

RUNNING HEAD: Creativity, ADHD symptomatology and psychosocial functioning

An investigation into the psychosocial functioning of creative children: The impact of
ADHD symptomatology.

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This study examined the relationship among creativity, ADHD symptomatology, temperament, and psychosocial functioning by comparing four groups of children aged 10-12 years: (1) 29 ADHD children without creativity, (2) 16 highly creative children displaying ADHD symptomatology, (3) 18 highly creative children without ADHD symptomatology, and (4) 30 normal controls. Children completed the TTCT, Child Depression Inventory, Revised Child Manifest Anxiety Scale, and Rosenberg Self-Esteem Scale. Parents completed the Junior Temperament and Character Inventory, Family Environment Scale, and the parent version of the Kastan Children's Attributional Style Questionnaire. Parents completed the Conner's Rating Scales and Child Behavior Checklist, and teachers completed the Child Behaviour Checklist. Results showed that the presence of ADHD symptomatology in creative children was related to their temperamental characteristics, and parent reports of children's levels of anxiety and depression. However, family environment and mother's attributions did not appear to be related to the presence of ADHD symptomatology in creative children. These findings have implications for the development and management of creative children.

Key words: Creativity, ADHD symptomatology and psychosocial functioning

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Both creativity and Attention Deficit Hyperactivity Disorder (ADHD) are extensively studied topics in child psychology. Some authors have argued that there are distinct similarities between children who are diagnosed with ADHD and those who are creative (e.g., Cramond, 1994; Leroux & Levitt-Perlman, 2000). A small number of studies have looked at the creative ability of children with ADHD (Shaw & Brown, 1991; Cramond, 1994; Sang, Yu, Zhangming, & Yu, 2002; Alt, 1999). However, to our knowledge only one study has empirically investigated the presence of ADHD symptomatology in the creative population. This study, conducted by Cramond (1994), showed that, according to their self reports on the Swanson, Nolan, and Pelham Checklist (SNAP), 26 % of the creative adolescents that she tested met criteria for a diagnosis of ADHD.

In reviewing current theories of creative behavior, it is not surprising that a large number of highly creative children display ADHD symptomatology. Carson, Peterson and Higgins (2003) found that highly creative individuals had lower scores on a measure of latent inhibition, which is the ability to filter out both internal and external stimuli previously experienced as irrelevant, than controls. This description is similar to that of two of the symptoms of ADHD described in DSM-IV-TR, “often has difficulty sustaining attention in tasks or play activities” and “is often easily distracted by extraneous stimuli” (American Psychiatric Association, 2000). Carson et al. (2003) argued that this inability to filter out information (in combination with high IQ) makes these individuals constantly open to much more information, increasing the chances of them coming up with an original recombination of information. A similar idea has been expressed by a number of creativity theorists who argue that attention to a wide array of stimuli, or defocused attention, allows an individual to consider possibilities that they may miss if they had a more narrow focus

(e.g. Eysenk, 1999; Gardener, 1982). Therefore inattention and distractibility would be expected to be present in the creative population.

Although Cramond (1994) reported on the prevalence of ADHD symptomatology in creative individuals, she did not investigate the impact that these symptoms have on the general functioning of the adolescents. To date, the only research findings are that a large proportion of creative children appear to display symptoms of ADHD. There has been no research on the possible role of temperament and family environment in the development of these symptoms, nor on the impact of ADHD symptomatology on the psychosocial functioning of creative children. Therefore, this study aims to compare the psychosocial functioning of ADHD and creative children. The areas of psychosocial functioning that children with ADHD have been shown to have the most difficulty with are higher depression and anxiety (Biederman, Faraone, Monuteaux, Bober, & Cadogen, 2004), lower self esteem (Topolski, Edwards, Patrick, Varley, Way, & Buesching, 2004), deficient social skills (Barkley, 1998; Tannock, 1998, Wolfle & French, 1990), negative perceptions from others (Werry, Reeves & Elkind, 1987), dysfunctional family environments (Halloran, Ross & Carey, 2002) and difficult temperament (Werry et. al., 1987), and thus these aspects will be measured and compared in this study.

