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Notes on Creative Potential and Its Measurement[1]

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ABSTRACT

The discussion raised by the Glăveanu target paper (Glăveanu, 2014) continues in the second issue of "Creativity. Theories – Research – Applications" (CTRA). In this editorial I focus on two elements shared by commentators whose articles are presented in this issue, namely: creative potential and its measurement. I start with the observation that potential is probably the most fuzzy and poorly defined construct in the creativity literature (and likely social science as a whole). As a result of different operationalizations of this category, its valid and reliable measurement is difficult – though not impossible – but, more importantly, several different theories of potential are being developed simultaneously. I focus mainly on critiques of the measurement of creative potential and show how recent developments in psychometrics make it more valid and reliable than critics tend to realize.

The discussion raised by Vlad Petre Glăveanu's critical article (Glăveanu, 2014) continues. After the publication of the first issue of the CTRA, fully devoted to commentaries prepared by leading creativity scholars, and author's response, we received several e-mails adding additional voices to the discussion, both critiques and praise for the article. This issue presents the second – and last – set of commentaries, summarized in the final response of Glăveanu (2015). The link between all the papers presented in this issue, is probably the focus on three quite loosely related concepts: (1) creative potential, (2) its measurement, and (3) the role of the "social" in the creativity literature. It is both pointless and impossible to summarize in this editorial, all the arguments that the commentators and Glăveanu himself, have raised. Instead of this, I focus briefly on issues associated with creative potential and its measurement.

Creative potential is a common theme prevalent in several of the commentaries included in this issue. Although potential is probably among the most poorly defined of con-

[1] This editorial is partially based on a keynote talk given at a congress of the Polish Society of Educational Assessment, Gdansk, 2014.

structs in psychology as a whole, it has played an important role in the creativity literature. Although potential, usually defined as the promise of creative achievement in the future, is of special interest to teachers, parents and scholars, it need not to be dichotomously separated from creative achievement – for educators and educational psychologists it is interesting and worthwhile to study it in its own right. Over the decades, the field has been organized around the classic Rhodes' (1961) 4P approach and creativity was analyzed through the lens of person, process, product and press, while potential quite naturally forms the fifth P in this family (Runco, 2003) and is probably the most interesting, for all educators, teachers, and a number of educational psychologists. One may also argue that potential is present across person and process or actor and action (Glăveanu, 2013), but anyway – it is surely important.

Of course, a clear definition or statement of how potential is understood is necessary to even make the discussion possible. Is it associated only with divergent thinking skills – the case Glăveanu criticizes – or maybe also with a wide array of different characteristics, including, but not merely limited to, cognitive factors, but also personality and motivational traits as well? Isn't openness or independence important as the fuel of creativity, similarly intrinsic motivation (Hennessey, 2015), curiosity (Karwowski, 2012), creative self-efficacy (Beghetto, 2006; Karwowski, 2011) or simply valuing creativity (Karwowski, Lebuda, Wisniewska, & Gralewski, 2013)? That is not to say that the field needs overinclusive definitions of potential, but the ordered and multidimensional operationalization of potential may not only be of interest, but may push creativity science in new directions. That being said, I would argue that although the concept of potential is usually poorly defined, this does not mean that it is fruitless or useless. Defining it in terms of more-or-less stable traits (personality, cognitive) as well as more malleable and dynamic characteristics (i.e. self-efficacy) may open new avenues for research.

Hence, although studying potential seems important for creativity science, its measurement is problematic. The first and most serious objection raised against tests of creativity is their low validity, as several scholars – Glăveanu among them – impute. This point is raised in almost all scholarly publications devoted to testing creativity (e.g. Hocevar, 1981; Plucker & Runco, 1998), though it is exaggerated. Theoretical, criterion, concurrent and predictive validity of the most popular tests of creativity, such as Torrance's TTCT (*Torrance Tests of Creative Thinking*) or Urban and Jellen's TCT-DP (*Test of Creative Thinking-Drawing Production*) has been convincingly demonstrated. These tests are based on clear theoretical models that describe hypothetical mechanisms of the course of creative thinking (Guilford, 1967); they make it possible to predict creative achievements

in various domains (Plucker, 1999) as well as being interrelated with each other (Karwowski, 2005), yet they do not correlate very strongly with intelligence or school performance (Gralewski & Karwowski, 2012; Karwowski & Gralewski, 2013) – which forms an argument for concurrent validity. Finally, they distinguish individuals involved in creative activities from those who do not have such experiences (Silvia & Nusbaum, 2012).

