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Metaphor Creation: A Measure of Creativity or Intelligence?

Débora Pereira de Barros[1], Ricardo Primi[1], Fabiano Koich Miguel[2], Leandro S. Almeida[2] and Ema P. Oliveira[3]
[1]Universidade São Francisco (Brasil), [2]Universidade do Minho (Portugal), [3]Universidade da Beira Interior (Portugal)

The goal of the present study was to verify whether the "Metaphor Creation Test" would really be a measure with unique characteristics of creativity, or a different way of evaluating constructs already known as intelligence. Two differentiated groups were considered: group 1 was comprised by 90 late course students, and group 2 included 73 undergraduate students from Architecture and Urbanism courses. The results showed lower correlation between metaphors production and abstract reasoning (r= .31) comparing with verbal reasoning test (r= .48). Correlations between the constructs reproduced what was already found in other studies, that is, intelligence and creativity are related, but not strongly enough to affirm that they are the same construct; therefore they are different but related constructs.

Key words: Creativity assessment, creativity and intelligence, psychological assessment, metaphor creation.

Creación de metáforas: ¿Una medida de creatividad o inteligencia? El objetivo del presente estudio fue comprobar si el "Test de creación de metáforas" sería realmente una medida con características únicas de la creatividad, o una manera diferente de evaluar constructos ya conocidos como la inteligencia. Se consideraron dos grupos diferenciados: el grupo 1 estaba formado por 90 estudiantes mayores en un programa de educación de adultos, y el grupo 2 incluyó a 73 estudiantes universitarios de las titulaciones de Arquitectura y Urbanismo. Los resultados mostraron correlaciones más bajas entre la producción de metáforas y el razonamiento abstracto (r =. 31) en comparación con la prueba de razonamiento verbal (r =.48). Las correlaciones entre los constructos concuerdan con las ya obtenidas en otros estudios, es decir, la inteligencia y la creatividad están relacionadas, aunque no con una intensidad, tal como, para afirmar que son el mismo constructo, por consiguiente, son constructos diferentes pero relacionados entre sí.

Palabras clave: Evaluación de la creatividad, creatividad e inteligencia, evaluación psicológica, creación de metáforas.

Correspondence: Ricardo Primi. Rua Ferreira Penteado, 1518, Apt. 41, 13025-357 Campinas-SP (Brazil). E-mail: rprimi@mac.com

Creativity is a multidimensional concept that involves cognitive skills, styles of thinking, personality traits, environmental and cultural elements (Lubart, 2003). It is thus a complex construct that can be studied by different theoretical perspectives and approaches, such as biological and philosophical. Within Psychology, creativity is seen through the behavioral, psychoanalytic, humanistic, gestalt, and developmental perspectives (Wechsler, 2002). When it comes to the definition of creativity, one of the main features is about the emergence of a new product, whether an idea or an invention, whether the singular elaboration or improvement of existing products or ideas.

Most research focused on creativity assessment refers to measures of divergent thinking, an essential ingredient in creativity and, more specifically, in the creative problem-solving process (Kaufman, Plucker & Baer, 2008; Lubart & Georgsdottir, 2004; Oliveira, Almeida, Ferrandiz, Ferrando, Sainz & Prieto, 2009). In this approach, the *Torrance Creative Thinking Test* (TCTT; Torrance, 1966) is assumed as the most internationally recognized test for the assessment of creativity (Almeida, Prieto, Ferrando, Oliveira & Ferrándiz, 2008; Cramond, Matthews-Morgan, Bandalos & Zuo, 2005; Kaufman, Plucker & Baer, 2008; Wechsler, 2009), although with some fragilities in terms of psychometric accuracy and validity (Oliveira *et al.*, 2009).

Aiming to define creativity, gestalt association theories support the contribution of the metaphorical and analogical thinking (Ambrose, 1996; Morais, 2001; Russo, 2004; Tourangeau & Sternberg, 1982; Wechsler, 2009). This approach has a prerequisite definition of creativity that emphasizes the ability to make associations between seemingly distant elements, creating new combinations that allow the achievement of the creative solution. In assessment, we can find *Metaphorical Thinking Test* (MTT-Morais, 2001), which consists of problems such as: "X is the Y of Z". For example, "the Ferrari is the? of the cars", followed by five possible alternatives from which the subjects must choose the option that they find most appropriate (in this case, the answers could be: a - the engine; b - the concorde; c - the cat; d - the red comet; e - the song). Then, the metaphorical reasoning is based on the cognitive processes of creativity, specifically the search for remote associations to words or ideas provided.

