Transferring Creativity across Disciplines: Creative Thinking for Twenty-First-Century Composing Practices

Sohui Lee and Russell Carpenter

Current academic research in creative thinking explores new ways creativity may be connected with student success from arts education to the sciences. Building on findings from creativity research across the disciplines, our study identifies and describes four approaches in creativity that may be of value as transferable strategies for writing and performance. We offer interdisciplinary perspectives based on available pedagogies that may help faculty relate the transferability of creativity and appreciate the profound role and relevance of creativity in academic thinking, composing, and performance.

During the last decade, primary and secondary (K-12) education through higher education have shown active interest in integrating creativity pedagogy as indicated by broad movements to include applied creativity in rubrics and frameworks for student success across disciplines. In 2010, the Association of American Colleges and Universities (AAC&U) developed a Creative Thinking VALUE Rubric to help faculty evaluate evidence of creative thinking in campuses across the nation. Two years later, the Council of Writing Program Administrators, National Council of Teachers of English, and National Writing Project developed "Framework for Success in Postsecondary Writing," which introduces essential "habits of mind" and experiences to intellectually and practically engage students in writing and communicating across a range of disciplines (CWPA, NCTE, & NWP, 2011, p. 1). Creativity plays a fundamental role as a habit of mind necessary for writing, speaking, performing, and visualizing, because "creativity focuses on invention and thinking processes by which students can learn to be astute consumers and creators of information and messages" (Lee & Carpenter, 2016, p. 224). As Hrenko and Stairs (2012) noted in their research on the intersections of arts and writing among K-12 students, creativity can also provide an opportunity to "retell, reinterpret, and redefine" concepts and themes that encourage engagement in the learning process. Beyond K-12 and postsecondary education, Partnership for 21st Century Skills—a national coalition of educators, policy makers, and business leaders—advocated an educational framework that identifies creativity as core twenty-first century learning and innovation skills, preparing students to effectively communicate in "a tech-

DOI: https://doi.org/10.37514/ATD-B.2019.0292.2.01

nology and technology driven environment" (Partnership for 21st Century Skills). Current academic interests in creative thinking and creativity explore new ways we might connect creativity with student success in a variety of public and private environments and invite us to consider domain-general creativity skills—those that apply across disciplines and expand the pedagogical connections between written, auditory, oral, and performance practices and theories. As Corbett and Cooper (2015) argued in their introduction to the special issue of *Across the Disciplines* (*ATD*), students in performing and visual arts engage in "generative creative processes" that may transfer to writing and vice versa (p. 1).

Composition scholars have been exploring the role of creativity in part because creativity shapes the rhetorical impact on student projects (Ridolfo & DeVoss, 2009; Shipka, 2011) and can supply "fresh approaches" to ways students connect, communicate, and synthesize knowledge in visual, written, and multimodal channels (Livingston, 2010, p. 59; Hrenko & Stairs, 2012; Smilan 2016). Delagrange (2011) noted the capacity and proclivity of multimodal text, in particular, to remix and expose "curious and unexpected connections" through innovation in arrangements and juxtapositions (cf. Kurtyka, 2015). But do the ways we use creative thinking in multimodal composing apply to engineering problems? Or composing plays? Can creative academic practices from one field help another? In exploring creativity in performing arts and management at the postsecondary level, Kern (2006) noted that a comparison may generate useful strategies. For Kern, performance arts involve not only aesthetic creativity connected with body movements but also critical creativity: "Thinking and doing are intrinsically linked within [performance] activity; repetition is never purely repetitive, but always implies creativity" (2006, p. 65). Rules, applied in performance arts and management, work in similar ways as "constraint and resource for creativity" (Kern, 2006, p. 68). Unlike Kern, who found that select performing arts approaches may provide a lens for reimagining management theory, Smilan (2016) argued for a more integrative approach to art in STEM-based lessons, especially K-12 education. Art and science, according to Smilan (2016) are "irreducible to each other" and a creative pedagogy involving the two areas should promote a "synthesis" of visual, experiential, and conceptual understanding (p. 169).

Creativity scholars have been concerned with exactly this classic debate: whether creativity skills are domain-specific or domain-general. Research addressing this debate suggests that both may be possible. In domain-specific creativity, scholars may be experts in a creative-thinking approach that is employed in one discipline. The approach might be taught in courses from departments in that field and the practice honed by its experts. Although domain-specific creativity presumes in-depth knowledge of approaches in a particular discipline, domain-general creativity seeks applications that transcend fields. In their study of domain-specific creativity, Silva, Kaufman, and Pretz (2009) noted, "Traits like divergent thinking,

creative potential, creativity-relevant skills, and ideational abilities presumably foster creativity across many disciplines. Most of these theories would agree that domain-general traits translate into domain-specific accomplishments" (p. 146).

