A Creativity Training Program With Teachers: The Effects on Creativity and Academic Performance of Students With or Without ADHD (Attention Deficit Hyperactivity Disorder)

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In the present context of contemporary education, there are students who exhibit characteristics of ADHD (attention deficit hyperactivity disorder), and experience unfavorable conditions to their development and learning process. This study aimed at evaluating the short and medium term effects of a creativity training program with a group of 4th grade elementary education teachers, in the creative skills and academic performance of students with and without ADHD. A group of 235 students and nine teachers from a private school participated in this study. Four teachers attended the nine training sessions, focusing on the development of the creative potential and updated information on ADHD. The instruments used were the ADHD scale—version for teachers, the TTCT (Torrance tests of creative thinking), interviews with teachers, and the document analysis of participants. Students had their academic performance analyzed through their grades in Portuguese and mathematics. The SPSS (Statistical Package for the Social Sciences) 13.0 was used for data analysis. A student's *t*-test was applied for intergroup (independent *t*-test) and within groups analysis (paired *t*-test). In the intergroup analysis, students from trained and untrained teachers were compared in relation to academic performance and creativity at different phases of the study (pre-, first post-, and second post-test). In the intra-group analysis, each group was compared within itself at different stages of the study with regard to academic performance and creativity. A variance analysis was also conducted. A thematic content analysis was employed based on the responses obtained in interviews. Students of trained teachers presented superior performance in relation to the three creativity measures in the pre-test and in the second post-test, but only in figurative creativity in the first post-test. Intra-group analysis pointed out differences for students of trained and untrained teachers separately, when comparing the different phases of this study. Student's *t*-tests comparing students with and without ADHD indicated higher performance for students without ADHD in creativity measures and academic performance in the three phases of the study. The content analysis revealed that teachers perceive themselves as creative and are aware of the importance of the development of their student's creative skills.

Keywords: creativity, ADHD (attention deficit hyperactivity disorder), teacher's training

Rapid changes experienced by modern society, as well as unimaginable technological advances, the stress and struggle for survival in a vulnerable world, require greater investments and the need for the development of creative abilities. Among many features, creativity involves the creation of alternative solutions, the search for

innovative responses, the use of imagination, and a different look at the world. Therefore, creativity is not only an individual ability to be valued, but a social responsibility (Cromptley, 2006) and an essential tool for human development. Lubart (2007) claims that creativity is one of the most important skills for the advancement of economic knowledge and culture.

Changes have also been observed in the educational context, which is responsible for enabling students to develop their ability to critically analyze and solve problems creatively. In this sense, Martínez (2006) highlights the importance of creative pedagogical work for the cultivation of new knowledge and skills, and she reminds us that creativity should be focused on adding value to learning and student development.

Studies have been conducted to investigate the conditions and environmental characteristics that may foster students' creativity in the classroom (Amabile, 1996; Csikszentmihalyi, 1996; D. H. Cromptley & A. J. Cromptley, 2000; Fleith, 2000; Novaes, 2001; Renzulli, 1992; Sternberg, 2000). The results indicate that both social and cultural factors, as well as psychological support are important for the development and expression of creativity in the school context.

According to Alencar (2001), an education focusing the development of creativity stimulates curiosity, playfulness, and the joy of creating and dreaming. Therefore, educational institutions need to create supportive environments, provide materials or tools that may facilitate the development of students' creative expression, and promote training programs that encourage the emergence of new ideas and products (Hunsaker, 2005; Smith-Bingham, 2006).

The teacher, a key element in the teaching and learning process, needs to be prepared and willing to foster creative thinking in the classroom. He/she also needs to fight a major obstacle to the creative process: the fear of making mistakes. Studies on the teaching profession indicate the existence of disillusioned, dissatisfied, and unmotivated teachers (Alencar, 2007; Codo & Jacques, 2002). This situation produces alienated educational work, which is limited and focused on the employer's specific purposes. Moreover, the lack of knowledge, combined with erroneous ideas on creativity, and the difficulty for teachers to innovate and break traditional patterns represent blocks to the development of creativity in the classroom.

Unquestionably, specific and continuous training is necessary for teachers to know, master, and implement teaching methodologies that may encourage their students' creative potential. Researchers interested in the area have evaluated programs designed to develop teachers' creative potential and have identified positive effects on academic performance and students' creativity (Alencar & Fleith, 1987; Alencar, Fleith, Shimabukuro, & Nobre, 1987; Amabile, 1996; Guerreiro, 1987).

However, literature reports a reduced number of studies on creativity training after the 1990s, which may reflect, among other issues, the need for updating the programs that aim at creativity development. Over time, many of these programs, which were initially developed as closed "packages", proposing predetermined content that could be adapted to different groups of users, without worrying about meeting specific needs, did not suffer any modifications and, consequently, remained with old and outdated exercises, in addition to outdated technology and formatting, not compatible with the high standards of new instructional materials that were emerging in the market (Dr. Treffinger, personal communication, December 18, 2008).

Few are the empirical studies that present data on the transference or application of creative strategies and behaviors learned through specific training in various situations. What is most commonly observed is the mere repetition of exercises performed during creativity programs (Meador, Fishkin, & Hoover, 1999; Hunsaker,

2005). Another aspect to be highlighted is the limited access of educators to studies on the effects of creativity training programs. There are few articles published in journals and even in scientific journals, and studies conducted are more regularly registered in theses and dissertations databases, a resource still little used by teachers (Hunsaker, 2005). Hunsaker suggests two measures to be taken: (1) the publication of scientific articles based on the results of theses and dissertations; and (2) the publication of articles of easy understanding for teachers, based on scientific articles.

Creativity is undeniably a construct with multiple dimensions and it can be considered from the product of a creation, the process that leads to something new or original, the creative abilities present in the individual, or the role the environment plays in stimulating or inhibiting creativity (Amabile, 1996; Alencar & Fleith, 2003; Lubart, 2007). Consequently, recognizing a creative behavior is not an easy task. Manifestations of the creative potential can often be linked to other existing behaviors. Thus, the creative student may, for example, be labeled as a student with ADHD (attention deficit and hyperactivity disorder) due to similar characteristics between these two conditions, as the high level of energy, curiosity, and divergent thinking (Cramond, 1995).