A major difference between the two aforementioned tests refers to the cognitive processes: a divergent production in TCTT (free production of responses) and a convergent production in MTT (choose the correct alternative). Although convergent tasks have an advantage especially because they facilitate the correction and encourage objectivity in the evaluation (precision), they are questionable in relation to their validity as measures of creativity. Indeed, creativity is associated with tasks of free production of ideas or products, which is quite different from the use of alternatives (Almeida *et al.*, 2008; Oliveira *et al.*, 2009). Faced with this dilemma, a study was conducted to adapt the instrument from a convergent to a divergent production form. That study resulted a first version of the so-called *Test of Creativity Assessment from Metaphors Production* (Dias,

2005; Nogueira, Dias & Primi, 2003). From this first study, other studies have followed, and the various modifications and improvements resulted in the *Metaphors Creation Test* (Primi *et al.*, 2006), in which is focused the present study.

This instrument uses the creation of metaphors as a means of measuring creativity, as proposed by Schaefer (1970). These knowledge resources have been very useful in creative production because it is believed that the creative person tends to see common points or make better associations between elements considered distant. For Abrams (1971), metaphors are implied comparisons that literally have no denotation, based on some point of similarity between the terms. Among the figures of language, metaphor is the one that makes a direct comparison between two or more different objects from a perceived similarity between them. This last point predicts the possibility to identify creative individuals using metaphor creation (Dias, 2005; Schaefer, 1970). Therefore, Tourangeau and Sternberg (1982) argue that the metaphors relate two systems of concepts from different semantic fields, so we should not look only to two individual things, but for the areas to which they belong. In the metaphor "men are wolves" it is not seen only men and wolves, but also the field of human social relations as analogous to the field of animals. That is, there is a feature (a predatory) typical of a particular field (animals/wolves) as being similar to that characteristic competitiveness that can be applied to another field (humans/men). According to this view, the concept of analogy is important for the construction of metaphor, contributing to the relationship between systems of different semantic fields.

According to Sternberg (1977), analogies are tasks that involve inductive reasoning. For example, in the type of reasoning involved in the analogy A:B//C:D as "page:book//petal:?", individuals must first encode the terms of recovering long-term memory of their meaning and attributes which are important to solve the problem (page:book); then to infer the relationships between the retrieved attributes with the intention of finding a rule that relates the first two terms (page is part of the book) and therefore do the mapping or correspondence between the first and third terms (page//petal). This association should be applied to the third term, creating an ideal alternative, then to be possible to compare the alternatives with the idealized response and answer. In this case, "flower" can similarly be seen as a set or requiring multiple petals (Morais, 2001; Sternberg, 1977; Tourangeau & Sternberg, 1982).

A metaphor involves associations in a slightly different way. For example, the metaphor has the format "A is C of B", or, as an example, "the camel is ? of the desert". First, the subject will identify and examine the terms (camel and desert), recovering their attributes in the long-term memory. After that, he/she infers the relations between recovered attributes, for example the camel is a vehicle of transport in the desert. Given this *relation*, the subject will look for similar ideas, by a process of associations, and may find boat, for example. Even with a semantic distance between two terms, there is a

characteristic that makes them similar, which is "both can be forms of transport". After this phase, the subject organizes the items of information mapping both fields of meanings in order to clarify the principle that relates the terms, creating a suitable alternative and completing the phrase: "camel is the boat of the desert". In this sense, we can say that metaphor involves associative production based on relations and not attributes, i.e., it is based on the discovery of similarity relations of A:B with C:D (requiring more of the mapping component in solving analogies; Sternberg, 1977). The metaphor that presents the items A:B and asks the subject to find the new term C from the relationship found between A:B can be understood as an analogy containing hidden items. In other words, it requires the subject to produce the words C:D which are not presented in the task. At this point, the metaphor tasks create a potential cognitive ambiguity - if these tasks assess the creativity and intelligence. Now, it´s important to clarify the concept of intelligence itself.