Beyond identified domain-general approaches, there may be domain-specific creativity approaches that are broadly applicable and relevant to multiple disciplines. They can be applied in ways that may be useful beyond the scope of the conventions common in that field. When investigating creativity scholarship and the connections between creative thinking and twenty-first century compositional practices, we were inspired by Palmeri's (2012) inquiry into whether "there are similarities in the creative composing process of writers, visual artists, designers, and performing artists" (p. 25). Although Palmeri recognized the "limitations of generalizable theories of creativity," he suggested that it "could be useful for compositionists to conduct comparative studies of students' creativity processes when composing alphabetic and visual texts" (2012, p. 31). The assumption here is that a comparison of domain-specific strategies in the composition process of writers, visual artists, and performance artists may lead to "generalizable theories" of creativity. Our approach expands the question even further to ask if a writer, communicator, artist, and performer may gain insight on transferable creativity strategies from an even broader comparative study of postsecondary creativity pedagogies that includes engineering, sciences, and education. Scholars in these fields outside communication and the arts have long investigated the role of creative thinking; understanding common or even different approaches may inform how we can enhance teaching and student learning across educational environments.

While Palmeri raised questions about modal affordances and their impact on creativity in multimodal composition, our investigation of pedagogies of creativity reviews literature from the arts, engineering, sciences, social sciences, and humanities; identifies creativity theories and practices with the highest potential for impact in its writing and performance applications; and finally offers some generalizable creativity approaches. While we situate creativity pedagogies within specific disciplines, we highlight how a selection of possible transferable applications may enrich our ways of teaching creativity to students in other fields. In our survey of literature on creativity across disciplines, we kept the following key questions in mind:

- How is creativity and creativity pedagogy defined and discussed across disciplines?
- How can the study of creativity pedagogies across various fields of study help us consider transferable creative processes and techniques that support writing or communicating through a variety of modes including performance and visual arts?
- How might transferable creativity strategies apply in pedagogical situations within the writing process?

This chapter first summarizes our assessment of creativity theories and strategies drawn from a survey of over seventy articles and chapters in composition, engineering, sciences, social sciences, and humanities. Building on our findings from creativity research across the disciplines, we identify four distinct approaches that may be of value as transferable strategies for writing and performance. In presenting these generalized approaches of applied creativity drawn from across disciplines, we offer interdisciplinary perspectives based on available pedagogies that may help faculty assess the relevance and transferability of creativity beyond what students do in a specific discipline. In doing so, students may be given tools to apply relevant and even innovative strategies of creative thinking essential for integrating writing and performance within Writing Across the Curriculum (WAC) and Writing in the Disciplines (WID) programs.

Creativity in Composition: Creativity as Thinking

Although creativity may be framed in a variety of ways in academic disciplines, scholars who study applications of creativity often discussed it as a "teachable" skill (Brent & Felder, 1992) that results in generating ideas, insights, or new perspectives that are not conventional or routine. For many interested in student learning, the pedagogical outcomes of creativity were also valuable because some scholars believed creativity engaged students through "deeper levels of understanding" in a subject (Korgel, 2002; Sweeney, 2003). Creativity can be discussed, as Howard, Culley, and Dekoninck (2008) noted, in terms of "the creative process, the creative product (output), the creative person, and the creative environment" (p. 161). We would add to this list creative pedagogy involving techniques or strategies applied to improving or achieving the creative process, product, or environment.

In this study, we focus on how creativity scholars in composition and across the disciplines frame and discuss pedagogical techniques to improve creativity in students and their academic work, whether this work is represented as expository essays or engineering problems. We then categorize relevant articles by author and discipline, creativity trend/concepts, and purpose/definitions (Appendix). Cataloguing the discipline allowed us to locate similar creativity strategies across fields and boundaries. The trends and concepts include ways scholars in the disciplines discussed creativity within their field. Furthermore, identifying the purpose/trend allows us to elaborate on and contextualize the creativity concepts from the literature. The following review of creativity scholarship covers six areas: composition, visual arts, engineering, sciences, social sciences, and humanities. Additionally, we provide a separate study of creativity in the visual arts because creativity is necessary in creating art, promoting art, advocating for art, and translating arts-based knowledge.