Several researchers have conducted studies regarding the relationship between creative abilities and cognitive, behavioral, or personality disorders (Cramond, 1995; Lovecky, 1999; Neihart, 2003). ADHD, in particular, has been thoroughly discussed by physicians (Abraham, Windmann, Siefen, Daum, & Güntürkün, 2006; Hallowell & Ratey, 2005), psychologists (Antony & Ribeiro, 2004; Cramond, 1994, 1995; Hartmann, 2003; Healey & Rucklidge, 2005; Honos-Webb, 2005; Lovecky, 2004), and anthropologists (Jacobson, 2003; Nowak, 2001).

Currently, ADHD is used to describe a disorder that is manifested most often in childhood, and it is considered to be a child's difficulty in sustaining attention, inhibiting impulses, and regulating motor activity in various situations. The disorder is characterized by inattention, hyperactivity, and impulsivity, as classified in the DSM-IV-TR (Diagnostic and Statistical Manual of Mental Disorders revised version) (American Psychiatric Association, 2002), under the code 314.01. Commonly considered, children who cannot be controlled are considered hyperactive.

According to Furman (2008), in the United States alone, between 2.4 to 4.4 million children and young people, aged ranging between four and 17, meet the criteria for an ADHD diagnosis. However, the disease has a biological cause and there are no established tests that can objectively make the diagnosis. Still, the author asserts that in the United States, approximately one in every 25 children is being prescribed stimulant medication to treat hyperactivity and attention deficit.

The yet limited knowledge on ADHD enables the emergence of different explanations from those traditionally provided by medicine. Hartmann (2003), for example, does not consider ADHD a disorder but a talent or gift, which comprises components such as adaptive multi-faceted interests, or the drive and courage to take risks. The author mentions the Indian culture, in which ADHD is understood from a spiritual perspective. Individuals with ADHD are at the end of a karmic cycle and are therefore, worthy of respect and special attention. Hartmann also states that in the Indian tribes in Caribou, composed of native hunters from northern Canada, ADHD is perceived as a highly adaptive set of behaviors that contribute to the perpetuation of these tribes. In this direction, Lovecky (2004) argues that ADHD can be extremely positive if individuals with this syndrome use their creative potential under conditions that allow them to engage freely and in any way they wish for the tasks required.

Jacobson (2003) concluded that ADHD is a culturally defined phenomenon, after conducting a study with 53 students in England aged between 10 and 11. He found that the diagnosis of ADHD is less frequent in the US. Only 1% of British children are diagnosed with ADHD, whereas 5% of American kids are labeled as inattentive and hyperactive. Furman (2002) supports the same position when he says that for every 250 children diagnosed with ADHD and treated in the United States, only one is diagnosed and treated in all Germany, Britain, France, and Italy together.

One possible explanation for the high frequency of children and youth with characteristics of ADHD in the United States is that the American media has built a culture that encourages and requires short span attention and high stress levels, indulging the picture named by doctors as ADHD. Armstrong (2003) claims that ADHD is religiously biased; it portrays the protestant work ethics from the times of American colonization, in which there was a need to label the child who presented undesirable behaviors.

The interest in the relationship between creativity and ADHD has generated many theoretical and empirical studies on the subject, helping parents, teachers, and educators on the differences and similarities between the two phenomena. Hartmann (2003) draws attention to the similarity of some ADHD characteristics, such as high-energy, dispersion of ideas, curiosity, and those observed in the creative individuals. Baum, Olenchak, and Owen (1998) corroborate this view by explaining that "Due to the fact that ADHD knowledge was first studied and investigated from a medical perspective, aspects such as the creative ability and talent of those individuals were left out" (p. 37) .

Other authors also highlight creative features in ADHD children. Honos-Webb (2005) proposes a paradigm shift about the disorder and emphasizes that individuals with ADHD are highly talented and creative for presenting some kind of divergent thinking and curiosity, which leads them to combine ideas in different ways. The author asserts that these children are indeed different and may exhibit behaviors that are considered problematic, rarely seen as a talent to be developed. This occurs because much of the cultures in which these children are inserted tend to consider any difference in behavior patterns as a disorder.

However, in the modern world we live, of fast and intense stimulation, in which jargons such as "Time is money" are often used and seem to prevail, the development of two or more simultaneous tasks is the most needed and relied response upon society as a whole. Thus, according to Hartmann (2003), features such as diffused attention, curiosity, and inner turmoil, present both in creative and ADHD individuals, may therefore generate alternatives for a more positive social and academic living, and as such, be seized and viewed more positively.

We cannot forget, however, that each individual who exhibits characteristics of ADHD is unique as to behaviors he/she presents and may manifest milder levels of disorder, from lack of attention and hyperactivity, learning difficulties or language disorders to more severe impairments, with possible comorbidities, for example, conduct, obsessive-compulsive, or an affective disorder, Asperger syndrome, autism, or Tourette's syndrome (Rief, 2005). The author lists several characteristics found in ADHD individuals that may help in the development of certain skills that facilitate learning and result in higher welfare and success in their lives. They are: high energy, spontaneity, imaginative, and creative potential, enthusiasm, humor, high verbal intelligence, improvisation and artistic potential, sensitivity to the needs of others, charisma, intuition, among others. However, the presence of comorbidities may result in depression, excessive use of chemicals, high anxiety, social phobia, nervous tics, and other psychiatric disorders (Brown, 2005).

Given the multiple characteristics of ADHD and the relationship with other phenomena, such as creativity,

erroneous diagnosis is increasingly common, especially in the educational context. It is worth pointing out that ADHD misdiagnosis can occur in two directions: Creative and talented children with high energy and curiosity can be considered ADHD, but also children who have long periods of concentration in some areas of interest cannot be recognized with characteristics of ADHD, when in fact, they are.

Moreover, we must stress the lack of teacher's preparation to resolve conflicts in the classroom creatively and to deal with students who do not fit the "desirable" profile, as it is the case of individuals with ADHD characteristics (Rief, 2005). Thus, specific training is necessary for both the identification and promotion of students' creativity, and for monitoring suspected cases of students with ADHD. The teacher should be guided on how to position in case of a student with the disorder and the possible consequences on the teaching and learning process.