In the last decade there was an integration of the "Gf-Gc theory" (Cattell, 1971) into the "Cattell-Horn-Carroll Theory" (CHC) of cognitive abilities, suggesting an approach of hierarchical intelligence into three strata (Almeida, Guisande, Primi & Lemos, 2008; Carroll, 1993; McGrew, 2005; Primi, 2003). In the first stratum, about fifteen dozen lower-level skills can be identified, most linked to the achievement of specific tasks. In the second level, ten larger factors are identified, combining common contents or cognitive functions: fluid intelligence (Gf), crystallized intelligence (Gc), quantitative knowledge (Gq), reading and writing (Grw), short-term memory (Gsm), visual processing (Gv), auditory processing (Ga), and storage capacity and retrieval of long-term memory (Glr), speed of processing (Gs) and speed of decision (Gt). In the third stratum, the authors mention a higher and wider skill, corresponding to the *g factor*. Under this model, the creativity is associated with cognitive functions defined by storage capacity and retrieval of long-term memory (Glr). Thus, we can understand creativity as linked to the ability to recover items of information from the knowledge base through associations, necessarily involving the fluency of ideas and associations, originality and metacognitive processes (Oliveira *et al.*, 2009; Primi, 2003; Wechsler, 2009).

Sternberg and O'Hara (2000) have studied the relationship between creativity and intelligence using five possibilities of association: (a) intelligence as a superset of creativity (*superset*), (b) intelligence as a subset of creativity (*subset*), (c) intelligence and creativity as related constructs (*overlapping sets*), (d) intelligence and creativity as essentially the same thing (*coincident sets*), and (e) intelligence and creativity as not having any relation with each other (*disjoint sets*). The idea that intelligence is a superset of creativity is based on Guilford's studies, an author who had a huge impact in the field of creativity (Guilford, 1956). His model, called *Structure of Intellect* (SOI), stipulated the existence of various intellectual abilities combining three dimensions - operations, products and content -, and traditional intelligence tests are classified into categories of

cognition and *convergent production* (knowing and understanding things) and the tests of creativity are classified as *divergent production* (generating new ideas from what is known). In this sense, intelligence is seen as a superset that involves creativity (Sternberg & O'Hara, 2000).

The perspective that assumes creativity and intelligence as related constructs (*overlapping sets*) implies that, in some respects, these capabilities are similar, but in others they can be distinguished. According to Sternberg and O'Hara (2000), the ability to establish these associations and find a creative solution necessarily implies the existence of a knowledge base and the subjects' ability to evoke this knowledge in an organized way. Thus, students who demonstrate high IQ, based on their higher-level cognitive skills, may access and manipulate information in easier ways, being more efficient in the use of logical reasoning, the establishment of associations between ideas and a more comprehensive understanding on various aspects of solving a problem (Sternberg, 1981).

Guilford and Christensen (1973) studied the correlations between tests of intelligence and creativity and found a triangular pattern in the dispersion diagrams relating the two variables, instead of the traditional elliptical pattern, with correlation coefficients around .32. The authors found that students with below-average intelligence also had below-average scores on creativity tests that involve divergent production. However, among subjects with high intelligence, there was a greater dispersion in scores of creativity, meaning that students with high intelligence were not necessarily more creative, but the most creative were among the most intelligent. These data support the hypothesis of the threshold, i.e., that below a certain level of intelligence both constructs are correlated, but not above that level. The authors explain that "*the IQ, strongly represented by cognitive abilities, depends directly on the amount of information that the person has stored in memory. In part their performance on divergent tests depend on this supply of stored information. If the information he needs is not there, he cannot, of course, recover it to use in the test. Highly productive and creative people say that a good stock of information in memory is very important*" (Christensen & Guilford, 1973, p. 248). Other studies have sought to examine the relationship between creativity and IQ, and some of them observed a similar pattern of correlation between the constructs (the threshold hypothesis) (Fuchs-Beauchamp, Karnes & Johnson, 1993; Getzels & Jackson, 1962; Kim, 2006; Moore & Sawyers, 1987; Renzulli, 1986; Runco & Albert, 1986). In the opposite direction, we have other studies that contradict the threshold hypothesis (Preckel, Holling & Wiese, 2006) or that show weak correlations between IQ and creativity (Barron & Harrington, 1981). Within this latter group, we highlight the study of Torrance emphasizing the distinction between intelligence and creativity, suggesting correlation coefficients between low-magnitude (coefficients around .06 for figurative tasks or .21 for verbal tasks) (Sternberg & O'Hara, 2000).

