

# What We Know About **CREATIVITY**

Part of the 4Cs Research Series



## ABOUT THE PARTNERSHIP FOR 21ST CENTURY LEARNING

P21, the Partnership for 21st Century Learning, recognizes that all learners need educational experiences in school and beyond, from cradle to career, to build knowledge and skills for success in a globally and digitally interconnected world. Representing over 5 million members of the global workforce, P21 unites business, government and education leaders from the U.S. and abroad to advance evidence-based education policy and practice and to make innovative teaching and learning a reality for every child.

## ABOUT THE RESEARCH SERIES

P21, in collaboration with its research partners, produced a series of research briefs and annotated bibliographies on key aspects of conceptualizing, developing, and assessing the 4Cs.

The research briefs in this series start with an overview of key conceptual issues related to the 4Cs of Creativity, Critical Thinking, Collaboration, and Communication, review research on interventions designed to increase student proficiency within each of the 4Cs, describe recent work on how to assess on the 4Cs, and conclude with major take-away points from the available research.

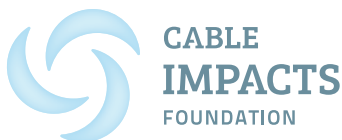
The series is edited by Helen Soulé, Executive Director at P21, and Jonathan Plucker, Neag Endowed Professor of Education at the University of Connecticut.

The 4Cs Research Series is dedicated to Dr. Ronald Thorpe, president and CEO of the National Board for Professional Teaching Standards. A friend and visionary we lost too early.

## AUTHORS

Jonathan A. Plucker, Raymond Neag Endowed Professor of Education, University of Connecticut  
James C. Kaufman, Professor of Educational Psychology, University of Connecticut  
Ronald A. Beghetto, Professor of Educational Psychology, University of Connecticut

## THANK YOU TO OUR SPONSORS



**First Five Years Fund**



The **WALT DISNEY** Company

'P21' is a registered trademark in the US Patent and Trademark Office.

Copyright © Partnership for 21st Century Skills. All rights reserved.



## INTRODUCTION

Creativity is widely acknowledged to be a key 21st century skill, and it is included in many countries' lists of desired college and career-ready outcomes for students. Creativity is included in the P21 Framework for 21st Century Learning as one of the Learning and Innovation Skills ([www.P21.org/Framework](http://www.P21.org/Framework)). Also known as the "4Cs," they include creativity, critical thinking, collaboration, and communication. From creating works of art, producing abundant inexpensive water, developing non-invasive health devices or net zero energy homes, finding medical cures, restoring and improving urban infrastructure, generating new energy sources, and preventing nuclear terror, to developing sustainable ways to solve complex geopolitical problems, the ability to produce and implement new, useful ideas is rapidly becoming a critical attribute for leveraging knowledge success and increasing quality of life.

The well-documented, shifting global paradigm from manufacturing to knowledge-based to innovation economies makes the ability to solve problems creatively a necessary skill for educational and workforce success. In an age when much of the world's information can be quickly accessed on a smartphone, a premium is placed on the ability to use that knowledge in creative ways to produce valuable outcomes and solve complex problems. The ability to innovate, both alone and in groups, leads to positive outcomes in the workplace, the playing field, and the family room.

But what do we know about creativity? A range of opinions appears to exist in response to this question: Some people think we know very little, with scholars struggling to define even the basic construct; others believe that we know more than enough to guide effective and efficient interventions. The reality probably lies somewhere between these two extremes. The purpose of this research brief is to review the state of the art regarding conceptual, enhancement, and assessment issues regarding creativity and innovation, with an emphasis on educational applications.

## DEFINITIONS AND MODELS

### Definitions

Although the term "creativity" has only been used for roughly 140 years, humans have been fascinated with the creative process at least as far back as the early Greeks. The large-scale, scientific study of creativity did not emerge until the decade after World War II, due in large part to an increased emphasis on creativity research within psychology and a surge in interest

regarding scientific creativity in the post-Sputnik era. The centuries of popular interest in creativity combined with the relatively recent growth in the science of creativity has led to a preponderance of myths and legends about creativity, with one of the most enduring being that no common definition of the term exists.

However, creativity has been well-defined, both explicitly and implicitly, for decades. For example, Stein (1953) defined creativity as "a novel work that is accepted as tenable or useful or satisfying by a group in some point in time" (p. 311). Over time, nearly all definitions have included both novelty and usefulness in some form, with the stipulation that creativity involves both characteristics. In other words, producing a different or useful potential solution to a problem is not enough—one must produce solutions that are unique and useful in order to be engaged in creative activity.

Plucker, Beghetto, and Dow (2004), in a study of definition use in published creativity research, found that the majority of researchers were not defining creativity explicitly in their work, but that the majority of implicit definitions conformed to the traditional unique-and-useful conceptualization. To more closely align this definition with advances in learning theory, Plucker et al. proposed a new definition:

*"Creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context" (p. 90).*

This definition, which has been widely adopted in the literature, broadens yet contextualizes the traditional definition in several ways. First, it emphasizes that judgments of the existence of creativity don't happen in a vacuum, and that the context in which the behaviors occur strongly influences evaluations of creativity. For example, the same product may be creative in a third grade classroom but not creative in an engineering firm. Second, the definition acknowledges recent research that creativity may be a solitary activity, a group activity, or more likely, both.

Some scholars suggest that a creativity product must also be surprising or non-obvious (Amabile, 1996; Boden, 2004; Simonton, 2012). This may be accurate in some settings, such as products evaluated for patent protection,<sup>1</sup> but it may not be true in all settings. This additional characteristic would appear to fall under the "social context" requirement in the Plucker et al. definition.

<sup>1</sup> See <http://bitlaw.com/patent/requirements.html>

## CREATIVITY IN PRACTICE: A P21 Member Perspective

We are at a unique place in time where the rapidly changing economy will open unprecedented opportunities for students. Fueled by technology, the status quo in global education and business is being challenged. The ability to design the future and to imagine new ways of combining old with new will be game-changing skills for students.

Learning how and when to be creative, how to build cross-cultural teams, how to manage budgets and risk, how to present a compelling proposal, and how to manage a project from beginning to end will provide students with the necessary skills to become the next generation of problem finders and solvers, innovators, cross-cultural collaborators, entrepreneurs, and leaders. Founded in 1982, Destination Imagination (DI), a 501(c)(3) nonprofit, is cause-driven to ready students worldwide for college, career, and life beyond school through opportunities that promote and support creativity, imagination, contextual learning, arts appreciation, STEM-based skills development, and entrepreneurship leading to an engaged and future-ready student population.

Research has examined the individual components of the perseverance construct (brain optimization, mindfulness, emotional intelligence, and self-determination) and their positive relationship to creativity and 21st century skill development. The perseverance construct is integral to the DI teaching methodology. Specific research findings from survey assessment prepared and scored by Dr. Mark Runco at the Torrance Center for Creativity and Talent Development at the University of Georgia on DI student perceptions and outcomes include:

89% agreed totally or mostly that “learning can be fun.”  
85% agreed that they keep their eyes open for opportunities to use imagination.  
93% agreed that it is good to solve problems by considering a variety of perspectives.  
85% agreed that it is useful to question assumptions and question the way a problem is presented.  
More than 90% agreed that originality can be useful even in school.

Customized project-based DI challenges ready students for the emerging STEM-C (science, technology, engineering, mathematics, & computer science) related economy by giving them the opportunity to learn and experience the creative process from imagination to innovation. More than 200,000 students worldwide participate annually in DI’s program under the guidance of 38,000 passionate volunteers. Global Finals, DI’s annual international creativity competition, draws more than 17,000 students, supporters, and industry practitioners.

Learn more at [www.destinationimagination.org](http://www.destinationimagination.org)



**Dr. Chuck Cadle**  
Chief Executive Officer  
Destination  
Imagination, Inc.

### Models

Countless models have been developed to help us understand and enhance creativity. A detailed review and discussion of these models is beyond the scope of this brief, although this brief reviews a few popular models that have had significant influence on the study and teaching of creativity, but interested readers are referred to several excellent and comprehensive reviews (Kaufman & Sternberg, 2010; Runco, 2014; Runco & Pritzker, 2011; Sawyer, 2012).

The first major model, which remains in widespread use to this day, is Rhodes’ (1961) Four-P model. The four phases of the model are person, process, product, and press,<sup>2</sup> emphasizing that creativity is multi-dimensional and has personality, cognitive, production, and environmental qualities.

<sup>2</sup> “Press” because Environment doesn’t start with P.

By far the most influential recent model is the Four-C model (Kaufman & Beghetto, 2009). This model proposes four different levels of creative accomplishment: Big-C, representing eminent creativity; Pro-C creativity of professional-level creators who have not yet attained eminent status; Little-C creativity, that which is involved in daily activities and experiences, and Mini-C creativity involving the novel and personally meaningful insights and interpretations involved in learning and experience.

The neurological underpinnings of creativity are also widely researched and modeled. The Facebook-quiz, tried-and-true, left brain/right brain theory of creativity has been largely laid to rest by the scientific community. Imagining technologies overwhelmingly show activation in all areas of the brain during creativity and creative thinking; and the levels of activation

## CREATIVITY IN PRACTICE: A P21 Exemplar Perspective

Laura Numeroff's famous children's book series started with *If You Gave a Moose a Cookie*. The gist of the story is that the Moose, given a cookie, continues to expand his wishes. Necessity may be the mother of invention, but creativity is the cog that drives the wheel. Our school mascot is the Moose, and our Professional Development promotes the educator as a life-long learner. My quest began with research on STEM, especially the technology, and what our school needed to keep ahead of the game.

Students need opportunities to use their hands and minds to create. It may mean rethinking the classroom model to embrace creativity. It's about letting students demonstrate the skills and concepts they have learned in exploratory and adventurous ways. Unleash their creativity. Let them own their learning.

So what does creativity look like in K-5?

### Making a better play dough

(Properties of matter - Grade 1)

Children mix many batches vary the amounts of salt, water, and flour and determine how each change a property. Children record results of each change. Add an art component by mixing food color to study primary and secondary colors. Survey another class to collect data on favorite color and graph results. Children take dough home and evaluate it. Is it smooth, does it roll out easily, can you make cut outs, does it stick?

### Design a Bridge with Toothpicks and Gumdrops

(All school project on structural engineering of bridges)

Can I build a bridge that will cover a 12" span and hold at least 50 pennies? Design/create a prototype. Collaborate, communicate. Build it. Test it. Modify it. Test it. Create! Are students using what they learned to modify? Do they use different shapes? Are they engaged in the task? How do they deal with success and/or frustration?

### Write a Circle Story

(Grade 2 - Language Arts/Writer's Workshop and Technology)

Students write a story that starts with a particular setting, has three episodes, and ends with the original setting. Then they use LEGO and myCreate to build the settings and scenes to tell and illustrate the story. Does the story flow in a circle? Do the LEGO scenes match the story? Does the student demonstrate good use of available techniques in the software?

### Design an Alarm System

(Grade 4 - Science)

Students learn how to build a simple circuit, a series circuit, a parallel circuit, and using universal symbols in a schematic diagram. Unit culminates in a visit to the Science Museum and the opportunity to design an alarm system including a buzzer and a light and the needed apparatus to build the circuit at home.