Preparing teachers for creative teaching, through the implementation of a targeted intervention can reduce stress and feelings of inadequacy that are manifested in face of the increasing demand and pressure from parents, superiors, and students themselves. They all demand solutions to problems such as inattention, agitation, or lack of interest to learn, which may or may not be associated with ADHD. According to Cortella (2003), the biggest challenge that educational systems can and will probably face is to provide education that is capable of dealing with inequalities and diversity.

Hartmann (1997) highlights that an educational environment that favors student's creativity and curiosity, and instigates research skill associated with a reduced number of students in classrooms, encourages a more active participation and can reduce ADHD symptoms. The researcher claims that the stimulation of creativity can help students with ADHD to focus their energy, which may result in possible academic achievement for these students.

This study questions the simplistic and reductionist view in which ADHD is commonly studied and treated, as well as the interventions based on the use of drugs alone for the inhibition of behaviors associated with the disorder. Thus, we intend to defend the existence of ADHD without the medical bias which considers ADHD a disorder with a physiological origin, exclusively.

Therefore, this study aimed at investigating the short and medium term effects of a creativity training program with the 4th grade elementary school teachers on creativity and academic performance of students with or without ADHD. Due to the limited number of empirical studies on the relationship between creativity and ADHD in Brazil, this study, one of the first to associate the two phenomena in our country, aims at contributing to preparing and raising awareness on the importance of teachers developing their students' creative potential in the school context. This study may also guide teachers in relation to the educational practices that may be used to stimulate the creativity of an increasing number of children and youth, regardless of presenting or not characteristics of ADHD. These students need to be challenged and supported in the school context they are inserted in.

The research questions investigated were:

Q1: Are there differences between students of teachers who were trained or not, regarding creativity and academic performance before, immediately after and four months after the creativity training had taken place?

Q2: Are there differences between students with or without ADHD, regarding creativity and academic performance before, immediately after and four months after the creativity training had taken place?

Q3: Do teachers identify similarities between ADHD and creativity? Which one (s)?

Method and Procedures

Design

A quasi-experimental design was used to answer research Q1 and Q2. The independent variables were the groups (students from trained and untrained teachers and students with or without ADHD from trained or untrained teachers) and the dependent variables were creativity and academic performance. A qualitative procedure was used to investigate research Q3.

Participants

The sample included 235 fourth grade elementary Brazilian students from nine classes of a private school in the Federal District. It also included nine fourth grade teachers from the same school. Some of these ($n = 4$) were part of the experimental group and the remainders ($n = 5$) the control group. The choice of school was based on a convenience criterion, once this was the only institution, at the time, to accept the teacher's training proposal.

Participant students were, in average, eight years of age. One hundred and twenty-nine students were male (54.9%) and 106 were female (45.1%). All 235 students took the Torrance Tests of Creative Thinking, Form A, before the beginning of the training process with teachers. Of the total participants, only 148 students, 83 male students (56.1%) and 65 females (43.9%) attended the second application of the Torrance Tests of Creative Thinking, Form B, once the application coincided with the end of the second semester and school year, culminating in the consequent outflow of students.

The third and final application of the Torrance Tests of Creative Thinking, Form A again, had the participation of 130 students, four months after the end of the creativity training with teachers, with students already in the 5th grade of elementary school. Many of the students participating in the previous year were at the time absent or had changed schools for various unspecified reasons.

Four 4th grade classes, with a total of 87 students (37%) comprised the experimental group. In this group, 45 students were male and 42 female. The other 147 students (63%) represented the control group. In addition, the students from both the treatment and control groups were formed by ADHD students ($n = 32$) previously identified by means of clinical evaluation performed by private physicians, according to DSM-IV criteria and recorded on their registration forms. Later on, the ADHD scale—version for teachers (Benczik, 2000b) was applied to confirm diagnostics.

Twenty-six students with ADHD characteristics (81.25%) were male and six (18.75%) were female. Fifteen of these students (46.8%) were part of the experimental group and 17 (53.1%) comprised the control group. Teachers who participated in the training were indicated by the school coordination, and met willingness and availability criteria. Still, teacher's participation in the creativity training sessions was considered voluntary.

Table 1

Number of Participants in Each Phase of the Study, by Group and the Presence or Non-presence of ADHD

	1st phase Pre-test	2nd phase 1st post	3rd phase 2nd post
Treatment group			
With ADHD	15	11	8
Without ADHD	72	52	44
Control group			
With ADHD	17	17	13
Without ADHD	131	89	89

Table 2

Number of Participants in Each Phase of the Study, by Group and Gender

	1st phase Pre-test	2nd phase 1st post	3rd phase 2nd post
Treatment group	42	32	29
Feminine masculine	45	31	23
Control group	64	42	40
Feminine masculine	84	64	62

Instruments

Documental analysis. Information contained on each student's registration form was analyzed and documented, including any notes on treatments or any medications the student was using.

ADHD scale—Teacher's version (Benczik, 2000b). The instrument aims at providing support to the psychological evaluation and the process of diagnosing an attention deficit hyperactivity disorder. The scale, which was answered by the teacher, is composed of 58 items related to characteristics presented by students on factors such as attention deficit hyperactivity/impulsivity, learning difficulties, and antisocial behavior. Items are rated on a 6-point Likert scale ranging from "Strongly disagree" to "Strongly agree". The items on the inattention factor investigate to what extent the teacher perceives aspects related to the student's lack of attention. An example of an item is "moves from one activity to another" or "easily distracted by noises in the classroom". The factor in hyperactivity/impulsivity is assessed to what extent the teacher feels that the student presents the characteristics associated with hyperactivity. Examples of items in this factor are "messes up and squirms in the chair" or "disrupts the lessons with different noises". The items related to the learning difficulty factor examine the teacher's perception regarding the student's learning process such as: "has verbal difficulty to express his/her thoughts" his logical reasoning is slow, "understands texts correctly" and "likes to do math exercises". Finally, the factor called antisocial behavior measures the teacher's perception towards the student's acceptance and interaction with other classmates and the teacher. Examples of items in this factor are: "classmates avoid him", "causes confusion in the classroom", or "knows how to respect teachers". Benczik (2000b) presents evidence of the scale's construct validity. The factor's internal consistency indexes range from 0.90 to 0.97.