In composition studies, instructors may think of creativity and creative thinking as a process such as brainstorming by which students generate new ideas or topics. For composition instructors who adhere to process-writing approaches, the writing process is generally understood to involve four stages (brainstorming, planning, composing, and revising) that may or may not unfold in a neat sequence. A range of critical thinking activities are involved during each of the four stages.

Early composition scholars who supported the "process movement" in composition studies strongly emphasized creativity as a thinking act. Lauer (1970) drew from psychology when she asserted that instructors can improve how they teach the creative process in composition by reflecting on creativity as a heuristic tool, which can stimulate problem solving, questioning (rethinking), and flexibility in writing approaches. Flower and Hayes (1977) also framed writing as a "highly goal-oriented, intellectual performance" (p. 449) that benefits from problem solving: "[Writing] is both a strategic action and a thinking problem" (p. 449). They argued that the creative process helps students solve language or intellectual problems and increases "self-awareness" of such heuristics (1977, p. 450). Elbow (1983) believed creativity was a "bona fide kind of thinking because it is a process of making sense, and putting things together" (p. 38). Elbow, however, distinguished creativity as "first order thinking" (p. 39), associated specifically with intuitive, free-form idea generation. This first order thinking was contrasted against "second order thinking," which he described as "directed, controlled thinking" in planning, organizing, or revising (1983, p. 38). Elbow saw creativity as distinct from directed thinking, while Flower and Hayes, especially in their later study, argued that creativity involved both kinds of free form and directed thinking in the "discovery process" of writing (1983, p. 22).

In more recent composition scholarship involving creativity, authors generally focused on creative techniques rather than debate the creative thinking process. Technology, media, and the visual arts have become more integrated into the composition classroom, and the affordances of composing in multiple modes were perceived to open new paths for communicating messages to audiences. However, these moves may have also complicated the ways we teach creativity in both technique and process. Recent articles explored ways in which new creative pedagogies were critical for teaching composition. Exploring academic creativity in the form of "play," Rouzie (2000) insisted that play should be structured in the curriculum because it facilitates a critical process that invites open exploration of possible approaches, scenarios, or topics. Play allowed students to freely experiment with visual and mediated elements, to make mistakes, and to try new combinations while learning about how these decisions affect the design of a text (Rouzie, 2000, p. 635). Play may be particularly important as a creativity tool for learning when students are working with media and modes with which they have never composed before.

Composition scholars investigating writing and multimodality have continued to draw from theories across disciplines to inform new approaches. For example, Newcomb (2012) and Purdy (2014) explored creativity through the lens of engineering design and design theory. Newcomb and Purdy identified how design strategies are useful tools for improving creativity in composition studies. Evoking arguments in design studies (and echoing Flower and Hayes), Newcomb contended that design work depends on an understanding of relationships "full of constraints" (2012, p. 594) and requires students to develop and write about solutions to complex writing problems through "situational creativity" (p. 607). Noting the emergent trend in composition, Purdy also identified the value of design thinking in "multimodal/multimedia composing tasks" (2012, p. 614) by helping students complicate single solutions and creatively work with problems that are "ambiguous, contingent, and recursive" (p. 613). In exploring the connections between writing and performance, authors in the *ATD* special issue *Create, Perform, Write* (Gerben, 2015; Henry & Baker, 2015; Marquez, 2015) reconceptualized creativity in communicative performance by foregrounding the process of performing in terms of metacognition: Gerben (2015), for instance, championed "the integrity of the rhetorical creation (the 'how')" and the process of making or performing; Henry and Baker (2015) identified rehearsal performance as playing a crucial metacognitive role in "performance consciousness." Extending the work of Newcomb and Purdy, this study gathered and processed disciplinary findings to further explore how design thinking and other creativity approaches might be transferred and applied to written and multimodal composing practices.

Creativity Across Disciplines

Across disciplines, creativity has been defined, studied, and explored in ways that compositionists may quickly recognize; because, as we noted, theories and practices in composition studies have integrated cognitive psychology and engineering design theory. Our study of creativity in visual arts, engineering, sciences, education, and humanities correlates to the interdisciplinary Creative Thinking VALUE Rubric presented by the AAC&U in 2010. Consolidating criteria of creative thinking learning outcomes, the Creative Thinking VALUE rubric highlighted common attributes across disciplines, including innovation, divergent thinking, and risk taking. Unlike the VALUE rubric, which was designed to help instructors assess the quality of students' creative thinking, we present a detailed exploration of theories and strategies that may be more valuable for composition pedagogy and administrative work associated with WAC and WID. A closer examination of creativity studies provides insights for composition practice by revealing transferable creativity approaches compositionists have yet to consider. In this section, we summarize

the ways various disciplines discuss creativity and then draw observations relevant to WAC and WID scholars.