Currently, the research that has been done on the family and psychosocial functioning of creative children is difficult to interpret. Although some researchers have reported that creative individuals experience low mood (Hershman & Lieb, 1998; Papworth & James, 2003), others have found that there was no correlation between creativity and current depressive state (Sitton & Hughes, 1995). Similarly, some authors have reported that anxiety is higher in creative children than in controls (Carlsson, 2002; Carlsson, Wendt, & Risberg, 2000), while others have reported that it is lower (Asthana, 1993; Matejick, Kovac, & Kondas, 1988). Again, there are

researchers who have reported a relationship between high self-esteem and creativity (Kemple, David, & Wang, 1996; Goldsmith & Matherly, 1988), and those who found no evidence that creative individuals have higher self-esteem than less creative individuals (Williams, Poole, & Lett, 1977). Highly creative children have been reported to have difficulty with, or little interest in, establishing warm interpersonal relationships (Ochse, 1990). In contrast, several studies have shown that creative children are seen as the most popular in a group (Aranha, 1997; Lau & Li, 1996). Further, Smith and Moran (1990) found that highly creative children were not less sociable, less cooperative, or more defiant and rebellious than their less creative peers.

Temperamentally, creativity has repeatedly been linked to the personality characteristic of “openness to experience” (King, McKee Walker, & Broyles, 1996; McCrae, 1987). Creative individuals have also been described as “sensation seeking” (Barron, 1998; Farley, 1985), moderately non-conforming, autonomous, and rebellious (Runco & Sakamoto, 1996). In relation to how others perceive creative children, Dawson’s (1996) work showed that teachers valued traits such as being considerate of others, being obedient, being popular with peers, and being willing to accept judgements of authorities, all of which are not highly correlated with creativity. Similarly, some past research has shown that parents do not perceive the personality characteristics of their creative children favourably (Singh, 1987; Paguio, 1982; Raina, Kumar & Raina, 1980), yet others have found the opposite (Albert & Runco, 1989; Runco, Johnson, & Bear, 1992).

In relation to family environment, creative children have been described as growing up in an environment that stresses independence, is less child-centred, has tense family relationships and experiences more negative affect than do non-creative, high achieving children (Olszewski, Kulieke, & Buescher, 1987). On the other hand, creative children

have been described as having families that are better educated, more open to experiences, and have higher educational aspirations for their children, than those of non-creative children (Jausevek, 1981).

It is possible that one factor that is contributing to these varying results in the literature across different psychosocial domains is the severity of ADHD symptomatology present in the creative populations studied. Indeed, some studies are showing similar psychosocial problems in creative children as have been evidenced in the ADHD population, however direct comparisons between ADHD and creative groups have never been made. The current study proposes that the conflicting literature on the psychosocial and family functioning, and the temperament of highly creative children may be due to the presence of two subtypes of creative children: (1) those who display symptoms of ADHD and therefore experience similar functioning difficulties as children diagnosed with ADHD, and (2) those who do not display ADHD symptomatology and therefore do not experience difficulties. Thus, the hypothesis for this study is that creative children displaying ADHD symptomatology will experience similar psychosocial difficulties to those of children diagnosed with ADHD, and will have significantly more difficulties than those creative children who do not display ADHD symptomatology.

Method

Participants

Ninety three children aged between 10 to 12 years old took part in the research: 1) 29 (21 male, 8 female) ADHD children with normal creativity scores, 2) 16 children (11 male, 5 female) displaying ADHD symptomatology and high creativity scores, 3) 18 (5 male, 13 female) highly creative children without ADHD symptoms, and 4) 30 (13 male, 17 female) normal controls with no indication of ADHD or high creativity. Participants were predominantly Caucasian of varying S.E.S. backgrounds, residing in Christchurch,

New Zealand. Recruitment was conducted through advertisements in local newspapers, gifted classes, school notices, and an ADD support group newsletter.

Measure of ADHD symptomatology

Conners' Parent Rating Scales - Revised (CRS-R, Conners, 1997). This scale is an 80 item self-report questionnaire which can be used for boys and girls aged 3 to 17. The reliabilities across forms and raters are in the .85 to .95 range. Test-retest reliabilities at 6 to 8 weeks average .70 for the long version forms (Reitman, Hummel, Franz, & Gross, 1998).

Measure of creativity

Torrance Tests of Creative Thinking (TTCT, Torrance, 1962). Creative potential was measured using Figural form A of the TTCT which is made up of three tasks, all of which involve coming up with unusual drawings that have standard shapes (e.g., a pair of straight lines) as a part of them. Each drawing is scored on five subscales: originality, fluency, elaboration, abstractness of titles, and resistance to premature closure. The final percentile ranking is based on a combination of the scores for the five subscales as well as additional aspects like humour, emotional expressiveness, and richness of imagery.