### 3D Printing

Study nutrition and create a food using the 3D printer. Study the pond and create an insect or fish. Study volume and create a net for a 3D figure.

### Laser Cut

Design (Tinkercad and Inkscape), create and cut fraction pieces, tangrams, tessellations, planes, boxes, puzzles and more.

Adding technology is not the same as integrating it. It must not be a substitute or an augmentation, but rather, it must be a redesign for a learning goal that allows for greater creative opportunity. Next year we will build a boat for Odysseus! If only we could create time.



### Dotty Corbiere

Teacher of  
Mathematics, Robotics,  
and Technology  
The Meadowbrook  
School (MA)



appear to be approximately equal in magnitude (see Sawyer, 2011, for an excellent review). Unfortunately, a model has yet to emerge with enough evidence to gather a general consensus across neuroscientists and creativity researchers (Dietrich & Kanso, 2010). At the moment, the most well-accepted neurological model for creativity is Martindale's (1999) theory of cognitive disinhibition. According to Martindale, the frontal lobe is responsible for the inhibition of creative behavior, meaning our natural state is a wildly creative one, but our brains wisely intervene and tone our creativity down so that we may function in day-to-day life. This is evidenced as activation in the frontal lobe—although creativity is being decreased, the brain is putting forth an effort—using resources, if you will—to make this happen. In experimental situations, those who are more creative show less activation in the frontal lobes—meaning their brains are doing less to “tone down” the natural creativity.

## INTERVENTIONS

Can we make students more creative? If so, how?

The short answer is, yes, creativity can be enhanced. Understanding how requires a bit more explanation. First, it is important to clarify a few assumptions about creativity enhancement. Creativity researchers generally agree that creative potential is a widely distributed human trait (Beghetto, 2013). As such, creative potential is not something only certain students have or something that can be given or taken away from students. However, under certain conditions students' creative potential is more likely to be developed into creative competence.

What are those conditions? The answer to this question, as implied by the definitions reviewed above, comes from recognizing that the development of creative competence results from an interaction between person and environment (Beghetto & Kaufman, 2014; Kozbelt, Beghetto, & Runco, 2010). With respect to the person, creativity researchers have highlighted several interrelated factors, including openness to experience (Feist, 2010), confidence in one's own creative ability (Bandura, 1997; Beghetto, 2006), task motivation (Amabile, 1996; Hong, Hartzell, & Green, 2009), domain knowledge and expertise (Ericsson et al., 1996), willingness to take sensible risks (Beghetto, 2009; Sternberg, 2010), and resilience in the face of criticism (Simonton, 2010; Sternberg & Lubart, 1995).

The learning environment also influences the development of students' creative competence. Creativity researchers have demonstrated that well-designed training programs (i.e., those that focus on developing creative thinking skills in realistic,

domain-specific exercises) are most likely to enhance creativity (see Isaksen & Treffinger, 2004; Scott, Leritz, & Mumford, 2004, for a review). With respect to the classroom, research suggests that learning environments play at least as great a role in student creativity as students' personal characteristics (e.g., Niu, 2007; Runco, 2014). Davies et al. (2012) have, for example, identified several features of the learning environment that have been linked with creativity development, including flexible use of the physical environment, balancing structure with freedom so students have an opportunity to engage in self-directed and exploratory learning, and establishing partnerships with outside organizations, businesses, and community agencies.

Teachers' instructional practices also play an influential role. Schacter and his colleagues (2006) have, for instance, outlined several creativity supportive practices, including: explicitly teaching for creative thinking, providing students with choice and exploratory learning, encouraging students' intrinsic motivation, and providing opportunities for students to use their imagination. Not only are such practices associated with promoting creativity, they can also boost student achievement. Unfortunately, Schacter and his team found that such practices were not frequently used by teachers, particularly if those teachers were assigned to teach in schools serving minority and low-performing students.

Although the vast majority of this research has been conducted in K-12 education or business contexts, the findings discussed in this brief should be equally applicable to other contexts, such as early childhood education; afterschool enrichment and tutoring programs; and informal education settings such as summer camps, museums and other cultural institutions, and internships.

The research on creativity development and enhancement demonstrates that creativity can be enhanced and points to personal and environmental factors that influence the development of creativity. Although there are no simple recipes or techniques that will instantly lead to creativity, educators can enhance student creativity by establishing learning environments that support key personal factors (e.g., development of domain knowledge, creative confidence, sensible risk-taking) and creativity-supportive environmental conditions (e.g., allowing for flexible use of the physical environment, providing opportunities for exploration, and using creativity-supportive instructional practices).

## ASSESSMENT

The assessment of 21st century skills is currently receiving extensive attention from educators, advocates, and policymakers.<sup>3</sup> Assessments for creativity have been developed, used, and evaluated for decades, with a great deal of development and scoring work conducted over the past decade (see Kaufman, Plucker, & Baer, 2008; Runco, 2014). The most promising categories of assessments include divergent thinking measures, product ratings (and other assessments that use someone's judgment), and self-assessments.

### Divergent Thinking

Divergent Thinking (DT) is the most common and the most popular way to measure creativity (Callahan, Hunsaker, Adams, Moore, & Bland, 1995). Divergent thinking, first posed by Guilford (1950, 1967) as part of a larger theory of intelligence, is the ability to generate many different possible responses to an open-ended question. It is often paired with convergent thinking, which is being able to select the best response out of many choices.

Although many (including Guilford) created measures based on the construct of divergent thinking, the most successful have been the Torrance Tests of Creative Thinking (TTCT) (Torrance, 1966, 1974).

These are the longest-running, continually published assessments of DT, most carefully studied, and most widely used in educational settings of all tests of creativity (Kaufman et al., 2008). The TTCT are divided into two sections, Verbal and Figural.

The Verbal section is comprised of seven subtests that range from Unusual Uses (in which the participant is asked to come up with many possible uses for a common object, such as a cardboard box) to Just Suppose (in which the participant is asked to come up with many different potential ramifications for an unlikely situation, such as people no longer needing sleep). The Verbal tests are scored along three dimensions: Fluency, Flexibility, and Originality. Fluency is the number of relevant responses (i.e., sheer output); Flexibility is the number of different categories (i.e., different types of answers); and Originality is the statistical infrequency of the responses (i.e., thinking of answers that very few other people have said).

The Figural section is comprised of three sections, which ask the participant to modify or expand shapes or drawings and, in the case of the Picture Completion subtest, give a title to the picture. They are also scored

<sup>3</sup> These discussions are described differently by different groups (e.g. hard-to-measure skills, soft skills), but they tend to discuss similar constructs.

for Fluency and Originality, as well as Elaboration (the amount of detail in a response), Resistance to Premature Closure (keeping an open mind), and Abstractedness of Titles (the degree to which the picture title moves beyond mere labeling).

Divergent Thinking tests in general (and specifically the TTCT) have demonstrated evidence of being both reliable and valid in that they often correlate with other measures of creativity (e.g., Plucker, 1999). One particularly appealing feature of these tests is that they are comparatively easy to score and provide a number of different scores. However, their ability to predict future creative behavior has been questioned, as has the narrow range of domains assessed (see Kaufman et al., 2008).

A related measure is the Remote Associates Test (RAT) (Mednick, 1962, 1968), based on the idea that creative people can make meaningful connections between seemingly remote ideas. This measure gives three words that are each separately connected by a fourth word. For example, the words might be Sleeping, Bean, and Trash, and the correct answer would be "Bag." Sleeping bag, bean bag, and trash bag are all common phrases. The RAT is easy to administer and score, which makes it a popular measure. One criticism is that it is strongly reliant on intelligence and academic knowledge (such as vocabulary).

### Product Ratings/Judgment

Another common way to assess creativity is to have teachers or other adults evaluate actual student products (anything from a poem to a collage to a mathematical equation). Amabile (1982, 1996) outlined a methodology called the Consensual Assessment Technique, in which experts review creative products and assign a score based on their own implicit definition of what is creative. They are not given specific instructions or allowed to discuss their ratings with each other. Creative products are compared to each other, as opposed to a specific ideal. The appeal of this methodology (which is more common in research studies than applied settings) is that theoretically any creative work can be assessed and that the expertise of the raters offers a certain type of validity. The downside is that obtaining the ratings can be time consuming (and potentially expensive).

Creative products can also be assessed using product rating scales, which ask specific questions about the product. Theoretically, less expertise is needed to rate creative work using these more detailed scales than the more open-ended Consensual Assessment Technique. That said, this class of assessments arguably has had the most extensive application to K-12 education and is particularly well-suited to problem-based learning



contexts. For example, the Creative Product Semantic Scale (Besemer & O’Quin, 1993; O’Quin & Besemer, 1989, 2006) allows raters to judge the novelty, problem resolution, and elaboration and synthesis attributes of products, and the Student Product Assessment Form (Reis & Renzulli, 1991), designed to serve as an evaluation instrument in gifted programs, provides ratings of nine product traits (e.g., problem focusing, appropriateness of resources, originality, action orientation, audience). Westberg (1991, 1996) designed an instrument to evaluate student inventions, with analyses producing evidence of originality, technical goodness, and aesthetic appeal factors. Each of these instruments is associated with evidence of reliability, although validity issues remain to be addressed. In the one available comparison of teachers’ and parents’ ability to evaluate children’s ideas, the two groups were similarly successful, with number of children and adult divergent thinking test scores positively and moderately correlated with evaluative skill (Runco & Vega, 1990).

## Self-assessments

Self-assessments are traditionally used for guidance or research purposes; they are generally not used for any type of high-stakes testing because of issues with faking or inaccuracy. Some self-assessments are designed to capture the creative personality. Most of these tests rely heavily on the personality construct of openness to experience. Being open to experience could be demonstrated experientially (such as liking to try new food) or intellectually/artistically (such as enjoying going to museums). These tests traditionally include statements that participants assign ratings reflecting their agreement. A typical item might be “I have a good imagination” or “I like thinking deep thoughts.” There is a near-universal finding that openness to experience is associated with creativity (e.g., King, McKee-Walker, & Broyles, 1996).

Other self-assessments look at creativity styles (how people choose to use their creativity), creative self-

## CREATIVITY IN PRACTICE: A P21 Member Perspective

“Bringing colorful wings to the invisible things that live in the hearts and minds of children,” is the Crayola® mantra. Helping parents and educators understand the creative process, how they can nurture children’s creative expression, and why creativity matters, is central to our work.

Research we’ve done shows that educators believe creativity is important and they want to do more art-infused teaching. Ninety-three percent of classroom teachers believe that art-integration has a high impact on building students’ creative skills. Nine out of ten elementary school principals place a high priority on integrating art across curricula. In fact, 90 percent of principals report that art-integration increases student engagement and learning across all subject areas.

We became curious about how to translate educators’ beliefs into action. We found that more creative experiences happen in schools where the principal articulates this priority to teachers, includes creativity in the school vision statement, and builds teachers’ creative capacity. Half of elementary school principals say, “there is a person, either at the school or at the district level, who is responsible for building both students’ and faculty’s creativity.” Of those who said, “yes,” 6 out of 10 said “that’s our art teacher.”