Visual Arts: Creativity as a Skill

The most common aesthetic understanding of creativity—the idea of artistic originality—is one that has been applied in visual arts, where creativity may be seen by some to be at the very heart of arts education. Nonetheless, Tutor (2008) noted that arts education, like other disciplines, often fails to treat creativity as a pedagogical product of deliberate learning rather than a by-product of theoretical or conceptual content delivery or technical performance. Creativity in the visual arts is unique because it is both a process and product of visual artists. Although often included as a discipline within the field of postsecondary education, we discuss it here separately because we see the visual arts as an entry point to discussing creativity across the disciplines. Examining the production of art in our modern "information society," Drucker (2005) noted how fine artists believe that creativity innovates the arts and may "lead the way for envisioning the future in all areas of contemporary life" (p. 37). In visual arts education, creativity was theorized as an aesthetic skill that was identified and measured to evaluate student performance. According to Eisner (1962), who outlined a typology of creativity in the visual arts, human creativity is comprised of "different kinds of creative competencies" (p. 12). Eisner identified four key behavioral characteristics of creativity that could be identified and measured by the facility of an individual to combine elements of a subject (such as genre) or forms (art material):

- boundary pushing creativity
- boundary breaking creativity
- inventive creativity, and
- aesthetic organizing creativity

Boundary-pushing creativity extends the subject or form in novel ways. One illustration of boundary pushing creativity might be seen in student-designed trade blankets assigned to Maine eighth and ninth graders (Hrenko & Stairs, 2012). Students were asked to design motifs that reflected "accurate regional patterns" made by a Maine native tribe, while adding an original motif that "identified" the students themselves (Hrenko & Stairs, 2012). By contrast, boundary breaking creativity provides an "utterly new" approach to subject or form. An example of boundary breaking creativity in performance might be seen in Gerben's (2015) performance piece "Grace" (Gerben, 2015, pp. 9-11): Gerben's piece, taught in a postsecondary educational setting, merged performance with multimedia art, requiring the audience (students) to experience a "park"-like space created through visual, auditory, tactile elements and actors. "Grace" may be seen as boundary breaking creativity because it reconceived the narrative of traditional performances in a radically different way,

replacing story with the audience's immersive experience of a concept instead. A third type of creativity, inventive creativity, is the ability to take existing forms and subjects to create something new. Examples of inventive creativity could be seen online with IKEA hacks, where DIYers use IKEA products for purposes completely different from its original intention: $2 vases become "bricks" for a curving wall in a bathroom and stools are installed as wall bookshelves. Finally, Eisner introduced aesthetic organizing creativity, which orders "specific forms so as to constitute a coherent, harmonious, and balanced whole" (1962, p. 13). Aesthetic organizing creativity, also understood as the practice of design approaches by graphic designers and others, represents one of the most flexible creativity skills: Aesthetic organizing creativity embodies transferable sets of skills across different modes of art forms, from haptic to visual (Eisner, 1962, p. 19). Figure 3 is a good example of aesthetic organizing creativity, being part of a student design project described by Fowler (2015) in his article, "Writing-Intensive Approaches in a Typographic Design Studio Class" (p. 6). The objective of the assignment designed for college students was to explore how typographic and graphic design choices can "transpos[e] concepts from an earlier era to the present" (Fowler, 2015, p. 5); in this case, a student takes a nineteenth-century French poster advertisement (see Figure 2 in Fowler, 2015, p. 6) and graphically updates it with a scene from a Peanuts cartoon (see Figure 3 in Fowler, 2015, p. 6). While Eisner described creativity as a measurable skill of creative talent, more recent arguments for creativity in visual arts education have situated artistic creativity as a transferable skill that helps students work with content (Livingston, 2010).

Four Types of Creativity

For instructors and scholars interested in writing and performance, a relevant observation from creativity scholarship in arts education at both the K-12 and postsecondary levels emerges: The four types of creativity may be used to help students identify and explore media forms and modes across disciplines. One of the major challenges to creativity is recognizing different kinds of creativity when it is seen while continuing to nurture students' creative confidence (Tutor, 2008). Understanding types of creativity (boundary-breaking creativity, boundary-pushing creativity, and inventive creativity) might provide new possibilities for ways in which students might be intentional about integrating creative approaches to reflect on and transfer strategies.

