DEVELOPMENT AND ASSESSMENT OF STUDENT CREATIVITY

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University of Michigan (U-M) students from the Program in American Culture and the Stamps School of Art and Design start work on what will become an exhibit about the history of Latina migrants to Michigan. Based on oral histories they have conducted and documents they have collected, the exhibit will be installed at the Boulevard House, a new community center in Detroit.[1]

Entering U-M students participate in a summer leadership program that prepares them to engage in collaborative projects to develop and implement creative ideas for campus and community change.[2]

U-M students from a variety of disciplines participate in a course that requires them to brainstorm ideas and design an approach to improving higher education, such as development of a student-alumni mentoring program or an app that connects students with similar research or social interests.[3]

All of these examples represent curricular projects at the University of Michigan that seek to promote students' creative thinking.

Introduction

The TLTC learning goal, Creativity, focuses on developing educational opportunities to foster students' creative processes and capacities to create new works and ideas. This goal also seeks to promote an understanding that creativity is not a rare gift to the few, but a fundamental human trait that can be developed and expanded.

This paper begins with a review of the various ways in which creativity has been conceptualized and a discussion of the importance of

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[2] Jason Owen-Smith, "Barger Leadership Bridge Institute." TLTC grant, funded 2014.
[3] Course offered by Joanna Millunchick and Mika LaVaque-Manty, "Education by Design: Campus of the Future."

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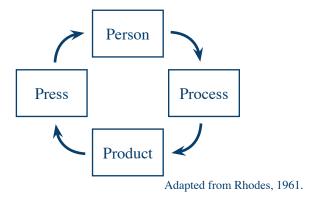
creativity. It then goes on to briefly summarize different approaches to fostering creativity among students and ends with a discussion on how to assess creativity, with an emphasis on choosing appropriate measures.

What Is Creativity?

Creativity is complex and multidimensional and has been defined in varied ways by different researchers. Among scholars of creativity, some define it in fairly simplistic terms, such as "creating something new" (Vygotsky, 1978), whereas others give more elaborate definitions that identify multiple phases in the process, such as "being sensitive to problems, searching for solutions, testing hypotheses and disseminating results" (Torrance, 1966). More recently, several scholars appear to be converging on agreement that creativity is best defined as **the production of ideas, processes or objects that are simultaneously *novel* (unique, original, atypical, cutting-edge) and *appropriate* (relevant, useful, applicable, fitting, effective)** (Amabile, 1983; Kleiman, 2008; Mumford, 2003; Plucker, Beghetto, & Dow; 2004; Runco, 2004; Runco & Jaeger, 2012; Sternberg & Kaufman, 2010; Sternberg & Lubart, 1999; see also Gruber & Wallace, 1999; Lumsden, 1999; Martindale, 1999; Mumford & Gustafson, 1988; Unsworth, 2001). Importantly, "novelty" does not mean that the product must be "new to the world" (El-Murad & West, 2004, p. 190), as creativity often involves the combination of two or more previously identified products or ideas in new ways. Likewise, "appropriateness" can be reflected in a variety of ways and is, in large part, dependent on the domain in which creativity is taking place. For instance,

"appropriate" art would be that which is aesthetically pleasing, communicates a compelling message, or provokes a response. Conversely, an "appropriate" product in the field of engineering would be one which has utility to solve a previously unaddressed problem.

Rhodes (1961) noted that creativity is a process influenced by multiple systems, and he described a taxonomy with distinct dimensions that interact when creativity takes place. These dimensions are commonly identified as "the Four P's of Creativity" and include 1) the creative *person*, who engages in 2) the creative *process*, which results in 3) the creative *product*, which is a response to and results in a change in 4) the creative *press*, or the environmental "pressure" that impels the creative person (see Figure 1). Furthermore, some scholars (e.g., Jauk, Benedek, & Neubauer, 2014; Runco & Charles, 1997) distinguish between *creative potential*, or the presence of personal dispositions and

Figure 1. Dimensions of Creativity

Adapted from Rhodes, 1961.

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process skills that are conducive to creativity, and *creative accomplishment*, or the actual production of a creative object, process, or idea. Both Rhodes's taxonomy of dimensions and the further distinctions between creative potential and creative accomplishment serve as useful frameworks for designing programs that foster creativity, as well as identifying outcomes for assessment of creative development among students at the University of Michigan. Each dimension is discussed in further detail below.