TTCT (Torrance tests of creative thinking) (Torrance, 1974; 1990). Four tests were used, two verbal and two figural in the three distinctive moments: Before the creativity training program was conducted (Form A), immediately after its conclusion (Form B) and three months after the training program had been concluded (Form A). In 2002, the TTCT was translated and adapted for the Brazilian population by Wechsler (2002), and it was named creativity evaluation with pictures and words.

Three characteristics of the creative thinking were evaluated: (1) fluency, the number of different answers and solutions students provide in a problem situation; (2) flexibility, the number of different categories of ideas or different ways of facing a problem situation; and (3) originality, which would be the ability to produce rare or unusual, statistically infrequent ideas. The two verbal exercises used in this study were: (1) product improvement, in which students had to think of interesting and unusual ways to improve an elephant toy (Form A) or monkey toy (Form B) in order to have more fun with it; and (2) different uses for cardboard boxes (Form A) or cans (Form B), in which students had to think of different and unique uses these objects could take. The two figurative exercises used were: (1) completing figures, in which students should attach lines to incomplete figures to produce interesting patterns; and (2) parallel lines (Form A) or circles (Form B), in which students should produce objects or pictures using pairs of straight lines or circles presented to them. Each subtest was

completed within a maximum period of 10 minutes.

The responses were evaluated following the test manual standards (Torrance, 1990). Fluency was assessed based on the number of responses relevant to each exercise. Flexibility had the total numbers identified for different categories of answers given by students. With regard to originality, it was assigned value zero to two points for each answer, according to the answer's statistical rarity (Alencar, Fleith, Shimabukuro, & Noble, 1987). The verbal creativity score for each student was obtained by adding up fluency, flexibility, and originality scores of the two verbal exercises. The same procedure was used to reach the final figurative creativity score. A total creativity score was also obtained with the sum of verbal and figural creativity scores.

The choice of the TTCT in this study was due to the fact that it presents strong validity and reliability evidence, besides being the most frequently mentioned test in related literature, and it is continuously used by researchers from several countries, including Brazil (Fleith, Renzulli, & Westberg, 2002; Gontijo, 2007; Healey & Rucklidge, 2005; Mendonça, 2003).

School report. Academic performance was assessed by means of students' assessment results in mathematics and Portuguese provided by the school coordinators, in accordance to official requirements by MEC (Brazilian Education Ministry).

Interview. A semi structured interview guide was used with teachers participating in the study, based on the script used by Mariani and Alencar (2005). It was built to investigate teacher's perception with respect to elements of the work conducted in the educational context that are favorable or limit the creative expression in the classroom. The interview also investigated how teachers perceive ADHD, its relationship with creativity and strategies teachers use to deal with students diagnosed with ADHD.

The Creativity Training Program

The creativity training program proposed in this study supported a diverse and open approach to possible changes and not just the transfer of skills from one context to another, to which it may not have any application. The objectives proposed were: awareness of the importance and urgency of a creative education, promoting the development of creative thinking skills, fostering the development of problem-solving activities, developing affective-emotional attitudes towards strengthening the teachers' confidence to enable them to express their feelings and difficulties, and providing the participants procedures and techniques for stimulating creativity in the classroom. In addition, ADHD was briefly discussed, with updated information on the phenomenon and its implications for teaching. However, it is worth pointing out that the training program was focused in theoretical and practical aspects of creativity.

The program consisted of nine meetings of one hour and 40 minutes each, conducted every two weeks, over a period of five months, comprising a total of 15 hours.

Procedures

The school was contacted and authorization was conceded by directors. Based on criteria such as experience and time in the school, in addition to readiness and willingness for the training program, four teachers were appointed to participate.

The project was then submitted to the Research Ethics Committee of the University of Brasilia. After the project's approval by the Committee, parents and teachers had to fill in a consent term for participation in the study.

Criteria for indentifying ADHD students were based on medical information in the student's school

registration form and/or by indication of the educational coordinator. Then the class teacher filled in the ADHD scale—teachers' version (Benczik, 2000b)—for evaluating each student with an ADHD indication, as well as others who the teacher considered to present ADHD characteristics, despite no medical diagnosis. During the application of the third and final phase of the Torrance Tests, on April 2010, the ADHD scale (Benczik, 2000b) was answered by the teachers considering, at that stage, all students participating in the study, and not just those first recognized with characteristics of the disorder, so that other students with ADHD could be identified.

Individual interviews with teachers were conducted in parallel with the first application of the ADHD scale (Benczik, 2000b). They were recorded and transcribed. Treatment group teachers were interviewed before the first creativity training session. Other teachers had their interviews done during the two weeks following weeks. Each interview took 12 minutes, in average. The next step was to implement the creativity training program with the four teachers assigned.

Participating students answered the TTCT on September 2009, by the time of the beginning of the school term and immediately after the training ended, on December 2009. In addition, the instrument was applied again four months later, on April 2010. The school administration provided the student's Portuguese and math results for the related period.

Data Analysis

The SPSS (Statistical Package for the Social Sciences) 13.0 was used for data analysis. For Q1, a student's *t*-test was applied for intergroup (independent *t*-test) and within groups analysis (paired *t*-test). In the intergroup analysis, students from trained and untrained teachers were compared in relation to academic performance (grades in Portuguese and math) and creativity (verbal, figurative, and total), at different times of the study (pre-, first post-, and second post-test). In the intra-group analysis, each group was compared within itself at different stages of the study (pre-, first post-, and second post-test) with regard to academic performance (grades in Portuguese and math) and creativity (verbal, figurative, and total).

The second question was also answered by a student's *t*-test for intergroup analysis (independent *t*-test) and within groups (paired *t*-test). The independent variables were students' groups (from trained and untrained teachers) and student characteristics (with or without ADHD), and the dependent variables were academic achievement (grades in English and math) and creativity (verbal, figurative, and total). Analyses of variance were performed in complement to the student's *t*-test to investigate significant interactions between independent variables.

The third question was answered by means of a TCA (thematic content analysis) of responses obtained in the interviews with the nine participant teachers. The analysis was conducted in three phases: pre-analysis, the exploration of the material and interpretation. In the pre-analysis, an initial reading of transcripts was done to certify the existence of the object to be exploited, in this case, perceptions on the similarities between ADHD and creativity and to connect the content with comprehensive data. In the operation phase, the codification of material occurred, i.e., a "process by which raw data is processed and aggregated into units, allowing an accurate description of the relevant characteristics of the content" (Bardin, 1977, p. 38). For organizing the codification, three choices are necessary: the choice of units to be considered, enumerating or choice for establishing counting rules, and classification and aggregation, which includes the choice of categories. Information was grouped and distilled into a list of common themes in order to give expression to the communality of voices across participants.

