Creativity and Intelligence in Primary School Children with and without Attention Deficit Hyperactivity Disorder

Master's thesis

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Abstract

The purpose of the present study was to examine the relationship between creativity and intelligence for children with and without Attention Deficit Hyperactivity Disorder (ADHD). First, this study explored if children with ADHD (n =22) were more creative than children without any diagnosis (n = 532). Second, intelligence scores were compared between children with ADHD and children without any diagnosis. Lastly, the study also examined if children with a higher intelligence were more creative. Results showed that children with ADHD were not more creative than children without any diagnosis (p = .494). Likewise, there was no difference in verbal intelligence (p = .515) and visual-spatial intelligence (p = .218) between both groups. Besides that, it appears that higher intelligent children without any diagnosis were more creative (p < .001). Finally, this study found that there was no difference in the relation between verbal intelligence (p =. 936) or visual-spatial intelligence (p = .276) and creativity for children with ADHD and without any diagnosis. These findings have implications for the support of children with ADHD in inclusive education, because children with ADHD demonstrate different problem behaviors and experience difficulties in regular classrooms. Therefore it is valuable to know the strengths and possibilities of children with ADHD, so that these can be used to support these children in an appropriate way.

Keywords: creativity, intelligence, ADHD, primary school children

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During the last century, inclusive education has become an important goal in education. This means that children with disorders like Attention Deficit Hyperactivity Disorder (ADHD) are educated in regular classrooms instead of being send to a special school (De Boer, Pijl, & Minnaert, 2011). ADHD is one of the most prevalent disorders in children. In most cultures it affects around 5% of the children (Polanczyk, Silva de Lima, Horta, Biederman, & Rohde, 2007). ADHD is characterized by a persistent pattern of inattention and/or hyperactivity and impulsivity, which influences daily functioning or development (Diagnostic Statistic Manual of Mental Disorders Fifth Edition, 2013). On the behavioral level, inattention manifests in lacking persistence, difficulty keeping attention, and being disorganized. Additionally, some features of hyperactivity involve being overly active at times when it is not appropriate and excessive fidgeting. Finally, impulsivity refers to actions that take place in a moment without thinking of the consequences or thinking ahead. These actions reflect a desire for immediate rewards or the inability to delay satisfaction. The several symptoms must be present before age 12, are not due to a limited understanding and occur in more than one setting, such as home and school. The existence of the symptoms can vary between settings because of the context within the setting. For example, when a child is interacting in a one-on-one situation, it is possible that he/she will not be distracted by his surroundings (American Psychiatric Association, 2013). Due to the different characteristics, children with ADHD demonstrate different problem behaviors at school, such as inattention, failing in finishing tasks, and difficulty ignoring distractions (Barry, Lyman, & Klinger, 2002; Fugate, Zentall, & Gentry, 2013). These behaviors could be associated with less positive academic achievement (Barry et al., 2002). However, despite academic problems, there are also many possibilities for children with ADHD (Fugate et al., 2013). For example, positive aspects of ADHD include individual productive qualities like being creative, good at creating new ideas (Lerner, 2016), and the ability to break through organizational inactiveness (Verheul et al., 2015).

Because ADHD had been linked to enhanced creative abilities (Lerner, 2016), the present study focused on creativity. Furthermore, nowadays creativity is seen as one of the skills that is necessary in the 21st century (Dede, 2010). Sternberg and Lubart (1996) even state that creativity is required to be successful. Creativity is seen as the production of something new, different, innovative and also relevant, and appropriate for the task (Sternberg, 1999a). Creative thinking is a part of creativity that requires the sensitivity to

