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Intelligence and Creativity: Relationships and their Implications for Positive Psychology

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Abstract
There is little consensus on the relationship between intelligence and creativity. This study aimed to investigate the associations between these constructs considering the importance that creativity has for positive psychology. Two studies were conducted using two test batteries: the first with 876 children and adolescents (55% female) using the Battery for Assessment of High Abilities/Giftedness and the second with 285 adolescents (54% female) with the Battery for Assessing Intelligence and Creativity. The results were analyzed by exploratory and confirmatory factor analysis and indicated that intelligence and figural and verbal creativity are independent factors, with little correlation between figural creativity and intelligence and a moderate relationship between verbal creativity and intelligence. In conclusion, it is necessary to evaluate both intelligence and the different types of creativity considering their contributions for identifying human potential and their influence on wellness.
Keywords: Creativity, intelligence, talents, human potential, wellness.

Inteligência e Criatividade: Relações e Implicações para Psicologia Positiva

Resumo
Existe pouco consenso na literatura científica acerca da relação entre inteligência e criatividade. Esse estudo teve como objetivo investigar as associações entre os dois construtos considerando a importância da criatividade para a Psicologia Positiva. Dois estudos foram conduzidos fazendo-se uso de duas baterias de teste: o primeiro com 876 crianças e adolescentes (55% mulheres) com a Bateria para Avaliação das Altas Habilidades/Superdotação, e o segundo com 285 adolescentes (54% mulheres) com a Bateria para Avaliação da Inteligência e Criatividade. Os resultados, analisados por meio da análise fatorial exploratória e confirmatória indicaram que inteligência, criatividade figural e criatividade verbal são construtos independentes, com baixa correlação entre criatividade figural e inteligência e correlação moderada entre criatividade verbal e inteligência. Conclui-se acerca da necessidade da avaliação tanto a inteligência quanto a diferentes tipos de criatividade considerando sua contribuição para a identificação do potencial humano e sua influência no bem-estar.
Palavras-chave: Criatividade, inteligência, talentos, potencial humano, bem-estar.

Inteligencia y Creatividad: Relaciones e Implicaciones para la Psicología Positiva

Resumen
Existe poco consenso en la literatura científica sobre la relación entre inteligencia y creatividad. Este estudio tuvo como objetivo investigar las asociaciones entre los dos constructos teniendo en cuenta la importancia de la creatividad para la psicología positiva. Dos estudios se llevaron a cabo mediante el uso de dos baterías de tests: el primero con 876 niños y adolescentes (55% mujeres) utilizándose el test para Evaluación de Altas Capacidades/Superdotación, y el segundo con 285 adolescentes (54% mujeres) con la Batería para Evaluación de la Inteligencia y la Creatividad. Los resultados, analizados a través del análisis factorial exploratorio y confirmatorio indicaron que inteligencia, creatividad figural y creatividad verbal son constructos independientes, con baja correlación entre creatividad figural e inteligencia, y correlación moderada entre creatividad verbal e inteligencia. Se concluye sobre la necesidad de evaluación tanto de la inteligencia como de los diferentes tipos de creatividad considerando su contribución para la identificación del potencial humano y su influencia en el bienestar.
Palabras clave: Creatividad, inteligencia, talentos, potencial humano, bienestar.

The broad interest in studying intelligence and creativity can be explained by the need to understand human potential and well-being (Sternberg, Grigorenko, & Singer, 2004; Kaufman & Beghetto, 2009). Both constructs were initially considered negative aspects of the individual. With creativity, this characteristic has been seen as associated with certain psychopathological characteristics (Batey & Furnham, 2008; Chavez-Eakele, Del Carmen Lara, & Cruz-Fuentes, 2006), that indicate the presence of madness or deviations from normality (Fink, Slamar-Habedl, Unterrainer, & Weiss, 2012).

Intelligence, however, has focused primarily on deficit identification and school failure since the beginning of its evaluation through tests (Funham, Batey, Anand, & Manfield (2008). Thus, one can note that from these perspectives, the definitions of these constructs in terms of assessment held, for many years,

a pejorative character. However, with the progress of cognitive and positive psychology, these constructs were valued for promoting the advancement of society, thus indicating the importance of identifying them to promote individual's well-being and creative contributions to humanity (Krentzman, 2013; Peiffer & Wechsler, 2013).