Inclusion/exclusion criteria

Inclusion criteria for the ADHD group: All children in the ADHD group had received a prior diagnosis of ADHD from either a psychiatrist or registered psychologist before entering the study. T-scores of 65 or above on the DSM-IV inattentive, DSM IV hyperactive-impulsive, and/or DSM IV total subscales of the long versions of the parent form of the Conners' Rating Scales-Revised (CRS-R; Conners, 1997) were used to confirm ADHD diagnosis. None of the children in this group were highly creative (i.e., they had Torrance Tests of Creative Thinking (TTCT, Torrance, 1962) scores below the 90th percentile).

Inclusion criteria for creative group displaying ADHD symptomatology (CA):

Those children who scored in the 90th percentile or higher on the TTCT, and also had T-scores of 65 or above on the DSM-IV inattentive, DSM IV hyperactive-impulsive, and/or DSM IV total subscales of the long version of the parent form of the Conners' Rating Scales-Revised were included in this group. While it would have been ideal to ensure that this group also had a confirmed ADHD diagnosis along with a high creativity score, only four children who entered the study with a diagnosis of ADHD happened to also have high creativity scores. Further, given that the main goal of this study was to explore the relationship among ADHD symptomatology, creativity and psychosocial functioning, rather than relationships associated with an actual ADHD diagnosis, it was deemed to be justified to include children scoring high on the Conners, but who had not been identified as having ADHD, in this group. This inclusion criteria allowed for 12 (40%) of the 30 children recruited for high creativity to be included in this group.

Inclusion criteria for the creative group not displaying ADHD symptomatology

(CNA): This group was established by confirming that each child scored in the 90th percentile, or higher, on the TTCT and had T-scores below 60 on the parent form of the Conners' Rating Scales-Revised.

Inclusion criteria for the control group: All the control children had T-scores

below 60 on the parent form of the Conners' Rating Scales – Revised, and TTCT scores below the 90th percentile.

Exclusion criteria for all groups: Individuals with uncorrected problems in vision

or hearing, serious medical problems such as epilepsy or cerebral palsy, an estimated IQ score below 80, using the Block Design and Vocabulary subtests of the WISC-III (Wechsler, 1991), or serious psychopathology, such as psychosis (that precluded an ability to diagnose ADHD accurately), and those with English as a second language, were

excluded. These exclusion criteria did not result in the exclusion of any participants from the analyses.

Exclusion criteria for the control group: Individuals with a history, or current complaints of problems with attention, hyperactivity or impulsivity were excluded. These exclusion criteria resulted in one participant being excluded from the control group.

Measures of psychosocial functioning

Rosenberg Self Esteem Scale (RSE, Rosenberg, 1979). Self-esteem was measured using the RSE, a 10 item, self report questionnaire where the individual indicates to what extent a statement (e.g., “I take a positive attitude toward myself”) accurately reflects their self image. Responses include either: strongly agree, agree, disagree, or strongly disagree. The reliability of this measure was found to be good with $r = 0.78$ (Westaway & Wolmarans, 1992).

Revised Child Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1985). Anxiety was measured using the RCMAS, a 37 item, true/false, questionnaire. It involves reading each statement and deciding whether or not it is true in relation to the way the individual sees him/herself (e.g., “I worry a lot of the time”). The individual’s responses indicate scores on five subscales: total anxiety, physiological anxiety, worry/oversensitivity, social concerns/concentration, and lie. Concurrent validity of the RCMAS has been supported by its correlation with many anxiety measures, particularly the State-Trait Anxiety Inventory for Children (Dierker et. al., 2001; King, Josephs, Gullone, Madden & Ollendick, 1994).

Child Depression Inventory (CDI; Kovacs, 1992). Depression was measured using the CDI, a 27 item self-report measure designed for use with children and adolescents. The questionnaire involves rating the severity of symptoms in the past two weeks, by selecting one of three possible answers (e.g., “I am sad once in a

while”, “I am sad many times”, or “I am sad all the time”). The individual’s responses indicate scores on six subscales: total score, negative mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem. Following an assessment of the internal reliability of this measure, the average split-half correlation resulted in Spearman-Brown, $r = 0.85$ and Guttman split-half, $r = 0.84$ (Helsel & Matson, 1984).

Child Behavior Checklist (CBCL, Achenbach, 1991). The CBCL is a measure designed to identify children who exhibit behavior problems serious enough to warrant clinical intervention. Both the Parent (CBCL) and the Teacher Report Form (TRF) versions of this checklist were used to assess children’s behavior. Separate norms are available for male and female children aged 4 to 18 years. The internal consistencies of the CBCL are typically good (i.e., above .80 for most subscales). One week test-retest reliability for the behavioral component of the parent scale was reported as .89 and as .87 for the social competence component of the scale (Reitman, Hummel, Franz & Gross, 1998).

