Practically Creative: The Role of Design Thinking as an Improved Paradigm for 21st Century Art Education

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Art and design education hold a unique role in preparing the kinds of innovative, balanced, synthetic creators and thinkers needed in the 21st century. This paper sheds shed light on how learner-centered art classrooms, that incorporate design thinking as a balanced process, can better develop the overall learning capacity of students. In a mash-up between mixed model research involving the impact of learner-centered pedagogies on visual art students' balanced intelligence and reviews of literature surrounding the promotion of depth and complexity of knowledge, new conceptual frameworks and assessments are offered. Towards a vision of fostering deep, connected, and independent thinkers, the author—as designer, artist, and art educator-- explores design thinking as an aesthetic, inquiry based process that integrates complex intelligence theories.

Keywords: Design thinking, critical, creative, practical thinking, learner-centered, learner-centered pedagogy

Teaching for 21st Century Skills

In this global economy, there is a critical need for training students to be more well-rounded, strong in collaborative skills, and able to think creatively, analytically and practically. Acquiring a balance of these skills and dispositions is essential if tomorrow's change makers and problem solvers are to become capable of responding reflexively to complex problems. Students must also be self-directed and independent thinkers, going beyond content knowledge toward anticipating creative solutions to problems (Lipman, 2003; McCombs & Whisler, 1997). Counterproductive to this need, at least in the United States, education and testing systems continue to promote students' abilities to find one right answer rather than challenging them to find answers to difficult problems through multiple solutions.

In preparing our students for needed creative and analytical thinking skills, art and design education may be better positioned from an approach that fosters balanced, interdisciplinary 21st century skills and habits of mind. As Powell suggests: "Our country and world are faced with challenges of an almost unthinkable scale… [A]rtists and designers—creative thinkers—are uniquely qualified to contribute meaningful answers to these critical social questions (2012, p. 1)."

Developing Capacity through Balance

This article investigates the ways learner-centered art and design education practices may advance a balance of students' thinking skills and dispositions, toward more in-depth and complex understandings. For this research, learner-centered classrooms are those that support the primary indicators of inquiry, connection-making, and self-direction (*Figure 1*: Balanced Learning Environments). We will consider the impact that visual art classrooms designed to be more learner-centered may have on students' balanced thinking—their abilities to think and act creatively, critically and practically. Design Thinking is considered as a model for developing students' balanced thinking,

sharing conceptually close ties with learner-centered teaching practices that fuse constructivist, inquiry-based, and self-directed learning with current research and best practices. Balanced thinking may potentially be developed through design thinking processes.

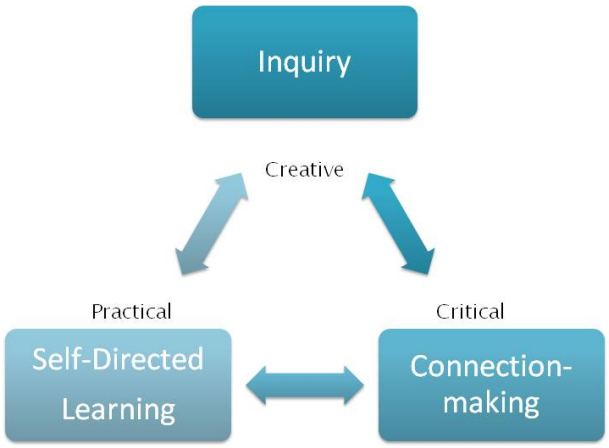

Figure 1: Balanced learning environments (Ingalls Vanada, 2011)

There is a need in 21st century art and design education for new paradigms of teaching and learning which embrace more balanced and equitable expressions of intelligence (Caine & Caine, 1997; Gardner, 2007; Ritchhart, 2002; Sternberg & Grigorenko, 2004), yet studies rarely focus on links between creative and critical thinking (Bailin, Case, Coombs & Daniels, 1999). Even less research exists on the development of a balance of creative, critical, and social/emotional thinking skills in the visual arts, with concern that fostering students' creative thinking alongside their problem solving competencies has suffered neglect in traditional arts classes (Ingalls Vanada, 2011; Zemelman, Daniels & Hyde, 1998).). Not every art and design teacher trains students to be creative; nor do they always facilitate analysis or practical responsibility with practical thinking skills. Thus, it is important to promote teaching and learning practices that focus on developing balance: creativity and innovation with criticality and practical wisdom (Craft, Gardner & Claxton, 2007; Sternberg, 2008). Sternberg's research (2008) on creative, cognitive, and affective dimensions of thinking also highlights the corresponding need for balance within art education.