The creative person

In terms of describing the "creative person," dispositional characteristics, including openness to new experiences, willingness to take risks, and acceptance of ambiguity, can all predict creativity (Bull, Montgomery, & Baloche, 1995; Cassandro & Simonton, 2010). Similarly, motivation, and particularly intrinsic motivation, also predicts creativity, as it prompts students to engage in creative effort and also facilitates persistence (Amabile, 1983, 1996; Collins & Amabile, 1999). An individual's discipline-specific and interdisciplinary knowledge, including facts and repertoires of exemplars of creative works produced by others, also appear to facilitate the process of creativity, allowing an individual to more clearly identify problems and make connections between previously disconnected ideas (Cropley, 2009; Weisberg, 2006). Creativity is also very sensitive to variations in affect, and different moods have differential effects on various phases within the creative process (Kaufmann, 2003). For instance, there is evidence that positive mood facilitates problem-solving tasks (Isen, Daubman, & Nowicki, 1987), whereas negative affect leads to improved problem-finding (Mraz & Runco, 1994). Finally, creative self-efficacy, which is defined as the belief "that one has the ability to produce creative outcomes," (Tierney & Farmer, 2002, p. 1138) can predict creative performance (Tierney & Farmer, 2011) as a belief in one's ability to carry out a task is a factor in whether one chooses to pursue such an endeavor. In short, people will not invest their time trying to carry out a creative task at which they feel they will not succeed.

Consistent with the University of Michigan's view that creativity is not a rare gift to the few, scholars emphasize that personal aspects of creativity are *not* "present or absent" (Kirton, 2003), nor are they innate and fixed. Instead, they are possessed by all individuals to varying degrees (Kurtzberg & Amabile, 2001) and are malleable and can be adapted and improved upon (Anderson, 1992; Sternberg, 2000). Because these dispositions are not indicative of creativity itself, but rather serve as precursors to creativity, they are more representative of *creative potential* and not *creative accomplishment* per se. These findings reinforce U-M's commitment to including the development of creativity as one of its core goals for all students.

The creative process

The creative process can be understood as a series of steps or phases carried out by the creative person that result in a creative product (Lubart, 2001). In addition to the phases of the creative process, researchers focused a substantial amount of attention on the cognitive processes – or modes of thinking – that underlie the ability to successfully navigate these phases (e.g., Torrance, 1966). Consistent with this dual definition of the creative process, the Association of American Colleges and Universities (AAC&U) defines creative thinking as "both the capacity to combine or synthesize existing ideas, images, or expertise in original ways and the experience of thinking, reacting, and working in an imaginative way characterized by a high degree of innovation, divergent thinking, and risk taking" (Rhodes, 2010).

Several scholars developed formal models of the creative process, most of which share substantial conceptual overlap.[4] For instance, most of the proposed models suggest the need to observe, find, or identify the problem; gather data or information; generate a variety of ideas or possible solutions; carefully select among those ideas or possible solutions; and finally, test or verify whether or not the chosen solution actually works. Today, Wallas's (1926) four-phase model of creativity is the most widely used (Cropley, 2009) and includes 1) preparation, or gathering of data, 2) incubation, or letting ideas marinate, 3) illumination, or allowing a solution(s) to become apparent and 4)

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[4] For further details on proposed phases of creativity, see Koberg and Bagnall, 1991; Mumford, Mobley, Reiter-Palmon, Uhlman, & Doares, 1991; Osborn, 1953; Rossman, 1931; and Wallas, 1926.

verification, or testing out the solution. Although these phases are described in such a way as to imply a strict order, the creative process is iterative, and these steps are often repeated out of order.

Within the scope of exploring the cognitive processes that underlie these phases, both *divergent* and *convergent* thinking skills are consistently identified as important types of creative thought (Cropley, 2009). Divergent thinking refers to the ability to generate multiple unique ideas or "think outside of the box," whereas convergent thinking refers to the ability to combine or synthesize ideas into a single best answer.

Similar to the characteristics of the creative person, creative process skills are not fixed traits. Rather, they can be developed so that students can learn to think more creatively (Sternberg, 2000). Likewise, awareness of the process and the presence of skills do not represent actual creative accomplishment. Instead, they reflect creative potential.