Measures of Family Functioning

New Zealand Socioeconomic Index of Occupational Status (NZSEI, Davis, McLeod, Ransom & Ongley, 1997). Socioeconomic Status. Socioeconomic status (SES) was determined using the NZSEI, an index which assigns New Zealand occupations with a socioeconomic score. Scores range from 10 (low SES) to 90 (high SES).

Family Environment Scale (FES; Moos & Moos, 1981). This measure assesses a variety of aspects of family functioning. Overall, three main family dimensions of interpersonal relationships are measured that provide 10 subscales. These are family relationships (cohesion, expressiveness, and conflict), personal growth and development (independence, achievement orientation, intellectual-cultural orientation,

active-recreation orientation and moral-religious emphasis), and system maintenance (organization and control). The FES is widely used, and the subscales have reported moderate internal consistency and discriminant validity (Stuifbergen, 1990).

Parent Version of the Kasan Children's Attributional Style Questionnaire (CASQ; Kaslow, Tanenbaum, Seligman, 1978). Mother's attributions about their children were obtained using the CASQ. The scale involves the mother interpreting the reason behind an event that occurs in relation to her child by selecting one of two possible responses (e.g., "Your child gets a bad grade at school." Response options: A. My child is not a good student or B. Teachers give unfair tests).

Measure of Temperament

Junior Temperament and Character Inventory (JTCI, Luby, Svrakic, McCallum, Przybeck, & Cloninger, 1999). The parent report version of the JTCI was used to examine the child's temperament and emerging personality characteristics. The JTCI has been adapted from the Temperament and Character Inventory (TCI; Cloninger, Przybeck, Svrakic & Wetzel, 1994) and is suitable for use with children aged 9 – 13 years. The measure consists of four temperament dimensions: Harm Avoidance (i.e., fearful), Novelty Seeking (i.e. exploratory), Reward Dependence (i.e., sentimental and affectionate) and Persistence (i.e., industrious); and three character dimensions: Self-directedness (i.e., disciplined), Cooperativeness (i.e, empathic and helpful), and Self-transcendence (i.e idealistic). According to this model, the temperament dimensions are believed to be heritable, to manifest early in life, and to involve preconceptual or unconscious biases in learning. With regard to the character dimensions, heritable temperamental factors are believed to initially motivate the development of these, which once established, continue to impact on the significance and salience of perceived environmental stimuli that the individual

responds to (Cloninger, Svrakic, & Przybeck, 1993). The JTICI has been shown to have internal reliability, and to be a valid measure of children's temperament (Luby, Svrakic, McCallum, Przybeck, & Cloninger, 1999).

Procedure

Each child was tested individually in a quiet room at the university for one hour. The measures were completed by each participant in the same order to ensure consistency. Ethics approval for the study was gained from the local Human Ethics Committee. Participation was voluntary and included parental and child consent. Parents were asked to fill in the long version of the CPRS-R, the CBCL, the JTICI, and the CASQ (parent version). Permission was gained to send the TRF to a current teacher who knew the child well.

Statistical Analyses

Results were analysed using the Statistical Package for the Social Sciences-windows version 11.5. Univariate analyses of variance were used to examine group difference and if the overall Wilk's Lambda was significant ($p < 0.05$), the subsequent univariate analyses were interpreted. Specific group differences were examined with post-hoc Tukey tests using a p value of .05. Cohen's d effect size (ES) calculations were used to determine the magnitude of group differences for comparisons most relevant to study.

Results

Sample Characteristics

Average age, CPRS-R, and TTCT scores of the four groups are displayed in Table 1. As group membership would suggest, the CA group were rated by parents as having similar behavioral characteristics to the ADHD group, both of whom were rated higher than the CNA and NC groups. The CA and CNA groups displayed significantly more creative ability, as measured by the TTCT, than the ADHD and NC groups.

Insert Table 1 about here

Measures of psychosocial functioning

The ADHD group self reported experiencing more anxiety and depressive symptoms than the other three groups; however, there were no group differences in self-esteem (see Table 2). For Total Anxiety, the ADHD group scored higher than the other three groups. This pattern was consistent across all subscales of the RCMAS. For depression, the ADHD group scored higher on the Total score than the other three groups, and again this pattern remained constant across all subscales of the CDI.