Especially in recent decades, a paradigm change in research involving remodeling the two themes in psychology began. In this way, two different research foci were created but not disassociated. The first was characterized by an interest in illness and psychopathology, and the other focused on the aspects that guarantee healthy individual development and was called positive psychology (Selingman & Csikszentmihalyi, 2000). Creativity, as a psychological trait, was also affected by this view, shifting through the decades to become the focus of studies that considered it a positive and important characteristic for human development (Charyton, Hutchinson, Snow, Rahman, & Elliot, 2009). As such, most studies have identified creativity as a characteristic that is present in all individuals, varying only by level (Beguetto & Kaufman, 2007; Kaufman & Beghetto, 2009). Similarly, intelligence has proved to be one of the attributes that is most valued today, with relevance not only for school systems in general but also for everyday behaviors and social and professional interactions (Faria, 2007).

Although intelligence and creativity are well-studied phenomena, there is disagreement concerning their definitions still today (Furnham, Batey, Anand, & Manfield, 2008; Silvia, 2008). The conceptualization of intelligence and its evaluation have undergone numerous changes, demonstrating the complexity of this construct. The main controversy still regards the dimensions of this construct, which was historically understood as one general factor (G) and subsequently understood as a composition of two factors (fluid or crystallized) or a combination of hierarchical factors or abilities (Carroll, 1997; McGrew, 2009; Sternberg & Kaufman, 2001). In contrast, creativity has been studied from different perspectives, thus implying the existence of multiple components (person, product, process and press), which interact with cognitive and personality characteristics and environmental factors, notably because of family, educational and societal influence (De La Torre & Violant, 2006; Wechsler, 2009 Wechsler & Nakano, 2011).

Although major theoretical advances have been made with respect to the isolated investigation of each construct, researchers have for many years debated the nature of their relationship; even after a great deal of research, consensus is far from being reached. Subsequent investigations have questioned the existence of this relationship and the level of the association, in addition to its stability in time and generalizability to different populations (Elisondo & Donolo, 2010). The results of empirical studies have suggested the existence of at least some relationship between creativity and intelligence, as noted by Kim (2005), who, after conducting a meta-analysis of 21 studies containing 447 correlation coefficients and more than forty-five thousand participants, identified a relationship that the author considered small (r =.17) but that was positive between the two constructs.

Three main models can be identified in the literature. The first explanation states that creativity and intelligence are highly related, thus assuming that people who can conceptualize and explore abstractions can also generate new ideas and exploit them (Sternberg, 2001). The second explanation questions whether intelligence and creativity are independent constructs, such that one does not need to be smart to be creative or vice versa (Getzels & Jackson, 1962). This suggests that other factors could determine creative potential beyond intelligence or IQ (Kim, Cramond, & Bandalos, 2006). Finally, the third model, also known from the theory of the threshold, defends that the relationship cannot be simply linear but that it must exist from a certain level of intelligence, from which creativity can express itself (Jauk, Dunst, & Neubauer, 2013; Preckel, Holling, & Wiese, 2006), especially with an IQ of approximately 120 (Lubart, 2007).

An important fact when discussing the relationship between creativity and intelligence is that, despite the important contributions of both constructs for understanding human functioning, there are no national test batteries that can assess them jointly. Consulting the tests that are currently approved by the Federal Council of Psychology as presenting scientific psychometric qualities – which are listed online through the System for the Evaluation of Psychological Test (SATEPSI; http://www2.pol.org.br/satepsi) – indicates that intelligence is typically evaluated based on the G-factor model. There are only three batteries of tests that measure intelligence through different abilities: the Battery of Differential Reasoning (BRD), the TSP Battery and the Battery of Reasoning Tests (BPR-5); the latter has more validation and reliability studies (Primi & Almeida, 2000; Primi, Nakano, & Wechsler, 2012).