The creative product

Alligned with the widely-accepted definition of creativity, a focus on "the *production* of ideas, processes or objects that are simultaneously novel and appropriate" indicates that the final product—whether it be a poem, a material object, or a scientific model—is the ultimate evidence of creativity (Amabile, 1983). As such, a product represents actual creative accomplishment, as opposed to creative potential. This explains why most descriptions of what constitutes a creative product are identical to the definition of creativity itself (i.e., a creative product is one that is both novel and appropriate; Zeng, Proctor & Salvendy, 2011).

The degree to which a product exhibits novelty and appropriateness is subjective, although there are models for more objectively identifying typical characteristics. For instance, Nilsson (2011) suggests that the degree of novelty of a product can be classified into one of five broad categories: 1) imitation of a single work, 2) variation of a single work, 3) combination of two or more works, 4) transformation of a work into a completely new form, or 5) creation of a product that was not previously recognized. Notably, despite the inherent subjectivity of assessing both novelty and appropriateness, researchers found a high degree of agreement among raters on what is considered to be a "creative product" (e.g., Amabile, 1982; Besemer & O'Quinn, 1986).

Creativity versus innovation

Some creativity scholars emphasize that a creative product must also be applied, implemented, or accepted by either the general public or authorities of the domain in which the creativity took place in order for it to be considered "creative" (e.g., Csikszentmihalyi, 1997; Policastro & Gardner, 1999). For instance, for a work of art to be considered creative, it must be accepted by expert art critics or purchased by an art collector. Likewise, a tangible object invented to solve a problem or improve the quality of individuals' lives must be produced in large quantities and purchased by the general public to be considered creative. However, others suggest that application and/or broad acceptance of a product represents *innovation* rather than creativity (e.g., Daly, Yilmaz, Christian, Seifert, & Gonzalez, 2012; Genco, Hölttä-Otto, & Seepersad, 2012). Some researchers describe innovation as the combination of creativity followed by exploitation, which encompasses development, commercialization, or persuasion of others to acknowledge a product (Roberts, 1988; see also Luecke & Katz, 2003). As Cropley (2009) notes, creativity is a necessary but insufficient component of innovation, and therefore, the ability to innovate is explicity captured in a distinct learning goal (Third Century Initiative Student Learning, http://thirdcentury.umich.edu/student-learning/). A detailed description of innovation and how it can be assessed can be found in a separate Occasional Paper.

Consistent with the distinction between creativity and innovation, researchers also distinguish between *everyday achievement* and *creative achievement* within the realm of creative accomplishment. Everyday achievement includes less significant, personal creative accomplishments, such as painting a portrait for leisure or coming up with a novel "fix" for a household problem. Creative achievement refers to accomplishments that are shared with, acknowledged, and accepted by the public (Jauk, Benedek, & Neubauer, 2014). In a similar vein,

some researchers use the terms "Little-c creativity" and "Big-C Creativity" to distinguish between everyday creative accomplishments and renowned or publicly influential accomplishments (e.g., Csikszentmihaly, 1997; Kaufman & Beghetto, 2009; Simonton, 2012).

The creative press

The creative press refers to the environment in which creators work. At the macro level, it includes ever-evolving physical, social, political, economic, and cultural aspects (Amabile, 1995; Csikszentmihalyi, 1997; Eysenck, 1997; Montuori & Purser, 1995; Seitz, 2003; Simonton, 1997). As several scholars note, creative achievement does not occur in a vacuum. It involves a social community in which others' beliefs, ideas and judgments about the problem to be solved and the creative solution must be considered (Dewey, Steinberg, & Coulson, 1998; Gruber & Wallace, 1999).

At the micro level, creative press includes aspects of one's immediate environment (i.e., work, home, class) that may either foster or discourage creativity. For instance, students are more likely to pursue creative endeavors in environments in which instructors value and encourage creativity and risk-taking (Thousand, Villa, & Nevin, 1994; Wilde, 1993).