Subscale scores of that Child Behavior Checklist that were directly relevant to the hypotheses of the study were analyzed. These included: Withdrawn, Anxious/Depressed, Social problems, and Social on the CBCL, and Withdrawn, Anxious/Depressed, and Social Problems on the TRF (see Table 2). On the CBCL, the ADHD group gained higher scores than the other three groups on Social Problems, and lower scores on the Social subscale of the measure. For the Withdrawn, and Anxious/Depressed subscales, the ADHD group scored higher than the CNA and NC groups, but did not differ significantly from the CA group. For the Social Problems subscale, the CA group differed significantly from the CNA and NC groups. Further, effect size calculations indicated small differences between the ADHD and CA groups for the Withdrawn and Anxious/Depressed subscales and large differences on the Social Problems and Social subscales. For the CA and CNA groups, the effect sizes were medium for all subscales, suggesting that the parents of the CA group are reporting more of these symptoms in their children than are the parents of the CNA group (see Table 3).

On the TRF of the Child Behavior Checklist, the ADHD group gained higher scores than the CNA and NC groups on all of the subscales. There were no significant difference between the ADHD and CA groups on any of the subscales. For the Social Problems subscale, the CA group scored higher than the NC group. Effect sizes between the ADHD and CA group were small for the Withdrawn subscale and medium for the Anxious/Depressed and Social Problems subscales. There was a large effect size between the CA and CNA groups on the Withdrawn subscale and a medium effect sizes on the Anxious/Depressed and Social Problems subscales, suggesting that group differences may exist, and that the CA group is struggling more in these domains.

Insert Table 2 about here

Measures of family functioning

The ADHD group differed from the other three in terms of SES and mother's attributions, but did not differ consistently on family environment. For SES, the overall effect for group was significant, $F(3, 92) = 12.566, p < 0.001$. Post-hoc analyses showed that both of the creative groups' and the control group's parents had higher SES ratings than the ADHD children's parents. With regard to mother's attributions about their children, the overall group effect was significant, $F(3, 92) = 16.324, p < 0.001$. Post-hoc analyses revealed that the mothers of the ADHD children viewed their children significantly more negatively than did the mothers of the children in the other three groups.

There were very few group differences on the Family Environment Scale. For the Conflict subscale, the overall effect for group was significant, $F(3, 92) = 3.487, p < 0.05$. Post-hoc analyses showed that the CA group scored lower than the CNA and NC groups indicating that there was less conflict within their families. For the Intellectual subscale, the

overall effect for group was significant, $F(3, 92) = 4.466, p < 0.01$. Post-hoc analyses revealed that the ADHD group scored significantly lower than the CNA and NC groups indicating that their families were less intellectual. For the Recreational subscale, the overall effect for group was significant, $F(3, 92) = 3.330, p < 0.05$. Post-hoc analyses revealed that the ADHD group scored lower than the CNA and NC groups indicating that they engaged in fewer recreational activities. There were no group differences on the Cohesion, Expressiveness, Independence, Achievement, Moral-Religious, Organizational, and Control subscales.

Measures of temperament and character

With regard to both temperament and character, the ADHD and CA groups were rated similarly and were significantly different from the CNA and NC groups (see Table 3). For the temperament dimension of Novelty Seeking, the ADHD group scored higher than the CNA and NC groups, and the CA group scored higher than the NC group. For Reward Dependence the ADHD group scored lower than the CNA group, and for Persistence the ADHD and CA groups both scored lower than the CNA and NC groups. There were no group differences on Harm Avoidance. For the character dimension of Self-Directedness, the ADHD scored higher than all other groups, and the CA group scored higher than the CNA and NC groups. For cooperativeness, the ADHD and CA groups scored higher than the CNA and NC groups. For Self-Transcendence 1, the ADHD group scored higher than the CNA group, and the CA group scored higher than the CNA and NC groups. Effect size calculations confirm this pattern of results with predominantly large effect sizes between the CA and CNA groups and predominantly small effect sizes between the ADHD and CA groups.

Insert Table 3 about here

Exploratory Correlations

Given that the effect size calculations suggest that the CA group may differ from the CNA group on a number of the psychosocial measures, correlations were conducted to specifically determine the strength of the relationship between ADHD symptomatology and those psychosocial variables where a significant difference between the CA and CNA groups was apparent. Since the CA group mostly displayed symptoms of inattention as opposed to hyperactivity (see Table 1), Parent's ratings on the Inattentive subscale of the Conner's Parent Rating Scale was used for the analyses. Correlations were conducted using the combined two creative groups only. Table 4 displays the correlations between ADHD symptomatology and CBCL scores, and Table 5 displays correlations between ADHD symptomatology and temperament and character, for the combined creative groups.