Regarding assessing creativity, despite the growing body of research in this area (Wechsler & Nakano, 2011), the number of valid tests for assessing this construct is also small. Two national instruments are approved and listed in SATEPSI: the Children's Creativity Figural Test (Nakano, Wechsler, & Primi, 2011) and the Scale of Thinking Styles and Create (Wechsler, 2006b). Two other creativity instruments, which were adaptations of the most internationally used tests for assessing creativity, are the Torrance creativity tests: Thinking Creatively with Words (Wechsler, 2004a) and Thinking Creatively with Pictures (Wechsler, 2004b). Thus, there is a great need to develop and validate new instruments to assess creativity in the Brazilian reality.

With awareness of this gap, efforts have been initiated by Brazilian researchers, so that two batteries of tests designed to assess these dimensions are currently in the process of validation: the Battery for the Assessment of High Abilities (Nakano & Primi, 2012) and the Intellectual and Creative Assessment Battery (Wechsler et al., in press). Considering the discussion about the relationship between the two constructs, discussed previously, this paper presents the results of two studies that elaborate on the two new test batteries to determine how the constructs of intelligence and creativity are present in these batteries and their relationships as cognitive structures.

Method

Study 1

Participants

The sample was composed of 867 children and adolescents (484 female), students from the fourth to ninth years of elementary, with ages ranging from 8 to 16 years old (M = 11.4 years, SD = 1.7 years). The participants were from eleven different schools located in two different regions of Brazil, the northeast (n = 210, students from two different schools) and the southeast (n = 538, students from nine different schools located in four cities). The participants were selected based on convenience criteria.

Instrument

Battery for Assessment of High Abilities/Giftedness (Nakano & Primi, 2012)

This test battery is composed of four subtests of intelligence (Verbal, Abstract, Numerical and Logical Reasoning) and two subtests of creativity (Completing Test Figures and the Metaphors Creativity Test). A small number of studies have already been conducted to examine the validity of this battery for the Brazilian culture, involving its factor structure as well as evidence of criterion validity (Ribeiro, Nakano, & Primi, 2014), analysis of adjustment indices based on item response theory and research evidence of construct validity by analyzing the hierarchical organization of the items in relation to their difficulty (Nakano et al., 2014).

The Verbal Reasoning test (VR) presents 12 pairs of sentences with related words to be completed by analogies. The Abstract Reasoning (AR) test is composed of 12 items containing sets of two pairs of images, one incomplete in each pair. On the Numerical Reasoning (NR) test, there are 12 numerical sequences in which the last two numbers of each sequence are missing. The Logical Reasoning (LR) test presents 12 questions consisting of practical everyday problems.

The Completing Test Figures test evaluates figural creativity using drawings that must be made to complete 10 different stimuli. The evaluation of each drawing is made considering the occurrence of eleven creative characteristics: Fluency, Flexibility, Elaboration, Originality, Expression of Emotion, Fantasy, Movement, Unusual Perspective, Internal Perspective, Use of Context and Expressive Titles. These scores are grouped into three factors: (1) Elaboration, consisting of Fantasy, Unusual Perspective, Internal Perspective, Use of Context and Elaboration); (2) Emotional, comprising Expression of Emotion, Movement and Expressive Titles; and (3) Cognitive, consisting of Fluency, Flexibility and Originality.

The Metaphor Creation Test consists of five items containing phrases to which the examiner can create metaphors. Each idea is scored by judges on a scale of 0 to 3 (from a non-metaphor to a well-created metaphor) evaluated in relation to its quality, composed of the equivalence (the effectiveness of the association between elaborate ideas) and remoteness (the distance between semantic fields, which comprises good metaphors).

Procedures

After approval by the Research Ethics Committee, parents' approval was requested to begin this research. The data were collected with the help of a graduate student and undergraduate students. A number of schools were contacted. Those who first responded affirmatively to the survey were selected. The battery

was administered in a single application session over approximately 1 h 40 min, with the intelligence tests administered before the creativity tests.

With the reasoning subtests, we considered the total number of correct answers on each of the four subtests as well as a total intelligence score (the sum of the results from the four subtests). On the figural creativity test, the occurrence of characteristics in each of the drawings produced by the participants was scored and subsequently summed to obtain a total quantity in each characteristic. Then, the scores on the three factors were calculated as well as a total score.