Although, in general, the threshold hypothesis is accepted by the scientific community (Lubart, 1994), it is important to examine in a more careful and systematic way the nature of the relation between these two constructs, as some inconsistency of results in research remains in the field (Lubart, 2003; Runco, 1991), mainly because of methodological differences of the various studies. Indeed, the available research results suggest that the correlations between intelligence and creativity seem to vary depending on the type of test used, for example the contents or dimensions considered in assessment (Almeida *et al.*, 2008; Oliveira *et al.*, 2009; Russo, 2004), age or level of schooling of the subjects (Guignard & Lubart, 2007; Wechsler, 2009), the criteria or cut-off points chosen for the formation of different groups in terms of performance (Preckel, Holling & Wiese, 2006), or according to the weight assigned to speed in tasks performance (Preckel, Holling & Wiese, 2006; Wallach & Kogan, 1965).

One factor moderating the association between creativity and intelligence tests is the complexity of the required associations. In general, tests of intelligence are based on understanding of abstract associations, while in tests of creativity, as the TCTT, the associations are at a lower level of complexity, for example, the use of two parallel lines to draw the greatest number of ideas (which again questions whether the creation of metaphors evaluates creativity or intelligence) (see Primi *et al.*, 2006). Moreover, the same can occur with the insight (integration of previous unrelated knowledge in a coherent whole), a creative form of problem-solving (Runco, 1993), but requiring higher order cognitive processes and, now, to be more associated with the IQ of the subject than the fluency or elaboration of ideas (Russo, 2004).

This is the background of the present research and its contribution to the study of correlations between intelligence and creativity, using the *Metaphors Creation Test* (MCT), anticipating that intelligence and creativity are related, since both reflect the ability to generate ideas through analogical associations. Accordingly, our objective was to verify the correlations between the MCT and results in tests of abstract and verbal reasoning of the Battery of Reasoning Tests (BPR-5). Two specific questions arise in our study: the test in question (MCT) evaluates a construct that is distinct from traditional measures of intelligence? And, the pattern of association is consistent with the idea of Torrance, in which the constructs are more distinct, or is it closest to the idea of Guilford, who proposed a closer relationship between the two constructs, consistent with the hypothesis of the threshold?

METHOD

Participants

Participants were divided into two groups. Group 1 was composed of 90 students attending a program of education for young adults – EJA, with 40 female, and

37.2% in 1st grade of high school, 40.7% in 2nd grade, and 22.1% in 3rd grade. Using the socio-economic classification levels of the Brazilian Research Companies Association (Brazilian Criterion of Economic Classification, *www.abep.org/codigosguias/Criterio_Brasil_2008.pdf*), there were 11.8% of subjects belonging to social classes D, 43.1% to class C, 29.4% to class B2, 11.8% to class B1, 3.9% to class A2, and no subject belonging to class A1 (A classes show people with higher economic income, while the class D shows lower social class). Ages ranged from 16 to 54 years, with the average at 27.8 (*SD*=10.70). Group 2 was composed of 73 students of Architecture and Urbanism, with 52 female. Regarding the social classes, 7.5% belonged to social class D, 20.9% to class C, 22.4% to class B2, 23.9% to class B1, 22.4% to class A2, and 3.0% to social class A1. The age ranged between 17 and 49 years, with the average at 23.36 (*SD*=6.47).

Instruments

Metaphor Creation Test – MCT Forms A, B and C (Primi *et al.*, 2006): The test consists of 9 items containing phrases to which the examiner can create up to four metaphors that express ideas. The instructions show the example "The camel is the _____ of the desert". Each idea is scored by judges on a scale of 0 to 3 (from non-metaphor to a well created metaphor), formalizing the score as follows: score 0 for an idea that is not metaphor, an analogy that is a mere association; score 1 for an idea that represents an adequate metaphor, with equivalence and remoteness; score 2 for an idea that reaches the criterion score of 1 and has an advanced equivalence and remoteness; score 3 for an idea that reaches the criterion 2 and a much more advanced remoteness relation. Several validation studies have been conducted with this test (Muniz *et al.*, 2007; Primi, Miguel, Couto & Muniz, 2007). This study will take six variables from the test scores: the number of answered items (*N_ans_items*) means the quantity of items that the subject responded; the number of ideas per item (*fluency*) means the average number of ideas that the subject gives for every item; the *theta* means the subject's ability according to the Item Response Theory (IRT); the *score* means average score, ranging from 0 to 3; the flexibility is divided into a metaphoric and non-metaphorical category, with the first (*Flex_cm*) means the average number of metaphor categories in the test; and the second (*Flex_cnm*) means the average number of non-metaphorical categories in the test.