Results

In order to answer research Q1, an independent student's *t*-test was first used to analyze intergroup differences and later, a student's *t*-test for paired samples was applied for intra-group analysis.

The results of the independent student's *t*-test for intergroup analysis presented statistical significance between students of trained and untrained teachers in relation to verbal creativity ($t_{[232]} = 2.95$; $p = 0.003$), figurative creativity ($t_{[232]} = 3.20$; $p = 0.002$) and total creativity ($t_{[232]} = 3.83$; $p = 0.0001$) in the pre-test. Students from trained teachers presented higher scores when compared to students from untrained teachers. No differences were observed between the two groups in relation to performance in Portuguese or mathematics in the first phase of this study.

The results of the first post-test revealed statistical significance between students of trained and untrained teachers in relation to figurative creativity ($t_{[167]} = 2.37$; $p = 0.019$). Students from trained teachers presented higher scores when compared to students from untrained teachers. No differences were observed between the two groups in relation to performance in Portuguese or mathematics in the second phase of this study.

The student's *t*-test also indicated statistical significance in the second post-test between students of trained and untrained teachers in relation to verbal creativity ($t_{[152]} = 3.56$; $p = 0.001$), figurative creativity ($t_{[152]} = 5.45$; $p = 0.0001$), and total creativity ($t_{[152]} = 5.59$; $p = 0.0001$). Students from trained teachers presented higher scores when compared to students from untrained teachers in the three creativity scores. Similarly to the previous phases, no differences were observed between the two groups in relation to performance in Portuguese or mathematics in this phase of this study.

The results of the student's *t*-test for paired samples verified intra-group differences considering the different phases of this study. Initially, for students of trained teachers, the study compared the results of the pre-test with results of the 1st post-test. Statistical significance was observed for figurative creativity ($t_{[62]} = 2.176$; $p = 0.033$), grades in Portuguese ($t_{[62]} = 4.185$; $p = 0.0001$), and mathematics ($t_{[62]} = 4.816$; $p = 0.0001$).

The students of trained teachers presented higher performance in the pre-test for figurative creativity and results in mathematics compared to results of the 1st post-test. However, in relation to Portuguese, students' results were higher in the 1st post-test when compared to the pre-test.

Further analysis compared the results of the pre-test with results of the creativity 2nd post-test. Statistical significance was verified for verbal creativity ($t_{[51]} = 4.74$; $p = 0.0001$), figurative creativity ($t_{[51]} = 2.803$; $p = 0.007$), and total creativity ($t_{[51]} = 4.47$; $p = 0.0001$). The students of trained teachers presented higher performance in the 2nd post-test in verbal creativity, figurative creativity, and total creativity.

Finally, the study compared results presented by students of trained teachers in the 1st creativity post-test with results from the 2nd creativity post-test. Statistical significance was observed for figurative creativity ($t_{[42]} = 4.14$; $p = 0.0001$), total creativity ($t_{[42]} = 3.67$; $p = 0.001$), and grades in Portuguese ($t_{[86]} = 2.45$; $p = 0.016$) and in mathematics ($t_{[86]} = 3.24$; $p = 0.002$).

Students of trained teachers presented higher performance in the 1st post-test in Portuguese. On the other hand, in figurative creativity, total creativity and mathematics, students' performance was higher in the 2nd post-test.

A student's *t*-test for paired samples was also run for students of non-trained teachers viewing the identification of intra-group differences in the different phases of the study. Initially, results of the pre-test were compared to results of the 1st post-test. Statistical significance was observed for verbal creativity ($t_{[105]} = 3.355$;

$p = 0.001$) and results in mathematics ($t_{[145]} = 4.365$; $p = 0.0001$).

Students of non-trained teachers presented higher performance in mathematics in the pre-test when compared to the 1st post-test. However, in relation to verbal creativity, students' performance was higher in the 1st post-test.

The study also compared the results of the pre-test with results of the 2nd creativity post-test. Statistical significance was observed for verbal creativity ($t_{[101]} = 5.01$; $p = 0.0001$), total creativity ($t_{[101]} = 3.64$; $p = 0.0001$), and grades in mathematics ($t_{[131]} = 6.06$; $p = 0.0001$).

Students of non-trained teachers presented higher performance in math in the pre-test when compared to results of the 2nd post-test. On the other hand, in relation to verbal creativity and total creativity, students' performance was higher in the 2nd post-test in comparison to pre-test results.

Finally, students of non-trained teachers had the results of the 1st creativity post-test compared to the results of the 2nd creativity post-test. Statistical significance was observed for figurative creativity ($t_{[84]} = 3.170$; $p = 0.002$) and results in mathematics ($t_{[131]} = 2.48$; $p = 0.014$).

The students of non-trained teachers presented higher performance in math in the 1st creativity post-test when compared to results of the 2nd post-test. On the other hand, in relation to figurative creativity, students' performance was superior in the 2nd post-test when compared to the results of the 1st post-test.

In order to answer research Q2, an independent student's *t*-test was once again used for the analysis of intergroup differences, followed by a student's *t*-test for paired samples for intra-group analysis.

The pre-testing results indicated statistical significance between students with and without ADHD in relation to figurative creativity ($t_{[233]} = 2.147$; $p = 0.033$), grades in Portuguese ($t_{[35,309]} = 5.229$; $p = 0.0001$) and mathematics ($t_{[35,981]} = 4.187$; $p = 0.0001$). Students without ADHD characteristics presented higher performance when compared to students with the disorder in relation to figurative creativity and grades in Portuguese and mathematics. No differences in relation to verbal and total creativity were observed between the two groups.

Statistical significant differences were also observed between students with and without ADHD in the 1st post-test results in relation to grades in Portuguese ($t_{[231]} = 6.479$; $p = 0.0001$) and mathematics ($t_{[231]} = 2.214$; $p = 0.028$). Students without ADHD characteristics presented higher performance in Portuguese and mathematics when compared to students with the disorder. No differences in relation to verbal and total creativity were observed between the two groups.