We work to help art teachers and principals build Creative Leadership Teams—colleagues who serve as creative coaches, building teachers’ creative

confidence. Working with educators over the past 110 years, we’ve seen a recent shift in attitudes towards art teachers that excites us. Today, principals and teachers believe it is important for art teachers to share their creative expertise with colleagues. In fact, 96 percent of principals report art teachers’ influence and value to their schools increases when they share their expertise with colleagues.

To help schools develop innovative creative leadership programs, Crayola® offers Creative Leadership grants. The grant winners’ stories are shared in the Crayola Champion Creatively Alive Children resources—a series of free professional development materials, focused on how art-infused education builds 21st century skills. These materials include videos, handouts, and facilitators’ guides so teacher-leaders can present workshops and have creativity discussions with colleagues.

Learn more at [www.Crayola.com/educators](http://www.Crayola.com/educators)



**Cheri Sterman**

Director, Education  
and Consumer  
Relationships  
Crayola

efficacy (people's beliefs in their own creativity), and creative behaviors. One example of a behavioral self-assessment is the Creative Achievement Questionnaire (CAQ) (Carson, Peterson, & Higgins, 2005). This instrument asks participants to check off their accomplishments on ten domains that broadly encompass the arts and science.

Broadly speaking, divergent thinking and remote associate tests are assessments that can be modified to fit the curriculum and can provide techniques to enhance creativity-relevant skills. Product ratings (or divergent thinking tests) can be used for any high-stakes situation (i.e., for grading, admissions, or giftedness placement). Self-assessments are valuable for student development and guidance.

## CONCLUSIONS AND RECOMMENDATIONS

The extensive research on creativity, reviewed briefly in this report and described in more detail in the accompanying annotated bibliography (starting on pg. 11 of this brief), led to a number of important conclusions and implications for practice, which are provided below. In addition, we refer readers to Table 1, a summary of key actions that can be taken within various educational contexts to enhance student creativity.

**Conclusion:** Creativity, contrary to conventional wisdom, has been carefully defined.

**Recommendation:** A great deal of energy is spent on continually defining and redefining creativity, innovation, and related constructs. In the end, these activities result in definitions that are very similar to those that came before. The field has standard definitions, and these should be used in intervention and assessment efforts.

**Conclusion:** Several helpful models of creativity exist to help guide intervention and assessment efforts.

**Recommendation:** These models complement the major definitions and provide good frameworks to help educators understand what creativity is, what it isn't, and what it can be across a variety of settings.

**Conclusion:** Regardless of whether creativity is innate, learned, or both, a large body of research suggests that creativity can be enhanced.

**Recommendation:** Nature-nurture debates are inherently interesting, but they are a distraction from efforts to enhance student creativity. We know we can enhance individual and group creativity.

**Recommendation:** Schools should adopt these specific instructional strategies.

**Conclusion:** Context matters when it comes to supporting creativity.

**Recommendation:** School and classroom contexts that expect and reward sensible risk taking and creative expression will increase the likelihood of creative teaching and creative learning.

**Conclusion:** Specific instructional strategies have been shown to increase student creativity, although the strategies are not widely used in schools.

**Recommendation:** Although these strategies are well-documented, their use is often discouraged by the current high-stakes accountability testing environment. Research is needed to determine the extent to which creativity enhancement impacts student achievement test scores.

**Conclusion:** Creativity can (and often does) thrive in constraints.

**Recommendation:** Educational environments contain various constraints (e.g., curricular standards, external accountability mandates, time, and resources). The good news is that constraints don't necessarily kill creativity. Rather, they provide situations that often necessitate creativity. Educators and instructional leaders who recognize this will be in a better position to respond creatively to the everyday constraints facing schools and classrooms.

**Conclusion:** Numerous, well-developed assessments of creativity exist, but they were developed primarily for use in research and need additional development to be transferred to educational contexts.

**Recommendation:** Assessment strategies for identifying creative potential are well-developed and widely available, as are creative product rating scales and can be used in schools. But assessments for classroom use (such as curriculum-based measures) and high-stakes contexts (state accountability systems, college admissions) are underdeveloped.

**TABLE 1: What do we need to do?**

Education Level	Intervention	Assessment	Evaluation
P-12 Classroom	Make classroom settings more inviting for creative input and thinking; embed creativity within the classroom culture	Promote and incorporate student creativity outcomes in curriculum and instruction	Develop and/or use formative, curriculum-based assessments of creativity; regularly assess student's creative growth and report the results to parents
School	Embed creativity within the underlying culture of the school and make sure learning spaces support creative output	Develop common vision, plan and strategy for incorporating creativity into teaching and learning; build staff capacity and support innovative teaching practices that develop creativity	Incorporate creativity into the students' assessment portfolio; encourage teachers to assess student's creative growth as regular part of the evaluation and reporting process
Out-of-School	Evaluate the extent to which programs, activities, services, spaces and culture support creativity; redesign learning/activity environment as needed	Incorporate creativity into programs, activities and support services; support building staff capacity through professional development, etc.	Encourage measurement of students' creative growth as integral part of desired 21st century outcomes
School District	Determine how resources are used to promote creativity-boosting learning spaces and learning culture; allocate resources as needed	Provide professional development and resources to schools regarding creativity intervention practices	Develop and support the use of high quality creativity assessments in schools as part of the district's assessment plan
State	Support the incorporation of teaching practices and learning environments that promote creativity	Develop or make available professional development and curriculum that build capacity for incorporating creativity into teaching and learning	Encourage the use of high quality creativity assessments at appropriate levels
National	Devote resources to support creativity research, interventions, and assessments	Fund development, pilot implementation, and evaluation of creativity interventions	Support development of high-quality, creativity assessments at all levels

## REFERENCES

- Amabile, T. M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology*, 43, 997-1013.
- Amabile, T. M. (1996). *Creativity in context: Update to "The social psychology of creativity."* Boulder, CO: Westview Press.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Beghetto, R. A. (2006). Creative self-efficacy: Correlates in middle and secondary students. *Creativity Research Journal*, 18(4), 447-457.
- Beghetto, R. A. (2009). Correlates of intellectual risk taking in elementary school science. *Journal of Research in Science Teaching*, 46, 210-223.
- Beghetto, R. A. (2013). *Killing ideas softly? The promises and perils of creativity in the classroom*. Charlotte, NC: Information Age Press.
- Beghetto, R. A., & Kaufman, J. C. (2014). Classroom contexts for creativity. *High Ability Studies*, 25(1). *Special Issue: The Significance of Learning Contexts in Talent Development*. doi:10.1080/13598139.2014.905247
- Besemer, S. P., & O'Quin, K. (1993). Assessing creative products: Progress and potentials. In S. G. Isaksen, M. C. Murdock, R. L. Firestien, & D. J. Treffinger (Eds.), *Nurturing and developing creativity: The emergence of a discipline* (pp. 331-349). Norwood, NJ: Ablex Publishing Company.
- Boden, M. A. (2004). *The creative mind: Myths and mechanisms*. New York: Routledge.
- Callahan, C. M., Hunsaker, S. L., Adams, C. M., Moore, S. D., & Bland, L. C. (1995). *Instruments used in the identification of gifted and talented students* (Research Monograph No. 95130). Storrs, CT: The National Research Center on the Gifted and Talented.
- 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.
- Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P., & Howe, A. (2012). Creative learning environments in education: A systematic literature review. *Thinking Skills and Creativity*, 8, 80-91.
- Dietrich, A., & Kanso, R. (2010). A review of EEG, ERP, and neuroimaging studies of creativity and insight. *Psychological Bulletin*, 136, 822-848.
- Ericsson, K. A. (Ed.). (1996). *The road to expert performance: Empirical evidence from the arts and sciences, sports, and games*. Mahwah, NJ: Erlbaum.
- Feist, G. J. (2010). The function of personality in creativity: The nature and nurture of the creative personality. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 113-130). New York: Cambridge University Press.
- Guilford, J. P. (1950). Creativity. *American Psychologist*, 5, 444-544.
- Guilford, J. P. (1967). *The nature of human intelligence*. New York: McGraw-Hill.
- Hong, E., Hartzell, S. A., & Greene, M. T. (2009). Fostering creativity in the classroom: Effects of teachers' epistemological beliefs, motivation, and goal orientation. *Journal of Creative Behavior*, 43, 192-208.
- Isaksen, S. G., & Treffinger, D. J. (2004). Celebrating 50 years of reflective practice: Versions of creative problem solving. *Journal of Creative Behavior*, 38, 75-101.
- Kaufman, J. C., & Beghetto, R. A. (2009). Beyond big and little: The Four C Model of Creativity. *Review of General Psychology*, 13, 1-2. doi:10.1037/a0013688
- Kaufman, J. C., Plucker, J. A., & Baer, J. (2008). *Essentials of creativity assessment*. New York: Wiley.
- Kaufman, J. C., & Sternberg, R. J. (Eds.) (2010). *The Cambridge handbook of creativity*. New York: Cambridge University Press.
- King, L. A., McKee-Walker, L., & Broyles, S. J. (1996). Creativity and the Five Factor Model. *Journal of Research in Personality*, 30, 189-203.
- Kozbelt, A., Beghetto, R. A., & Runco, M. A. (2010). Theories of creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 20-47). New York: Cambridge University Press.
- Martindale, C. (1999). Biological basis of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 137-152). New York: Cambridge University Press.