Battery of Reasoning Test – BPR-5 (Almeida & Primi, 1998): consists of five different reasoning tests: abstract reasoning (RA), verbal reasoning (RV), space reasoning (RE), numeric reasoning (RN) and mechanical reasoning (RM). The battery includes Form A (7th grade through 8th grade of elementary school) and Form B (1st, 2nd and 3rd grades of high school). For this study we used only tests RA and RV of Form B. Abstract reasoning (RA) test consists of 25 items involving analogies with geometric

figures, with time limit of 12 minutes. Verbal Reasoning (RV) test is made of 25 items involving analogies between words, with time limit of 10 minutes.

Procedure

The instruments were applied collectively in a single session, and respecting the following order: Socio-Economic Questionnaire; BPR-5 subtests, with half the sample answering RV and half answering RA; and the Metaphor Creation Test, forms A, B and C were applied at random. All subjects were informed about the purpose of the search and signed the Free and Informed Consent Form.

RESULTS

Initially, descriptive statistics of the tests were made, including scores from MCT, RA and RV. Table 1 presents the results of this analysis, for the two groups of subjects: Group 1 (Schooling for Young Adults - EJA) and Group 2 (Architecture and Urbanism - Arq).

Table 1. Descriptive statistics of MCT, RA and RV of two groups

		M	*N*	*SD*	Minimum	Maximum
EJA	N_ans_items	5.47	73	2.8	1	9
	Fluency	2.53	53	1.14	1	4
	Theta	-4.89	53	1.24	-6.66	-0.8
	TRI Score	0.4	53	0.29	0	1.38
	Flex_cm	0.82	53	0.59	0	2.56
	Flex_cnm	1.5	53	1.02	0	3.5
	TRI Score	0.43	53	0.49	0	1.93
	RA	95.23	39	19.24	67	146
	RV	87.81	48	13.56	66	117
Arq	N_ans_items	7.42	65	2.27	1	9
	Fluency	1.7	57	0.9	1	4
	Theta	-3.45	57	1.72	-6.86	-0.34
	TRI Score	0.77	57	0.38	0	1.5
	Flex_cm	0.91	57	0.47	0	2.67
	Flex_cnm	0.59	57	0.65	0	3.71
	TRI Score	0.79	57	0.56	0	2.21
	RA	105.31	32	13.51	79	131
	RV	104.12	34	13.51	85	132

The average difficulty of MCT items is centered in .00 and the Thetas, that show the skills of the participants, are on the same scale. The average scores are below zero in both groups because the majority of scores are between 0-1 in raw scores. So it is rare to find scores 2 and 3. We see that students of EJA had a lower Theta than undergraduate students. The latter tended to have higher averages on tests of BPR-5, which was presented in standardized scale (M=100, SD=15), according to the Brazilian

manual. This difference between the students is most evident in RV test, probably because of a more specific association between the test and the academic nature of crystallized intelligence.

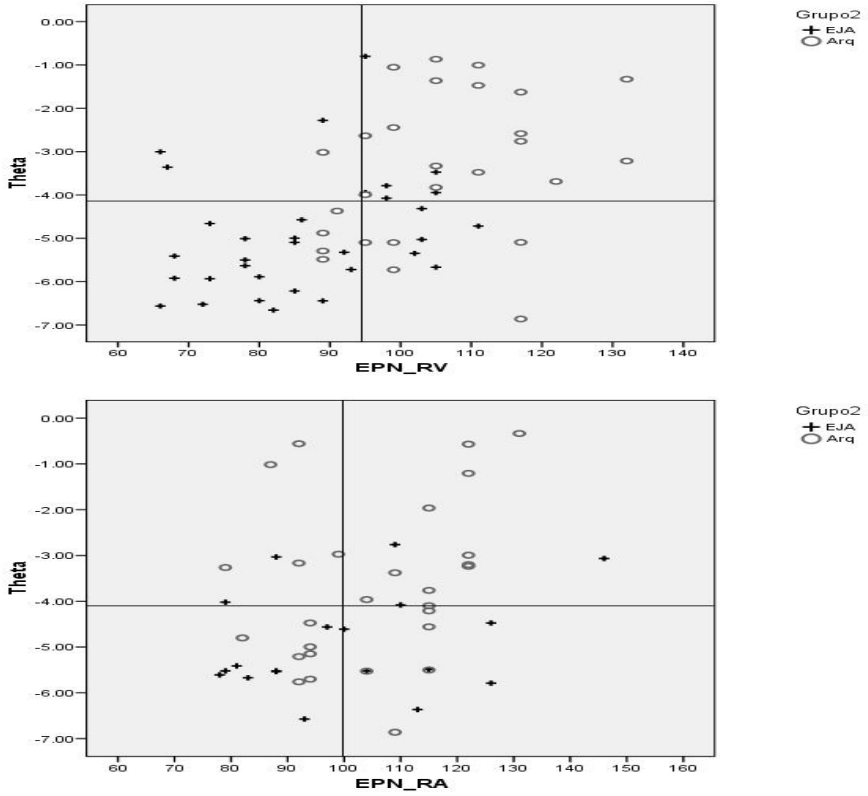
Data related to the two central issues in this article are presented in table 2, which shows the correlations between the MCT and tests RA and RV. Figure 1 presents the correlation dispersion Theta x RV and Theta x RA.