solve problems as well as the ability to redefine problems, which include transformation of thoughts and fixedness in achieving a unique solution to the problem. Creative thinking consists of verbal and visual creative thinking (Guilford, 1960). The difference between verbal and visual creative thinking is that the solution for the problem can be written in words (i.e. verbal) or in drawings (i.e. visual). It appears that children and adolescents with ADHD are more creative than children and adolescents without ADHD (Abraham, Windmann, Siefen, Daum, & Güntürkün, 2006; Cramond, 1994). In the study of Abraham and colleagues (2006) adolescents with ADHD and a control group did four tasks, which focused on different processes of creative cognition. In addition, Cramond (1994) tested adolescents with ADHD, and a control group of highly creative adolescents, who had to complete the *Torrance Tests of Creative Thinking Figural Form A* (TTCT). Both studies compared the results of both groups and found that children and adolescents with ADHD were more creative. Additionally, some researchers propose that there are similarities between creative individuals and those with ADHD, such as inattention, oversensitivity and impulsivity (e.g. Cramond, 1994; Healey & Rucklidge, 2006). Children with ADHD would have high performances in some domains of creativity. They may be better problem-solvers and more creative in unusual ideas (Lawrence et al., 2002; Zentall, Kuester, & Craig, 2011). However, Lawrence and colleagues (2002) state that their findings were not generalizable to the general population of children with ADHD because of the use of an atypical sample. In addition, the sample tested in the research of Zentall and colleagues (2011) is not clinically labeled with ADHD. Instead, they used teacher-ratings of hyperactivity and/or inattention. Both limitations may ensure that these findings do not entirely apply for children with ADHD. On the other hand, some studies suggest that there were no differences in the creative abilities of children with and without ADHD (e.g. Aliabadi, Davari-Ashtiani, Khademi, & Arabgol, 2016; Healey & Rucklidge, 2005). Aliabadi and colleagues (2016) and Healey and Rucklidge (2005) tested children with ADHD and children without any diagnosis to find out if children with ADHD were more creative. Both studies administered the TTCT to measure creativity and found that there were no differences between both groups. While other studies report that creative functioning is worse in children with ADHD (Alessandri, 1992; Funk, Chessare, Weaver, & Exley, 1993).

Besides that ADHD and creativity seems to correlate with each other, some studies indicated that creativity and intelligence could also be related (Ojha, Indurkya, & Lee, 2017; Runco, 2007; Silvia, 2015; Sternberg, 1999b). Intelligence is considered to be a heterogeneous construct that exists of different aspects of cognitive functioning and problem solving (Maehler & Schuchardt, 2016). One of these aspects is the ability of reasoning (Süß,

Oberauer, Wittmann, Wilhelm, & Schulze, 2002), which is used during problem-solving (Sternberg, 1980), and depends on general knowledge (Kyllonen & Christal, 1990). In addition, Kyllonen and Christal (1990) found that reasoning and working-memory, which is another aspect of intelligence, were highly correlated (close to $r = .90$) and thus similar aspects. This supports the finding of Shah and Miyake (1996) indicating that verbal working memory is involved with tasks that consists of reasoning with verbal materials, whereas visual-spatial working memory is involved with tasks that consists of reasoning with visual-spatial materials. It appears that intelligence and creativity are related to each other (Ojha et al., 2017; Runco, 2007; Silvia, 2015; Sternberg, 1999b). First of all, the threshold theory state that an individual needs a certain level (the threshold) of intelligence to have the possibility to be creative (Runco, 2007). This implicates that intelligence is necessary but not satisfactory for creative achievement. Thus someone can be highly intelligent without being creative or can be creative without having high levels of intelligence (Sternberg, 1999b), but only if the levels of intelligence are above the threshold. In addition, Silvia (2015) argued in his review that there is a strong relation between intelligence and creativity, because they use the same cognitive processes. This corresponds with the research of Ojha and colleagues (2017), who found that adolescents with different levels of intelligence used the same characteristics of information processing in both creative and intelligence tasks. In conclusion, it remains unclear in which way intelligence and creativity are related to each other.