Finally, the Creation Metaphors Test followed a correction system that was attended by twelve judges, who received databases with all of the answers to be evaluated by assigning a score for the Quality factor (0 to 3). Zero points indicated an idea that was not a metaphor, one point indicated an idea that was a metaphor but with little semantic distance between the two words, two points indicated a good metaphor with semantic distance between the ideas and three points denoted a very advanced and remote metaphor.

Subsequently, the "Many-Facet Rasch Model" or Facets model (Linacre, 1994) was used to estimate item difficulty, the subjects' abilities and the judges' requirements. The participants' theta scores participant were equalized as assessed by an "average" judge to make comparable the differences in requirements of the judges who corrected the answers.

Results

At first, the relationship between the constructs of intelligence and creativity was investigated through Pearson's correlation. Considering the total scores on the subtests, there was a moderate correlation between intelligence and figural creativity (.25) and high correlation between intelligence and verbal creativity (.53). Irrespective of the type of creativity considered, the correlation with intelligence was significant, with the magnitude varying according to the type of creativity considered.

Measures of intelligence showed relationships of greater magnitude with verbal measures of creativity, and some measures of creativity had low correlation between themselves (.18). Subsequently, a more detailed analysis that focused on investigating these relationships among the various measures that comprised each construct evaluated was performed. The results are presented in Table 1.

Table 1
Correlations between Measures of Creativity and Intelligence

Measure	Fig_Elab	Fig_Emo	Fig_Cog	Metaphor
VR	.173**	.169**	.074*	.422**
AR	.172**	.171**	.037	.408**
NR	.139**	.150**	.059	.389**
LR	.276**	.212**	.128**	.487**

*p≤0.05; **p≤0.01.

Note. VR = verbal reasoning, AR = abstract reasoning, NR = numerical reasoning, LG = logical reasoning, Fig_Elab = elaboration figural creativity factor, Fig_Emo = emotional figural creativity factor, Fig_Cog = cognitive figural creativity factor.

According to the results in Table 1, the correlations between the four subtests of intelligence and verbal creativity were positive and significant, and the same is verified with figural creativity, in the elaboration and emotional factors. The exception occurs with the cognitive factor, whose relationship with AR and NR was not significant.

After the correlations were estimated between the observed measures of intelligence and creativity, a second analysis was performed to estimate the correlations between latent variables using a structural equation model. The statistical analysis was performed with the program AMOS 16 (Arbuckle, 2007) using the method of maximum likelihood. The fit of a three-factor model (intelligence, verbal creativity and figural creativity) was tested.

To identify the model, the metric of the latent variables was fixed at zero for the mean and one for the standard deviation. Four indices were used to analyze the models' fit, following the literature recommendations (Byrne, 2001; Schweizer, 2010). The chi-square index indicates the magnitude of the discrepancy between the observed covariance matrix and the modeled matrix. Higher values indicate poor fit; however, the chi-squared (in AMOS, this appears as CMIN) is affected by sample size; thus, we recommend using the $\chi 2/df$ index (values above two indicate good fit). The Comparative Fit Index calculates the model's relative fit model by comparing it with the null model (in which the variables have zero correlation between them). Values above .95 indicate good fit. The root-square error of approximation index is also a measure of discrepancy but one that penalizes model complexity. Values less than .05 indicate good fit. Finally the standardized

root mean square residual (SMR) reports the standardized means of the errors (discrepancies between the observed and modeled matrices). Values less than .10 are indicative of good fit.

The results showed that the three-factor model showed good model fit: $\chi 2 = 71.874$, df = 24, $\chi 2/df = 2.995$, RMSEA = .058, CFI = .98. In Figure 1, the final model is presented with the estimated parameters.

As observed in Figure 1, there were higher correlations between the intelligence and creativity constructs. Intelligence was correlated especially with verbal creativity at moderate magnitude (.58), and there was low magnitude between intelligence and figural creativity (.36, with .26 between the two types of creativity). In this model, intelligence, figural creativity and verbal creativity proved to be separate constructs.

