Creativity Research Journal

ISSN: 1040-0419 (Print) 1532-6934 (Online) Journal homepage: https://www.tandfonline.com/loi/hcrj20

Estimating Creativity with a Multiple-Measurement Approach Within Scientific and Artistic Domains

Sergio Agnoli, Giovanni E. Corazza & Mark A. Runco

To cite this article: Sergio Agnoli, Giovanni E. Corazza & Mark A. Runco (2016) Estimating Creativity with a Multiple-Measurement Approach Within Scientific and Artistic Domains, Creativity Research Journal, 28:2, 171-176, DOI: 10.1080/10400419.2016.1162475

To link to this article: https://doi.org/10.1080/10400419.2016.1162475

CREATIVITY RESEARCH JOURNAL, *28*(2), 171–176, 2016

ISSN: 1040-0419 print/1532-6934 online
DOI: 10.1080/10400419.2016.1162475

Routledge
Taylor & Francis Group

Estimating Creativity with a Multiple-Measurement Approach Within Scientific and Artistic Domains

Sergio Agnoli
Marconi Institute for Creativity, Bologna, Italy

Giovanni E. Corazza
DEI Department, Marconi Institute for Creativity, University of Bologna, Bologna, Italy

Mark A. Runco
American Institute for Behavioral Research and Technology, San Diego, California, USA

This article presents the structure and the composition of a newly developed multifaceted test battery for the measurement of creativity within scientific and artistic domains. By integrating existing procedures for the evaluation of creativity, the new battery promises to become a comprehensive assessment of creativity, encompassing both domain-general and domain-specific components. In particular, the test battery was designed for the measurement of the 2 main stages of the creative thinking process: ideation and evaluation. The test battery also includes 2 measures of creative achievement and can be used to assess professional levels of creativity in artistic and scientific creativity, as well as everyday creativity. Because creative thinking is not an isolated phenomenon in human behavior, the battery includes the measurement of 2 constructs, intelligence and personality, both of which are highly relevant for creativity. Preliminary results from a vast administration campaign of this test battery are presented.

The measurement of creative behavior is a difficult pursuit. Creativity is a complex, multifaceted construct that defies a single definition (Corazza, in press). The challenge is enhanced when addressing domains as different as those of artists/musicians and scientists/technologists, which can be expected to be varied in their personal traits and methodological approaches to work. Yet it is absolutely crucial to tackle this challenge, and thus take a significant step toward understanding and finally enhancing creativity in disparate domains.

With this in mind, the European Commission launched a specific targeted research project under the acronym CREAM (CReativity Enhancement through Advanced brain Mapping and stimulation), focused on the multidisciplinary study of the neural substrates of creativity in different knowledge domains. Using a multidisciplinary approach, this project joins (a) cognitive psychology, to provide a reliable, standardized measurements of creativity; (b) neuroscience, to reveal the neuronal network underlying creative cognition and its constituent stages; and (c) information and communication technologies, to apply advanced signal processing techniques to monitor the creative cognitive states in real time and to use brain stimulation instrumentation in order to establish a causal link between brain and body states with creative cognition.

This article focuses only on (a) the integrated approach adopted to measure creative abilities and achievement and the development of a specific multiple-measurement test battery. By uniquely combining and integrating some of

Sarah Sumners was the Guest Editor of this article. An earlier version of it was presented at the Creativity Collaborative of the University of Georgia. The research reported in it was supported by the CREAM project funded by the European Commission under Grant Agreement n° 262022. This publication reflects the views only of the authors; the European Commission is not responsible for any use which may be made of the information contained therein

Correspondence should be sent to Sergio Agnoli, Marconi Institute for Creativity, Villa Griffone, Via dei Celestini 1, 40037 Sasso Marconi (BO), Italy. E-mail: sergio.agnoli@unibo.it

Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/HCRJ.

the existing procedures for evaluating creativity, this approach promises to reveal a well-rounded and a comprehensive assessment of creative abilities, encompassing both domain-general and domain-specific components. The main aim of this approach is, indeed, to measure the individual abilities associated with creativity in the artistic and scientific domains, identifying the common principles regulating creativity within both domains, and isolating the creative skills and tendencies primarily associated with each. This article presents the structure and the measurement purposes of the test battery and explains in detail the instruments composing this multifaceted measurement method. Moreover, the concluding section provides a compendium of preliminary results that emerged from the administration of this test battery.

