



From Theory to Practice

# Translations

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## Creativity and the Murky Mind: Mental Mechanics of the Creative Process

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Creativity is a natural capacity available to all of us. It develops our human potential beyond the boundaries of intelligence as it has been traditionally defined by many cognitive psychologists. Creativity enhances the process of learning, contributes to the maintenance of our mental health, and supports the capacity of our culture and social institutions to evolve.

Today's students will need to develop creative thinking skills to solve the increasingly complex and unprecedented problems they will confront in the 21st century. In this context, the urgent challenge for art educators is to use instructional practices that optimize students' creative thinking abilities in the art classes they teach every day. One way to optimize students' development of creative thinking abilities is to better understand how instructional practices in the art classroom can enhance the brain's creative problem-solving potential. In this paper, I review the recent brain-based research on creativity and make connections to effective teaching practices.

### Functional Magnetic Resonance Imaging Offers New Insights into Creativity

The recent use of low-invasive, functional Magnetic Resonance Imaging (fMRI) machines that measure change in blood flow related to neural activity in the brain has produced a steady increase in the amount of research on cognitive behavior (Gore, 2003; Mao, 2002). The fMRI allows us to see activity in the brain in relation to the performance of particular behaviors. As an example, fMRI research has offered us insights into how creative thinking ability includes shifts between divergent and convergent thinking—especially when forming new ideas that challenge previously held belief systems (National Research Council Institute of Medicine, 2000). When this kind of innovative brain function occurs, the anatomically distinct areas of the brain that store different forms of knowledge become co-activated. This pattern of thinking between divergent and convergent brain functions can also be thought of as a shift between associative thinking and cause-and-effect thinking (Gabora, 2002). Creative people tend to look at possible relationships between two or more things and then

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shift to analytical thinking to search for appropriateness of a solution.

## The Brain: The 3.5 Pound Dynamo

The human brain does not fully mature until an individual reaches his/her twenties; the female brain matures at around 21 years of age compared to 29 years for men. Most art educators are familiar with popular descriptions of brain function described in *Drawing on the Right Side of the Brain* (Edwards, 1979) and in *Unicorns are Real: A Right-Brained Approach to Learning* (Meister, 1986). Both of these books convey the notion that the left hemisphere of the brain excels at naming and categorizing, symbolic abstraction, speech, reading, writing, and arithmetic—and the right hemisphere of the brain excels in non-verbal functions that process visual, spatial, perceptual, and intuitive information. These distinctions are generally true. However, as we now are learning, the brain has the amazing capacity to wire itself in what I will call “patterns of thought.” As indicated in the Dana Foundation report (Dunbar, 2004) on “Training in the Arts, Reading and Brain Imaging,” researchers are now learning through the use of Diffusion Tensor Imaging (DTI) that separate regions in the brain are intertwined with trillions of connections between tens of billions of neurons when we learn new information.

One salient characteristic of creative people is the highly developed connectivity exhibited between seemingly unrelated regions of their brain. When describing *The Study of Jazz Improvisation*, Braun (in Limb & Braun, 2008) states, “One important thing we can conclude from this study is that there is no single creative area of the brain—no focal activation of a single area... you see a strong and consistent pattern of activity throughout the brain that enables creativity” (p. 1679). This study examined the brain patterns of highly trained jazz musicians playing improvisational jazz while being hooked up to a fMRI machine. Musicians consider improvisation to be a peak creative experience. To prepare all students to think creatively and some to even achieve peak creative performance, we need to rethink some of the basics about how we teach based on a deeper awareness of how the brain functions.

### Formation of Patterns of Thought

The electro-chemical connections of the brain’s neurons result in modifications in the synaptic connections between cells. Different types of patterns of thought are found in particular areas of the brain where corresponding transformations have occurred (Richards, 2003). The entire neurobiological process relies on hair-like extensions called dendrites on one end of neurons, and axons on the other.

The dendrites are the electrical receivers of the neuron and the axons are the electro-chemical producers of the neurons.

### Culture and Patterns of Thought

Depending on an individual’s gender, culture, etc., electro-chemical connections in the brain can be formed into different kinds of thought patterns. For example, Villalobos (2009) explains that the ways math skills are taught in elementary schools support girls’ thought patterns more than boys. However, the **strategic dissonance** thinking patterns more typical of boys is favored in higher math where switching strategies is demanded. Another example provided by Villalobos describes a research experiment that showed an fMRI image of a pattern of brain activity in one region of the brain when a student was asked to respond to a passage of literature presented to her in her native tongue. When the same student was asked to respond to a new passage written in a language learned as a second language, the fMRI showed a pattern of brain activity in an entirely different region of the brain.

In a like manner, Nisbett (2003) demonstrated how culture could influence patterns of thought through a triadic-graphic card exercise that depicted an image of a cow, a chicken, and grass. When asked, “What goes with this?” the western research participants tended to mentally categorize images in a “taxonomic” relationship—they see a relationship between the cow and the chicken. The Asian research participants were mentally predisposed to find a cause and effect relationship between the images—they see a relationship between the cow and the grass.

