loadings (SE)			Two-Factor Intercepts (SE)			One-Factor Intercepts (SE)		
Items	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2
O5: Ideas												
O5-1	.809 (.042)			.785 (.042)			4.070 (.075)			3.993 (.066)		
O5-2	.601 (.053)			.552 (.054)			3.895 (.071)			3.809 (.068)		
O5-3	.440 (.046)			.428 (.051)			3.989 (.059)			3.936 (.050)		
O5-4	.626 (.052)			.575 (.048)			4.046 (.072)			3.967 (.068)		
O5-5	.460 (.043)			.447 (.047)			4.193 (.057)			4.138 (.048)		
O5-6	.679 (.055)			.622 (.054)			3.567 (.076)			3.480 (.070)		
O5-7	.514 (.035)			.481 (.039)			4.376 (.053)			4.314 (.046)		
O5-8	.558 (.035)			.552 (.040)			4.283 (.056)			4.227 (.047)		
Intellectual OE												
TOE-1	.357 (.036)			.348 (.036)			4.277 (.045)			4.307 (.039)		
TOE-2	.615 (.043)			.593 (.044)			3.677 (.064)			3.729 (.056)		
TOE-3	.589 (.046)			.575 (.051)				4.095 (.080)	3.820 (.073)		4.112 (.077)	3.891 (.064)
TOE-4	.690 (.042)			.666 (.044)			3.581 (.069)			3.641 (.061)		
TOE-5	.581 (.042)			.562 (.046)			4.039 (.062)			4.089 (.052)		
TOE-6	.766 (.042)			.764 (.043)			3.725 (.075)			3.799 (.066)		
TOE-7	.824 (.043)			.813 (.042)			3.813 (.080)			3.902 (.066)		
TOE-8	.646 (.045)			.634 (.047)			3.715 (.068)			3.772 (.061)		
TOE-9	.488 (.044)			.464 (.051)			3.951 (.058)			3.992 (.051)		
TOE-10	.762 (.042)			.740 (.047)			3.786 (.074)			3.857 (.063)		

Note. All factor loadings are significant at a $p < = .001$ level and are based on the most constrained models. One-factor model loadings and intercepts are reported because the final model was deemed satisfactory. Items were renamed to protect copyrighted scoring keys for both instruments.

Table 15

O6: Values and Emotional OE Factor Loadings and Intercepts

	Two-Factor Loadings (SE)			Two-Factor Intercepts (SE)		
Items	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2	Invariant	Noninvariant, Sample 1	Noninvariant, Sample 2
O6: Values						
O6-1		.696 (.152)	.883 (.063)		3.885 (.099)	4.177 (.096)
O6-2		.717 (.103)	.322 (.051)		4.149 (.074)	4.281 (.052)
O6-3	.629 (.054)			4.079 (.062)		
O6-4	.484 (.049)			4.317 (.049)		
O6-5	.780 (.048)			3.865 (.069)		
O6-6		.572 (.120)	.231 (.060)		4.109 (.076)	4.116 (.054)
O6-7		.470 (.089)	.727 (.058)		4.228 (.069)	4.255 (.081)
O6-8	.861 (.049)			3.699 (.077)		
Emotional OE						
EOE-1	.524 (.060)			3.870 (.064)		
EOE-2	.294 (.070)				3.616 (.102)	2.999 (.095)
EOE-3	.448 (.062)			3.716 (.066)		
EOE-4	.768 (.052)			3.134 (.093)		
EOE-5	.776 (.046)			3.666 (.090)		
EOE-6	.530 (.050)			3.799 (.067)		
EOE-7	.944 (.049)				2.979 (.106)	3.494 (.128)
EOE-8	.595 (.045)			3.762 (.076)		
EOE-9	.641 (.055)				3.893 (.090)	4.362 (.095)
EOE-10	.617 (.051)				3.248 (.098)	3.651 (.093)

Note. All factor loadings and intercepts are significant at a $p < .001$ level and are based on the most constrained model. Items were renamed to protect copyrighted scoring keys for both instruments. Emotional OE was included twice as it was part of two O/OE combinations.