- Mednick, S. A. (1962). The associative basis of the creative process. *Psychological Review*, 69, 220-232.
- Mednick, S. A. (1968). The Remote Associates Test. *Journal of Creative Behavior*, 2, 213-214.
- Niu, W. (2007). Individual and environmental influences on Chinese student creativity. *The Journal of Creative Behavior*, 41, 151-175.
- O'Quin, K., & Besemer, S. P. (1989). The development, reliability, and validity of the revised creative product semantic scale. *Creativity Research Journal*, 2, 267-278.
- O'Quin, K., & Besemer, S. P. (2006). Using the Creative Product Semantic Scale as a metric for results-oriented business. *Creativity and Innovation Management*, 15, 34-44.
- Plucker, J. A. (1999). Is the proof in the pudding? Reanalyses of Torrance's (1958 to present) longitudinal study data. *Creativity Research Journal*, 12, 103-114.
- Plucker, J. A., Beghetto, R. A., & Dow, G. (2004). Why isn't creativity more important to educational psychologists? Potential, pitfalls, and future directions in creativity research. *Educational Psychologist*, 39, 83-96.
- Reis, S. M., & Renzulli, J. S. (1991). The assessment of creative products in programs for gifted and talented students. *Gifted Child Quarterly*, 35, 128-134.
- Rhodes, M. (1961). *An analysis of creativity*. *Phi Delta Kappan*, 42(7), 305-310.
- Runco, M. A. (2014). *Creativity: Theories and themes: Research, development, and practice (2nd ed.)*. San Diego: Academic Press
- Runco, M. A., & Pritzker, S. R. (Eds.). (2011). *Encyclopedia of creativity (2nd ed.)*. Boston: Academic Press.
- Runco, M. A., & Vega, L. (1990). Evaluating the of children's ideas. *Journal of Social Behavior and Personality*, 5, 439-452.
- Sawyer, R. K. (2011). The cognitive neuroscience of creativity: A critical review. *Creativity Research Journal*, 23, 137-154.
- Sawyer, R. K. (2012). *Explaining creativity: The science of human innovation (2nd ed.)*. New York: Oxford University Press.
- Schacter, J., Thum, Y. M., & Zifkin, D. (2006). How much does creative teaching enhance elementary school students' achievement? *Journal of Creative Behavior*, 40, 47-72.
- Scott, G., Leritz, L. E., & Mumford, M. D. (2004). The effectiveness of creativity training: A quantitative review. *Creativity Research Journal*, 16, 361-388.
- Simonton, D. K. (2010). Creativity in highly eminent individuals. In J. C. Kaufman, & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 174-188). New York: Cambridge University Press.
- Simonton, D. K. (2012). Taking the US Patent Office criteria seriously: A quantitative three-criterion creativity definition and its implications. *Creativity research journal*, 24(2-3), 97-106.
- Stein, M. I. (1953). Creativity and culture. *The Journal of Psychology*, 36(2), 311-322.
- Sternberg, R. J. (2010). Teaching for creativity. In R. A. Beghetto & J. C. Kaufman (Eds.), *Nurturing creativity in the classroom* (pp. 394-414). New York: Cambridge University Press.
- Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity*. New York, NY: Free Press.
- Torrance, E. P. (1966). *The Torrance Tests of Creative Thinking—norms—technical manual research edition—verbal tests, forms A and B—figural tests, forms A and B*. Princeton, NJ: Personnel Press.
- Torrance, E. P. (1974). *Torrance Tests of Creative Norms-technical manual*. Lexington, MA: Ginn.
- Westberg, K. L. (1991). The effects of instruction in the inventing process on students' development of inventions. *Dissertation Abstracts International*, 51. (University Microfilms No. 9107625)
- Westberg, K. L. (1996). The effects of teaching students how to invent. *The Journal of Creative Behavior*, 30, 249-267.



## ANNOTATED BIBLIOGRAPHY

Creativity is included in the P21 Framework for 21st Century Learning as one of the Learning and Innovation Skills ([www.P21.org/Framework](http://www.P21.org/Framework)). Also known as the “4Cs,” they include creativity, critical thinking, collaboration, and communication.

The study of creativity has a long and rich history, with clearly delineated definitions, theories, and models; extensive basic and applied research; and a vibrant community of scholars and educators who make creativity and innovation the focus of their work. In this annotated bibliography, an emphasis was placed on resources that are likely to be found online or in most university and many public libraries, that are especially comprehensive, are accessible to the lay reader to the extent possible, and collectively represent the major figures in the field.

The creativity bibliography was compiled by Ronald Beghetto, James C. Kaufman, and Jonathan Plucker, faculty members at the University of Connecticut’s Neag School of Education and affiliated faculty at the Center for Educational Innovation. They appreciate the assistance of Lamies Nazzal and the helpful feedback and recommendations provided by the P21 Staff.

## GLOSSARY

**Affect** - related to emotion and mood.

**Appropriateness** - in the context of creativity, whether a response/idea/product is relevant to the task at hand and useful. Does not necessarily mean socially appropriate.

**Cognition** - mental processes, such as thinking, remembering, or problem-solving.

**Convergent Thinking** - the ability to evaluate many different ideas and select the one that is the most likely to work. An under-rated component of creativity.

**Crystallized vs. Fluid Intelligence** - one well-known theory separates intelligence into (at least) two central factors. Crystallized intelligence is a person’s acquired knowledge (such as vocabulary). Fluid intelligence is a person’s ability to solve new problems (such as detecting patterns).

**Divergent Thinking** - the ability to generate many different ideas in response to an open-ended question. Divergent thinking is a core concept in creativity measurement.

**Domain-General/Domain-Specific** - one of the debates in creativity focuses on the degree to which creativity is domain-specific or domain-general. Domain-specific aspects of creativity are those skills or abilities that are unique to creativity in a particular domain (such as math); these might include content knowledge or particular intellectual or personality factors that are more important for one domain than another (for example, creative scientists need to be conscientious, whereas this trait is less important for creative artists). Domain-general aspects are characteristics that are helpful for any type of creativity.

**Historiometry** - a methodology that studies creative genius by using historical resources (like biographies) to get information about eminent people.

**Intrinsic vs. Extrinsic Motivation** - one of the main conceptualizations of motivation is to distinguish between these two types. Intrinsic motivation is being driven by internal needs, such as task enjoyment or a desire to learn. Extrinsic motivation is being driven by external needs, such as praise, money, or grades.

**Little-c vs. Big-C** - a standard distinction between types of creativity. Little-c is everyday creativity that nearly anyone can do. Big-C is genius-level creativity that has a large influence on the world.

**Personality** - the predominant theory of personality is the Five Factor Model, which separates personality into Extraversion (outgoing/sociable), Agreeableness (good-natured/friendly), Conscientiousness (disciplined/organized), Emotional Stability (calm/even-keeled), and Openness (curious/seeking new experiences).

**Self-Efficacy** - someone’s belief in his/her ability to succeed at a particular task

## BROAD OVERVIEWS

These resources are edited volumes that contain a wide range of theory and research on numerous related to creativity and innovation.

**Kaufman, J. C. (2009).** *Creativity 101*. New York: Springer.

Kaufman offers a primer on recent research in creativity, with an emphasis on individual differences (mental illness, gender and ethnicity, personality, motivation, and intelligence).

**Kaufman, J. C., & Sternberg, R. J. (Eds.) (2010).** *Cambridge Handbook of Creativity*. New York: Cambridge University Press.

This handbook focused both on how creativity was perceived by different areas of study (including recent perspectives such as evolutionary psychology and neuroscience) and on hot topics (such as creativity and mental illness) that are still being debated.

**Runco, M. A. (2014).** *Creativity: Theories and Themes: Research, Development, and Practice (2nd Edition)*. San Diego: Academic Press

A textbook, aimed at scholars and advanced students of creativity, that provides a summary of vast amounts of creativity research, covering numerous concepts, theories, methods, measures, and themes.

**Runco, M. A., & Pritzker, S. R. (Eds.). (2011).** *Encyclopedia of creativity (2nd Edition)*. Boston: Academic Press.

A two-volume set that includes more than two hundred brief entries in which scholars highlight various topics and aspects of creativity—everything from “Art” to “Zeitgeist.”

**Sawyer, R. K. (2012).** *Explaining creativity: The Science of human innovation (2nd ed.)*. New York: Oxford University Press.

Contains an incredibly comprehensive, accessible, and interdisciplinary survey of the field of creativity studies.

**Shiu, E. (Ed.). (2014).** *Creativity research: An inter-disciplinary and multi-disciplinary research handbook*. London: Routledge.

A collection of essays from leading scholars aimed at helping researchers and advanced students understand and investigate creativity from an interdisciplinary perspective—exploring opportunities for and challenges of combining and communicating efforts across disciplines, such as business, education, music, and psychology.

**Sternberg, R. J. (Ed.). (1988).** *The nature of creativity: Contemporary psychological perspectives*. New York: Cambridge University Press.

This edited volume helped kick-start a new wave of interest in creativity. Most of the major theoretical and empirical contributors to creativity research at that time are represented in this book.

**Sternberg, R. J. (Ed.) (1999).** *Handbook of creativity*. Cambridge: Cambridge University Press.

This handbook presented many key theories and reviews in the field, including key work by Csikszentmihalyi, Gruber, and Martindale. Even after more than a decade, it is still an outstanding reference.

## KEY CONCEPTS/CONCEPTUAL MODELS (LISTED ALPHABETICALLY)

Where is a good place to start when trying to understand creativity? One strategy is to become familiar with the key concepts and conceptual models of creativity researchers. These concepts and models not only help clarify the nature of creativity, but also serve as a useful framework for helping to organize the complexity of the topic. Examples of the kinds of concepts and models reviewed below include: steps involved in the creative process, what factors help determine whether something or someone is considered creative, and the role that various personal and environmental factors play in creative development and expression.

**Amabile, T. M. (1996).** *Creativity in context: Update to “The Social Psychology of Creativity.”* Boulder, CO: Westview Press.

Amabile’s revised book (the original edition was 1982) proposes the Componential Model of Creativity, which includes domain-relevant skills, creativity-relevant skills, and task motivation. Domain-relevant skills include knowledge and technical skills, and specialized talent; creativity-relevant skills are personal factors that are associated with creativity. Amabile also discusses the association between intrinsic motivation and creativity and outlines the Consensual Assessment Technique (see Amabile, 1982).

**Batey, M., & Furnham, A. (2006).** *Creativity, intelligence and personality: A critical review of the scattered literature. Genetic, Social, and General Psychology Monographs, 132, 355-429.*

This vast review of the literature offers interesting theoretical analysis of how crystallized and fluid intelligence may shift across the lifespan of a creative person. The authors argue that fluid intelligence may be more important in the early development of a creator, whereas crystallized intelligence may be more important for creativity later in a career.

**Cropley, D., & Cropley, A. (2010).** *Functional creativity: “Products” and the generation of effective novelty.* In J. C. Kaufman, & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 301-317). New York: Cambridge University Press.

The authors present a model of functional creativity that highlights which creative processes are particularly involved in creating products that are concrete and useful. In functional creativity, a creative product has specific requirements and purposes, such as a bridge that must be constructed and designed to withstand weather and not collapse. Functional creativity is contrasted with aesthetic creativity, which has fewer constraints.

**Csikszentmihalyi, M. (1996).** *Creativity.* New York: Harper Collins.

Csikszentmihalyi’s work on Flow, or optimal experience, is strongly tied to creativity. This book, featuring interviews with many eminent creators, summarizes and applies the key components of Flow. This book is one of very few by prominent creativity researchers/thinkers to reach a large mainstream audience.

**Csikszentmihalyi, M. (1999).** *Implications of a systems perspective for the study of creativity.* In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 313-335). Cambridge: Cambridge University Press.

Csikszentmihalyi proposes that creativity is an interaction between the domain, field, and person. A domain is a preexisting area of expertise (e.g., “science”). The field is defined as the “gatekeepers” - teachers, editors, or critics. The person is the one who creates an idea or theory or piece of art. Over time, members of a domain may change their perceptions (for example, scientific views can shift and develop), leading to the possibility that a product that was once considered creative may no longer be thought of in that light after many years. Conversely, some products may be underappreciated in their time but eventually recognized as quite creative.

**Dietrich, A. (2004).** *The cognitive neuroscience of creativity. Psychonomic Bulletin & Review, 11, 1011-1026.*

Dietrich’s model focuses on four modes of creative insights and how they connect to brain function. He proposes two “processing” modes (deliberate and spontaneous) and two “knowledge” modes (emotional and cognitive). He argues that prefrontal circuits of the brain are involved in judging novelty and appropriateness, and then activating its creative expression.

**Eisenberger, R., & Shanock, L. (2003).** *Rewards, intrinsic motivation, and creativity: A case study of conceptual and methodological isolation. Creativity Research Journal, 15, 121-130.*

The authors reviewed many studies on the harm or benefits of reward and conclude that much of the debate is surrounding methodological issues. Rewarding creative performance, they argue, increases both intrinsic motivation and creativity; rewarding conventional performance decreases both intrinsic motivation and creativity.