Alignment of U-M and scholarly definitions of creativity

In May 2015, the provost's office and CRLT convened a gathering of several TLTC grantees who are leading programs meant to develop creativity and asked them what they see when U-M students engage in the creative process. Consistent with the literature, participants gave a broad scope of responses that clearly correspond to the dimensions of creativity, such as:

"Flexibility/versatility in ways of knowing/methods" (person)
"Different relationship to failure" (person)
"Creativity is a system of relationships – we should encourage teams to learn how to navigate the system" (process*)*
"Assemble skill sets towards a solution" (process)
"Moving beyond application of known products toward actual creation of new process and products" (product)

Why Is Creativity Important?

The development of creativity among university students has important implications for their personal and professional lives after graduation. Specifically, research indicates that creativity is important to the success of individuals, industries, and societies (Ford & Gioia, 2000; Moran, John-Steiner, 2003; Sternberg & Lubart, 1999), resulting in improvement and progression in the arts (Csikszentmihalyi, 1997), sciences (Sternberg & Lubart, 1999), economy (Amabile, 1997; Florida, 2002; Simonton, 1999; Wise, 1992), and individuals' standard of living and overall well-being (Cropley, 1990; Reiter-Palmon, Mumford, & Threlfall, 1998). Furthermore, projections for job growth within the United States continue to focus on fields such as healthcare and technology (Bartsch, 2009) – sectors that emphasize the need for creativity (Ensor, Cottam, & Band, 2001; McGourty, Tarshis, & Dominick, 1996; Mumford, Peterson, & Childs, 1999). Indeed, results from an AAC&U survey indicate that most (65%) employers value creativity as an important learning outcome among college students (Hart Research Associates, 2015). Despite its importance to maintaining a functional society, Kim (2011) found evidence that overall creativity has been declining across all ages in the United States, suggesting a need to foster this capacity among youth and young adults who will soon be the driving forces behind our increasingly complex and globalized world.

Developing Creative Potential and Fostering Creative Accomplishment

A primary reason researchers study creativity is to understand how it can be fostered and developed (e.g., Haensly & Torrance, 1990). Several methods are used to encourage creativity in a variety of contexts, and they are usually based on theoretical frameworks that roughly correspond to the "Four P's" of creativity. Methods to enhance students' creativity can include:

1) Targeted improvement of very specific skills, dispositions, or characteristics (e.g., openness to risk-taking within the dimension of person or problem-identification skills within the dimension of process)

2) Multiple skills within a dimension of creativity (e.g., divergent and convergent thinking skills within the dimension of process)

3) Broader approaches that simultaneously address multiple dimensions of creativity (e.g., problem-identification and divergent thinking skills within the dimension of person combined with fostering a classroom culture that espouses creativity and encourages risk within the dimension of press)

Consistent with many of the previously identified precursors to creativity, five common approaches to enhancing creativity are (Scott, Leritz, & Mumford, 2004):

1) Providing incentives to increase motivation (e.g., Collins & Amabile, 1999; Eisenberger & Shanock, 2003)

2) Imparting knowledge to increase expertise (e.g., Ericsson & Charness, 1994; Weisberg, 1999)

3) Structuring interactions to improve the creative process in groups (e.g., King & Anderson, 1990; Kurtzberg & Amabile, 2001)

4) Improving micro-level environments to impart a culture that explicitly values creativity, by encouraging risk-taking and allowing for failure without repercussions (e.g., Ambile & Gryskiewicz, 1989; Anderson & West, 1998)

5) Teaching creative skills to improve individuals' creativity across contexts, which has been by far the most prevalent type of approach to cultivating creativity (Montuori, 1992)

At the University of Michigan, examples of intentional approaches to enhancing students' creativity include UARTS 250: Creative Process. This interdisciplinary course is co-taught by faculty from the Taubman College of Architecture & Urban Planning, the Stamps School of Art & Design, the College of Engineering, and the School of Music, Theatre and Dance. The class focuses on 1) increasing students' creative self-efficacy and motivation through weekly colloquia that emphasize the malleability of creative potential, identifying issues such as fear, ego and open-mindedness (person); 2) fostering an understanding of the phases of creativity through biweekly workshops that explore how musicians, engineers, artists and dancers practice creativity (process), 3) fostering a classroom culture in which creativity and risk-taking are encouraged (press); and 4) giving students opportunities to practice creative accomplishment and demonstrate understanding of their lessons via multiple project-based assignments (product). While this course can be characterized primarily as a training approach to creativity, it also encompasses improvement of a micro-level environment (i.e., the classroom) to impart a culture that values creativity, illustrating that these approaches need not be mutually exclusive.