In response to these findings, it can be concluded that the relations between creativity and intelligence, and creativity and ADHD can be viewed from many different perspectives. Due to the inconclusive results, it is unclear whether ADHD and creativity are related to each other in primary school children, and how intelligence affects creativity and ADHD. Therefore, the present study examined whether there is a relationship between creativity and ADHD, how intelligence is related to both constructs and if there is a difference within this relation between children with and without ADHD. For this reason the following question will be answered in this research: What is the relationship between creativity and intelligence in primary school children with and without ADHD? To answer this question, the following sub-questions were formulated: (a) Are children with ADHD more creative than children without ADHD?; (b) Do children with ADHD have a lower or higher IQ than children without ADHD?; (c) Are children with a higher IQ more creative?; and (d) Is the relation between creativity and intelligence different for children with ADHD and without ADHD?

By answering these questions, the current study aims to fill the gap in the existing knowledge, because limited research has been done regarding creativity and intelligence in

children in primary school. This is important because creativity is seen as an important skill to be successful (Sternberg & Lubart, 1996). If children with ADHD are indeed more creative than their peers without ADHD, and intelligence and creativity seems to be related to each other, this could be helpful in supporting these children in inclusive education. As supposed by the research of Fugate and colleagues (2013) and Lerner (2016), creativity is a strength of ADHD and the support could be based on this strength. For example, through using strategies like creative writing, problem solving and using different ways (e.g. cartoons and role-plays) to educate children with ADHD (Fugate et al., 2013). In addition, these strategies can be adapted to the level of intelligence of a child, so that these strategies could be sufficiently challenging for each child.

Method

Participants

The population consisted of children in group 6 or group 7 of schools for regular primary education in the Netherlands. The schools were selected through a convenience sample. Twenty-four schools agreed to participate in this study. Fourteen schools had a contract with the University of Utrecht to join a broader study. The broader study investigated the characteristics of imagery thinking in primary school children. In addition, the other 10 schools were recruited by the researchers of this study. They contacted their existing network of primary schools in the Netherlands. After active consent was obtained from their parents, 765 children between eight and twelve years old took part in this study. Children with any other disorder then ADHD, with missing scores or with outlying scores were removed from the data. So that these disorders, missing scores and outliers did not affect the results. This resulted in the removal of 223 children from the total sample. The sample (n = 554), tested in this study, consisted of 285 girls (M = 119,75 months old, SD = 8,81 months) and 269 boys (M = 121,21 months old, SD = 8,83 months). Prior to this study, the teacher was asked which children were clinically diagnosed with ADHD or any other disorder. This made it possible to divide the total sample in two groups, one group consisting of 22 children who had the diagnosis ADHD, and one group consisting of 532 children who had no diagnosis. Because the original sample of children with ADHD was too small (n = 11), 11 additional children with ADHD were selected, who participated in the same study a year prior to the current study.

Instruments

Intelligence. In this study, two types of intelligence were measured namely: verbal intelligence and visual-spatial intelligence.

Verbal intelligence was measured by the subtest “Categorieën” from the Nederlandse Intelligentietest voor Onderwijsniveau (NIO; Van Dijk & Tellegen, 2004). In this subtest children have to find a logical relation between two words. The words can be identical, contrary, a sort of, a part from, or a cause and meaning to each other. The children get a piece of paper with 30 groups of two words. For each couple of words they have to choose between the six options. An example: the two words *light-dark* were presented to the child. In which way are these words related to each other? The right answer is that they are contrary to each other. The reliability of the subtest “Categorieën” has been assessed as good (α = .86; Van Dijk & Tellegen, 2004).

Finally, visual-spatial intelligence was measured with the subtest “Uitslagen” from the NIO (Van Dijk & Tellegen, 2004). Children get a piece of paper with eight items. The items consist of one three-dimensional figure and five two-dimensional options. One or more of the five options can be folded into the three-dimensional figure. Children had to choose which items were the right options (see Figure 1). The reliability of the subtest “Uitslagen” has been assessed as good (α = .82;Van Dijk & Tellegen, 2004).