**Feldman, D. H., Csikszentmihalyi, M., & Gardner, H. (1994).** *Changing the world: A framework for the study of creativity.* Westport, CT: Praeger.

Three leaders in the field of creativity take stock of the field and offer recommendations. One of their primary points is that creativity research has emphasized little-c too much, and Big-C, genius-level creativity merits more analysis. Csikszentmihalyi’s Systems model (see Csikszentmihalyi, 1999) is used as an organizing framework.

**Finke, R. A., Ward, T. B., & Smith, S. M. (1992).** *Creative cognition.* Cambridge, MA: MIT Press.

Finke, Ward, and Smith’s Geneplore model of creative cognition is presented here. Generation is the first stage, in which many different ideas are conceived. In the next stage, Exploration, one evaluates the different possibilities and selects the best ones. There may be several cycles of Generation and Exploration in the course of a product being developed.

**Florida, R. (2004).** *The rise of the creative class: And how it’s transforming work, leisure, community and everyday life.* New York: Basic.

Presents an economic argument for the importance of recognizing the value of creativity and the types of societal contexts (e.g., cities, regions) that support it. It argues that the creative class (people whose work requires knowledge, problem-solving, and creativity) will be a key to future economic trends.

Galenson, D. W. (2006). *Old masters and young geniuses: The two life cycles of artistic creativity*. Princeton, NJ: Princeton University Press.

Galenson argues there are two types of artistic creators: experimental and conceptual. Experimentalists gradually arrive at later-in-life masterworks, whereas conceptualists have early genius-level contributions.

Gardner, H. (1993). *Creating minds*. New York: BasicBooks.

Gardner's writings on intelligence have had a tremendous impact on the field of creativity; this book applies his multiple intelligence theory specifically to creativity. Each intelligence (musical, visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinesthetic, interpersonal, and intrapersonal) is illustrated by a case study of a creative genius. Gardner would later add naturalistic and existential intelligence to his model.

Glaveanu, V. (2013). Rewriting the language of creativity: The five A's framework. *Review of General Psychology*, 17, 69 - 81.

Glaveanu recommends revising the Four P framework (Person, Process, Product, Press) into the 5 A's, with the intention of incorporating context. Most notably, he splits Press into Audience (those who will receive the creative work) and Affordances (the resources needed for the work).

Helson, R. (1996). Arnheim award address to division 10 of the American Psychological Association: In search of the creative personality. *Creativity Research Journal*, 9, 295-303.

Helson reviews the field of creativity and personality, paying particular attention to personality across different creative domains and interests. Certain truisms are reviewed from years of research, such as creative people tending to be more focused on themselves than other people, generally loving their work, and having some difficulty in interpersonal relationships.

Hennessey, B. A., & Amabile, T. M. (2010). Creativity. *Annual Review of Psychology*, 61, 569-598.

Presents a review of the contemporary creativity studies literature, highlighting how the rapid growth of psychological research on creativity has resulted in new opportunities as well as some challenges (e.g., fragmentation of the field) and arguing for the need for creativity researchers to take a more interdisciplinary perspective.

Kaufman, J. C., & Baer, J. (Eds.). (2005). *Creativity across domains: Faces of the muse*. Mahwah, NJ: Lawrence Erlbaum.

This edited volume contains essays on what it means to be creative across different domains. The concluding matter include an alternate perspective by Plucker and two chapters in which Kaufman and Baer present their Amusement Park Theoretical Model of Creativity.

Kaufman, J. C., & Beghetto, R. A. (2009). Beyond big and little: The Four C Model of Creativity. *Review of General Psychology*, 13, 1-12.

The Four C Model expands on the distinction between little-c and Big-C by adding mini-c (subjective, personal creativity) and Pro-c (expert-level, professional creativity that may not reach greatness).

Kaufman, J. C., & Beghetto, R. A. (2013). In praise of Clark Kent: Creative metacognition and the importance of teaching kids when (not) to be creative. *Roeper Review*, 35, 155-165.

This article describes the construct of creative metacognition, which is defined as the combination of insight into one's creative strengths and an awareness of the contexts that are most appropriate for creative behavior. The authors argue that creative metacognition is a key ability related to creativity itself.

Kaufman, J. C., & Sternberg, R. J. (Eds.). (2006). *The international handbook of creativity*. New York: Cambridge University Press.

This volume puts forth different cultural perspectives on human creativity, offered by scholars from around the world.

Kirton, M. (1976). Adaptors and innovators: A description and measure. *Journal of Applied Psychology*, 61, 622-629.

The Adaption-Innovation theory, described here, argues that people solve problems in one of two ways. They either adapt (use given resources to find a solution) or innovate (think of new possibilities). This theory is the basis of a commercial instrument.

Lubart, T. (2010). Cross-cultural perspectives on creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *Cambridge Handbook of Creativity* (265-278). New York: Cambridge University Press.

This chapter is a recent review of cross-cultural perspectives on creativity. The chapter first examines whether



the concept of creativity has the same meaning across different cultures. It also reviews a wide array of studies on how different cultures vary on different aspects of creativity. Finally, it examines how multicultural experiences can enrich creativity.

**Martindale, C. (1999). Biological bases of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 137-152). New York: Cambridge University Press.**

This “state of the field” review was one of the first of its kind, and is still notable for its thoroughness. A strong primer on how the brain is used during the creative process.

**Mumford, M. D., Medeiros, K. E., & Partlow, P. J. (2012). Creative thinking: Processes, strategies, and knowledge. *Journal of Creative Behavior*, 46, 30-47.**

This article provides a review of the cognitive capacities involved in creative problem solving. The authors also present a creative process model, in which the process moves through eight stages, from problem definition to solution monitoring.

**Mumford, M. D., Scott, G. M., Gaddis, B., & Strange, J. M. (2002). Leading creative people: Orchestrating expertise and relationships. *The Leadership Quarterly*, 13, 705-750.**

Mumford and colleagues discuss creative leadership and its complexities, such as the inherent conflict between innovation and the organization. Creative work is basically different from other types, they argue, and traditional rewards or influences that apply to other types of work may harm the creative process.

**Piirto, J. A. (2004). *Understanding creativity*. Scottsdale, AZ: Great Potential Press.**

Rich with anecdotes and stories, Piirto reviews theory and research about creativity. She specifically discusses her Pyramid of Talent Development model of the Seven I's -- Inspiration, Imagery, Imagination, Intuition, Insight, Incubation and Improvisation.

**Plucker, J. A., & Beghetto, R. A. (2004). Why creativity is domain general, why it looks domain specific, and why the distinction does not matter. In R. J. Sternberg, E. L. Grigorenko, & J. L. Singer (Eds.), *Creativity: From potential to realization* (pp. 153-168). Washington, DC: American Psychological Association.**

Presents an argument that stresses the importance of recognizing a flexible, or middle-ground, position between domain generality and domain specificity.

**Plucker, J., Beghetto, R. A., & Dow, G. (2004). Why isn't creativity more important to educational psychologists? Potential, pitfalls, and future directions in creativity research. *Educational Psychologist*, 39, 83-96.**

This review of the field is likely most cited for its sophisticated definition of creativity: “Creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context” (p. 90). The paper also reviews several key myths about creativity that are still believed by laypeople.

**Reiter-Palmon, R., & Illies, J. J. (2004). Leadership and creativity: Understanding leadership from a creative problem-solving perspective. *Leadership Quarterly*, 15, 55-77.**

This paper explores the way that supportive leadership can nurture creative problem solving ability and performance. One key factor is that leaders need to both understand the cognitive demands of creativity and offer support to employees.

**Richards, R. (Ed.) (2007). *Everyday creativity and new views of human nature*. Washington, DC: American Psychological Association.**

This edited volume emphasized everyday creativity (as opposed to eminent creativity), with many essays focusing on positive outcomes and behaviors associated with creativity.

**Rickards, T., Runco, M. A., & Moger, S. (Eds.). (2009). *The Routledge companion to creativity*. Routledge Companions. London: Routledge.**

This large collection of articles provides an overview of the nature of creativity from the perspectives of psychology, business, and design.

**Rothenberg, A. (1990) *Creativity and Madness: New findings and old stereotypes*. Baltimore: The Johns Hopkins University Press.**

Rothenberg argues against many stereotypes about creativity (such as it being “mystical”). He proposes that although eminent creativity may resemble psychosis, actual creation typically does not occur during periods of illness.



Runco, M. A. (2004). Creativity. *Annual Review of Psychology*, 55, 657-687.

Contains a summary of the nature of creativity, highlights key influences on creative development and expression. This review outlines the various approaches and disciplinary perspectives that researchers have taken when studying creativity, from historical and clinical to social and organizational.

Russ, S., & Fiorelli, J. A. (2010). Developmental approaches to creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *Cambridge handbook of creativity* (pp. 233-249). New York: Cambridge University Press.

This recent review chapter discusses the developmental processes that are essential to creativity, including cognition, affect, and (especially) play. Children who engage in pretend play tend to be more creative later in life and there are interventions (such as dramatic exercises) that can enhance pretend play.

Sawyer, K. (2007). *Group genius: The creative power of collaboration*. New York: Basic Books.

Argues that creativity is always collaborative and provides an accessible discussion of cases and narratives that underlines this assertion.

Shalley, C. E., & Gilson, L. L. (2004). What leaders need to know: A review of social and contextual factors that can foster or hinder creativity. *The Leadership Quarterly*, 15, 33-53.

The authors review how a good leader, combined with appropriate human resources, can nurture creativity in the workplace. They cover concepts such as supervisory support, having sufficient resources, appropriate goal setting, and the general organizational climate.

Shin, S. J., & Zhou, J. (2007). When is educational specialization heterogeneity related to creativity in research and development teams? Transformational leadership as a moderator. *Journal of Applied Psychology*, 92, 1709-1721.

This paper argues for the importance of transformational leadership in fostering creativity. A transformational leader encourages new ideas, interacts at an individual level, and should inspire workers.

Simonton, D. K. (1988). Age and outstanding achievement: What do we know after a century of research? *Psychological Bulletin*, 104, 251-267.

Although not explicitly focused on creativity, this paper reviews the literature on aging and eminence. The average age of a creative peak depends on the domain. For example, poets, theoretical physicists, and mathematicians are more likely to peak in their 20's. In contrast, novelists, historians, and academics are more likely to peak in their 40's or 50's.

Simonton, D. K. (2004). *Creativity in science: Chance, logic, genius, and zeitgeist*. New York: Cambridge Univ. Press.

Simonton gives a book-length explanation of four key factors (chance, logic, genius, zeitgeist) that serve as the basis for his evolutionary perspective on eminent creative contributions and scientific breakthroughs.

Simonton, D. K. (2009). *Genius 101*. New York: Springer.

Simonton's work on genius has virtually defined the field for more than the last thirty years. This book provides a concise and readable overview of what we know.

Singer, J. L. (2009). Researching imaginative play and adult consciousness: Implications for daily and literary creativity. *Psychology of Aesthetics, Creativity, and the Arts*, 3, 190-199.