Finally, the 2nd post-test results pointed out statistical significant differences between students with and without ADHD in relation to verbal creativity ($t_{[152]} = 2.766$; $p = 0.006$), total creativity ($t_{[152]} = 2.526$; $p = 0.013$), Portuguese ($t_{[217]} = 6.439$; $p = 0.0001$), and math grades ($t_{[234]} = 4.608$; $p = 0.0001$).

Students without ADHD characteristics presented higher performance in verbal creativity, total creativity, Portuguese, and mathematics when compared to students with the disorder. No differences in relation to figurative creativity were observed between the two groups.

Student's *t*-tests for paired samples were also conducted to verify intra-group differences considering the different phases of the study. Initially, students with ADHD characteristics had the results of creativity tests in the pre-testing compared to results from the 1st post-testing. No statistical significant differences were observed for any creativity measure, Portuguese, and mathematics.

Yet, when comparing results of the pre-testing with the 2nd post testing of students with ADHD, statistical significance was observed in relation to grades in mathematics ($t_{[31]} = 2.279$; $p = 0.030$). These students

presented higher performance in math prior to the creativity training program. No statistical significant differences were observed when comparing results of the 1st post-test with the 2nd post-test for any measure.

Student's *t*-tests for paired samples were also conducted to verify intra-group differences of students who did not present ADHD characteristics in the different phases of the study. Initially, results of the pre-test were compared to results of the 1st post-test. Statistical significant differences were observed for students without ADHD characteristics in verbal creativity ($t_{[140]} = 3.827$; $p = 0.0001$), figurative creativity ($t_{[140]} = 3.788$; $p = 0.0001$), and grades in Portuguese ($t_{[200]} = 2.583$; $p = 0.011$) and mathematics ($t_{[200]} = 7.054$; $p = 0.0001$).

Students without ADHD presented higher performance in figurative creativity and math in the pre-test results. Yet, in verbal creativity and Portuguese, a higher performance may be observed in the 1st post-test results.

Now the comparison of results obtained in the pre-test with results of the 2nd creativity post-test, pointed statistical significant differences in relation to verbal creativity ($t_{[132]} = 7.845$; $p = 0.0001$), figurative creativity ($t_{[132]} = 2.899$; $p = 0.004$), total creativity ($t_{[132]} = 6.260$; $p = 0.0001$), and mathematics ($t_{[186]} = 5.604$; $p = 0.0001$). Students without ADHD characteristics presented higher performance in pre-test results only in mathematics. However, these students presented higher performance in all creativity measures in the 2nd post-testing results.

Finally, results that compared the 1st post-test with the 2nd post-test results revealed statistical significant differences for figurative creativity ($t_{[108]} = 6.076$; $p = 0.0001$), total creativity ($t_{[108]} = 4.093$; $p = 0.0001$), and Portuguese grades ($t_{[186]} = 2.229$; $p = 0.027$). Students without ADHD characteristics presented higher performance in Portuguese in the 1st post-test, whereas figurative and total creativity had higher performance in the 2nd post-testing results.

In order to complete the data analysis and check possible interactions between groups (students of trained teachers and students of untrained teachers) and students (with and without ADHD) in relation to total creativity, figurative and verbal creativity in the first and second post-test results a univariate analysis of variance was conducted.

Once results of the students *t*-test results presented before did not evidence gains in academic achievement for students participating in the study, an analysis of variance was not conducted for this dependent variable.

In order to answer research Q3, a thematic content analysis was held as proposed by Bardin (1977). The nine teachers who participated in the study, four in the treatment group and five in the control group were interviewed individually at their school before the beginning of the creativity training program.

Teachers' perception in relation to creativity was investigated by means of an interview. They were first asked about what it was to be a creative teacher and whether they considered themselves creative teachers. All the respondents emphasized elements such as fun, play, new and different ideas, resource availability and innovation as key elements to be creative and to work in an environment that stimulates creativity. Only one teacher stated not to consider herself a creative teacher all the time. She said: "Sometimes, yes. Because of routine and rush, we sometimes cannot prepare a lesson which is so dynamic, cool, and creative as, students deserve".

Another teacher said that at the moment, after four years of training provided by the school, she considered herself creative. The teacher made a reference to the mathematical training offered to teachers by the school on a continuous basis, year after year.

The participants were asked to talk about the characteristics and identification of an ADHD student. All

the teachers characterized this student as restless and impatient, and that this condition could lead to lack of attention. The responses obtained characterized ADHD as a harm that impairs learning. In addition, some of the teachers stated that these students require more from teachers, which demands different, creative classes in order to enable them to pay attention and participate. One of the teachers responded: "These children have difficulty to concentrate, learn a lesson that is not creative, that's it".

Another teacher added: "It's not that this student does not learn, but everything calls his/her attention, then the teacher must know, be careful, understand the details and use creativity to do a different work".

The teachers also were directly asked whether they perceived similarities between ADHD and creativity. Two major thematic groups emerged from responses: (1) valued or positive perceptions; and (2) rejected or negative perceptions. Valued or positive perceptions relate to how teachers see or perceive reality in such a way as to cause positive reactions. Negative perceptions were related to or rejected as they see or perceive reality in such a way as to generate negative reactions. The group of responses concerning perceptions of positive and valued relationship of similarity between ADHD and creativity comprised coding units that were categorized as (1) movement, represented by the components agitation, fast response, and high energy; and (2) search for new, represented by the components making something differently, construction, curiosity. Therefore, both in creativity and in ADHD, the search for new and movement is present.

Rejected or negative perceptions of the relationship between ADHD and creativity were: (1) restlessness, represented by words such as nervousness and lack of limits; (2) lack of interest, represented by words such as dispersion and disorganization; and (3) inattention, lack of focus. Both the creative and the student with ADHD are restless, inattentive, and uninterested. It is interesting to note that the characteristic agitation is sometimes perceived as positive and other times negative, when it is called nervousness. The positive or negative perception from the teacher, in this case, varied according to the proposed academic activity in the classroom.

The interviews revealed that eight teachers identified similarities between ADHD and creativity, but these similarities were not always perceived as positive. Six teachers had a negative perception of the relationship between creativity and ADHD. Many of the features present in creative students, as well as students with ADHD, are perceived as difficult to understand and to be accommodated in the school environment.