Study 2

Participants

This sample consisted of 255 participants (54% female) of ages ranging from 15 to 19 years old (M = 15.29; SD = 0.52). They were students enrolled in the 2nd and 3rd years of public high school (56.9%) and private schools located in two cities in Sao Paulo state). The sample selection criterion was parents' permission or the students' signed agreement to participate in 3 testing sessions of 1.40 hours each.

Instruments

1) Adult Battery of Intelligence and Creativity-BAICA (Wechsler et al., in press). This battery is composed of 4 intelligence subtests (verbal ability,

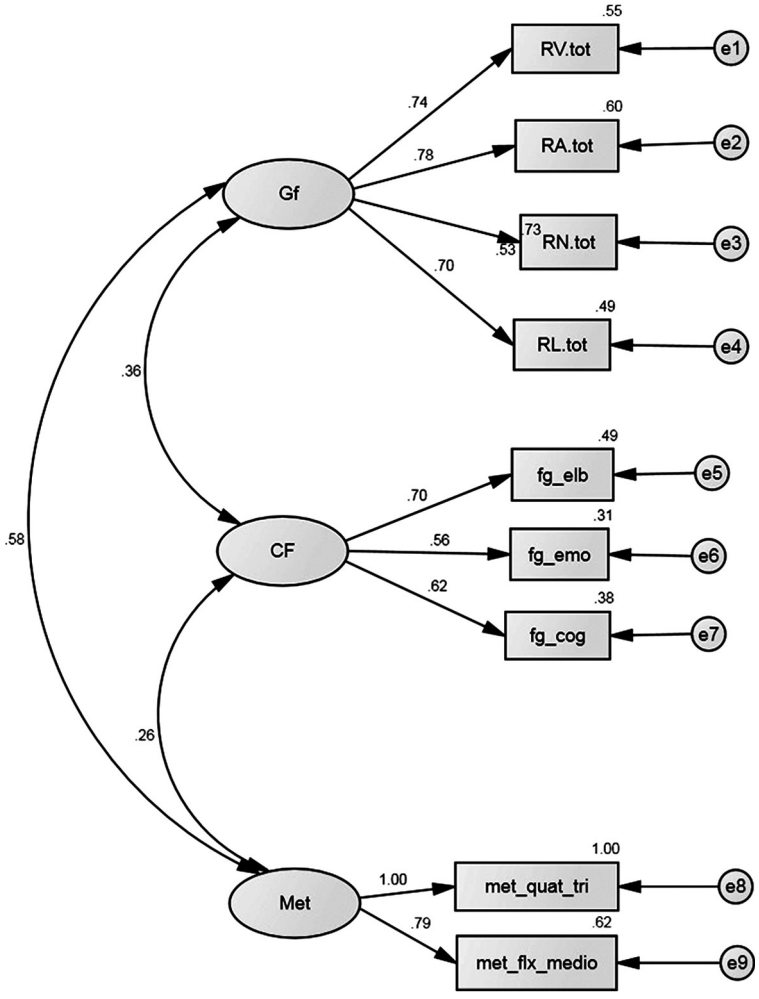

Figure 1. Model of three related factors with standardized factor loadings (Gf = fluid intelligence; CF = figural creativity; Met = metaphor production).

spatial reasoning, logical thinking, reasoning speed) and one creativity test (figural and verbal activities). The intelligence subtests were elaborated based on the results of previous research with the Woodcock-Johnson III battery (WJ-III), which demonstrated the need to construct Brazilian items to identify intellectual abilities (Wechsler, Vendramini, & Schelini, 2007; Wechsler et al., 2010a). The creativity test was constructed to amplify the evaluation of cognitive abilities because this dimension is not evaluated in the WJ-III battery. New items were elaborated to allow for evaluating each cognitive dimension in the BAICA battery by group administration, thus differing from the WJ-III, which is individually administered.

The verbal ability test is composed of 3 measures: synonyms with 31 substantives, antonyms with 30 adjectives and analogies with 30 pairs of words. Responses are presented in multiple-choice format. Items for the BAICA verbal ability tests were retrieved from the Houaiss electronic dictionary of the Portuguese language (Houaiss, 2007). Items that were extremely easy (90% or more correct answers) or difficult (1% or fewer correct answers) were eliminated, resulting in the present test composition. The spatial reasoning test is composed of 31 incomplete forms to be rearranged as a puzzle. The logical tests present 16 geometrical forms to be selected in 31 situations according to different criteria: size, shape and position. The reasoning speed test presents 60 lines with pairs of duplicate stimuli, composed of mixtures of letters and numbers.