Another objection – more justified – is that of the limited reliability of tests of creativity, especially when they are compared to intelligence tests. The data that are usually reported on reliability, estimated in accordance with classical test theory, such as internal consistency or test-retest correlation, fall between .70 and .80. This is sufficient in research conducted on large samples, especially when measurement error is partialled out thanks to the application of latent variable models. Yet, such reliability is often too low to consider using these tests for individual assessment series – since, in this case, the range of confidence intervals around individual results is so high, that the probability of type I or II errors is serious. Construction of creativity tests on the basis of item response theory (IRT) is only in its infancy, though initial examples of tests and questionnaires created in this way, i.e. those that are oriented towards measuring creative dispositions and creative achievements, are already beginning to appear (Karwowski, 2014; Wang, Ho, Cheng & Cheng, 2014). Application of the IRT makes special sense, or may even be necessary, because in situations where the standard error of measurement relates in a curvilinear form to the level of creative abilities, that error is the largest and the smallest at the lowest and the highest end of abilities. Hence, where there is a need for individual assessment diagnosis, one should provide this additional evaluation of the error rate and include it in determining the creative potential of the individual.

The third objection – of a serious nature, raised by Glăveanu and worth discussing here – focuses on the static character of test results. Participants are usually asked to perform some kind of activity, most frequently in the form of making a drawing or coming up with diverse and unique solutions to a problem and then they are assessed in terms of how they handled the task. On this basis, conclusions are drawn with regard to creative abilities. However, as critics of this approach note, the problem here is that when assessing the finished product (after all, this is how one views the effect of work on a creativity test) we do not learn much about the process that led to the creation of the product. As I mentioned above, these elements of criticism must be taken seriously, even though it is easy to downplay them by stating that such is the nature of not just creativity tests, but also many other tests of abilities – those of intelligence, to say the least. On the other hand, modern statistics make it possible to at least partially cope with this

problem. After all, traditionally, in order to capture the process of solving test tasks (implicitly – the creative process) researchers used think-aloud methods while solving tasks or creativity tests (e.g. Ruscio, Whitney, & Amabile, 1998). This brought about many interesting findings, especially in the domain of intuition and insight – processes that are close to that of creativity (Metcalfe & Wiebe, 1987). Nowadays, researchers use other ways of analyzing the process. Firstly, they combine testing creative abilities with such neuropsychological methods as EEG or magnetic resonance imaging (Fink & Benedek, 2012). Sometimes, they also use the more classic measures of physical effort (Silvia, Beaty, Nusbaum, Eddington, & Kwapil, 2014). Though brain activity alone or increases in vascular responses are not able to provide answers to the questions of cognitive processes, they still enable us to formulate new hypotheses that refer to the course of the creative process. Secondly, statistical techniques provide some assistance – especially in the use of multilevel modeling or latent growth curves. Usually multilevel modeling is most commonly used in order to control grouping pupils in classes or schools and to properly estimate standard errors, as well as second-level variance (for classes in schools, see Gralewski & Karwowski, 2012). However, in experimental psychological studies, including those that use creativity tests, researchers are increasingly using multilevel models to estimate the effects of "intra-individual grouping" appropriately. This applies to situations where, for example, researchers are examining whether consecutive ideas generated by the same person are more or less creative. Contemporary studies (Beaty & Silvia, 2012) clearly indicate that with time, ideas become more and more creative, a fact that has been the subject of theorizing within the field of the psychology of creativity for decades (Christensen, Guilford, & Wilson, 1957; Mednick, 1962). Analyses of this kind, which not only focus on an individual's end result, but also incorporate intra-individual variations in the dynamics of creating, may also explain this differentiation on an interpersonal level (e.g. with intelligence level: Beaty & Silvia, 2012; motivational states: Silvia, Beaty, Nusbaum, Eddington, Levin-Asperson & Kwapil, 2014) and is much closer to processual analysis than to the simple statistical conclusion that someone falls within the low, moderate or very creative level on an assessment tool.