MULTIFACETED TEST BATTERY STRUCTURE

Figure 1 presents an overall view of the test battery. Because creativity is a multidimensional construct, different measurement methods have been included in the battery to quantify creative behavior. Besides the measurement of ideational and assessment abilities, the battery includes two measures of creative achievement in scientific, artistic, and everyday contexts. Finally, methodologies aimed at measuring and controlling for the effect of constructs that are highly related to (i.e., influencing) creative behavior (e.g., intelligence and personality) have been included in the battery. Next we present a detailed description of the methodologies included in the battery.

CREATIVE BEHAVIOR MEASUREMENT

The battery is focused on measuring two main states (or stages) of the creative thinking process: ideation and evaluation. Ideation, in particular, is measured considering both the convergent and the divergent modalities. While convergent thinking is usually defined as the thinking modality aimed at finding the correct solution, divergent thinking is defined as the thinking modality aimed at producing all possible alternatives. These modalities are tested using quite different methods: Convergent thinking using tests of verbal, spatial, and numerical nature; divergent thinking using tests of verbal, figural, and realistic nature.

Even though the ideational phase of the creative thinking process is the most explored stage in creativity research, it is not sufficient to represent that process by itself. The evaluation of ideas has, for example, been demonstrated to be extricable from ideation (Runco & Charles, 1993). Therefore, a measurement of this ability has been included in the battery.

CONVERGENT THINKING

Remote Associates Test (RAT)

RAT was developed by Mednick (1962) as a measure of creative thought that does not require specific knowledge of any field. Each question on the RAT is composed of three apparently unrelated cue words (a triplet) that are associated with a fourth word, which is the correct answer. This test is typically used to study insight or insight-like phenomenon,

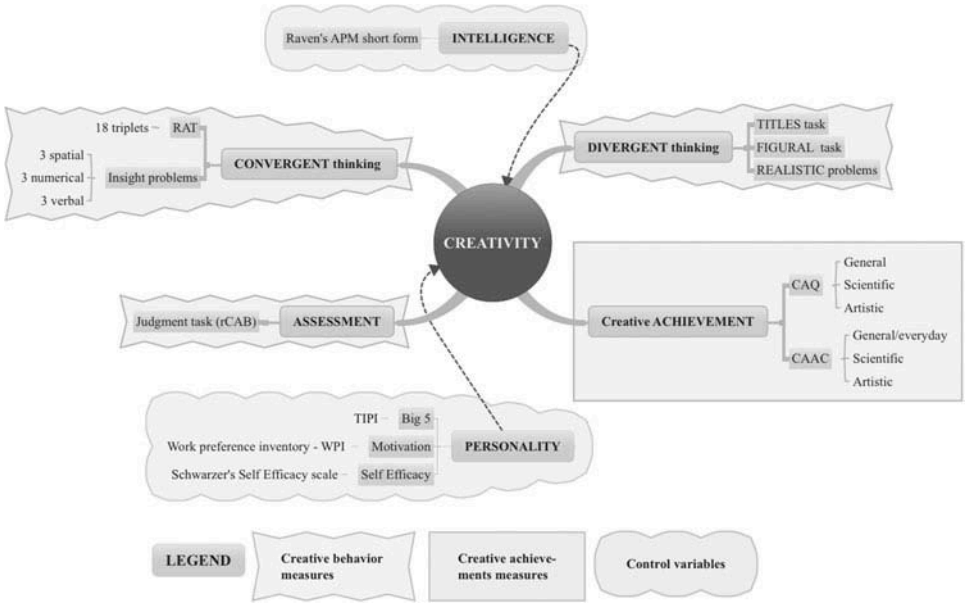

FIGURE 1 Structure of the multi-faceted measurement battery. The legend below the main figure indicates the inclusion of the measurement methods within three main categories: creative behavior measures, creative achievement measures, and control variables.

as upon solving RAT items solvers often have the Aha! experience. Because remote associate problems have a single-word, unambiguous solution, the RAT is used in the test battery to assess verbal convergent thinking ability.