The creativity test is composed of 3 activities: 1 figural task, for which 8 pairs of parallel lines in different positions are to be completed by drawings; 2 verbal tasks, the first one presenting a situation that requests questions and the second depicting an imaginary situation the consequences of which are to be described. The construction of the creative thinking subtest was based on previous research with the figural and verbal Torrance tests of Creative Thinking, which were already validated for Brazilians (Wechsler, 2004a, 2004b, 2006a).

2) *Battery of Reasoning Abilities-5 (Bateria de Provas de Raciocinio-BPR-5) by* Almeida and Primi (1998). This battery is composed of different cognitive abilities: verbal, spatial, abstract, mechanical and numerical. The first three were used for this research to enable comparisons with the same constructs measured by the BAICA. The validity and reliability of these tests for high school students are presented in the test manuals. These tests evaluate fluid intelligence (Gf, abstract and visual thinking) and crystallized intelligence (Gc, verbal reasoning), according to Primi and Almeida (2000).

3) *Divided and Alternated Attention tests* (*Teste de Atenção Dividida – TEADI e Teste de Atenção Alternada – TEALT*) by Rueda (2010). These tests were selected for comparison with the BAICA subtest because the tasks are very similar to that presented on the WJ-III to measure Gs (reasoning speed). Abstract designs with small details are presented on the same line and require the detection of repeated items in a short amount of time. The validity and reliability of these tests compared with other measures are presented in the test manuals.

4) *Torrance Tests of Creative Thinking- verbal and figural-TTCT (*Wechsler, 2004a, 2004b). These tests were created by Torrance (1966) and validated for Brazil by Wechsler. The figural test is composed of 3 activities, for which drawings are requested for different types of stimuli. The verbal test is composed of 6 activities, depicting a figures and situations that require the respondent to ask questions, draw conclusions and make suggestions and inferences. Although these tests can be scored for both cognitive and emotional characteristics, in this study, only the cognitive characteristics were used (Fluency, Flexibility, Elaboration, Originality, Expressiveness of Titles) to compare them with the BAICA cognitive measures. The validity and reliability of these tests are reported in the test manuals and were reported as well by Wechsler (2006a).

Procedures

The institutional Ethical Committee previously approved the research. Students were invited to participate in four testing sessions of 2 hours each, during or after school, depending on the school directors' approval. The intelligence measures (4 BAICA subtests, 3 BPR tests) were administered in the first sessions, followed by the TEADI-TEALT, the figural and verbal TTCT and the BAICA creativity test.

The verbal, logical and spatial reasoning subtests were each corrected, giving 1 point for a correct answer and zero for incorrect ones. The speed reasoning test was corrected by the total number of correct answers given in 5 minutes of testing time. The 3 creativity test activities were scored according to the cognitive characteristics of Fluency, Flexibility, Originality, Elaboration, and Title abstractness (for the figural activity only). Originality scores were given according to the following criteria: an answer of 5% or more frequency is considered common and receives zero; all others receive one point because they are considered to be original.

These are the same criteria utilized in Torrance's creativity tests (Torrance, 1990). The raw scores obtained for correct answers on the BPR-5 and on the TEADI/TEALT tests were used for comparison.

The Pearson correlation was first calculated to investigate the convergence among the BAICA intelligence scores and the BPR-5 and attention tests (TEADI, TEALT). The convergence between the BAICA creativity scores and Torrance's measures was also explored. Then, exploratory factor analysis was undertaken to investigate whether creativity and intelligence would form more than one factor, using each individual intellectual and creativity score.

Results

To investigate the association between intelligence and creativity, the Pearson correlation was calculated. The results are presented in Table 2. As can be observed in Table 2, there were significant correlations between the total BAICA intelligence score and the total BPR-5 cognitive score (.65; $p \leq .01$). Significant correlations were also found between the total BAICA intelligence score and the TEADI (.35; $p \leq .01$) and the TEALT (.35; $p \leq .01$).