The third way of dealing with the objection about the non-processability of creativity tests is by attempting to explicitly consider the elements of process in newly created tests. It is no easy task, but it is not impossible, either. This can be achieved directly or indirectly. Let us first consider the indirect example. An attempt to analyze the process is possible when we take the example of hypothetical strategies for solving the Test of Creative Imagination, developed years ago by Kujawski (2000; see also Karwowski, 2008a,

2008b, 2009). A typical exemplar of this test that aims at examining creative imagination consists of a sheet with drawings of 16 elements – 4 dots, 4 line segments, 4 semicircles, and 4 wavy lines. The subject is expected to make the largest possible number of drawings that represent something that does not exist and that should exist (for examples, refer to Karwowski, 2009). So far, analyses show that this test can be solved in at least two different ways, using different processes. The first way, is similar to the process of solving problems when the "product strategy" method is applied. The subject considers the problem of "what does not exist and what could be useful," generates a solution to this problem and then, using the elements provided, the subject schematically presents the idea in the form of a drawing. Such a mechanism does not have much to do with creative imagination measurement, which was the purpose of this test, because it is more applicable to the process of problem solving. Although more rarely observed, the second possible solution is known as "processual," and may also be called "imaginative." Here the subject first makes a more or less random drawing (this process is sometimes differently defined in different theories of creativity; for example Kujawski (2000), the test developer, called it the phase of chaos; Finke, Ward & Smith (1992) call it the phase of generating pre-creative structures; and the language of the theory of creative interaction by Necka (1987) refers to it as a sample structure) and then attempts to interpret the image, i.e. see its inherent possibilities. This phase seems much more interesting, yet both have the potential of enriching our understanding of the process of struggling with the test and creating. There remains the question of how to detect these phases? One may not be concerned with doing so subtly and surely therefore, not very accurately, i.e. by basically asking the subjects. It is also possible to try to manipulate the instructions, leading the subjects to either the first or the second strategy, in order to test the effects they yield and using them to draw conclusions about the characteristics of the strategy used. Finally, it is also possible, although it is also not a very reliable method, to draw indirect conclusions about the strategies, by analyzing the products themselves. Evaluation shows that the products generated on the basis of the "product strategy" are usually simpler. This is so, because the drawing is a pretext and an individual dot may mean almost anything. In the case of the processual-and-imaginative strategy, products are more elaborate, richer, and they are characterized by what the language of creative imagination theory calls vividness (Dziedziewicz & Karwowski, 2015).

A more direct way of considering processuality, even in a static test, is an attempt to define and measure it beforehand. The Test of Creative and Imaginative Abilities (TCIA) is based on this very premise (Dziedziewicz & Karwowski, 2015). This test,

measures three operations that are typical for creativity: vividness, originality, and transformativeness. Much indicates that it is the ability to transform images in one's mind that is the key characteristic of individuals who have a rich imagination. The TCIA measures a variety of transforming operations. Among them are: (1) associations; (2) reintegrations; (3) bissociations; (4) multiplications; (5) hyperbolizations; (6) majorizations; (7) schematizations; (8) amplifications; (9) metaphorizations; (10) animizations; (11) conversions; (12) rotations, or spatial inversions; (13) manipulations of time; (14) animations; (15) or metamorphoses. Therefore, even though as a result of the test, the subject obtains a global score of his or her imaginative abilities, as well as additional assessments of vividness, transformativeness and originality (each of which make it possible to conduct a profile analysis of imagination), it is also possible to take a more processual view that searches for key types of applied images.