Results show that inattentive symptoms of ADHD are related to higher CBCL scores on the Withdrawn, Anxious/Depressed, and Social Problems subscales; and lower scores on the Social subscale which measures how many hobbies and friends a child has. Inattentive symptoms were also related to higher TRF scores on the Withdrawn, Anxious/Depressed, and Social Problems subscales. Parent's ratings of children's temperament and character showed a strong positive relationship between inattention and the temperament dimension of Novelty Seeking, and a strong negative correlation between inattention and Persistence. For the character dimensions, there were strong negative correlations between inattention and Self-Directedness and Cooperativeness, and a strong positive correlation between inattention and Self-Transcendence 1.

Insert Tables 4 & 5 about here

Discussion

This study is the first to explore the temperament, character, and general functioning of creative children with and without ADHD symptomatology, and to compare them with both ADHD and normal control children. Although there were few significant group differences between the CA and CNA groups, effect size calculations indicated that parents and teachers reported that the CA group were experiencing more withdrawal, anxiety, depression, and social difficulties than the CNA group. However, it was only on the Anxious/Depressed and Social Problems subscales of the CBCL that they scored within the clinical range. Furthermore, the correlations conducted between ADHD symptomatology and measures of psychosocial functioning, using the combined creative groups, indicated that the presence of ADHD symptomatology in creative children was related to increased levels of both parent and teacher reported withdrawal, anxiety/depression and social problems. The overall pattern of results from this study suggest a continuum effect where increases in the severity of ADHD symptomatology in creative children are related to increases in experiences of withdrawal, anxiety, depression and social difficulties.

Despite the lack of significant group differences in self, parent and teacher reports of depression and anxiety between either creative group and the control group, effect size calculations suggest that there are medium to large differences between the CA and NC groups on parent and teacher reports of anxiety, depression, and social problems; and predominantly small effect sizes between the CNA and NC groups on all measures of anxiety, depression, self esteem and social problems. Thus, the results

of this study suggest that creative children displaying ADHD symptomatology experience higher levels of anxiety, depression and social difficulties than controls, but creative children without the symptoms do not. These findings may explain the contradictory results of studies investigating the relationship between creativity and depression, anxiety or social problems. Future research should consider the levels of ADHD symptomatology when comparing creative and control groups on measures of psychopathology in order to further explore the role of these symptoms in any connections found between creativity and psychopathology.

A further link between the ADHD and CA groups was highlighted by their temperament and character ratings. There were significant differences in the temperament and character of the two creative groups, but little difference in the temperament and character of the ADHD and CA groups. This suggests that both temperament and character may be linked to the development of ADHD-like behavior. Unlike temperament, mother's attributions and family environment did not appear to be related to ADHD-like behavior. Although the findings of this study suggest possible links between temperament, behavior and environment, it is important to note that causation cannot be inferred from this data.

In regard to temperament, the creative group displaying ADHD symptomatology were rated as having a similar temperament to that of the ADHD group, and one that was significantly different from the CNA group. Creativity has repeatedly been linked to the personality characteristic of "openness to experience" which includes novelty seeking (King, McKee, Walker, & Broyles, 1996; McCrae, 1987) and to "sensation seeking" which is similar to novelty seeking (Barron, 1998; Farley, 1985); yet by subdividing the creative group, this study has shown that only

the CA group was significantly higher than controls on the inborn temperament dimension of Novelty Seeking.

With the exception of three subscales, family environment did not differ across groups, suggesting that family environment is not strongly linked to the presence of ADHD symptomatology. Similarly mother's attributions about their children did not appear to be linked to the presence of ADHD symptomatology as, if this were the case, one would expect the mothers of both the ADHD and CA groups to have made similar attributions about their children, and that these would differ from the attributions made by the mothers of the CNA and NC groups. This was not the case as there was a significant difference in the attributions of mothers of the ADHD and CA group, and no difference between the CA, CNA and control groups. These results support the findings that parents have positive perceptions of their creative children (Albert & Runco, 1989; Runco et. al., 1992) and contradicts the findings parents do not perceive the personality characteristics of their children favourably (Singh, 1987; Paguio, 1982; Raina et. al., 1980). Further, the findings of this study suggest that it may be the significant impairment imposed by the symptoms of the ADHD group that leads mothers to make negative attributions about their children, rather than the attribution style of the parent leading to ADHD symptomatology.

This study has given us a unique insight into the possible mechanisms underlying the development of ADHD symptomatology. Having two groups (CA and ADHD) that both display similar behaviors, we were able to compare their psychological functioning, character, in born temperament, and family functioning and hypothesise as to which of these factors seem to relate to ADHD symptomatology. The findings of this study appear to support the past research

findings that ADHD is not simply a disorder of the environment, but more likely a disorder stemming, at least in part, from a child's biological makeup (Teeter, 1998).