RAT cue words are usually associated either through semantic association, synonymy, or formation of a compound word. However, triplets based on associations through synonymy or formation of a compound word are highly language dependent, (i.e., their associations are related to the language of the three cue words). Associations based on semantic associations, in contrast, are not language-dependent, as the semantic meaning is the same in the different languages. For this reason, in the new test battery 18 different triplets were chosen with associations of a semantic nature. This choice allows translating and using the battery in different languages. Triplets of different difficulties have been selected from past literature. (The difficulty of a triplet is defined by the percentage of participants who accurately find the associated word.) Following common practice (see Bowden & Jung-Beeman, 2003) a time limit of 30 sec is given to the participants to solve each problem.

Insight Problems

Insight problems may be seen as a special type of nonroutine problem in which the situation primes an inappropriate solution procedure that is familiar to the problem solver. During an insight problem, the problem solver must overcome this familiar way of looking at the problem and invent a novel approach. Dow and Mayer (2004) categorized insight problems as verbal, mathematical, or spatial. In the new battery, there were three of each. Participants have 2 min to find the solution to each problem.

DIVERGENT THINKING

Titles Task

Title task is used within the battery as a measure of participants' verbal divergent thinking and has been widely used in research (Guilford, 1968; Hocevar, 1980; Runco, Mohamed, & Paek, in press). This version of Titles asks examinees to produce alternative titles for some widely known books or movies. To adapt the use of this task to the Italian culture, two books and one movie that are very well known to the Italian audience were chosen. Unlike convergent thinking tasks, divergent thinking tests do not require the identification of correct or conventional responses, but instead require the production of alternatives. To stimulate the production of alternatives, participants were assured that these tasks are not graded, nor were points awarded for particular answers. They were told that their ideas were confidential. They were given 3 min for each Titles task.

Figures Task

The Figures task within the new battery is also a test of divergent thinking. Figural tasks tend to elicit higher originality scores than verbal DT tasks, probably because verbal tasks are more constrained or familiar and allow rote associations (Runco & Albert, 1985). The new battery contained three abstract black-and-white line drawings, much like those used by Wallach and Kogan (1965). Participants were asked to list all the things they can think of that each figure could represent. They were given 3 min for each figure.

Realistic Problems

The third divergent thinking task was based on realistic situations from the natural environment. Realistic tasks may have an advantage because the realism can be more interesting than an abstract problem, and it is possible that the individual has more relevant experience and, therefore, relevant information (Runco, Dow, & Smith, 2006). The problems included in the test battery have been used in past research (e.g., Runco, Illies, & Eisenman, 2005). The realistic tasks are open-ended questions, but unlike the other two divergent tasks, the problems focus on situations that participants (students) might actually experience. Participants are asked to produce as many alternative solutions as they can in 3 min for each problem (for a total of 9 min).

EVALUATION OF IDEAS: JUDGEMENT TASK

This task measures participants' evaluative ability. It has been used in previous research (Runco, 2013; Runco & Acar, 2012; Runco & Chand, 1994), but the version used in the new battery represents an adaptation. Participants are asked to judge the originality of 10 uses of five different common objects on a 5-point scale (from 1 = *highly conventional/unoriginal*, to 5 = *highly original*). These uses were derived from the uses produced in a previous study by 30 students of the same age range of the students involved in the present campaign (Agnoli, Franchin, Rubaltelli, & Corazza, 2015). The five most original and the five least original uses produced in the previous study were chosen for each of the five common objects and included in the Judgement Task of the new battery. They were presented to the participants in alphabetical order. Participants were given 6 min to complete this task.