One teacher said she first believed in the similarity between creativity and ADHD, but then contradicted herself, making reference to a polarity in her evaluation, in which the creative student is normal and the one with ADHD characteristics is not. She had a negative perception of the relationship between the two phenomena: "Yes, I believe in the similarity between, but in creativity the student develops the normal way, just like all the other students, which does not happen with ADHD students".

Two teachers made references to the similarities between creativity and ADHD and had a positive perception of the relationship when they said: "I have two ADHD diagnosed children who are really creative. They are the leaders, they want to do everything, models, play games, the problem is only in reading, or when they need to copy something".

They seem to have their attention turned towards everything and everyone: "I believe gifted children are also impatient".

Look, sometimes, if we are not very careful, we end up confused. What the child present is a high ability on one hand. On another context, you end up by considering that as an attention deficit.

Those kids are very curious; they ask too much.

It may also be observed that one of the nine teachers stated not to identify similarities between creativity

and ADHD; thus, no relationship between the two phenomena was identified. This teacher's statement reveals a positive perception of what creativity is, while she perceives ADHD as a negative condition, as reported: "In the creative student, you notice a twinkle in the student's eye, his thirst, restlessness, to show his/her creativity, not the impatience of being in the school environment".

It is also interesting to observe how the above teacher perceives the student with characteristics of ADHD negatively, a student who does not act according to the expectations for the rest of the students in the class. The teacher expressed her feeling with a metaphor: "It is like a granulate mixture; it may be mixed, but it will continue to be grainy, not as the other ingredients that remain homogeneous".

Discussion

Creativity has been increasingly recognized as a valuable and indispensable skill that needs to be developed in personal and social terms, especially at this time in history marked by rapid and radical changes, with an increasing demand for flexibility and imagination (Cropley, 2006). In this sense, it is important to stress the role that schools can play in stimulating the creative potential of its teachers and students. Therefore, this study aimed at investigating the short- and medium-term effects of a creativity training program with 4th grade elementary school teachers in relation to the creativity and academic performance of students with and without ADHD.

The results of the pre-training phase indicated superior performance for students of trained teachers in relation to the three creativity measures, pointing towards a previously existing advantage of these teachers' students when compared to students of non-trained teachers. However, it is of our knowledge that teachers selected to participate in the training was not done randomly, but through indication of the school coordination, based on the teaching time in that institution and the additional fact that those teachers had already participated in an ongoing mathematics training program, which was occurring concurrently with the creativity training program, involving all other 4th grade teachers from that school.

Thus, teachers were chosen based on their experience, recognized for their outstanding professional performance, in addition to the availability presented at the time, which may explain the results obtained in the pre-test.

The mean results obtained in the 1st intra-group post-tests revealed superior performance in figurative and total creativity for students of trained teachers in relation to students of untrained teachers. Similarly, the results of the 2nd post-test showed superior performance of students of trained teachers in verbal creativity, figurative creativity and total creativity, thereby confirming an advantage in relation to students of trained teachers when compared to those students of the control group teachers regarding creativity scores.

Despite results that demonstrated higher performance in creativity measures in the 1st and 2nd post-testing results, this study cannot surely state the influence of the creativity training program with teachers in the creative potential of their students, since these students had already started with an advantage over the treatment group. Moreover, other variables such as the greater experience of teachers in the treatment group may also have influenced the results.

A study conducted by Castro and Fleith (2008) focusing on creativity and the relationship between teaching experience and type of school indicated that more experienced teachers give greater support to students when they want to express their ideas. These students also demonstrated a more positive perception of the climate in the classroom as for an interest to learning. Moreover, the study states that perhaps, when in

action, new teachers are more concerned with the transmission of content or with other aspects such as discipline, giving little attention to students' ideas, and so, corroborating the results in this study.

The analysis for the verification of intra-group differences in the different phases the study revealed, once again, that students of trained teachers presented higher performance in the pre-test results for figurative creativity and grades in mathematics when compared to the 1st post-test results. One possible explanation for the improved performance of these students may once again be the higher experience of treatment group teachers.

With respect to Portuguese grades, students of trained teachers obtained higher results than in the 1st post-test compared to the results of the pre-test, which is a possible positive indication of the creativity the training program on their teaching practices. The discussion and proposal for the implementation of some strategies to develop their creative potential such as brainstorming, divergent thinking stimulant activities, which favor the development of critical thinking, as well as drama and the use of metaphors, may have cooperated for the favorable results.

Bragotto's (2003) creativity development program makes use of strategies like my story, puzzles, playing with words, use of metaphors, guided fantasy, adventure, poetry, establishing connections, recreation with popular sayings and others to encourage participation, involvement and the development of the creative potential. The researcher says that the stimulus to new forms of reasoning and of an inquisitive and spontaneous behavior releases the independent thinker, encouraging him/her to learn the language (in this case Portuguese) and fosters self-discovery for those involved in the learning process.

It is an interesting aspect to point out that students from untrained teachers presented higher performance in mathematics in the pre-test results when compared to both the 1st post and 2nd post-test results. We can infer a possible influence of the mathematics training program these teachers were part of, at the time, as determinant for this outcome. On the other hand, there were gains in relation to verbal, figurative, and total creativity by students, pointing to the influence of other variables in action or the exchange of experience with trained teachers, a common practice in schools.

Results of the pre-test compared to 2nd post-test demonstrated higher performance in the post-test in the three creativity measures for students of trained teachers. However, there are also gains in verbal and total creativity in the results of students in the control group. Therefore, we cannot state with precision that gains in verbal and total creativity of students in the treatment group were solely due to the creativity training program conducted in this study.

In addition, the 1st post compared to the 2nd post-test results of students from trained teachers exhibit higher performance for figurative and total creativity, as well as mathematics in the 2nd post-test, except for Portuguese, which showed higher performance in the 1st post-test results. However, with the group of control students the results differed; there was higher performance only in figurative creativity in the 2nd post compared to the 1st post-test results and in math in the 1st post compared to the 2nd post test. These results indicate a medium term effect of the training program or the impact of any other change in the school environment.

The results of the analysis that investigated the differences between students with and without ADHD in relation to creativity and academic performance indicated that students without ADHD characteristics obtained higher performance when compared to students who had these characteristics in relation to figurative creativity, Portuguese and mathematics in the pre-test. In the 1st post-test, we observed gains for students without ADHD

in relation to performance in Portuguese and mathematics. Results from the 2nd post-test presented, once again, superior performance for students without ADHD in relation to verbal and total creativity, Portuguese and mathematics. In other words, the academic superiority of students without ADHD was evident.