Clinical Implications

Although this study showed that, on average, creative children displaying ADHD symptomatology were not experiencing clinically elevated levels of anxiety, depression, low self esteem, or deficient social skills; parents did rate their anxiety, depression and social problems within the clinical range (i.e. one standard deviation above the mean). Furthermore, based on the correlational analyses within the creative group, the presence of ADHD symptomatology was clearly related to elevated scores on these measures. Therefore, highly creative individuals who display ADHD symptomatology appear to be at a higher risk of developing depression, anxiety, and social difficulties than those creative children without the symptoms.

Limitations

There are a number of limitations that hinder the generalizability of these results. First, the inclusion criteria for the creative group with ADHD symptomatology was based on parent ratings rather than a formal diagnostic assessment. Therefore it is unclear how many of these children would have met full criteria for a diagnosis of ADHD. This, in turn, resulted in a heterogeneous sample of creative children with ADHD symptomatology (i.e., one quarter of them had a formal diagnosis of ADHD). However, the analyses were conducted with and without those four children with no change in the pattern of results. Further, we did not assess the ADHD group with a standardized interview, instead the diagnosis came from community practitioners and was then confirmed with parent rating scales, which inevitably produces some variability into the diagnostic procedures. Future studies could include a creative group of children with diagnosed ADHD, and a creative group displaying symptoms of ADHD but not meeting full criteria for the disorder. A third

limitation is that because the creative groups were formed experimentally and not directly recruited for ADHD symptomatology, the sample sizes of both of the creative groups were small, impacting on the power of the results. Fourth, the groups had unequal numbers of male and female participants with too few girls in the ADHD and creative group with ADHD symptoms to determine whether there were differences in functioning based on gender. Fifth, the ADHD group consisted of all three types of ADHD: predominantly inattentive, predominantly hyperactive/impulsive and combined type, but due to small sample sizes in each of these groups, comparisons could not be made within the ADHD sample. Finally, the creativity measure used (TTCT) provides a measure of creative potential rather than creativity per se.

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Table 1

Sample characteristics: means and standard deviations

Variable	ADHD (n=29)		CA (n=16)		CNA (n=18)		NC (n=30)		Wilk's	Contrasts ^a
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Lambda F (3, 92)	
Age	11.44	0.85	11.24	0.96	11.10	0.80	11.10	0.89	0.928	
TTCT	37.83	30.48	94.31	3.14	94.89	3.85	45.97	23.37	44.022***	ADHD,NC<CA,CNA
CPRS-R Inattentive	75.43	8.53	70.87	6.45	47.18	5.46	47.32	5.56	109.964***	ADHD,CA>CNA,NC
CPRS-R Hyperactive	82.07	8.29	69.38	13.19	48.29	6.07	47.80	4.93	98.365***	ADHD>CA>CNA,NC
CPRS-R DSM-IV total	81.07	6.19	71.31	9.60	47.47	5.68	47.32	4.97	158.81***	ADHD>CA>CNA,NC

Note: ^aTukey's HSD, $p < .05$, CA = creative with ADHD symptomatology, CNA = creative without ADHD symptomatology, NC = normal control,

CPRS-R = Conners' Parent Rating Scale-Revised, TTCT = Torrance Tests of Creative Thinking, *** $p < .001$.

Table 2

Psychosocial functioning by group: means and standard deviations

Variable	ADHD (n=29)		CA (n=16)		CNA (n=18)		NC (n=30)		Wilk's Lambda <i>F</i> (3, 92)	Contrasts ^a	Effect Sizes (<i>d</i>)			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD			ADHD &CA	CNA &CA	CA &NC	CNA &NC
<i>Rosenberg Self Esteem</i>	8.62	5.31	7.53	3.39	6.58	3.47	7.23	3.83	0.098		0.24	0.28	0.08	0.17
<i>RCMAS</i> : Total Anxiety (<i>T</i> scores)	51.69	12.79	42.81	9.52	42.61	10.05	41.90	7.61	5.592***	ADHD>CA,CNA, NC	0.79	0.02	0.11	0.08
<i>CDI</i> : Total Score (<i>T</i> scores)	52.62	10.94	45.00	7.27	42.06	5.63	45.17	6.89	7.438***	ADHD>CA, CNA, NC	0.82	0.45	0.02	0.49
<i>CBCL</i> (<i>T</i> scores)														
Withdrawn	59.42	9.56	57.25	11.02	52.47	5.35	52.92	6.18	3.852**	ADHD>CNA,NC	0.21	0.55	0.48	0.07
Anxious/Depressed	64.61	11.96	59.31	11.01	53.29	5.74	52.48	4.82	9.638***	ADHD>CNA, NC	0.46	0.69	0.80	0.15
Social Problems	69.32	8.02	60.00	14.07	52.00	4.12	51.80	4.00	26.137***	ADHD>CA>CNA,NC	0.81	0.77	0.79	0.05
Social	35.29	8.22	45.00	9.66	51.29	5.68	50.56	5.37	25.159***	ADHD>CA,CNA,NC	1.08	0.79	0.71	0.13
<i>TRF</i> (<i>T</i> scores)														
Withdrawn	56.75	7.91	55.62	6.63	50.28	1.18	51.91	5.45	4.985**	ADHD>CNA,NC	0.15	1.12	0.61	0.41
Anxious/Depressed	58.60	8.41	53.46	4.33	51.61	3.75	51.95	4.70	6.289***	ADHD>CNA,NC	0.77	0.46	0.33	0.08
Social Problems	62.00	7.35	56.92	8.07	52.72	4.21	51.64	3.49	13.002***	ADHD>CNA,NC	0.66	0.65	0.85	0.28
										CA>NC				