Engineering: Creativity as Heuristic Tool and "Event"

In fields outside of the visual arts, creativity is not usually categorized by degrees of aesthetic originality but by the quality of cognitive problem solving. Essential qualities of creativity are described in fields as diverse as composition, psychology, mathematics, and engineering as generating a unique combination of elements,

developing novel perspectives for a performance, or solving a problem (Brent & Felder, 1992; Bump, 1985; Dorst, 2001; Elbow, 1983; Flower & Hayes, 1977, 1980; Kokotovich, 2007; Korgel, 2002; Lauer, 1970; Lumsdaine & Lumsdaine, 1994; Mednick, 1962; Siswono, 2010). One of the earliest to propose processes for creative thinking, psychologist Mednick (1962) drew evidence from poets as well as mathematicians and scientists to theorize that creative "performance" of these artists and thinkers is due to the unique "combinations of associative elements" and that creative solutions of this nature were teachable through specific processes of thinking (p. 220). Whereas creativity theory from cognitive psychology emphasized the creative process involving cognitive thinking alone (Mednick, 1962), engineering discussed creativity in terms of solving a design problem, process, and activity (Howard, Culley, & Dekoninck, 2008).

Engineering researchers interested in creativity commonly referred to creativity as a heuristic tool or process. Because engineers commonly rethink systems, procedures, and performance tasks, these creative processes necessitated the development of systematized thinking practices that encourage engineers to break from standard approaches. In our review of engineering creativity research, we identify the following key concepts of creativity process that may be valuable for composition and performance studies.

Divergent Thinking and Convergent Thinking

While Elbow (1983) made the case for two separate modes of thinking, one that is "creative" thinking and another that is "rational" thinking, engineering scholars have consistently argued that both approaches were parts of a greater creative thinking process: divergent thinking and convergent thinking necessarily work together to generate creativity. For Lumsdaine and Lumsdaine (1994) and others in engineering, "divergent thinking" is an ability to think imaginatively and innovatively about the problem by seeking to understand its broader context and generate ideas without evaluation. While divergent thinking helped with generating innovative ideas that challenge conventional or status-quo thinking, engineers considered "convergent thinking" to be a complementary ability to logically select, evaluate, synthesize, and refine "many potential ideas into one or more workable solutions" (Sweeney, 2003, p. 139).

Involving Constant Questioning and Reshaping of the Problem and Solution

The hallmark of design thinking in engineering is the notion of constantly and creatively rethinking both the problem and the solution to produce a better solution that diverges from the "routine product" (Howard, Culley, & Dekoninck, 2008, p. 160). Design thinking, thus, involves a dynamic, creative cognitive process that

never settles on one given solution. In "Creativity in the Design Process," Dorst (2001) called creativity an "event"; that is, "a period of exploration in which problem and solution spaces are evolving and are unstable until (temporarily) fixed by an emergent bridge which identifies problem-solution pairing" (p. 435). Creativity scholars in engineering generally argued that the best creative solutions occur when the problem or solution is consciously and methodically redefined and re-visited numerous times through an iterative practice.

Sciences: Creativity as Situated Process

"Creativity," Langley and Jones (1988) explained, "lies at the heart of the scientific process" (p. 177). As in engineering, creativity literature in the sciences generally addresses two concerns: the measuring of creative ability and the improvement of creative ability. The literature reviewed for our study focuses primarily on discussions about how students' creativity may be improved to increase the quality of student research (Baily, White, & Pain, 1999; DeHaan, 2009; Siswono, 2010), although some have also studied how creativity motivates students in the sciences (Lee & Erdogan, 2007). Scholars in the sciences have made a particular case for asserting the importance of creativity in the research process and offered ways to explicitly teach creativity that take into consideration the rhetorical context or applications of creativity techniques.

Situated Creativity

The following domain-specific creativity approaches may be applied more generally in other disciplines: Scientific research processes like design thinking involve creativity and rhetorical thinking situated in historical, cultural, and subjective contexts. Bailey, White, and Pain (1999), scientists in geography and environmental management, argued that science is always about interpretation of data, and creativity comes in contextual interpretation in the research process. In the life sciences, DeHann (2009) also situated creativity in scientific research as a multicomponent process occurring in particular social contexts, often involving "a remarkable degree of influence and collaboration" (p. 174). Like scholars in engineering, DeHann asserted that creativity includes divergent thinking or "cognitive flexibility" and convergent thinking, or the ability to have analytic focus and select the best solution (2009, p. 174).