Many traditional art classrooms continue to promulgate back-to-basics approaches meant for the 20th century, at the expense of preparing students' abilities as creative, analytical, problem solvers who can communicate and collaborate well with others (Partnership in 21st Century Skills, 2007). A deep need exists for developing thinking as connected to big ideas of social consequence, in order to build students' conceptual artistic practice, creativity, criticality, and social-emotional practicality.

Design Thinking Frameworks

Design Thinking is a cross disciplinary creative problem-solving process which combines analytical thinking, creative thinking, and practical skills (Ingalls Vanada, 2011). Design thinking is an approach to learning that involves hands-on learning projects, focusing on inquiry and problem solving, investigation of possible solutions, sketching and prototyping, collaboration and feedback, created 'products' or ideas, as well as reflection and redesigns if necessary (Razzouk et al., 2012). Design

thinking is above all, an iterative process that requires flexible and integrative thinking; it can be incorporated into any discipline—science as easily as visual art or history.

Design thinking is aligned with active and experiential learning; it has long focused on processes familiar to students in schools of art and architecture: the posing of a problem which is ambiguous or open-ended, with some constraints (Kellogg, 2006). Thus for teachers, design thinking requires a pedagogical shift (Daichent, 2011) toward learning that is: 1) human-centered; 2) action oriented; and 3) process-oriented (Carroll, Goldman, Britos, Koh, Royalty & Hornstein, 2010).

For students, design thinking develops both their inductive and deductive reasoning along with intuition (abductive thinking), concept development through ideation and brainstorming, collaboration and risk-taking, and improved craftsmanship as attached to empathic, deep meaning (Kolko, 2010). Students are invited to bridge the gap between subjective and objective reasoning by using "intuitive analytics" (or the ability to combine ideas and common sense into a new whole), says Kellogg (2006). As IDEO design firm's website (2013) suggests:

> Design thinking is a deeply human process that taps into abilities we all have but get overlooked by more conventional problem-solving practices. It relies on our ability to be intuitive, to recognize patterns, to construct ideas that are emotionally meaningful as well as functional, and to express ourselves through means beyond words or symbols… Design thinking provides an integrated third way.

Harvard, Stanford, MIT and other U.S. universities have worked to train teachers and administrators in design thinking strategies (Dow, 2012). Stanford's Research in Education and Design lab (Stanford University, 2012) promotes the integration of design thinking in 21st century K-12 education. The RED lab focuses on developing design thinking as key to activating students' critical, creative, and practical capacities and as a tool for learning that supports a diverse range of interdisciplinary academic content (Carroll et. al, 2010).

Students learn to see failure as an opportunity to gather and incorporate important information, so they are less likely to give up (Gow, 2010). They learn *how* to think, instead of *what* to think to give one right answer on a test (Resnick, 1999). The key components of the design thinking process, as identified by the Hasso Plattner Institute of Design or "d.school" are shown in *Figure 2*.

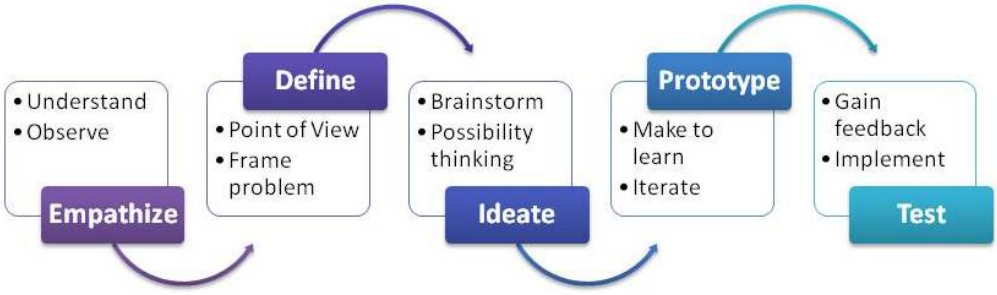

Figure 2: Overview of the design thinking process (d. school as cited in Carroll et al., 2010)

Design educator, Dr. Charles Burnette (2005) defined "design thinking" as the following:

> Design Thinking is what people do when they pursue their goals. Everyone focuses their thinking in order to satisfy wants and needs regarding a particular situation. They recognize and define information according to their purpose, consider alternatives, decide what to do, do it, determine if they are satisfied with the results, and if not revise their approach until they are successful, all while learning through the

> experience. This is designing. It is a process of creative and critical thinking that allows information and ideas to be organized, decisions to be made, situations to be improved and knowledge to be gained (p. 1).