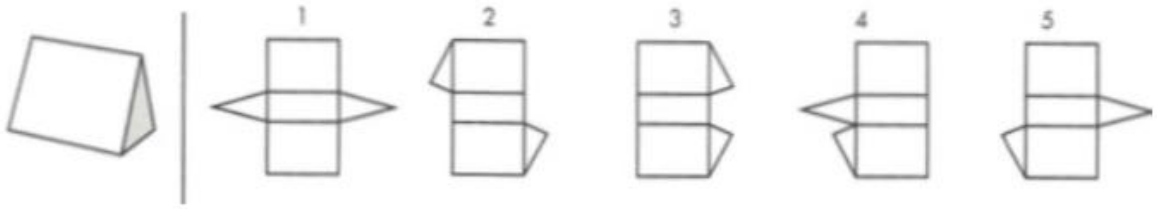

Figure 1. Example of one item from the NIO subtest ‘Uitslagen’ (Van Dijk & Tellegen, 2004).

Creativity. In this study visual creative thinking will be measured by the Test for Creative Thinking – Drawing Production (TCT-DP; Urban & Jellen, 1996). In this test, children received a drawing of six unfinished figures. Each figure has a different shape, design, and position in the drawing. The children were asked to finish the drawing (see Figure 2). The results were scored according to fourteen key criteria such as continuation, new elements, perspective, humor and affectivity. The interrater reliability has been assessed as good (α = .87; Urban, 2004).

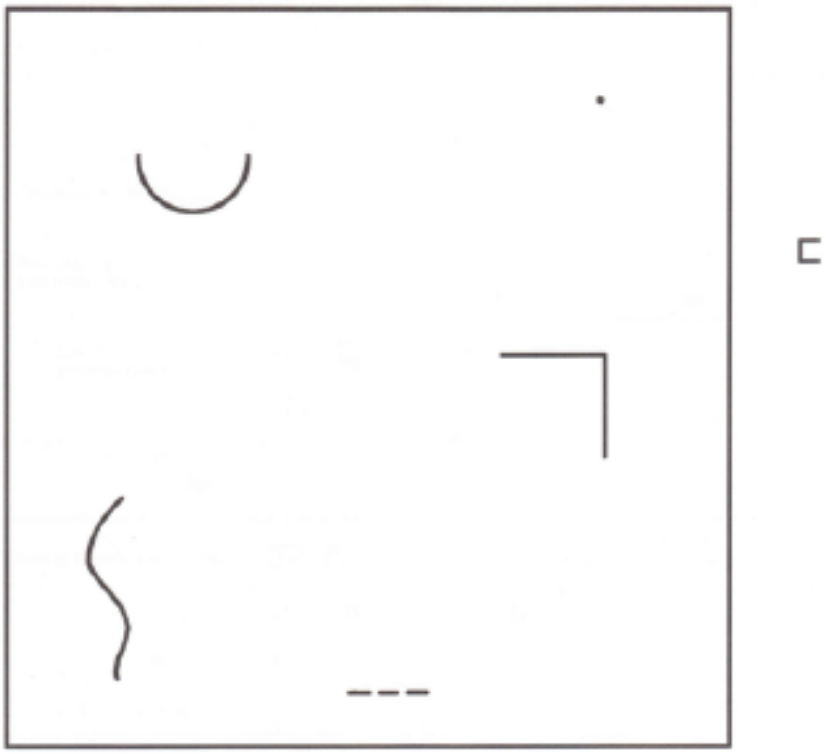

Figure 2. The TCT-DP (Urban & Jellen, 1996)

Procedure

Prior to the start of the different tests, this study was approved by the Ethics Committee of the Faculty of Social and Behavioral Sciences of the University of Utrecht. In this way, consideration has been given to different ethical aspects of the current study. For example, whether or not children with ADHD were allowed to use medication. This study did not control for medication use of children with ADHD because it consisted of an one-time participation for each child. In addition, the children who used medication have certain medication levels in their blood, which we did not want to influence for an one-time participation. Finally, this study did not focused on the influence of medication on the performance of the children with ADHD, so therefore it would have been unethical to ask them to use no medication.