The BAICA creativity tests were analyzed for figural and verbal tasks. The verbal tasks had significant correlations with the Torrance verbal creativity test (.52; $p \leq .01$). However, the BAICA figural creativity score had only slight correlation with the Torrance figural creativity tests. The total BAICA intelligence score also had either small or no significant correlations with the BAICA figural and verbal creativity tests. Only the BPR-5 correlated with Torrance's verbal creativity test (.33; $p \leq .05$). Thus, intelligence and creativity were found to have slight relationships.

The factorial structures of the intelligence and creativity tests were then analyzed through exploratory factor analysis using the principal components method. For this purpose, all dimensions measured by the subtests were entered in the analysis, not only the total scores. The criteria for including a variable were eingenvalue > 2 and loading ≥ .30. The rotation method was Oblimin with Kaiser Normalization because of the supposed correlations among the measured dimensions. The results are presented in Table 3.

The results obtained by the exploratory factor analysis indicated the existence of 4 main components or factors that explained 53.61% of the total variance. Inspections of each of the loading dimensions clearly indicate that intelligence and creativity are present in separate factors.

The first factor is composed of the 4 BAICA intelligence tests (speed, verbal, and spatial reasoning and logic), the three BPR-5 tests (spatial, abstract and verbal) and the two TEADI/TEAL tests, explaining 20.07% of the variance. Thus, this is a definite intelligence factor.

The second, third and fourth factors are composed of creativity measures. The second factor is composed of the three BAICA figural creativity dimensions (fluency, flexibility, elaboration) and 2 measures

Table 2
Correlations among the Total Scores for the Intelligence and Creativity Measures

Tests	BA intel	BA vercre	BA figcrea	BPR-5 cog	TTCT vercrea	TTCT figcrea	TEADI	TEALT
BAintell	----	.131	.148	.656**	.141	.127	.352**	.359**
BAvercreat		-----	.094	.171	.520**	.090	.141	.151
BA figcreat			-----	.105	-.032	.122	.236*	.254*
BPR-5 cog				-----	.333**	.188	.136	.235*
TTCTverbcrea					------	.264**	-.065	.129
TTCTfigcrea						-------	-.006	.128
TEADI							------	.592**
TEALT								-------

*$p \leq .05$; ** $p \leq .01$

Note. BAinte = BAICA total score intelligence subtests, BAICA vercrea = BAICA verbal creativity; BPR-5: BPR cognitive scores; TTCT vercrea = Torrance test of creative thinking verbal creativity; TTCT figcrea = Torrance test of creative thinking figural creativity.

Table 3
Factorial Structures of the Intelligence and Creativity Subtests

Tests	Factor 1	Factor 2	Factor 3	Factor 4
BPR-5 spatial	.716			
BAICA speed	.709			
BPR-5 abstract	.701			
BPR-5 verbal	.679			
BAICA spatial	.614			
BAICA verbal	.608			
TEALT	.549			
TEADI	.496			
BAICA logic	.492			
BAICA figural creativity fluency		.846		
BAICA figural creativity flexibility		.841		
BAICA figural creativity originality		.770		
BAICA verbal creativity elaboration		-.626		
Torrance verbal creativity elaboration		-.513		
BAICA verbal creativity fluency			-.874	
BAICA verbal creativity originality			-.833	
Torrance verbal creativity fluency			-.789	
Torrance verbal creativity flexibility			-.707	
BAICA verbal creativity flexibility			-.688	
Torrance verbal creativity originality			-.648	
Torrance figural creativity fluency				.747
Torrance figural creativity originality				.639
Torrance figural creativity elaboration				.563
Torrance figural expressive titles				.563
Torrance figural creativity flexibility				.549
BAICA figural creativity elaboration				.466
BAICA figural expressive titles				.381
% Variance	20.079	14.461	11.186	7.888
Cumulative Variance	20.079	34.540	45.727	53.614

of verbal creativity (negative loadings) from the BAICA (verbal elaboration) and Torrance (verbal elaboration), explaining 14.46% of the variance. The third factor is composed only of the verbal creativity dimensions (3 from BAICA, fluency, originality and flexibility, and 3 from Torrance, verbal fluency and flexibility), all with negative loadings, explaining 11.18% of the variance. The fourth factor is composed only of the figural creativity dimensions from both BAICA (figural elaboration and expressiveness of titles) and Torrance (fluency, flexibility, originality, elaboration, expressiveness or titles), explaining 7.88% of the variance. The component correlation matrix among these factors indicated that there were negative correlations among factors 1 to 2 (-.02) and to 3 (.14) and low positive correlations with factor 4 (.22).