CREATIVE ACHIEVEMENT: CREATIVE ACHIEVEMENT QUESTIONNAIRE (CAQ)

Creative achievement was first assessed by the CAQ (Carson, Peterson, & Higgins, 2005). This questionnaire measures

creative accomplishments in 10 different domains. The CAQ focuses on significant, observable accomplishments. Carson et al. (2005) demonstrated a two-factor solution for the CAQ scores, explaining creative achievement in the scientific and artistic domains. A maximum of 10 min was allowed to complete the CAQ.

CREATIVE ACTIVITY AND ACCOMPLISHMENT CHECKLIST (CAAC)

The CAAC is a self-report measure of creative achievement that covers a range of domains. It was first used by Holland (1960) and then adapted and updated by Hocevar (1981), Milgram and Hong (1999), Runco, Noble, and Luptak (1990), and Paek, Park, Runco, and Choe (in press). The present version of the CAAC uses 45 items to measure creativity accomplishments in the artistic, scientific, and everyday life domains. Likert responses are required (A = *never did this*, B = *did this once or twice*, C = *3–5 times*, and D = *more than 5 times*). To take into account, also, the different levels of motivation in creative activities, each item asked how many times each activity was performed both within (low motivation) and outside (high motivation) the scholastic environment. There was a 10 min limit.

CONSTRUCTS RELATED TO CREATIVE PERFORMANCE

Because creative thinking is not an isolated phenomenon, the new battery included the measure of two constructs that have been found to be highly related to creativity: intelligence and personality. There are indications that intelligence and creativity are largely distinct (Hocevar, 1980; Runco, 2007), yet intelligence does play a role in many expressions of creative talent (Cropley, 2006). The influence of personality on creativity is at least as well known (e.g., Feist, 1998). For this reason, the new battery includes measures of both general traits of personality, as well as self-efficacy and motivation. Each of these has been related to creative behavior (Amabile, Hill, Hennessey, & Tighe, 1994; Bandura, 1984, 1986, 1997; Lubart, 1994; Prabhu, Sutton, & Sauser, 2008).

Intelligence: Raven's Advanced Progressive Matrices (APM) Short Form

Raven's APM are one of the most employed intelligence tests in Europe. They are widely used to assess fluid ability in adolescents and adults (Raven & Raven, 2008). A limitation of this test is its length. To shorten the administration time, the new battery included a short form of the test (APM- SF) developed by Arthur and Day (1994; Chiesi, Ciancaleoni, Galli, Morsanyi, & Primi, 2012). This form is composed of 12 items from the APM—II Set (see APM Manual; Raven, Raven, & Court, 1998). Consistently with the long form, three items derived from Set I were used for practice before completing the APM—SF. After the completion of the practice items, participants have 20 min to complete the test.

Big-Five Dimensions: Ten Item Personality Inventory (TIPI) Scale

The TIPI Scale is a methodology developed within the Big-Five theoretical framework. Among different instruments developed to measure the Big-Five dimensions, TIPI has been demonstrated to allow a rapid and valid assessment (Gosling, Rentfrow, & Swann, 2003). Each item in this 10-item version represents one pole of the Big Five dimensions. As for format, each item consists of two descriptors, separated by a comma. Each item is rated on a 7-point scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*). Participants are instructed to write one of the seven numbers next to each of the 10 items to indicate the extent to which they see themselves fitting the descriptors. Participants are given 2 min to respond to the 10 items.

Self-Efficacy: Self-Efficacy Scale

In the new battery, self-efficacy was measured by the General Self-Efficacy Scale (Schwarzer, 1993). It is a 10-item scale that aims at measuring a broad and stable sense of personal competence to effectively deal with a variety of situations. Participants are instructed to choose a number next to each of the 10 statements to indicate the extent to which the statement is true or not true for them. They are instructed to use a four-point scale, from 1 (*not at all true*) to 4 (*exactly true*). Participants are given 2 min to respond to the 10 items.