The three different tests were conducted in each class consisting of circa 25 to 30 children, depending on how many children had received permission from their parents. Only children in group 6 or group 7 were allowed to participate in this study. The only inclusion criterion was that they had permission from their parents. When the children did not get permission, they received another task from their teacher. First, the children started with the

two subtests of the NIO, followed by the TCT-DP. This part took about one hour. The current study is part of a larger study, therefore children had to do three more tasks. They filled in a questionnaire about imagery thinking and another creative task, which took about 30 minutes. After the group wise administration the class was divided in groups of four or five children, which came in turns to a separate room to finish different computer tasks. These tasks measured working-memory and executive functions and took about 45 minutes for each child. When all the tests were finished, the teacher received a book voucher, as a gift for participating in this study. The children, who participated, did not get anything for their participation. Because this study was part of a larger study not all the obtained data was used. Only the data acquired from the instruments as described above was used in this study.

Data-analysis

Statistical tests were performed with the data analytic program SPSS. Previous to each test the relevant assumptions, as written in Field (2013), were checked. These will only be discussed when the assumptions were violated.

For the group with ADHD, the assumption of normality proved to be violated on the TCT-DP, according to the Shapiro-Wilks test of normality, $W(22) = 0.910$, $p = .046$. For the group without any diagnosis, the assumption of normality proved to be violated on the TCT-DP, $W(532) = 0.964$, $p < .001$, on the NIO subtest 'Categorieën', $W(532) = 0.984$, $p < .001$, and on the NIO subtest 'Uitslagen', $W(532) = 0.984$, $p < .001$, according to the Shapiro-Wilk test of normality. Because some assumptions were violated, non-parametric tests were conducted. The descriptive statistics for each group are described in Table 1.

For the first research question, a Mann-Whitney U test was used to interpret if there was a significant difference in creativity between children with and without ADHD. Because the distributions of scores for the two groups had a different shape, mean ranks of the scores were used to compare the groups. For the second research question a Mann-Whitney U test was used to interpret if there was a significant difference in intelligence between children with and without ADHD. The distributions of these scores also had different shapes, therefore mean ranks of the scores were used to compare the groups. For the third research question a Spearman's Rho was used to interpret if there was a significant relation between creativity and intelligence for children without any diagnosis. Finally, also for the fourth research question a Spearman's Rho was used to interpret if there was a significant difference in the relation between creativity and intelligence for both groups. To compare the correlational values of both groups, the Fisher r to z transformation (Lowry, 2013; Steiger, 1980) was

conducted to find out if there was a significant difference between the relation of intelligence and creativity for children with and without ADHD.

Table 1.
Mean scores and standard deviations for the group without any diagnosis and the ADHD-group on the TCT-DP, NIO Subtest 'Categorieën' and NIO Subtest 'Uitslagen'

	No diagnosis (n = 532)		ADHD (n = 22)	
	M	*SD*	*M*	*SD*
TCT-DP	22.42	9.20	22.09	8.30
NIO Subtest 'Categorieën'	9.14	4.02	8.55	4.36
NIO Subtest 'Uitslagen'	24.80	4.87	23.41	4.47

Results

Creativity in children with ADHD (*Mean Rank* = 276.95) did not differ significantly from children without any diagnosis (*Mean Rank* = 277.52), U = 5840.00, z = - .016 (corrected for ties), p = .494, one-tailed. This indicates that children with ADHD were not more creative than children without any diagnosis.