This paper reviews Singer's major contributions to the field over a lifetime, including pioneering research on daydreaming and imaginative play.

Sternberg, R. J. (2010). *College admissions for the 21st century*. Cambridge, MA: Harvard University Press.

This book outlines Sternberg's work at Tufts and Oklahoma State in overseeing the (optional) addition of creativity and other variables to admission criteria. Minority enrollment went up and SAT scores stayed the same.

Sternberg, R. J., Grigorenko, E. L., & Singer, J. L. (2004). *Creativity: From Potential to Realization*. Washington, DC: American Psychological Association.

The collection, like Kaufman and Baer (2005), contains essays that focus on the domain-specificity/domain-general debate. Unlike Kaufman and Baer, whose edited book focused on prowess in specific domains, Sternberg, Grigorenko, and Singer include essays that address the question in broader, more conceptual ways.

Sternberg, R. J., Kaufman, J. C., & Pretz, J. E. (2002). *The creativity conundrum: A propulsion model of kinds of creative contributions*. New York: Psychology Press.

In this book the authors describe their propulsion model of creative contributions. This model serves as a useful framework for differentiating various levels of creative impact—everything from slightly new advances (e.g.,

replications) to iterative works (e.g., incrementations) to new combinations (e.g., syntheses) to completely unique works that are radically different (e.g., reinitiations).

**Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity*. New York: Free Press.**

Sternberg and Lubart present the Investment Theory, in which a creative person must “invest” in ideas the way a stockbroker might invest in the market. A good creator, according to this model, would find undervalued ideas, work with them, persuade other people that these ideas are important, and then move on to other topics. They discuss six key components that influence creativity: Intelligence, personality, motivation, thinking styles, knowledge, and the environment.

**Treffinger, D. J., & Isaksen, S. G. (2005). Creative Problem Solving: The history, development, and implications for gifted education and talent development. *Gifted Child Quarterly*, 49, 342-353.**

The Creative Problem Solving (CPS) model has been developed and studied for years. Although often applied in business and applied settings, this paper stresses its implications for teaching and learning.

**Ward, T. B., & Kolomyts, Y. (2010). Cognition and creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *Cambridge Handbook of Creativity* (93-112). New York: Cambridge University Press.**

Ward and Kolomyts offer a recent overview of cognitive approaches to creativity. Using the Geneplore model as a basis (see Finke, Ward, and Smith, 1992), the authors review both empirical studies and illustrative anecdotes.

**Weisberg, R. W. (2006). *Creativity: Understanding innovation in problem solving, science, invention, and the arts*. New York: Wiley.**

Weisberg argues that the thinking processes used by the average person when being creative are the same as those used by geniuses. Even if the final product may not be remembered for generations, we are all capable of productive and creative thought.

## EMPIRICAL STUDIES

What are some of the things that creativity researchers study? The citations below provide an overview of the kinds of topics studied by creativity researchers. Developing an awareness of these topics can help develop one’s understanding of the breadth of the field of study.

**Baer, J. (1997). Gender differences in the effects of anticipated evaluation on creativity. *Creativity Research Journal*, 10, 25-31.**

Baer found a gender interaction in how motivation impacts creativity. For boys, there was virtually no difference in creativity ratings under intrinsic and extrinsic conditions, but for the girls these differences were quite large.

**Beghetto, R. A. (2006). Creative self-efficacy: Correlates in middle and secondary students. *Creativity Research Journal*, 18, 447 - 457.**

Beghetto studied the idea of creative self-efficacy (CSE), the belief in your own ability to be creative. He found that high CSE was associated with more school participation and generally positive academic beliefs.

**Chamorro-Premuzic, T. (2006). Creativity versus conscientiousness: Which is a better predictor of student performance? *Applied Cognitive Psychology*, 20, 521-531.**

This study contrasted creative thinking and conscientiousness in predicting student success. Creativity was associated with dissertation performance, whereas conscientiousness was more associated with exam scores. Creative students tended to prefer oral exams, group projects, and working on their dissertation; more conscientious students preferred multiple choice and essay exams.

**Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review*, 2, 290-309.**

Feist’s meta-analysis, the first that examined personality and creativity, offered (among other things) evidence that artistic and scientific creativity were associated with different personality traits. Feist updated this paper for Kaufman and Sternberg (2010).

**Helson, R. (1999). A longitudinal study of creativity personality in women. *Creativity Research Journal*, 12, 89-101.**

This article reports on a pioneering thirty-year longitudinal study exploring the creative potential and personality of one hundred college women.

**John-Steiner, V. (2006).** *Creative collaboration*. New York: Oxford University Press.

The author draws on various case studies and writes from a sociocultural perspective to illustrate how creative achievement often results from joint effort and collaboration (rather than individual ideas and effort).

**King, L. A., McKee-Walker, L., & Broyles, S. J. (1996).** Creativity and the five factor model. *Journal of Research in Personality, 30*, 189-203.

This empirical study of creativity and personality finds support for the link between openness to experience and creativity. It also found some interesting interactions. People with high creativity ability and low openness to experience produced fewer creative accomplishments; people with low creativity ability had more creative accomplishments if they were higher in conscientiousness.

**Paletz, S. B. F., & Peng, K. (2008).** Implicit theories of creativity across cultures: Novelty and appropriateness in two product domains. *Journal of Cross-Cultural Psychology, 39*, 286-302.

The researchers asked Chinese, Japanese, and American students to rate creative artwork. Chinese raters valued originality more than the other countries and valued appropriateness the least.

**Park, G., Lubinski, D., & Benbow, C. P. (2007).** Contrasting intellectual patterns predict creativity in the arts and sciences: Tracking intellectually precocious youth over 25 years. *Psychological Science, 18*, 948-952.

This longitudinal study presented evidence that math and verbal SAT scores predict artistic and scientific creativity (via literary publications and patents) 25 years later.

**Perrine, N. E., & Brodersen, R. M. (2005).** Artistic and scientific creative behavior: Openness and the mediating role of interests. *Journal of Creative Behavior, 39*, 217-236.

This study examined the facets of openness to experience and artistic vs. scientific creativity. Five of the six facets of openness to experience were related to artistic creativity - all but values - with the strongest relationship found in aesthetics. Ideas and values were the only facets related to scientific creativity.

**Carson, S. H., Peterson, J. B., & Higgins, D. M. (2003).** Decreased latent inhibition is associated with increased creative achievement in high-functioning individuals. *Journal of Personality and Social Psychology, 85*, 499 - 506.

Latent inhibition (LI) is a person's ability to ignore irrelevant distracters. Schizophrenics and those with schizotypy typically have low LI. This study, building on past work by Peterson and Carlson, found that low LI in highly intelligent people was linked to higher creativity. Perhaps people with low LI who are smart can use their proclivity for distraction as a resource for creativity.

**Simonton, D. K. (1997).** Creative productivity: A predictive and explanatory model of career trajectories and landmarks. *Psychological Review, 104*, 66-89.

This remarkably thorough paper investigates career trajectories across many different creative domains. Simonton predicts annual productivity as a function of career age. Typically, output begins in one's 20's, ascends to an optimum at some point near age 40, and then gradually approaches zero output.

**Westby, E. L., & Dawson, V. L. (1995).** Creativity: asset or burden in the classroom? *Creativity Research Journal, 8*, 1-10.

In this inventive study, teachers reported liking creative students yet then defined creativity with adjectives such as well-behaved or conforming. When the same teachers were given adjectives that were more typically used to describe creative people, they said they disliked students who possessed those adjectives.

## INTERVENTIONS

Can creativity be enhanced? If so, how? The following sources provide insights into these questions. Several of the sources below highlight factors that are supportive of creativity (e.g., mood, instructional techniques, teacher beliefs, and features of the learning environment). The resources listed below also highlight how creativity might be enhanced in various contexts (e.g., K-12 general education classrooms, gifted education programs, higher education courses, stand-alone training programs) and domains (e.g., mathematics, science, language arts, history).

**Amabile, T. M., Barsade, S. G., Mueller, J. S., & Staw, B. M. (2005).** Affect and creativity at work. *Administrative Science Quarterly, 50*, 367-403.

After much general debate about the role of mood/affect and creativity, Amabile and her colleagues conducted a

thorough, careful study that found that positive mood in the workplace leads to higher creativity.

**Beghetto, R. A. (2013).** *Killing ideas softly? The promise and perils of creativity in the classroom.* Charlotte, NC: Information Age.

This book gives an accessible overview of the challenges and opportunities facing teachers interested in incorporating creativity into their everyday classroom teaching.

**Beghetto, R. A. (2014).** *Creativity: Development and enhancement.* In J. A. Plucker & C. M. Callahan (Eds.), *Critical issues and practices in gifted education: What the research says (2nd ed.)* (pp. 183 - 196). Waco, TX: Prufrock Press.

Summarizes research on creativity development and enhancement interventions. Provides an outline of major questions addressed in creativity intervention research, summarizes the conclusions that can (and cannot) be drawn from the research, and provides guidance for creativity development and enhancement in educational settings.

**Beghetto, R. A., & Kaufman, J. C. (Eds.). (2010).** *Nurturing creativity in the classroom.* New York: Cambridge University Press.

Nurturing Creativity in the Classroom provides a collection of chapters by leading scholars who provide practical advice for nurturing P-16 student and teacher creativity in the context of the everyday, academic curriculum.

**Cardarello, R. (2014).** *Enhancing scientific thinking in children: Suggestions based on studies about creativity.* *New Perspectives in Science Education.* Available at <http://conference.pixel-online.net/NPSE/files/npse/ed0003/FP/0306-SERA206-FP-NPSE3.pdf>.

This brief conference paper provides a European perspective on the advantages of conceptualizing science education through the lens of creativity. The paper includes a justification of this conceptualization and suggestions for interventions in science education settings.

**Chen, C., Kasof, J., Himsel, A., Dmitrieva, J., Dong, Q., & Xue, G. (2005).** Effects of explicit instruction to “Be Creative” across domains and cultures. *Journal of Creative Behavior*, 39, 89-110.

This study found that simply telling people to be creative had a positive impact across cultures (America and China) and domains (verbal, artistic, and mathematical).

**Clements, D. H. (1995).** Teaching creativity with computers. *Educational Psychology Review*, 7, 141-162.

This paper suggests that integrating certain technology and computers into the curriculum can facilitate students' creativity. Using a computer program such as Logo can inadvertently enhance students' creativity while simultaneously teaching them math. Using a computer word processor, students tend to worry less about making mistakes in their writing and focus more on their creative process rather than their writing. Computer environments encourage more “play” and lead to more “exploratory and venturesome writing”.

**Cho, Y., Chung, H. Y., Choi, K., Seo, C., Baek, E. (2013).** The emergence of student creativity in classroom settings: A case study of elementary schools in Korea. *Journal of Creative Behavior*, 47, 152 - 169.

This article reports on research that documented the expression of student creativity in science and social studies classrooms. The article provides concrete examples of what the emergence of creativity looks like in the classroom and how teachers might facilitate it.

**Craft, A. (2011).** *Creativity and education futures: Learning in a digital age.* Stoke-on-Trent, UK: Trentham.

In this book the UK-based scholar Anna Craft looks at the educational challenges and possibilities presented by life in the digital age, offering educators, researchers, and parents concrete insights into helping youngsters more wisely and creatively participate in shaping their own educational future.