Another U-M example involves an authentic research design approach that has been implemented in CHEM 216: Organic Chemistry. Rather than teaching students using traditional, "recipe-based" approaches to conducting chemistry experiments, the focus of this course is to identify a problem with an experimental method and have students develop and test their own solutions. In particular, students learn about health hazards associated with a standard chemical process (the Wittig Reaction), and they are asked to improve its environmental impact. The course focuses on 1) fostering an understanding of the phases of creativity in the context of experimental work, especially generating ideas and testing solutions (process); 2) fostering a classroom culture in which creativity and risk-taking are encouraged, by emphasizing that failed experiments do not result in failing grades (press); and 3) giving students opportunities to practice creative accomplishment and demonstrate understanding of their lessons via actual experimental work developed by the students (product). To accomplish these goals, students are not graded by typical standards (i.e., efficiency of the reaction) because proposed solutions may not work at all. Instead, they are rewarded if they demonstrate an in-depth understanding of the reaction they are investigating, as well as novel approaches to solving the problem.

Assessing Development of Creative Potential and Creative Accomplishment Among Students

How can a U-M faculty or staff member assess creativity? Key outputs will reflect one or more of the four dimensions of creativity. This section will briefly review some of the theoretical and empirical research

on types of outcomes that might be expected from a creativity exercise or program, and it will highlight established measures that represent the different dimensions of creativity. For additional assistance with developing an assessment plan, please see this web resource: http://www.crlt.umich.edu/assessment/planning or contact crltassessment@umich.edu for a tailored consultation.

Different program characteristics influence different creative outcomes

When developing an assessment plan and deciding which measures of creativity to use, it is important to think about program characteristics such as the duration, scope, and specific content, as research suggests that these characteristics influence creative outcomes in different ways (Perry, 2014).

For example, because creative achievement results from the confluence of multiple factors, long-term, multiple-intervention approaches can better facilitate "moving the needle" than one-time, short-term interventions. However, short-term interventions can be most successful in fostering creative potential when they are 1) targeted toward specific skills, such as identifying problems or thinking divergently and 2) based in specific disciplines, such as engineering or creative writing (Nickerson, 1999). This implies that short-term interventions lasting a term or less may exhibit some successful outcomes when they focus on a specific set of skills within a single dimension, such as convergent thinking within the dimension of process. In such cases, gains may be best measured by an instrument that taps into the specific skill, such as the Remote Associates Task (RAT; Mednick, 1962), which gives a series of three seemingly unrelated cue words and requires respondents to think of the fourth word that is linked to them. For example the prompts "rocking," "wheel," and "high" are all linked to the word "chair." In a similar vein, everyday achievement may be more sensitive to short-term training than creative achievement. In this context, the subscale within the Inventory of Creative Activities and Achievements (ICAA; Jauk, Benedek, & Neubauer, 2014) that focuses specifically on everyday achievement may be more useful than the subscale that

focuses on creative achievement.

Within the scope of programs that teach creative skills, Scott, Leritz, and Mumford (2004) conducted a meta-analysis of 70 creativity programs to explore their overall effectiveness on four types of outcomes: 1) divergent thinking, 2) problem solving, 3) attitudes and behaviors, and 4) performance. They found that, in general, creativity development had positive, sizable effects on all four types of outcomes, although these effects tended to be larger for divergent thinking and problem solving outcomes. Furthermore, interventions that focused on cognitive processes were the most effective for outcomes associated with creative potential (i.e., divergent thinking, problem solving, and attitudes and behaviors), whereas interventions that focused on personal dispositions and motivation were most effective for creative accomplishments (i.e., performance). This implies that interventions that focus on the development of creative processes may not result in immediate performance gains as assessed by the products that students create, but gains in skills or behaviors may be more apparent. Conversely, interventions that focus on the facilitation of motivation or risk-taking may be more likely to result in performance gains as assessed by student products.

Creativity measures

In addition to representing the four dimensions of creativity (person, process, product, press), measures of creativity can also be direct or indirect assessments of student learning (Maki, 2004). Below are some examples of each (see Table 1), along with a description of the dimension of creativity they measure. These examples are chosen to illustrate different approaches to measuring similar constructs, and each of them is free and accessible.