Also verbal intelligence in children with ADHD (*Mean Rank* = 255.77), did not differ significantly from children without any diagnosis (*Mean Rank* = 278.40) , U = 5374.00, z = -.652 (corrected for ties), p = .515, two-tailed. Thus verbal intelligence appears to be similar in children with ADHD and without any diagnosis. Additionally, visual-spatial intelligence in children with ADHD (*Mean Rank* = 236.43) did not differ significantly from children without any diagnosis (*Mean Rank* = 279.20), U = 4948.50, z = -1.231 (corrected for ties), p = .218, two-tailed. This indicates that visual-spatial intelligence was similar in children with ADHD and without any diagnosis.

Furthermore, we found a positive correlation between verbal intelligence and creativity in children without any diagnosis, r_s = .170, p < .001, one-tailed. Moreover, we also found a positive correlation between visual-spatial intelligence and creativity in children without any diagnosis, r_s = .195, p < .001, one-tailed. Thus, it appears that children without any diagnosis, who had higher levels of verbal and visual-spatial intelligence were more creative.

Lastly, we found no significant correlation between verbal intelligence and creativity, r_s = .151, p = .501, two-tailed, and between visual-spatial intelligence and creativity in children with ADHD, r_s = -.058, p = .787, two-tailed. This indicates that in children with

ADHD, intelligence and creativity do not interfere with each other. To compare the correlational values, the Fisher r-to-z transformation was conducted. We found no significant correlation between the two groups (see Table 2), which indicates that there was no difference in the relation between creativity and intelligence for children with ADHD and children without any diagnosis.

Table 2
Fisher r-to-z transformation scores for correlations between the TCT-DP and NIO Subtest 'Categorieën' and NIO Subtest 'Uitslagen'

	TCT-DP	
	z	*p**
NIO Subtest 'Categorieën'	0.08	.936
NIO Subtest 'Uitslagen'	-1.09	.276

Note. *two-tailed, *z* = *z*-score on the Fisher r-to-z transformation

Discussion

The current study focused on the relationship between creativity and intelligence in primary school children with and without ADHD. Many research is done about the relation between creativity and ADHD (e.g. Alessandri, 1992; Funk et al., 1993; Lawrence et al., 2002; Zentall et al., 2011) and creativity and intelligence (e.g. Ojha et al., 2017; Runco, 2007; Silvia, 2015; Sternberg, 1999b), however the findings were inconclusive. Therefore, the purpose of the current study was to fill in the gap of existing knowledge. This is important because nowadays inclusive education plays an important role in education. Children with ADHD demonstrate different problem behaviors and experience difficulties in regular classrooms (Barry et al., 2002; Fugate, et al., 2013). Therefore, it is valuable to know the strengths and possibilities of these children, so that these can be used to support these children in an appropriate way. The current study found no differences in creativity and intelligence for children with and without ADHD. However, it appears that children without any diagnosis who had higher intelligence were also more creative. Finally, the main finding of this study indicated that there was no difference in the relation between creativity and intelligence for children with and without ADHD.

A first result of this study showed that children with ADHD were not more creative than children without any diagnosis. This finding is in line with research done by Aliabadi and colleagues (2016) and Healey and Rucklidge (2005), who also found that there were no

differences between both groups. However, there is a contradiction to the findings of Lawrence and colleagues (2002) and Zentall and colleagues (2011), who found that children with ADHD were more creative in some domains of creativity. An explanation could be that the studies of Lawrence and colleagues (2002) and Zentall and colleagues (2011) were not entirely focused on the relation between creativity and ADHD, and therefore used other measures, like videogames and video recording, to find their outcomes. While this study and the studies of Aliabadi and colleagues (2016) and Healey and Rucklidge (2005) were entirely focused on the relation between ADHD and creativity, and used respectively well known creativity measures like the TCT-DP and TTCT.