**Cropley, A. J. (2001).** *Creativity in education and learning.* New York: Routledge.

In this book aimed primarily at teachers, Cropley reviews the research literature on creativity in higher education. He places a special emphasis on nurturing creativity.

**Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P., Howe, A. (2012).** Creative learning environments in education: A systematic literature review. *Thinking Skills and Creativity*, 8, 80 -91.

Reports on a systematic review of studies, published 2005 - 2011, pertaining to creativity learning environments in schools. The following factors were identified as most important to supporting the development of creativity: flexible use of space and time; availability of appropriate materials; working out-side the classroom/school; ‘games-bases’ approaches with a degree of learner autonomy; respectful relationships between teachers and learners; opportunities for peer collaboration; partnerships with outside agencies; awareness of learners' needs;



and non-prescriptive planning. The review also found evidence for impact of creative environments on pupil attainment and the development of teacher professionalism.

**Ericsson, K. A., Charness, N., Feltovich, P. J., & Hoffman, R. R. (Ed.). (2006). *The Cambridge handbook of expertise and expert performance*. New York: Cambridge University Press.**

Ericsson and colleagues present a thorough collection of essays on the development of expertise (including many chapters on expertise in artistic/creativity-related domains). Ericsson's concept of deliberate practice being the key to expertise is reflected in many chapters.

**Harrington, D. M., Block, J. H., & Block, J. (1987). Testing aspects of Carl Roger's theory of creative environments: child-rearing antecedents of creative potential in young adolescents. *Journal of Personality and Social Psychology*, 52, 851-856.**

Demonstrates that child-rearing practices based on Carl Rogers' work (such as encouraging curiosity and exploration, letting children make decisions, and respecting children's opinions) can lead to increased later creative potential.

**Hong, E., Hartzell, S. A., Greene, M. T. (2009). Fostering creativity in the classroom: Effects of Teachers' epistemological beliefs, motivation, and goal orientation. *Journal of Creative Behavior*, 43, 192 - 208.** Reports on a study that examined the relationship between teachers' beliefs and their use of instructional practices supportive of student creativity. Results of this study demonstrate that teachers' learning goal orientation was the most significant teacher attributed that impacted creativity-fostering instructional practices. Results also demonstrated a link between creativity-support practices and teachers' who held more sophisticated beliefs about knowledge and who enjoyed creative work.

**Isaksen, S. G., & Treffinger, D. J. (2004). Celebrating 50 years of reflective practice: Versions of creative problem solving. *Journal of Creative Behavior*, 38, 75-101.**

This summary article provides a historical and conceptual review of fifty years of work in the area of creativity problem solving (CPS) training and enhancement—starting with one of the earliest models, proposed by Alex Osborn, and documenting variations and refinements to CPS models and training over the intervening years.

**Leung, A. K., Maddux, W. W., Galinsky, A. D., & Chiu, C. (2008). Multicultural experience enhances creativity: The when and how. *American Psychologist*, 63, 169-181.**

The authors found that when students were given information about another culture (China), they subsequently wrote more creative stories set in a different culture (Turkey) than students who had not been exposed. The authors infer that multicultural experiences enhance creativity.

**Levenson, E. (2011). Exploring collective mathematical creativity in elementary school. *Journal of Creative Behavior*, 45, 215 - 234.**

Reports on research that explored the role of the teacher in fostering mathematical creativity. The article provides concrete examples of how collective mathematical learning can result from creative ideas that start from an individual and are then elaborated on by teachers and peers.

**Mumford, M. D., Medeiros, K. E., Partlow, P. J. (2012). Creative thinking: Processes, strategies, and knowledge. *Journal of Creative Behavior*, 46, 30 - 47.**

This article provides an overview of the various factors associated with promoting creative thinking and creative achievement. The authors also discuss implications for improving creative thinking.

**Nickerson, R. S. (1999). Enhancing creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 392-430). New York: Cambridge University Press.**

In this chapter, Nickerson reviews and discusses theoretical and empirical issues and findings related to creativity enhancement.

**Niu, W. (2007). Individual and environmental influences on Chinese student creativity. *Journal of Creative Behavior*, 41, 151 - 175.**

Reports on findings of a study exploring individual and environmental factors that contribute to creativity. Individual factors included ability, personality factors, motivation, and thinking styles. Environmental factors included type of school, parental education level, and beliefs of parents. Results indicate that both individual and environmental factors play decisive roles in student creativity.

**Piirto, J. (2011). *Creativity for 21st century skills: How to embed creativity into the curriculum*. Boston: Sense Publishers.**



This is one of the few attempts to comprehensively address the integration of creativity-fostering material into the curriculum and classroom instruction. In addition, Piirto emphasizes the role of creativity as a 21st century skill throughout the volume.

**Russ, S. W. (2013).** *Pretend play in childhood: Foundation of adult creativity.* Washington, DC: American Psychological Association.

In this book, Russ outlines decades of her seminal research about how imaginative play in childhood helps foster creativity into adulthood.

**Schacter, J., Thum, Y. M., Zifkin, D. (2006).** How much does creative teaching enhance elementary school students' achievement. *Journal of Creative Behavior*, 40, 47 - 72.

Reports on the findings of a study that examined the relationship between creative teaching and elementary students' achievement gains in 48 upper-elementary classrooms. Results indicate that students whose teachers elicited student creativity made substantial achievement gains. Results also indicate that the majority of teachers did not use strategies that foster creativity and teachers who taught in classrooms with high proportions of minority and low-performing were significantly less likely to use creative teaching strategies.

**Scott, G., Leritz, L. E., & Mumford, M. D. (2004).** The effectiveness of creativity training: A quantitative review. *Creativity Research Journal*, 16, 361-388.

Reports on the findings of a meta-analysis of seventy studies of creativity training programs. The results suggest that well-defined training programs can cause gains in a variety of creativity-related outcomes (e.g., divergent thought, problem solving, performance, attitude).

**Tan, A. G. (Ed.). (2007).** *Creativity: A handbook for teachers.* Singapore: World Scientific.

This book compiles a collection of essays, written by leading creativity scholars from around the globe, that provide educators with an accessible introduction to creativity theory and research as well as practical teaching suggestions.

**Warner, S. L., Myers, K. L. (2009).** The creative classroom: The role of space and place toward facilitating creativity. *Technology Teacher*, 69, 28-34.

This paper suggests that simple changes can be made to the physical classroom to help facilitate creativity in students. Small changes such as displaying students' creative work, allowing for more natural light to enter the classroom, moving furniture to make the classroom more open and spacious and less cluttered, and use of appropriate music at the right time and volume can enhance the creative atmosphere of any classroom.

**West, M. A. (2002).** Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied Psychology: An International Review*, 51, 355-424.

This model of group creativity studies how contextual factors (such as social influence) impact group-level innovation.

## ASSESSMENT

Can creativity be assessed? If so, how? This is a key question for educators and policymakers. Creativity is often considered a "difficult to measure" construct. The resources below highlight how creativity researchers have assessed creativity across various populations, settings, and domains. These sources provide insights into how creativity has (and continues to be) assessed over the past several decades. These sources also point toward new and needed directions in creativity assessment.

**Amabile, T. M. (1982).** Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology*, 43, 997-1013.

This paper introduces the Consensual Assessment Technique, in which expert raters evaluate creative products. This technique is now often used in research studies of creativity.

**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.

This study presents a large new database (with norms and times for solution) for the Remote Associates Test (see Mednick, 1968).

Callahan, C. M., Hunsaker, S. L., Adams, C. M., Moore, S. D., & Bland, L. C. (1995). *Instruments used in the identification of gifted and talented students (Research Monograph No. 95130)*. Storrs, CT: The National Research Center on the Gifted and Talented.

This broad survey includes a discussion of which creativity instruments are most commonly used for giftedness programs (Torrance Tests are number one). Several districts reported using group-administered intelligence or achievement tests to assess students' creativity.

Carson, S., Peterson, J. B., & Higgins, D. M. (2005). Reliability, validity and factor structure of the creative achievement questionnaire. *Creativity Research Journal*, 17, 37-50.

The Creative Achievement Questionnaire is a recent survey designed to measure creative achievements based on self-reported past performance across ten domains.

Gruber, H. E., & Wallace, D. B. (1999). The case study method and evolving systems approach for understanding unique creative people at work. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 93-115). New York: Cambridge University Press.

In more recent years, creativity journals have tended to focus more on empirical studies of creativity, yet case studies can remain powerful and insightful. Gruber and Wallace provide a sterling overview.

Kaufman, J. C., Plucker, J. A., & Baer, J. (2008). *Essentials of creativity assessment*. New York: Wiley.

This book, the first attempt to provide a comprehensive overview of creativity assessments and related research, is an overview of many types of creative assessment, from divergent thinking to the consensual assessment technique to self-ratings.

Plucker, J. A., & Makel, M. C. (2010). Assessment of creativity. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 48-73). New York: Cambridge University Press.

The authors give a historical overview of creativity assessment, outlining various approaches, and discuss strengths and weaknesses of early-21st-century assessment approaches.

Silvia, P. J., Wigert, B., Reiter-Palmon, R., & Kaufman, J. C. (2012). Assessing creativity with self-report scales: A review and empirical evaluation. *Psychology of Aesthetics, Creativity, and the Arts*, 6, 19-34.

The authors examine the psychometric properties of four different measures of self-reported creativity (Creative Achievement Questionnaire, Biographical Inventory of Creative Behaviors, Creative Behavior Inventory, Creative Domain Questionnaire) and offer evidence of convergence among these measures.

## HISTORICAL PERSPECTIVES AND CLASSIC RESOURCES (LISTED CHRONOLOGICALLY)

What might we learn from historical perspectives on creativity? One key insight that can be gained from understanding the classic resources is to recognize that scholars have been studying and thinking about creativity for more than 60 years. Although creativity is a hot topic in educational policy and practice, there has been a long history of scholars engaged in explaining what creativity is and how it might be cultivated. Another key insight that can be gleaned from exploring classic resources and historical perspectives is an awareness of what knowledge about creativity has remained consistent over the years, what has changed, and what topics are in need of further exploration.

Galton, F. (1869). *Hereditary genius: An inquiry into its laws and consequences*. London: MacMillan.

Arguably among the first psychological research studies, Galton's book describes an early study of genius that was one of the first to use historiometric methods. Galton, a towering if controversial figure, had considerable influence on the development of psychology and statistics, in addition to his contributions to the study of human abilities.

Terman, L. M., & Oden, M. H. (1925-1959). *Genetic studies of genius (Vols. 1-5)*. Stanford, CA: Stanford University Press.

Encompasses several volumes produced from a study begun in 1921 at Stanford University. Terman identified over 1,500 children from the Bay Area with IQs greater than 140 and followed them throughout the course of their lives. Terman's study was the first longitudinal study specifically to focus on intellectually gifted children.

Wallas, G. (1926). *The Art of Thought*. New York: Harcourt, Brace, & World.

Hutchinson, E. D. (1931). Materials for study of creative thinking. *Psychological Bulletin*, 28, 392-410.