The use of design thinking models in the art education classroom have been found to advance students' balanced thinking skills and dispositions (creative, critical, and practical) because they bring awareness to the supportive role of critical thinking to creativity and creativity to critical thinking, with greater development between both processes (Cross, 2007; Burnette & Norman, 1997). Design thinking processes help to foster students' abilities for creative problem solving (Carroll et al., 2010).

Burnette's "Design for Thinking" model (2005) named "iDESiGN," represents an acronym for seven modes of thinking identified as Intending, Defining, Exploring, Suggesting, Innovating, Goal-getting, and Knowing . This design-based process aligns with the types of thinking defined by Bloom's revised taxonomy (Anderson and Krathwhohl, 2001), bringing students into higher order or more complex ways of thinking: analytical thinking and problem-solving, cross disciplinary connection-making, and synthesis of ideas into new creations.

Aims of the Article and Study

The dual aims of this article are: (1) to summarize findings from a mixed model study that the researcher conducted in middle school art classrooms (designed to be more or less learner-centered) and (2) to offer a framework for design thinking for elementary and secondary visual arts classrooms that developed out of the research project.

The reported study was directed by two research questions:

- Is there a difference in students' balanced thinking skills and dispositions in classrooms that are designed to foster inquiry, connection-making, and self-directed learning and those that are less so?
- How do students perceive their intelligence and understanding of a subject in these classrooms?

Frameworks

The theoretical framework of "successful intelligence" served as the principal informant for assessing quality thinking as a balance of analytical, creative, and practical thinking skills and dispositions (Sternberg, 1999; Sternberg & Grigorenko, 2004). This theory asserts that the application of a balance of analytical, creative, and practical thinking and dispositions allows people to be more successful in life and learning, affirming the modifiable and expandable aspects of learning (Resnick, 1999). Dispositions are defined as a collection of habits, behaviors, or attitudes that drive one's patterns of thinking and whether or not students are motivated to use the skills that they have.

In this balance, analytical thinking involves analyzing, comparing/contrasting, evaluating, explaining, solving problems; creative thinking involves creating, designing, imagining, finding new solutions; practical thinking involves applying new knowledge in real life situations (including knowledge learned tacitly) in ethical ways. Woven together, successful intelligence says that it is not enough to memorize and analyze ideas; students also need creative abilities to generate good ideas, and the practical and positive social skills to persuade others of their value and successfully implement them. Successful intelligence frameworks represent the knowing, understanding, and doing that constitutes balanced intelligence.

For this study, the theoretical ideals inherent in learner-centered classrooms build upon constructivist approaches to education and contend that students should be actively involved in the learning process. For instance, John Dewey (1910) proposed that students should be active learners and self-directed. Piaget (1952) strengthened this work, as he recognized that knowledge is not acquired in a vacuum or by absorbing information; it is constructed actively through direct involvement and making connections to prior learning. Lev Vygotsky (1978) added the importance of social learning in cognitive development.

Methods and Matrix

This mixed model research study utilized a Mixed Model research design in three phases, in order to explore the impact of learner-centered environments on art students' balanced thinking. Both qualitative and quantitative data sources in three phases of the study provided a richer elaboration of the variables and their relationships (Plano Clark & Creswell, 2008). Qualitative data (observation notes, informal interview data, and initial surveys) and quantitative data (survey data and quantitized qualitative data) provided overall scores for each classroom which were correlated with each school's level of learner-centeredness. Phases of the study are described here:

Phase One: Five middle school classrooms in a large suburban district in the U.S. were chosen and rank ordered according to five predetermined factors of learner-centeredness: (1) connection making, (2) student self-direction, (3) inquiry-based practices, (4) depth of learning, and (5) content focus and balance.

Phase Two: Over the course of a semester, middle school art students were then assessed in the three balanced domains: (1) analytical, creative, and practical skills, (2) analytical, creative, and practical dispositions, and (3) overall quality of thinking. These domains were measured using a matrix of assessments (*Figure 3*) based on extensive research and review of existing literature, created by the researcher after extensive reviews of the literature when appropriate assessments did not pre-exist. Inspired by the "Rainbow" and the "Aurora" batteries (Sternberg and the Rainbow Project Collaborators, 2006), seven assessments were designed to tap into the intelligence sub-areas of analytical, creative, and practical, yet domain specific to the arts. The matrix design operationalized the theory of balanced intelligence (Sternberg, 2008) in this study.

Phase Three: Data for Phase Three (Research Question Two) was collected through a student-oriented questionnaire regarding students' self-beliefs about learning and intelligence. Burden's Myself-As-A-Learner Scale (MALS, 1998) was used.