Motivation: Work Preference Inventory (WPI)

The WPI was designed as a direct, explicit assessment of individual differences in the degree to which adults (college students) perceive themselves to be intrinsically and extrinsically motivated (Amabile et al., 1994). Correlations between WPI scores and behavioral creativity measures showed that *intrinsic* scores correlated positively with creativity, and *extrinsic* scores correlated negatively with creativity (Amabile et al., 1994). The original version of the WPI containing 30 items was written for working adults and was thus adapted and rewritten for college students. Participants are asked to respond on a 4-point scale how much each of the 30 items is true for them (from 1 = *never or almost never true of me* to 4 = *always or almost always true of me*). Four minutes are given to respond to this 30 item scale.

RESULTS AND DISCUSSION

An administration campaign was performed with students studying science and art at the graduate level. More than 300 students from the University of Bologna have been involved in the campaign. It was intended, in part, to establish a normative database to be used during the ongoing analysis of the brain substrates associated with creativity in science and art. As proposed, establishing the creativity characteristics in these two domains (art and science), using reliable methodologies that had been developed within the psychological research and using a psychometric approach to the analysis of the outcomes, are prerequisites to guarantee a correct neuroscientific approach to the analysis of cerebral activity associated to creative behavior. Preliminary analyses shows several clear data trends:

First, correlational analyses uncovered a positive association between the two convergent abilities assessed within the test battery (i.e., the associative ability measured by RAT and insight measured by insight problems) and between these abilities and the cognitive abilities measured by the Raven intelligence test. Of these three, only insight was associated with creative achievement, and in particular with scientific creative achievement. On the other hand, divergent thinking abilities were highly associated with personality traits (Extraversion and Openness) and tendencies (intrinsic motivation) and with artistic creative achievement.

Further analyses are under way to identify the best predictors of creative achievement, with the CAAC data as reference scores for creative achievement. Recall here that the CAAC has proven itself many times over to be a useful indicator of creative achievement (Hocevar, 1980; Holland, 1960; Milgram & Hong, 1999; Runco, 1986; Paek et al., in press; Runco et al., 1990; Wallach & Wing, 1969). Tentative analyses with the current data suggest that personality traits and divergent abilities are not significant predictors of scientific creative achievement. An exception is the fluency index from the Titles task, which highlights the importance of thinking of many different alternatives when facing a problem in the scientific domain. At the same time, self-efficacy seems to be emerging as the most accurate predictor of creative achievement in science. As pointed out previously, this tendency is related to the belief in being able to control a challenging environment by means of adaptive action (Paek et al., 2016; Schwarzer et al., 1997). Moreover, self-efficacy interacted with the ability to solve problems by insight in the prediction of creative achievement. In particular, at low levels of ability to solve problems through insight, believing in one's capacities is essential to predict creative achievement, but at high levels of insight, self-efficacy is no longer an essential requirement. This result suggests that a complex interaction between convergent ability and individual tendency is necessary to explain and predict scientific creative achievement.

Analyses also show that personality and divergent abilities (i.e., both producing original responses and producing many alternatives) are important predictors of artistic creative achievement. In contrast to the scientific domain, convergent abilities were not useful predictors, but like the analyses of scientific achievement, self-efficacy was important. Self-efficacy thus appears to be a central individual disposition for outstanding creative achievement. Similar to the results emerged in the scientific domain, divergent thinking (namely the ability to produce original alternatives) interacted with personality in predicting the artistic creative achievement. An interaction effect between Openness and originality was uncovered, with originality important at low levels of Openness, in the artistic domain, but not important at medium and high levels of Openness. Once again, these results demonstrate the importance of considering a complex blend of thinking and personality dispositions in measuring and predicting creative achievement.