According to the Wallas model, creativity problem-solving's first stage is often called preparation, in which the problem is first considered. Next is incubation, in which one's mind works on the problem while performing other

tasks. Illumination contains an aha moment bringing insight, during verification, one expands and tests the ideas. Hutchinson, in this and other papers, expands on the model and its implementation.

**Vygotsky, L. S. (1930/2004).** Imagination and creativity in childhood (M. E. Sharpe, Inc., Trans.). *Journal of Russian and East European Psychology*, 42, 7-97. (Original work published 1930)

Vygotsky's ideas about child development and intelligence have had a tremendous influence on many creativity scholars; in this essay, he argues that anything that produces something new is a creative act.

**Stein, M. I. (1953).** Creativity and culture. *Journal of Psychology: Interdisciplinary and Applied*, 36, 311-322.

Stein's paper is one of the first to truly consider the role of culture in creativity. Cultures that offer freedom and allow diversity and ambiguity will be more conducive to creativity.

**Taylor, C. W. (Ed.). (1956).** *The 1955 University of Utah Research Conference on the Identification of Creative Scientific Talent, held at Alpine Rose Lodge, Brighton, Utah, August 27-30, 1955*. Salt Lake City: University of Utah Press.

**Taylor, C. W., & Barron, F. (Eds.). (1963).** *Scientific creativity: Its recognition and development*. New York: Wiley.

These and related texts include papers and committee reports from the Utah creativity conferences organized by Taylor. The majority of the papers focus on the nature and measurement of creativity.

**Mednick, S. A. (1962).** The associative basis of the creative process. *Psychological Review*, 69, 220-232.

**Mednick, S. A. (1968).** The Remote Associates Test. *Journal of Creative Behavior*, 2, 213-214.

Mednick argued that creativity consisted of making associations between disparate concepts. More creative people could make connections between less-related ideas. The Remote Associates Test (RAT) presents three seemingly unrelated words and seeing if people can derive a fourth word that connects them. Although the measure also taps into vocabulary and intelligence, the RAT is frequently used in studies; despite its problems, it is quick and easy to score.

**Wallach, M. A., & Kogan, N. (1965).** *Modes of thinking in young children: A study of the creativity-intelligence distinction*. New York: Holt, Rinehart and Winston.

Wallach and Kogan were early proponents of divergent thinking, and created many of the basic tasks that are still used today.

**Torrance, E. P. (1963).** *Education and the creative potential*. Minneapolis: University of Minnesota.

Torrance wrote many books, in addition to his tests (see entry below) and scholarly papers. This one focuses on such topics as how teachers often value creative students less than bright students and on the obstacles that creative students face. Its message is as important today as it was 50 years ago.

**Torrance, E. P. (1966).** *The Torrance Tests of Creative Thinking - Norms - Technical Manual Research Edition - Verbal Tests, Forms A and B - Figural Tests, Forms A and B*. Princeton, NJ: Personnel Press.

**Torrance, E. P. (1974).** *Torrance Tests of Creative Thinking: Norms—technical manual*. Lexington, MA: Ginn.

The Torrance Tests of Creative Thinking remain the most commonly-used creativity test. Although the tests are still being developed and normed today (the latest revision came out in 2008), the basic principles have been in place for years. Torrance's divergent thinking tests, developed and updated over several decades, has become one of the most widely known and used measures of creativity (or, perhaps more accurately, creative potential), employed in psychological research and applied settings.

**Vernon, P. E., (Ed.). (1970).** *Creativity: Selected readings*. Harmondsworth, UK: Penguin.

One of the earliest edited volumes of essays by research psychologists and creativity scholars. Many of the ideas in this text remain relevant and have influenced the theoretical and empirical work being done by contemporary creativity researchers.

**Marland, S. P. (1972).** *Education of the gifted and talented: Report to the Congress of the United States by the U.S. Commissioner of Education*. Washington, DC: Department of Health, Education and Welfare.

The first official document to explicitly include creativity as an integral part of giftedness. It defines gifted students as having high abilities and being capable of advanced performance. Six areas that may reflect giftedness were specified, including creativity (the others were intelligence, academic performance, leadership, visual/performing arts, and psychomotor ability).

**Renzulli, J. S. (1978).** *What Makes Giftedness? Reexamining a Definition*. *Phi Delta Kappan*, 60, 180-184, 261.

Conceptualizes giftedness as part of a "three ring" model. The "rings" in the model represent high abilities,

high task commitment, and high creativity. Gifted behavior must draw from all three of these areas and the interaction between them. Highly influential in gifted education.

**Barron, F., & Harrington, D. M. (1981). Creativity, intelligence, and personality. *Annual Review of Psychology*, 32, 439-476.**

This Annual Review chapter highlighted key work being done in creativity, intelligence, and personality. The authors highlight several key distinctions still discussed together, such as whether creativity is best conceived as an achievement, ability, or attitude.

## WHERE TO FIND ADDITIONAL RESEARCH

---

Creativity Research Journal (<http://www.tandfonline.com/loi/hcrj20#.UydVME1OWM8>)

Journal of Creative Behavior (<http://www.creativeeducationfoundation.org/what-we-do/journal-of-creative-behavior>)

Psychology of Aesthetics, Creativity, and the Arts (<http://www.apa.org/pubs/journals/aca>)

Empirical Studies of the Arts (<http://www.baywood.com/journals/previewjournals.asp?ld=0276-2374>)

Gifted Child Quarterly (<http://gcq.sagepub.com>)

Roeper Review (<http://www.tandfonline.com/loi/uror20#.UydVqE1OWM8>)

Thinking Skills and Creativity (<http://www.journals.elsevier.com/thinking-skills-and-creativity>)





## P21 MEMBERS ORGANIZATIONS

---

AFT  
American Camp Association  
Apple Inc.  
Asia Society  
Bahcesehir K-12 Schools  
Cable Impacts Foundation  
Common Sense Media  
Crayola  
Destination Imagination  
Duck Learning  
EF Education First  
ENA  
First Five Years Fund  
Fisher-Price  
Ford Motor Company Fund  
Future Problem Solving Program International  
Gale Cengage Learning  
The Goddard School  
Intel Corporation  
Learning.com  
LEGO Education  
National Board for Professional Teaching Standards  
National Education Association  
PBS  
Pearson  
People to People International  
Playworld, Inc.  
Project Management Institute Educational Foundation  
VIF International Education  
The Walt Disney Company

## P21 LEADERSHIP STATES

---

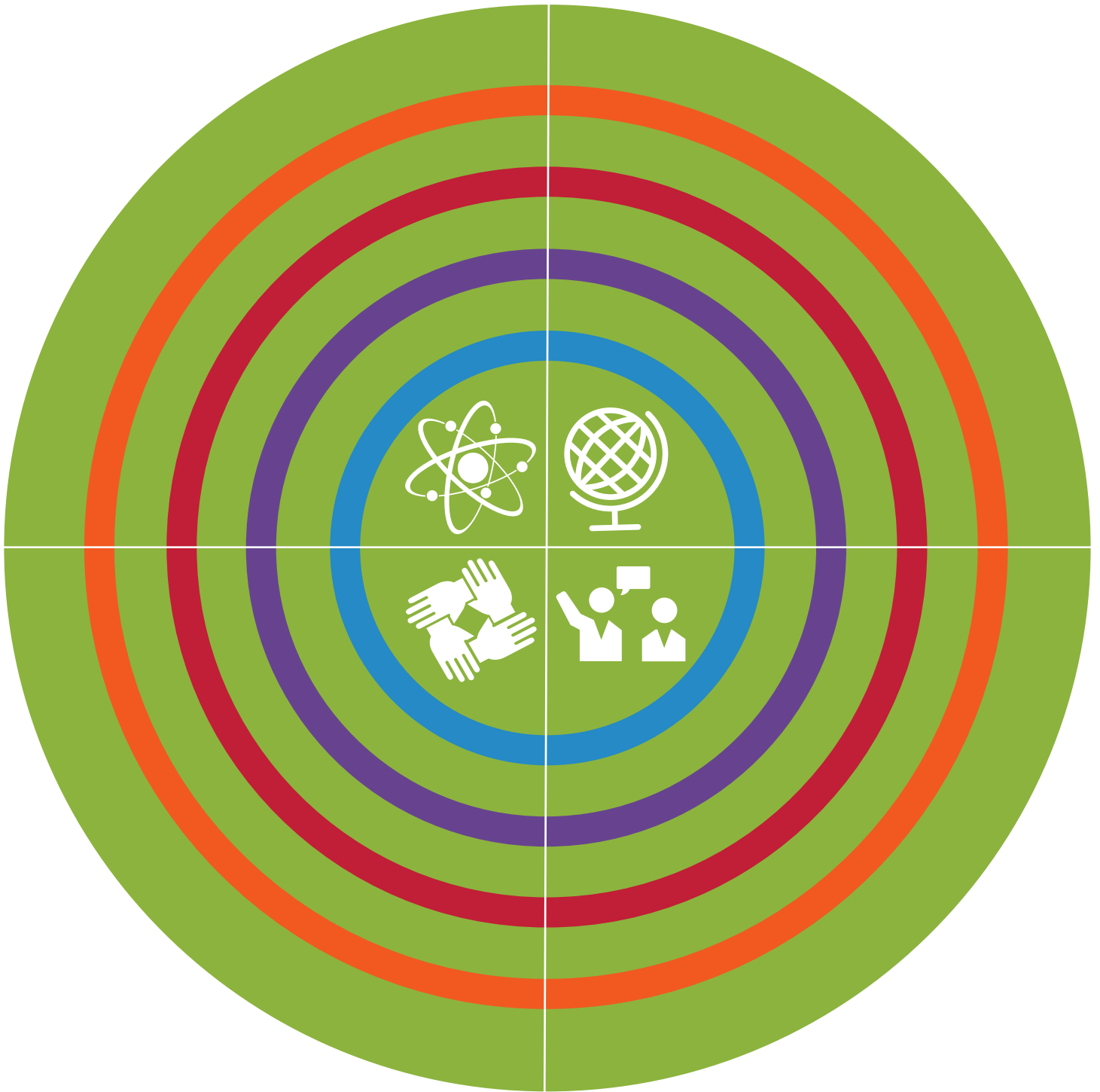
Arizona  
California  
Illinois  
Iowa  
Kansas  
Kentucky  
Louisiana  
Maine  
Massachusetts  
Nevada  
New Jersey  
North Carolina  
Ohio  
Oklahoma  
South Carolina  
South Dakota  
Vermont  
West Virginia  
Wisconsin

## P21 STAFF

---

Lizzette Arias, Administrative Coordinator  
Helen Soulé, Executive Director  
Barbara Stein, Director of Strategic Partnerships  
Tatyana Warrick, Communications Manager  
Kevin Wesolowski, Chief Operating Officer

To learn more about P21, the Partnership for 21st Century Learning, and our work please visit [www.P21.org](http://www.P21.org).



# P21<sup>®</sup> PARTNERSHIP FOR 21ST CENTURY LEARNING

---

One Massachusetts Avenue NW, Suite 700 • Washington, DC 20001  
(202) 312-6429 • [www.P21.org](http://www.P21.org)