The fourth, and most likely not the final, serious objection to creativity tests, that formally questions the validity and reliability of conducting measurements with these instruments, is the fact that results obtained by researchers are greatly influenced by a series of factors that are external to the test itself. In particular, these objections concern the role of instruction (Harrington, 1975; Nusbaum, Silvia & Beaty, 2014). After all, subjects who are explicitly asked to be creative (or inventive, original, atypical, creative, etc.) generate more original ideas than those who do not receive such instructions, or those who are, for example, solely asked for considerable fluency. Though ostensibly this objection crushes creativity tests – because the fact that it is not difficult to influence their results would appear to disqualify the instruments themselves – the matter is not entirely obvious. For purely measurement-related reasons, variability of results under the influence of subtle manipulation of instructions (sometimes a single word is enough!) remains highly unfortunate. On the other hand, however, as today's researchers (e.g. Nusbaum et al., 2014) rightly point out, this sheds considerable light on the process of struggling with the test and may reveal wider determinants of creativity – for example at school. It is worth following this thought through. If it is believed that the fact that individuals under investigation need to be informed that they are required to be creative in order to actually be creative, and without this information that they generate fewer creative ideas, this may mean that their creative thinking is not supported, or is even actively suppressed under typical conditions (Gralewski & Karwowski, 2013; Karwowski, 2007, 2010). From the processual point of view, the fact that activating creativity by means of instruction brings about more creative solutions, while stimulating fluency, for example, makes more intelligent individuals do better in the test (because verbal fluency is one of the compo-

nents of intelligence), may reveal metacognitive stimulants of the creative process.

Criticism of erstwhile *state of the art* measurement of creative potential must not be underestimated. Indeed, the fact that despite progress in the development of brain studies and appearance of new theories and hypotheses of creativity over the course of the last half a century, the tests are still the same or have changed only slightly, is highly unfavorable. However, this criticism should not go too far. After all, the validity of creativity tests is not really as meagre as critics posit. Their reliability is perhaps not as high as that of intelligence tests, yet they are able to compete with many tests of school achievement, and at least to some extent, it is possible to weaken the objection against non-processuality by means of using new statistical methods and the stronger application of the operations of creative thinking in tests. However, this does not really change the fact that when we consider this from the educational perspective, the usefulness of test results is obviously limited. Firstly, application of creativity tests requires particular, professional competences that teachers usually do not have. Secondly, if we are expected to develop creativity, a test will only be useful, if it shows what aspects of creativity (for example imagination or flexibility of thinking) need to be developed most and if it makes it possible for us to examine whether the action has been performed effectively. However, in this case it would be much more useful to apply dynamic and adaptive testing. Thirdly, in their vast majority, creativity tests consider creative abilities as a general characteristic that is relatively independent from the domain of student functioning. Consequently, even though in the tradition of the psychology of creativity we are indeed able to find verbal tests (more strongly dependent on intelligence), as well as nonverbal ones, tests of creative mathematical abilities (Haylock, 1987), language or naturalistic thinking are still rare. Meanwhile, from the perspective of school education practice, students' creativity is much more interesting when it expresses itself in non-typical solutions on tasks rather than in the form of test results. Such an assessment of subject-oriented creativity is still in its infancy, especially when it comes to the psychometric aspects. It is true that we can find some empirical studies that reveal the relations of creative self-efficacy in various school subjects with school performance (Beghetto, Kaufman & Baxter, 2011), yet they infrequently focus on young children and even less frequently do they manage to inquiringly integrate creativity in the process of teaching and learning the given subject.

Finally, however, let us return to measurement of student creativity that would be more educationally relevant. At this point, it is worth explicitly formulating a number of claims and recommendations for (the nearest) future. I can see 5 such key points:

(1) measurement dynamism; (2) its domain-specificity; (3) processuality; (4) naturalness and contextuality; and, finally, (5) the profiling character of creativity diagnosis. I believe that all these postulates concur with Glăveanu's arguments.