In addition, this study also indicated that children with ADHD were not more or less intelligent than children without ADHD. However, children with ADHD demonstrate problem behaviors at school (Barry et al., 2002), which undermine their academic performances (Barry et al., 2002) and hinder the ability to obtain crucial skills such as social contact with peers and teachers (Greenfield Spira & Fischel, 2005). For example, they experience difficulties with impulse control and hyperactivity (Greenfield Spira & Fischel, 2005). On the other hand, we found no difference between the intelligence of children with and without ADHD, meaning that this does not seem to be a cause of the negative academic performance. In addition, it might be possible that, with appropriate support, children with ADHD perform on the same level as children without ADHD. Further research should therefore examine the relation between ADHD and negative academic performance, so that children with ADHD could be better supported in the classroom.

Despite that children with ADHD were not more creative than children without any diagnosis, the current study found that higher intelligent children without any diagnosis were more creative on a visual-spatial creativity task. This relation applied for both verbal and visual-spatial intelligence. Silvia and Beaty (2012) state in their research that intelligence is associated with creative reasoning and imaginary in visual-spatial creativity. In this research intelligence was measured by verbal and visual-spatial reasoning which, according to Silvia and Beaty (2012), fits well with the visual-spatial creativity task and could be the cause of this relation. The current study only used a visual-spatial creativity task, thus no statements could be made about verbal creativity. Therefore further investigation should examine both domains of creativity and in which way they are related to the different domains of intelligence. In contrast to the above finding, no correlation was found between intelligence and creativity in children with ADHD. This makes sense because, as stated by Lawrence and colleagues (2002) and Zentall and colleagues (2011), children with ADHD would be better in some domains of

creativity, and the current study only measured the domain of visual-spatial creativity. Besides that, according to Silvia and Beaty (2012), the measurements of intelligence and creativity used in the current study should fit together. Furthermore, there were no differences in intelligence between both groups, from which can be concluded that they score both above the threshold of intelligence (Runco, 2007). It remains unclear why this relation does not apply for children with ADHD. Therefore further research should examine the influence of ADHD in this relation.

Finally, the relation between creativity and intelligence for both groups were compared to each other. Results showed that there was no difference in the relation between creativity and intelligence for children with and without ADHD. This indicates that this relation is the same for children with and without ADHD. All the previously mentioned recommendations could have an influence on this finding.

In addition, there were also a number of limitations of this study. A first limitation involved the possibility that children with ADHD took medication before taking part in this study. A limitation is therefore that we did not control for medication use, which may have influenced results. This may be a possible explanation for finding no differences between both groups. For example, Hernández and Selva (2016) suggest that medication affects the creative skills of children with ADHD. However, research also indicates that medication does not affect the creative skills of children with ADHD (Funk et al., 1993; Swartwood, Swartwood, & Farrel, 2003). Thus, it remains unclear whether medication does have influence on the creativity of children with ADHD. Further research should therefore examine what the influence of medication could be on the creativity of children with ADHD. Another limitation has to do with the environment where this study took part. The different tests were administered in the classroom, with all the children together. As many researchers proposed, this environment has a negative influence on the performance of children with ADHD (Barry et al., 2002; Greenfield, Spira, & Fischel, 2005). This study has not taken into account the influence of this environment on the results of children with ADHD. Also, this may be a possible explanation for finding no difference between the two groups. Therefore, further investigation should do research to children with ADHD in other settings like one-on-one situations, in which children with ADHD were less distracted and could easier focus their attention.

A strength of this study was that it only included children who were clinically diagnosed with ADHD. This made it possible to make statements about this population. Likewise, the influence of self-, parent- and teacher-ratings of characteristics of ADHD, used

in other research (Fugate et al., 2013), can be excluded. Besides that, for the group of typically developing children were strict exclusion criteria, so that no other disorders would have influence on their scores. This made it possible to make a pure comparison with the group of children with ADHD and forms another strength of this study.

In general, the current study found no difference in the relation between creativity and intelligence for children with and without ADHD. However, this does not mean that the different variables could be related and have influence on each other. All recommendations together show that further research must be done to explore this relation and to find new ways in which children with ADHD could be supported in an appropriate way in school.

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