Creativity as a Teachable Skill

Creativity scholars in the sciences generally agreed that "creativity does not happen by chance" and have argued for creative learning environments (Lee & Erdogan, 2007, p. 1317), discussions of creativity theory and techniques (DeHann, 2009),

and the teaching of creativity stages (Siswono, 2010). Students can be stimulated to be more creative if teachers actively encourage them to use creativity when identifying and solving problems; and if teachers explicitly guide students in how to be creative by "inform[ing] students about the nature of creativity and offer[ing] clear strategies for creative thinking" (DeHann, 2009, p. 176).

Education and Social Sciences: Creativity as Constructed Environments

Creativity pedagogies in education focused on teaching creatively with an emphasis on instructing teachers to apply creative pedagogies in the classroom while constructing creative learning environments. The research in education also drew heavily from cognitive psychology and design, focusing on how to encourage students to be active creative thinkers. Areas within Education and Social Sciences often adopted a domain-general approach, as Sawyer (2011) notes: "[T]he implicit assumption made by arguments to justify arts education—[is] that such education results in domain-general creativity skills that will transfer to other subject areas" (p. 3). As Sawyer explained, teachers might look for approaches that transcend disciplines that can adapt to fit a variety of composing contexts. Furthermore, teachers might repurpose domain-general strategies for multimodal composition instruction.

Education focused on the process of creative teaching itself through studying strategies and approaches. In the education disciplines, emphasis was placed on how the class environment and curriculum shapes student creativity (Lin, 2011). Other education scholars have further investigated creative teaching, teaching for creativity, and creative learning (Baker & Burns, 2010; Jeffrey & Craft, 2004). Especially in the last decade, education scholars emphasized the important relationship between creativity and technology, particularly how technology in the classroom enables creativity with the digital generation (Livingston, 2010; Mishra & the Deep Play Research Group, 2012).

Improvisation and Risk-taking

In our review of the research on creativity in education and the social sciences, improvisation and risk-taking in high and low-tech forms enhance creativity in education. For instance, Sawyer (2011) argued that the most effective way to foster creative thinking in learners is to "guide them in a process of disciplined improvisation" (p. 14). Education creativity research suggests that risk-taking activities help students learn from making mistakes and, when reflected upon and discussed explicitly, lead students to engaging in deeper and more productive creative experiences (Gibson, 2010).

Problem Solving and "Possibility Thinking"

Like creativity scholars in engineering and the sciences, education and social science creativity scholars present creativity as a critical tool for problem solving. Scholars in education suggest that looking at the available approaches to solving problems or even constructing problems to be solved can facilitate creative thinking in students and can help shape a creative pedagogy. Problem solving allows students a way into a discussion, debate, or experiment. A characteristic of creativity itself, as Jeffrey and Craft (2004) explained, is "possibility thinking," which "includes problem solving as in a puzzle, finding alternative routes to a barrier, the posing of questions and the identification of problems and issues" (pp. 81-82).

Humanities: Imaginative Thinking and Doing

The humanities presented a challenge when tracking creativity approaches because its fields recognize creativity as product and/or process. In some cases, such as creative writing, creativity was the "focus of artistic energy" and the goal itself (Sewell, 2018, p. 64). As in the arts, creative writing was defined by creativity and evaluated by its successful implementation. In literary studies, creativity was essential for investigating "literary imagination," because the choice and syntax of words become "the chief participants in imaginative sequences" (Gardner, 1982, p. 173). While academic disciplines such as English evaluated creativity in the final product and was a salient part of disciplinary work, other fields such as history viewed creativity as informing the processes of disciplinary thinking, much like the broad-based creativity strategies discussed earlier in other disciplines.

Historians discussed creativity in a variety of ways, including "counterfactual thinking" that parallels how engineering and sciences describe creative thinking for problem solving (Jackson, 2005). According to Jackson (2005), historians used creativity to imagine what cultures and belief systems were like in the past (p. 2) as well as to "engage with historical problems" (p. 2). "Counterfactual thinking" was, in fact, crucial for historians to think in alternative ways or to challenge assumptions and expand on commonly accepted views.

One approach to promote literary imagination or counterfactual thinking has been to explore visual thinking, which has resurged as a result of new methodologies and practices introduced by digital humanities. Coleman and Colbert (2001), for instance, highlighted the inherent connection between creative thinking skills and visual communication (p. 10). Similarly, Welch (2010) examined how students can improve technical writing by exploring creativity through visual design (p. 41). Digital humanities, moreover, have reinvigorated how scholars interpret text through data mining and have explored creative methods of critical theorizing through digital storytelling (Benmayor, 2015).