Table 2. Correlations between MCT and BPR-5 tests

	RA	RV
Theta	.31*	.48**
TRI Score	.31*	.50**
N_ans_items	.25	.22
Fluency	-.04	-.41**
Flex_cm	.25	.07
Flex_cnm	-.26	-.46**

* p<.05 ** p<.01

Figure 1. Dispersion between measures of intelligence and creativity



Significant and moderate correlations have been found between Theta and test RA (*r*= .31), and a higher correlation with test RV (r=.48). A possible explanation for this difference in correlation coefficients may be related with the fact that the MCT and RV share, in terms of assessment, both the knowledge of vocabulary and the use of analogies. On the first issue of the study, regarding the convergence of MCT with traditional measures of intelligence, we can conclude that MCT cannot be considered just a traditional intelligence test. Although related, the magnitudes are low enough to infer that there is something specific to the MCT that differentiates it from traditional intelligence tests.

Regarding the second issue, the patterns of association are more consistent with Guilford's model than with Torrance's. Especially in the verbal test, it was possible to observe the triangular patterns of association discussed by Guilford and Christensen (1973). An interesting aspect of these correlations is the negative correlation found when one considers the single measure of fluency without considering the quality of metaphor. This variable was correlated with intelligence in the opposite direction, a result that is contrary to that found for the variable theta – associated with the production of ideas but with a minimum quality (the condition to be metaphor) – which was positively correlated with intelligence. These data suggest that, while on divergent production tests the ideas are scored without considering the quality, this variable is in the opposite direction of intelligence and, when considering the quality, it will follow a straight direction. Considering that the Torrance Test includes a dimension consistent with what we call here simply the fluency, along with other variables that consider the quality of ideas, such as flexibility, it is expected that there are low correlations with the tests of intelligence, supporting these two constructs are more distinct than related. Moreover, as the criteria for scoring divergent production become more complex, they get closer to measures of intelligence. Thus, for the variable category of non-metaphor flexibility (Flex_cnm) with test RV, there was a moderate negative correlation (*r*= -.46). As expected, those with higher scores in RV show less categories of non-metaphor (linking this variable to produce ideas without quality).

DISCUSSION

The results show low and moderate correlations between the BPR-5 tests and Metaphor Creation Test, specially the abstract reasoning test that can be assumed as a test that's nearest *g factor* or fluid intelligence (Almeida *et al.*, 2008; Primi, 2003; Sternberg, 1977). With verbal reasoning test, the correlation was higher and a hypothesis for explaining this correlation is that MCT and RV use the subject's knowledge of vocabulary and make use of analogy. This result is consistent with the point raised by

Guilford and Christensen (1973) that it is important for creativity to have a good background of information in memory.

The results, regarding the objectives of this study, allow us to say that the resolution of tasks calling for metaphorical reasoning should not to be confused with intelligence, as is evaluated through tests of analogical reasoning type, given that this is the most traditional format of the items in intelligence tests (Sternberg, 1977). The creation of metaphors calls for a considerable background of knowledge and an ability to make remote associations combining the information stored in long-term memory. In this sense, compared to some definitions of creativity as association of remote ideas (Dias, 2005, Schaefer, 1970; Tourangeau & Sternberg, 1982), we assume that the metaphor production can be used both in assessment of intelligence and creativity in the common cognitive processes.

This study presented data relevant to the new creativity assessment instrument (MCT), as well as BPR-5. The results found here can be used as validation evidence for the metaphor creation test as a separate construct of intelligence, but related to it. It should also be noted that further studies should be conducted in order to extend the results found in this study and to analyze the consistency of the results to increase the cognitive meaning of them, in particular the relationship between intelligence and creativity.

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