Note: ^aTukey's HSD, $p < 0.05$, CA = creative with ADHD symptomatology, CNA = creative without ADHD symptomatology, NC = normal control,

RCMAS= Revised Child Manifest Anxiety Scale, CDI = Child Depression Inventory, CBCL = Child Behavior Checklist, TRF = Teacher Report Form,

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 3

Junior Temperament and Character Inventory (Raw Scores) by group: means, standard deviations, ANOVA results and effect sizes

Variable	ADHD (n=29)		CA (n=16)		CNA (n=18)		NC (n=30)		Wilk's Lambda <i>F</i> (3,92)	Contrasts ^a	ES (<i>d</i>) ADHD & CA	ES (<i>d</i>) CA& CNA
	Mean	SD	Mean	SD	Mean	SD	Mean	SD				
<i>Temperament Dimensions:</i>												
Novelty Seeking	10.96	3.29	8.81	3.10	6.59	2.48	5.54	2.89	15.524***	ADHD>CNA,NC CA>NC	0.67	0.79
Harm Avoidance	9.57	5.63	8.63	6.39	8.59	4.70	8.64	4.17	0.203		0.16	0.01
Reward dependence	4.96	2.36	5.88	2.70	7.53	1.42	6.00	2.27	4.581**	ADHD>CNA	0.36	0.76
Persistence	1.21	1.20	1.63	1.31	3.65	1.69	3.82	1.68	18.491***	ADHD,CA<CNA,NC	0.33	1.34
<i>Character Dimensions:</i>												
Self-Directedness	7.42	3.58	11.75	4.04	16.76	3.98	16.32	2.63	36.159***	ADHD<CA<CNA,NC	1.13	1.25
Cooperativeness	10.29	4.57	12.56	4.75	16.88	2.34	16.64	2.54	16.595***	ADHD,CA<CNA,NC	0.49	1.15
Self-Transcendence 1	1.18	1.42	1.75	1.29	0.29	0.69	0.68	0.78	5.422**	ADHD>CNA CA>CNA,NC	0.42	1.41
Self-Transcendence 2	1.21	1.52	1.68	1.70	1.29	1.10	0.73	1.20	1.467		0.29	0.27

Note: ^aTukey's HSD, $p < .05$; CA = creative with ADHD symptomatology, CNA = creative without ADHD symptomatology, NC = normal control,

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4

Correlations between Conners' Parent Ratings of ADHD symptomatology and CBCL scores, collapsing across the two creative groups.

Variable	Inattention (r)
<i>CBCL</i> (T scores)	
Withdrawn	0.407**
Anxious/Depressed	0.453**
Social Problems	0.494**
Social	- 0.377*
<i>TRF</i> (T scores)	
Withdrawn	0.509**
Anxious/Depressed	0.298*
Social Problems	0.401**

Note: CBCL = Child Behavior Checklist, TRF = Teacher Report Form, * $p < 0.05$, ** $p < .01$, *** $p < .001$

Table 5

Correlations between Conners' Parent Ratings of ADHD symptomatology and scores on the Junior Temperament and Character Inventory, collapsing across the two creative groups.

Variable	Inattentive (r)
<i>Temperament Dimensions</i>	
Novelty Seeking	0.412**
Harm Avoidance	0.038
Reward dependence	-0.230
Persistence	-0.603***
<i>Character Dimensions</i>	
Self-Directedness	-0.549***
Cooperativeness	-0.412**
Self-Transcendence 1	0.639***
Self-Transcendence 2	0.256

Note: * $p < .05$, ** $p < .01$, *** $p < .001$