These results do not support the studies by Honos-Webb (2005), which consider that the presence of ADHD features may represent a difference, which will stand out in the form of a creative ability in the educational environment. In a bold and exciting proposal, the researcher seeks to convince parents, doctors, and professionals that the educational problems presented by children with ADHD characteristics should be viewed as differences that may be transformed and emerge as opportunities and unique talents for this group of people. Hartmann's (2003) and Palladino's (1999) studies suggest that ADHD characteristics are yet little understood and corroborate Honos-Webb's (2005) view.

Without discarding the creative skills inherent to the fact students may or may not have ADHD characteristics, the results in this study cannot confirm the aforementioned research. Empirical data here stated give us evidence that students without ADHD are more creative than those with the disorder. Even after the teacher's training, students with ADHD showed no significant differences in creativity or academic performance.

The results of teachers' perception on the similarity between creativity and ADHD revealed, at first, that all of them believe the development of the creative potential is important in the educational context and they consider themselves to be creative. In addition, teachers in the treatment group characterized students with ADHD as restless and impatient, with an imbalance, a condition that could lead to lack of attention. The responses of these participants also stressed ADHD as a disease that impairs learning, similar to studies by Barkley (2002), which state that a third or more of all children with ADHD characteristics are unlikely to achieve the objectives proposed by regular schools and thus, will not achieve the results projected for them.

Similarly, several other studies (e.g., DuPaul & Stoner, 2007; Moon, 2002; Pastor & Reuben, 2002; Rapport, Scalan, & Denney, 1999; Tanelotto, 2003; Woolfolk, 2006) call attention to the negative impact of ADHD on learning, emphasizing the poor performance of students with ADHD characteristics in doing tests, as well as difficulties in carrying out tasks related to studies, lack of organization in relation to school material and desks, lack of attention to teacher's explanation and frequent interruptions of ongoing class.

Regarding the similarities between ADHD and creativity, teacher's reports revealed that almost all of them identified similarities between ADHD and creativity, but that these were not always perceived as positive. These data corroborate Neihart's study (2004), in which the researcher asserts that when establishing a relationship between creativity and ADHD, teachers tend to focus attention on the negative behaviors or on those that negatively affect the teaching and learning process, with greater impact on results, thus failing to perceive the students' creative expressions.

In this sense, even though the teacher has a key role in stimulating the creative potential, a teacher or student training alone as a methodology is not sufficient for the development of creativity. Accordingly, other practices should be suggested, for example, incorporating creativity into the curriculum, the content being taught in a constant manner throughout the school year, instead of attempting a single training program (Fleith, 1999). Moreover, ongoing training for teachers is necessary with the use of appropriate technology in order to make them conscious and prepared for changes in the so called information society, where everyone is relearning how to learn, communicate, and teach a new generation of students.

It is essential that we continue the search for alternatives to develop the creative potential of teachers and

students in the school environment. Content adaptation, teacher's training, as well as teaching practices that encourage divergent thinking, curiosity, and independent behavior are essential in building a new consciousness, involvement, and motivation in the teaching and learning process.

Finally, we must learn to deal with children presenting ADHD characteristics, know their limitations, and find teaching methods that best suit this group. These children must be taught to focus on a learning situation, to analyze, verify the possible solutions and their consequences. It is important that teachers understand that the ADHD child is someone with a potential that may or may not be developed, and recognize their responsibility for the outcome in this process. The best teacher should be one that by developing the student's creative potential will have greater balance and readiness to establish and evaluate the alternatives that best function in practice.

It is necessary that researchers conduct a deeper analysis of interventions to be performed, time to be consumed, appropriateness of content and activities, and focus on understanding the psychosocial environments in which the student is inserted. We must also remember the importance of training all professionals involved in this process, in order to foster the development of these students' creative abilities and ensure their implementation in the personal and social context, in solving problems, and in handling the uncertainties arising from present changes.

Conclusion

With the increasing prevalence of ADHD in Brazil and worldwide, it is mandatory that we find educational solutions, as the implementation of teacher's training programs, which should have a continuous and systematic focus, as to combine preventive and remedial approaches in teaching this particular group students, thereby avoiding academic failure and dropout (Du Paul & Stoner, 2007).

According to Bekle (2004), the various myths in relation to ADHD, such as the relationship with absent parents, a disease that must be treated with a medical approach or even the dependence that ADHD medication may cause, suggest lack of information and the need for a greater number of studies. It is imperative that the disorder be considered not only from a medical standpoint, but also that ADHD's implications in the school performance be analyzed, so that educators may elaborate plans and proposals that meet the needs of this group of students.

The presence of a medical model in the school environment is still prevalent not only in Brazil but also elsewhere in the world. Therefore, any different or unusual behavior is regarded as a sign of a disease (DuPaul & Stoner, 2007). A paradigm shift is necessary, so schools and professionals may consider the differences from a point of the inclusion, not exclusion, as in the case of ADHD, and the creative potential as an alternative, prior to a possible disorder. Honos-Webb (2005) points out features in individuals with ADHD as divergent thinking and great curiosity, and points to the stimulation of the creative potential as a tool that can be developed by schools in favor of learning.

However, this study provides empirical evidence of the difficulty and disadvantage in the learning process of students with ADHD characteristics and, therefore, to consider the disorder as a talent or gift, as suggested by Hartmann (2003) is very simplistic and even naive. Even so, his theory inspires us to consider ADHD differently, trying to understand the increasing number of ADHD diagnoses in the world. It is necessary that educators have an educational focus and acquire technical and scientific knowledge in search for solutions to behavioral and learning problems presented by these students. We must not forget that the difficulties in

sustaining attention, lack of organization and agitation will affect academic performance of students with ADHD.

According to Evans and Meyer (1985), an educational focus should not only focus on teaching the necessary skills and knowledge to replace problem behaviors of a specific and singular group. Given the chronic nature of ADHD, a continuous and systematic approach should be adopted by teachers and schools. Only the control of social behavior and conduct in the classroom via drugs is not enough. Schools and teachers must be prepared to optimize academic achievement (DuPaul & Stoner, 2007).

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