Learning by Doing, Making, and Visual Modeling

Creativity in the humanities emphasized an interdisciplinary approach to design and communication, specifically in the visual, cultural, performative, and media arts. Researchers highlighted experiences that lead to creative thinking. Creative thinking was experiential in that creativity involved learning by doing or, as in the visual or performative arts, learning by making. One type of experiential learning in creativity was visual modeling, which included recreating scenes, events, or concepts or visualizing patterns, options, problems, and solutions. Through a visual modeling approach, students were asked to employ creativity to construct or reconstruct samples and consider multiple options, variations, and new interpretations.

Four Approaches of Transferable Applied Creativity

When reviewing creativity scholarship together, we find that there is consensus on the value of academic creativity both as a practice in the academy and a process legitimized in academic frameworks for higher education. The primary goal of academic creativity is one of purposeful problem-finding or problem-solving, but the nuanced disciplinary approaches we've explored also reveal the multidisciplinary nature of creativity (Bremmer & Rodgers, 2013, p. 11): understanding different disciplinary approaches to creativity may introduce perspectives and concepts about creativity that may generate productive discussions on how creativity theory and techniques can be freshly applied or even rethought for written and multimodal composition at the K-12 and postsecondary level. Creative thinking is a skill, a heuristic process, situated event, and a product of constructed environments. Our study has led us to identify four general approaches of transferable applied creativity.

Creative Thinking as a Critical Skill

Scholars argue that creativity is a skill that can be strengthened and improved through an awareness of creativity as risk taking and applying techniques that help students challenge existing approaches, thinking, or imagining. To cultivate creativity as a skill, instructors of writing and performance might focus on quantity not quality through divergent thinking applications. For instance, instructors can help students generate ideas during the task defining and invention stages by giving them tools to generate a large quantity of ideas, topics, questions, or concepts.

Creative Thinking as a Heuristic Process

In addition to a skill, creative thinking is part of an ongoing and dynamic process

of discovery. To increase students' awareness, instructors might talk about creative thinking alongside the process of composing writing, performance, and visual arts. The most rhetorically effective, convincing, and original projects are produced when students are asked to be creative in various stages of task defining, inventing, researching, producing, and revising. A discussion of the creativity process makes explicit the method and application of creativity, and allows for students to actively challenge and rethink their assumptions along the process of generating their product.

Creativity as a Situated Event

In addition to being a heuristic, problem-solving process, creativity is a situated event, and creative choices are shaped by historical, social, cultural, rhetorical, and modal contexts. Increased awareness of the situational context of creativity helps students understand how they can be original with their written or performance projects as limited by these contexts. Students might be encouraged to provide a self-assessment of the various contexts of their projects, including an evaluation of whether certain contexts are underdeveloped or overlooked and whether some contexts have the potential to be helpful or detrimental to the project.

Creativity as a Product of Constructed Environments

Creativity can be learned and improved through explicit ongoing instruction. Teachability of creativity has been a focus in social sciences, especially education, but scholars in engineering and sciences have also examined how students' creative thinking is reinforced by curriculum that teaches creativity. Instructors can help cultivate creative thinking in their courses by inviting students to define the task/problems of assignments creatively and providing safe learning environments to do so.

Conclusion

In this chapter, we explored the roles of creativity pedagogy by investigating the scholarly literature drawn from across the disciplines and by examining how this research provides ways for considering creativity processes and techniques for composition studies. A review of creativity theories and strategies drawn from composition, engineering, sciences, social sciences, and humanities led us to conclude that creative processes offered value in creative thinking across the disciplines, especially in:

- idea generation
- quality of product
- innovative pedagogical approaches

The study resulting from the collection of creativity pedagogies across disciplines suggests the importance of problem-solving approaches not only as a visible performance of knowledge but also a means of raising the quality of the final product, whether that "product" involves scientific research, a slideshow presentation, or a dance performance. Creative thinking strategies reinforce the awareness of the situational and iterative nature of composition and performance, encouraging students to actively consider multiple paths toward a solution as well as questioning and revisiting results for quality, innovation, and/or rhetorical effectiveness.

Although discussions of applied creative thinking come at a particularly important time in composition studies, creativity research in written and multimodal composition is, in some ways, just beginning. In our attempt to examine transferable creativity approaches across disciplines, we hope to encourage further explorations of WAC/WID programs that teach creative thinking skills. Following Purdy (2014), future studies might examine creativity approaches within a specific discipline such as engineering or the sciences to deepen the connections with other disciplinary approaches. As K-12 classrooms and WAC/WID courses offer more assignments in genres different from traditional academic writing forms, and as writing instructors are asked to relate how students' learning outcomes in composing connect with other disciplinary ways of thinking and doing (Carter, 2007), writing studies will benefit from joining the rich interdisciplinary conversations on creativity.