Discussion

The associations between intelligence and creativity were investigated in these two studies using two new instruments, the Battery of Assessment of High Abilities/ Giftedness and the Battery for Assessing Creativity and Intelligence. Although samples were

collected in different places with distinct methodologies, the results are congruent, indicating that there are slight to moderate relationships between intelligence and creativity.

The analysis of the relationship between intelligence and creativity highlighted different values depending on the type of creativity. In the first study, the correlation's magnitude was higher between intelligence and verbal creativity (moderate) than with figural creativity (low). Similar results were found in the second study. The total BAICA intelligence score also had slight or no significant correlations with the BAICA figural and verbal creativity tests. Only the BPR-5 correlated with the Torrance verbal creativity test (.33; $p \leq .05$), specifically, the figural test. Thus, intelligence and creativity were found to have slight relationships.

The results converge with those reported by Nakano and Brito (2013), who found a low correlation between measures of figural creativity and intelligence through reasoning subtests. According to those authors, verbal reasoning showed more significant correlations with creativity, just as in the current research (positive and significant correlations with three factors of figural creativity and with verbal creativity). These findings also confirmed Kim's perception (2005) that the value and significance of this relationship depend on the types of creativity and intelligence that are measured, so that different results are reported according to the type of study, and the findings, seemingly contradictory, can be explained in part by the heterogeneity of the measures employed and the populations studied.

These results also confirmed the findings from other international studies (Rinderman & Neubaer, 2004, Elisondo & Donolo, 2010) in which the correlation between intelligence and creativity was positive but with low or moderate values between the constructs. Brazilian studies that compared students' high and low intelligence scores with their creativity scores also found slight relationships between these constructs (Wechsler at al.2010), and Nakano (2012) found a correlation of .47 between two drawing tests. The author, however, calls attention to the similarity of the tasks to be performed on both instruments (drawings), which could have increased the correlation between the measurements. Findings on the slight relationship between figural creativity and intelligence were also observed by Nakano and Primi (2013). Therefore, the question of whether creativity and intelligence are related appears to converge at the conclusion of an only slight association.

Separate factors that measured intelligence and creativity were observed in this study. Different measures of intelligence were combined in a single factor. However, different dimensions of creativity were combined into separated factors in both studies. The results presented in the first study confirmed the exploratory factorial analysis reported by Nakano and Primi (2014). These results call attention to the need to comprehend and measure creativity through more than one perspective because depending on the instrument used and the samples' characteristics, these results may present great variation, as observed and highlighted by Preckel et al (2007) and Silvia (2008). A moderate correlation was found between reasoning and the production of metaphors. This finding agrees with results reported from Barros, Primi, Miguel Almeida and Oliveira (2010), who also found a moderate correlation between metaphor production and verbal reasoning tests, possibly because of the vocabulary knowledge and use of analogies required for both tasks. However, considering the importance of analogical reasoning for creativity, especially in producing metaphors, this measure is recommended to be included in cognitive testing.

The studies presented confirmed the importance of measuring intelligence and creativity using tests that were designed to evaluate cognitive performance. Considering the impact of both dimensions on identifying and developing human potential, they should jointly evaluated, which has seldom occurred with any test battery available in Brazil to date. The results indicated that these measures can be obtained using valid instruments, and they bring additional contributions to understanding human potential and wellness.

The studies presented here have limitations, given that a convenience sample was used, which can impact the generalizability of the findings. The use of different procedures or the use of a different instrument might have produced different results. Further analysis and refinement of both the instruments and the procedures should be undertaken before their repeated use. Future studies are still required to investigate the ways in which these abilities are related to subjective measures of well-being, happiness and hope, which are measures that are typically related to positive psychology.

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