Further analyses must be performed to fully understand the best predictors of creative achievement in scientific and artistic domains. However, some useful suggestions can be drawn from these preliminary analyses. First of all, the complex interactive effects emerged between personality factors and convergent or divergent abilities show that creative achievement must be considered as a blend of attitudinal and cognitive abilities, and measurement must necessarily consider both elements. Moreover, the estimation of creative achievement performed through this new multiple-measurement approach shows that performance in a single creative test cannot be considered sufficient to understand the creative achievement within a specific domain. On the contrary, the measurement of a blend of specific variables is emerging. The multiple-method approach, with a focus on particular domains, can be considered valuable for the analysis of creativity and will no doubt prove to show additional usefulness as we turn to the neuroscientific data from the CREAM project.

ACKNOWLEDGMENTS

We acknowledge the helpful support received by all CREAM Partners in the definition of the framework and requirements for the creativity measurement campaign, and in particular we thank Joydeep Bhattacharya for valuable suggestions and discussion.

REFERENCES

Agnoli S., Franchin L., Rubaltelli E., & Corazza G.E. (2015). An eye-tracking analysis of irrelevance processing as moderator of openness and creative performance. *Creativity Research Journal*, *27*, 125–132.

Amabile, T. M., Hill, K. G., Hennessey, B. A., & Tighe, E. (1994). The work preference inventory: Assessing intrinsic and extrinsic motivational orientations. *Journal of Personality and Social Psychology*, *66*, 950–967. doi:10.1037/0022-3514.66.5.950

Arthur, W., & Day, D. (1994). Development of a short form for the Raven advanced progressive matrices test. *Educational and Psychological Measurement*, *54*, 395–403. doi:10.1177/0013164494054002013

Bandura, A. (1984). Recycling misconceptions of perceived self-efficacy. *Cognitive Therapy and Research*, *8*, 213–229. doi:10.1007/BF01172995

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.

Bowden, E. M., & Jung-Beeman, M. (2003). One hundred forty-four compound remote associate problems: Short insight-like problems with one-word solutions. *Behavioral Research, Methods, Instruments, and Computers*, *35*, 634–639. doi:10.3758/BF03195543

Carson, S. H., Peterson, J. B., & Higgins, D. M. (2005). Reliability, validity, and factor structure of the creative achievement questionnaire. *Creativity Research Journal*, *17*, 37–50. doi:10.1207/s15326934crj1701_4

Chiesi, F., Ciancaleoni, M., Galli, S., Morsanyi, K., & Primi, C. (2012). Item response theory analysis and differential item functioning across age, gender and country of a short form of the advanced progressive matrices. *Learning and Individual Differences*, *22*, 390–396. doi:10.1016/j.lindif.2011.12.007

Corazza G. E. (in press). Potential originality and effectiveness: The dynamic definition of creativity. *Creativity Research Journal*.

Cropley, A. J. (2006). In praise of convergent thinking. *Creativity Research Journal*, *18*, 391–404. doi:10.1207/s15326934crj1803_13

Dow, G. T., & Mayer, R. E. (2004). Teaching students to solve insight problems: Evidence for domain specificity in creativity training. *Creativity Research Journal*, *16*, 389–398. doi:10.1080/10400410409534550

Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review*, *2*, 290–309. doi:10.1207/pspr.1998.2.issue-4

Gosling, S. D., Rentfrow, P. J., & Swann, W. B., Jr. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality*, *37*, 504–528. doi:10.1016/S0092-6566(03)00046-1

Guilford, J. P. (1968). *Creativity, intelligence and their educational implications*. San Diego, CA: EDITS/Knapp.

Hocevar, D. (1980). Intelligence, divergent thinking, and creativity. *Intelligence*, *4*, 25–40. doi:10.1016/0160-2896(80)90004-5

Hocevar, D. (1981). Measurement of creativity: Review and critique. *Journal of Personality Assessment*, *45*, 450–464. doi:10.1207/s15327752jpa4505_1

Holland, J. (1960). The prediction of college grades from personality and aptitude variables. *Journal of Educational Psychology*, *51*, 245–254.

Lubart, T. I. (1994). Creativity. In R. J. Sternberg (Ed.), *Thinking and problem solving* (pp. 289–332). San Diego, CA: Academic Press.

Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review*, *69*, 220–232. doi:10.1037/h0048850

Milgram, R. M., & Hong, E. (1999). Creative out-of-school activities in intellectually gifted adolescents as predictors of their life accomplishments in young adults: A longitudinal study. *Creativity Research Journal*, *12*, 77–88. doi:10.1207/s15326934crj1202_1

Paek, S.-H., Park, H., Runco, M. A., & Choe, H.-S. (in press). The contribution of ideational behavior to creative extracurricular activities. *Creativity Research Journal*.

Prabhu, V., Sutton, C., & Sauser, W. (2008). Creativity and certain personality traits: Understanding the mediating effect of intrinsic motivation. *Creativity Research Journal*, *20*, 53–66. doi:10.1080/10400410701841955

Raven, J., Raven, J. C., & Court, J. H. (1998). *Raven manual section 4: Advanced progressive matrices*. Oxford, UK: Oxford Psychologists Press.

Raven, J. C., & Raven, J. (Eds.). (2008). *Uses and abuses of intelligence: Studies advancing Spearman and Raven's quest for non-arbitrary metrics*. Unionville, New York: Royal Fireworks Press.

Runco, M. A. (1986). Divergent thinking and creative performance in gifted and nongifted children. *Educational and Psychological Measurement*, *46*, 375–384.

Runco, M. A. (2007). *Creativity: Theories and themes, research, development, and practice*. San Diego, CA: Academic Press.

Runco, M. A. (Ed.). (2013). *Divergent thinking and creative potential*. Cresskill, NJ: Hampton Press.

Runco, M. A., & Acar, S. (2012). Divergent thinking as an indicator of creative potential. *Creativity Research Journal*, *24*, 66–75. doi:10.1080/10400419.2012.652929

Runco, M. A., & Albert, R. S. (1985). The reliability and validity of ideational originality in the divergent thinking of academically gifted and nongifted children. *Educational and Psychological Measurement*, *45*, 483–501.

Runco, M. A., & Chand, I. (1994). Problem finding, evaluative thinking, and creativity. In M. A. Runco (Ed.), *Problem finding, problem solving, and creativity* (pp. 40–76). Norwood, NJ: Ablex.

Runco, M. A., & Charles, R. (1993). Judgments of originality and appropriateness as predictors of creativity. *Personality and Individual Differences*, *15*, 537–546. doi:10.1016/0191-8869(93)90337-3

Runco, M. A., Dow, G., & Smith, W. (2006). Information, experience, and divergent thinking: An empirical test. *Creativity Research Journal*, *18*, 269–277. doi:10.1207/s15326934crj1803_4

Runco, M. A., Illies, J. J., & Eisenman, R. (2005). Creativity, originality, and appropriateness: What do explicit instructions tell us about their relationships? *Journal of Creative Behavior*, *39*, 137–148. doi:10.1002/j.2162-6057.2005.tb01255.x

Runco, M. A., Mohamad, A., & Paek, S.-H. (in press). Which is the best test of divergent thinking? *Creativity: Research, Applications, Practice*.

Runco, M. A., Noble, E. P., & Luptak, Y. (1990). Agreement between mothers and sons on ratings of creative activity. *Educational and Psychological Measurement*, *50*, 673–680. doi:10.1177/0013164490503025

Schwarzer, R. (1993). *Measurement of perceived self-efficacy. Psychometric scales for cross-cultural research*. Berlin, Germany: Freie Universitat Berlin.

Schwarzer, R., Baessler, J., Kwiatek, P, & Schroeder, K. (1997). The assessment of optimistic self-beliefs: Comparison of the German, Spanish, and Chinese versions of the general self-efficacy scale. *Applied Psychology: An International Review*, *46*, 69–88.

Wallach, M. A., & Kogan, N. (1965). *Modes of thinking in young children*. New York, NY: Holt, Rinehart & Wintson.

Wallach, M. A., & Wing, C. (1969). *The talented student*. New York, NY: Holt, Rinehart & Winston.