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Appendix: Major Creativity Scholarship and Concepts across Disciplines

Author and Discipline	Creativity Terms/ Concepts	Purpose/Definition of Creativity
Mednick (1962) *Psychology*	"associative" process of creativity	Creative people (regardless of discipline) form "associative elements" into new combinations that are useful Creativity is originality plus "usefulness"
Lauer (1970) *Composition*	"heuristics" and invention	Prewriting, generation of goals, and problem solving
Flower & Hayes (1977); Flower & Hayes (1980) *Composition*	"problem-solving strategies" "discovery"	Brainstorming; role playing; analogies to see problems through a different lens
Gardner (1982) *History*	"counterfactual thinking"	Teaches students to re-evaluate thinking throughout the process
Elbow (1983) *Composition*	"first order thinking"	Intuitive, creative thinking through brainstorming
Bump (1985) *Technical Writing*	metaphorical thinking	Creative scientific writing uses metaphors to enable new conditions, models, and world-pictures; generate insights; clarify complex theories and objects
Carey & Flower (1989) *Composition*	creativity is situational	Openings for creativity in writing are in: 1. constructing and modifying task representation; 2. managing topic/content knowledge; 3. keeping track of evolving sets of goals and applying problem-solving strategies
Brent & Felder (1992) *Composition*	"creative thinking"	Creativity is a teachable skill; creativity requires students to move beyond the "surface approach to learning" Scaffolding of creativity through techniques of brainstorming; Assignments should encourage problem solving
Lumsdaine & Lumsdaine (1994) *Engineering*	visual thinking is placed with "imaginative, conceptual, and innovative thinking"	Creative thinking process involves the process of "defining problem," "idea generation," "synthesizing ideas," and "implementing ideas" Creative value of collaborative work (especially with a group make up of different cognitive styles)
John-Steiner (2000) *Education*	"integrative collaboration" facilitates creativity	Creative/collaborative process of artists, musicians, and authors

Author and Discipline	Creativity Terms/ Concepts	Purpose/Definition of Creativity
Dunn (2001) *Composition*	using visual to promote creativity in writing	Creativity as a tool to help students retain metacognitive distance from writing and process; to generate different perspectives
Dorst (2001) *Design Studies*	"creative event"	Creativity is critical for defining the design problem A creative event is the period of "exploration" in which problem and solution spaces are evolving
Korgel (2002) *Engineering (Chemical Engineering)*	creativity and dialogue	Creativity in design problem-solving; writing to learn activities to nurture independent thought.
Riedl & Young (2006) *Engineering*	"exploratory creativity" in storytelling versus "transformational creativity"	Creativity storytelling is important as a skill that helps humans build cognitive structures for understanding the world
Sawyer (2011) *Education*	"creative spark"	Power/value of groups in creative thinking
Kokotovich (2007) *Design*	"creative problem solving"	Design comes out of solving design issues; use cognitive maps to allow for discovery loops; associative mind mapping is a type of cognitive map
Howard, Culley, & Dekoninck (2008) *Engineering Design*	"creativity" in the design process, creative product (output), creative person, creative environment	Survey of design and creative processes from literature on creativity in psychology and engineering The creative process has moved from one that is seen as a cognitive process to one that is more "activity-based" (what the producer/composer is doing)
DeHann (2009) *Life Science*	creativity pedagogy: multicomponent, social, and teachable	Creativity is "multicomponent" process (divergent and convergent thinking, and analogical thinking) Creativity occurs in a social context
Siswono (2010) *Mathematics*	creative thinking as a skill	Stages of creative thinking: 1. awareness of creative thinking 2. observation of creative thinking 3. creative thinking strategies 4. reflection on creative thinking Divergent and convergent thinking are part of creative thinking

Author and Discipline	Creativity Terms/ Concepts	Purpose/Definition of Creativity
Newcomb (2012) *Composition*	"situational creativity"	Creativity focuses on how students think about the problem in writing, not about how the student applies creative strategies in writing
Alexander, Powell, & Green (2011/2012) *Composition*	creativity and multimodal composition	Creativity as an affordance of multimodal text (among first year writers, for example). Students respond to multimodal composition in light of their own experience in writing formal written academic genres