Dynamism of creativity examination

The claim of dynamic testing is cognate with constructivist ideas inspired by Vygotsky's (1930) sphere of proximal development. Consequently, it is not about the problem of measurement itself, but the systematic posting of such tasks that are the building blocks of development and learning, to the same extent as they are diagnostic materials. The challenge lies in combining the dynamism of testing and rigorous psychometric quality. Adaptive testing, whereby students are exposed to tasks that are better and better at matching their abilities, is successfully applied in the case of ability tests, though a creativity test that is based on adaptive algorithms has not yet been developed, or at least, has not yet been popularized. It is possible, however, that even in the case of creativity tests that are open by nature and include many possibilities for correct responses, qualitative assessment will be possible in the foreseeable future. It is true that this will require the compilation of enormous databases of previously assessed responses, as well as advanced models that assess and learn on the basis of neural networks, yet their application could produce a simple test for almost anybody to take online. This test would also be training in creative thinking. It would be more complicated – though also likely to be do-able – to develop domain – specific tests of this kind. Creativity tests probably require a revolution – changes effected in them, have for too long, been so small, that one can posit that they have been almost imperceptible.

Domain-specificity of creativity examination

Even if psychologists of creativity are right in stating that mini-c creativity (Kaufman & Beghetto, 2009) is of a domain-general character, crystallizing creativity (Necka, 2001), not yet professional, but already visible in certain domains, is of particular importance for schools. This is what creative education is in need of – instruments that would make it possible to assess creative potential in basic school subjects. Analyzing sets of tasks used in educational studies, it is not difficult to see that this is indeed possible. It is important to reformulate assessment criteria – seeking correct solutions not in formal correctness (as is usually done in school achievement tests), but in going beyond schema towards generating fresh solutions. Hence, these same tasks that are used to measure school achievement (or at least some aspects of it) may be successfully applied in measuring domain-specific creativity.

Processuality of creativity measurement

Dynamic measurement should obviously enable one to capture the creative process more effectively. Recently, psychologists of creativity have successfully applied methods of latent semantic analysis to analyze the process of reaching solutions in creativity tests (Beaty, Silvia, Nusbaum, Jauk & Benedek, 2014). Possibly, it is one of the ways. Another way may be to interfere in the creative process by means of distractors or dead ends in order to verify how subjects deal with such situations. Examination of process is difficult and no one who is seriously involved in diagnosis claims otherwise. Yet even partial understanding of how a metaphor or analogy takes shape is a step towards its more effective stimulation – and this is already quite a lot.

Naturalness and contextuality of examining creativity

A much more useful form of assessment is one has clear drawbacks that mainly lie in its de-contextuality and artificiality that cause the result itself to be of limited validity. This is why researchers nowadays already prefer to analyze creativity in fun situations (Russ & Wallace, 2013) or everyday activities (Silvia et al., 2014). Much indicates that virtual space is a more and more natural environment for testing creativity, though many will shrug at this. The reality of social networks is for many, becoming a context for the most genuine of activities. Years ago, Ceci (1990) showed that the results of young people's intelligence tests depend on whether the test form they had received was "paper-and-pencil" or that of a computer game, which was more attractive to them. Which result is more real? The one obtained as the result of a standardized test, or the one obtained during a computer game? Why not offer a similar procedure for examining creativity? This is obviously a rhetorical question.

Profile character of examining creativity

The last claim is also the least controversial. In assessing creative potential, we should use a more profiling, ipsative form of assessment. Little relevant information, and sometimes none at all, stems from conclusions that a given pupil fits within the 10th percentile of results on a thinking fluency test. A much more useful form of assessment is one that uses many different measures that often come from various theoretical traditions, and results obtained in this way are analyzed in such a way that makes it possible to capture the strengths and weaknesses of an individual. Methodological purists may be offended by this proposal. After all, different tests account for different understandings of creative abilities that frequently do not match, so application by means of combining them may bring about more confusion than valuable information. However, awareness of the theoretical origin of various instruments makes it possible to use them appropriately and also to appropriately interpret results obtained with their use.

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