### Early Learning Experience and Patterns of Thought

The more ways we can learn in early childhood, the easier it is to access creative patterns of thought later in life. According to Nisbett (2003), there is evidence that our cultural environment has a major influence on how we form neurological connections or patterns of thought in the brain. The ways patterns of thought are formed in the brain relate to how an individual develops the ability to think creatively. Young children who have not experienced strict impositions of cultural norms and societal conventions exhibit higher ability to think creatively (Diamond & Hopson, 1999) because conventional and conformist patterns of thought have not yet been formed. However, by the time most students enter the 4th grade, they have become more thoroughly socialized and prefer conventional forms of thought—regardless of their early socialization experiences. Many art teachers recognize this stage as the “4th-grade slump” in which students

are inclined to prefer representational, literal imagery to metaphoric imagery in art.

Thus, bringing up children in an enriched environment and making certain that they are exposed to multimodal/multisensory learning experiences is critical for their brain development. As art teachers, we have the training and resources as well as the responsibility to provide experiences and environments that stimulate the development of diverse modes of thinking. Our goal as educators should be to create an environment that helps enhance students' natural talents and stimulate their interest in a wide range of subject matter and learning activities (Breen, 2007). The more facile students become at switching thinking patterns to solve problems and interpret information, the more potential they have for engaging in creative thought. Creativity is literally the "path less taken" concept applied to the brain.

## Strategies for Art Educators

So how do we as art educators offer a rich and diverse environment that can lay the foundation for the development of creative thinking? When should we focus on developing these kinds of diverse experiences? What instructional strategies should we use in our classrooms? According to Lightfoot (2008), the best time for fostering creativity in a child's life is between the ages of 1½ and 4 years of age. This is the time when there is the greatest potential for the brain's development of dendrites and axons. Once students enter elementary school, art educators can begin to enact teaching practices that can encourage the development of creative thinking. Based on the recent research on brain function described above, these practices could include some of the following strategies.

**Daily routines.** Too much indoctrination in any path of learning makes it harder to switch habits of thought and action later in life. We have to consider how the students' personal habits in the art room may or may not promote flexible thinking habits: the ways work space is arranged, how materials are stored, how completed work is exhibited, the kinds of music played in the background, the visual elements on the walls, and the physical architecture of the art room.

**New curriculum models.** Harvard university researcher Breen (2007) has suggested new curricular models for teachers of all subject areas. Art educators might find her suggestions useful in shaping curriculum that promotes creativity. She suggests that students be grouped based on

common knowledge sets and interests—not on common age. Additionally, her research indicates that curriculum should be challenging, broadly based, interdisciplinary, and project-oriented with the freedom to foster discovery. Learning activities should also be based on students' interest, enjoyment, satisfaction, and the challenge of the work itself, not on external standards and pressures. Breen found that people will be most creative when intrinsically motivated. She states, "My 30 years of research and these 12,000 journal entries suggest that when people are doing work that they love and they're allowed to deeply engage in it, and when the work itself is valued and recognized then creativity will flourish" (p. 3). When students' learning is based on intrinsic motivation, the stress level is lower as well. The lower the stress level, the better the health of the brain. Dendrites wither away when under stress and, once dead, the dendrites do not return, limiting the electrochemical connections in the brain and thus causing aging.

**Risk taking.** Art educators need to foster safe risk taking in the classroom and expect the student to fail at some point. If students are not taking risks, they are not trying new patterns of thought. A technique that allows for failure during an assignment is achieved by providing students a "get out of jail free card" that allows for one utterly failed result per assignment.

**Collaborative art assignments.** Like different regions of the brain, different students can bring specialized ways of thinking to the solution of open-ended art assignments. Being able to listen and value others' ideas is also part of the creative process, and allows students to see how their own thinking patterns differ from the group. Collaboration also provides students with the experience of knowing when to trust their own intuition in spite of other group members' beliefs. Additionally, working in collaborative groups can prevent thinking patterns that are counterproductive to creative thinking, such as students' tendencies to seek absolute answers, pursue perfectionism, and exhibit complacency—behaviors that can limit the incubation time needed to think creatively. ■

## The Big Ideas

In this paper, I have argued that an understanding of the brain's functions related to creative thinking can inform the kinds of instructional practices used by art educators to leverage students' creative thinking potential. The list below summarizes the big ideas that have been presented in this paper.

- Our understanding of the dynamic functions of the brain has improved dramatically thanks to fMRI machines. We have redefined creativity as the alternating processes that occur between divergent and convergent modes of thinking.
- Brain activity stimulates neurons in patterns throughout the brain called “patterns of thought.”
- Researchers have evidence of strong and consistent patterns of activity throughout the brain that enable creativity.
- The brain naturally evolves to form conventional patterns of thought to solve problems. As art educators, we need to stress alternative options for mapping new patterns of thought that will promote more creative thinking ability later in life.
- Early childhood is the period in human development with the greatest potential for nurturing patterns of thought related to creative thinking.
- To promote creativity in their classrooms, art educators should:
  1. **Create assignments that allow for student autonomy.** Freedom to organize the task and responsibility to make decisions fosters intrinsic motivation and, thus, creativity.
  2. **Allow for risk taking.** Creative thinking requires risk. A vehicle to promote risk taking without penalty should be employed.
  3. **Limit rigid management structures that impede intrinsic motivation.**

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