Whenever feasible, it is useful to include more than one measure of the variable(s) to be assessed, because some research has documented differences in the sensitivity of measures for the same variable (e.g., Cropley, 2000; Zeng, Proctor, & Salvendy, 2011) and having multiple measures may increase the ability to capture desired results.

Direct measures are associated with student output and represent actual student learning such as performance on the design of a creative product. In addition, measures within the scope of direct assessment can be further categorized into authentic measures or other direct measures. The former demonstrates "real-world," integrated learning via performance on open-ended tasks, such as the design of a creative product, whereas the latter demonstrates learning via performance on close-ended and possibly standardized tasks, such as a prompt that measures convergent thinking. Thus, while authentic measures provide a richer understanding of student learning and its applicability to the real world, they can be more time intensive and costly to quantify for purposes of student comparisons. Conversely, other direct measures are usually standardized, and thus easily quantifiable, but may be a less valid measure and fail to tap into the extent to which students are able to apply what they have learned. *Indirect measures* are associated with students' attitudes and opinions, such as responding to a survey asking whether they believe a course improved their creative skills. The advantages of using indirect measures are that they are comparatively easy to administer and they may help identify the extent to which motivational intentions precede performance or behavior. The disadvantage is that intentions may fail to culminate in increased performance or changed behaviors, which may lead to inflated estimates of actual outcomes. The use of both direct and indirect measures is recommended to get different perspectives on student learning and experiences.

Table 1. Examples of Measures

Instrument	Dimension	Notes	Measure Type
Student Product Assessment Form (SPAF; Reis & Renzulli, 1991)	Product	This is a 15-item Likert-scale assessment that was originally developed for use with gifted children in K-12. It is used by an observer to evaluate the quality of students' creative products.	Direct
Creative Thinking VALUE Rubric (Rhodes, 2010)	Product	This is a rubric-style instrument developed by a team of faculty experts used by an observer to evaluate the quality of postsecondary students' creative products.	Direct
Creative Achievement Questionnaire (CAQ; Carson, Peterson & Higgins, 2005)	Product	This is a self-report measure of the frequency and scope of one's creative achievement in 11 domains (e.g., visual arts, scientific discovery, inventions, creative writing). Sample items include, "My work has been reviewed in national publications" (creative writing) and "I have received a grant to pursue my work in science or medicine" (scientific discovery). It exhibits acceptable validity.	Direct
Remote Associations Test (RAT; Mednick, 1962)	Process	This measure of students' convergent thinking processes gives a series of three seemingly unrelated cue words and requires respondents to think of the fourth word that is linked to them. For example the prompts "rocking," "wheel," and "high" are all linked to the word "chair." It exhibits acceptable reliability and validity.	Direct
Short Scale of Creative Self (SSCS; Karwowski, 2011)	Person	This is a self-report, 11-item Likert-scale that measures self-perceptions of one's creative ability. It exhibits acceptable reliability and validity.	Indirect
Gough Personality Scale (Gough, 1979)	Person	This measures the number of adjectives that students use to describe themselves and which represent characteristics of creative personality. It exhibits acceptable reliability and validity.	Indirect

Conclusion

Creativity is an important skill for students to develop, with implications for their personal futures and for society as a whole. At the University of Michigan, results from the 2015 UMAY survey, conducted by the Office of Budget and Planning, suggest that while many students report opportunities to develop creative thinking through their educational experiences, there is still room for growth. Out of all undergraduate students who participated in the survey (N ≈ 5,000), a majority (60.9%) reported that they are often required to "create or generate new ideas, products, or ways of understanding." An even larger proportion (79.9%) described satisfaction with opportunities to produce research or creative products, both of which require creative thinking. However, opportunities for creative thinking may be more prevalent later in the curriculum. While almost half of U-M first-year students (47.7%) and sophomores (45.3%) indicated that they have never engaged in a creative activity as part of their coursework, only about a third (33.2%) of seniors reported such a gap. In short, these statistics suggest that additional opportunities to foster creativity would benefit a substantial number of students.

In terms of pedagogical strategies that focus on fostering creativity, research and practice indicate that successful approaches work across multiple dimensions, including person, process, product and press. As U-M focuses on promoting creativity as a core TLTC learning goal, it will be important for existing and new efforts to include careful assessment measures so that effective approaches to improved creative capacity can be shared.

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