Figure 3: The Quality Thinking Assessment Matrix (Ingalls Vanada, 2011)

Assessment Examples: CvTS and OQO

Two assessments developed for this study will be highlighted for their link to design thinking processes. In the sub-area of creative thinking, the CvTS assessment measured students' (1) process (problem finding, planning, and problem solving), (2) perceptual/conceptual growth (meaning-making, expressiveness and connection-making), (3) product creation (originality, craftsmanship, complexity of thinking), (4) observed dispositions of creativity, and (5) value-added evidence (student research workbooks/portfolios and observed student levels of sustained and concentrated effort. Data were collected using the CvTS rubric, anecdotal notes of observed student artworks and discussions with students regarding their process and their final product, as well as observed evidence of students' visible thinking of the design and creation process (i.e., sketches, written reflections, notes showing design-thinking process). Creative dispositions were factored into the scoring design, informed by research that creativity is not developed apart from the dispositions to be so (Claxton, 2006; Cunliffe, 2007). Student data was recorded by researcher and teacher using consensual assessment technique (CAT) and the CvTS rubric, a method found to alleviate problems with objectivity (Amabile, 1996).

Reviews of the literature led to the need for and development of an Overall Quality Thinking tool (OQO), as shown in *Figure 4*. In order to operationalize quality thinking in terms of balance, complexity, and depth, it was important to view students' thinking as a complex and nonhierarchical process—as a whole. The OQO acknowledged the overlapping properties of critical, creative, and practical thinking and the research suggesting that the critical cannot be separated from the creative (or the creative from the critical) (Paul & Elder, 2006). This tool also affirms research indicating that assessing only single aspects of each category of intelligence or discrete skills puts at risk the success of capturing either the quality of that thinking or the relation of the identified thinking skill to the tasks being assessed (Moseley et al., 2005).

	T- H-I-N-K Tool for Assessing Quality of Thinking in Visual Art				
	Cognitive Process Dimensions (degree of complexity)				
	Level 1: **Think** (1 pt.)	**Level 2:** **Have a Plan** (1 pt.)	**Level 3:** **Investigate** (2 pts.)	**Level 4:** **New Ideas** (2 pt.)	**Level 5:** **Know** (3 pt.)
Knowledge Dimensions:	*Determine* ***the alignment*** *between the level/depth of knowledge (DOK) (complexity) for each knowledge dimension.*				
Factual (Critical) Factual Stds: i.e. Elements & Principles, technical quality (ability to identify, use, apply, elaborate)					
Depth of Rigor *0 - 1 - 2 - 3*					
Conceptual (Creative) Creative Stds: i.e. Meaning-making; creative structure, communication					
Depth of Rigor *0 - 1 - 2 - 3*					
Procedural (Practical) Procedure/ skill Stds: i.e. Plan, set goals & self-direct (tools/process, etc)					
Depth of Rigor *0 - 1 - 2 - 3*					
Dispositions Dispositions observed: Self-motivation, curiosity, reflection, self-assess					
Thinking Culture Observed engagement, focused attention, Q's IN class/ thinking words used					
Total Points/ 24					Ingalls Vanada, 2010 ©

Kinds of Knowledge (as held to a standard)

Figure 4: T-H-I-N-K assessment tool (Ingalls Vanada, 2011)

The OQO assessment tool takes into account the types of thinking students are engaged in during creative processes, defined by Bloom's revised taxonomy (Anderson and Krathwhohl, 2001) as the "knowledge dimensions": factual, conceptual, procedural, and metacognitive. The complexity of students' thinking while engaged in art and design processes are known as the "cognitive process dimensions", with Level 1being more about *information gathering* (perceiving and defining), Levels 2-3 involved in *gaining more understanding* (imposing/organizing structures), and Levels 4-5 as more *productive/complex thinking* (analyzing, supporting, elaborating). In measuring higher order thinking, Webb (2005) refers to complexity of knowledge as *depth of knowledge* (DOK). The role of dispositions in acquiring knowledge is also considered, as the knowledge dimensions involve both thinking skills *and* the dispositions of strategic and reflective thinking (i.e. metacognition).

The T-H-I-N-K Model

In the development of the assessment matrix for this study and the OQO, the T-H-I-N-K model (*Figure 5*) emerged as a means of supporting balanced thinking skills and dispositions. The T-H-I-N-K model integrates design thinking with the development of the cognitive process dimensions, as described in the OQO assessment's alignment with Bloom's taxonomy (Anderson & Krathwohl, 2001). As a tool for students' creative problem-solving processes, it is designed to help drive project-based learning in art and design, as well as cross disciplinary projects.

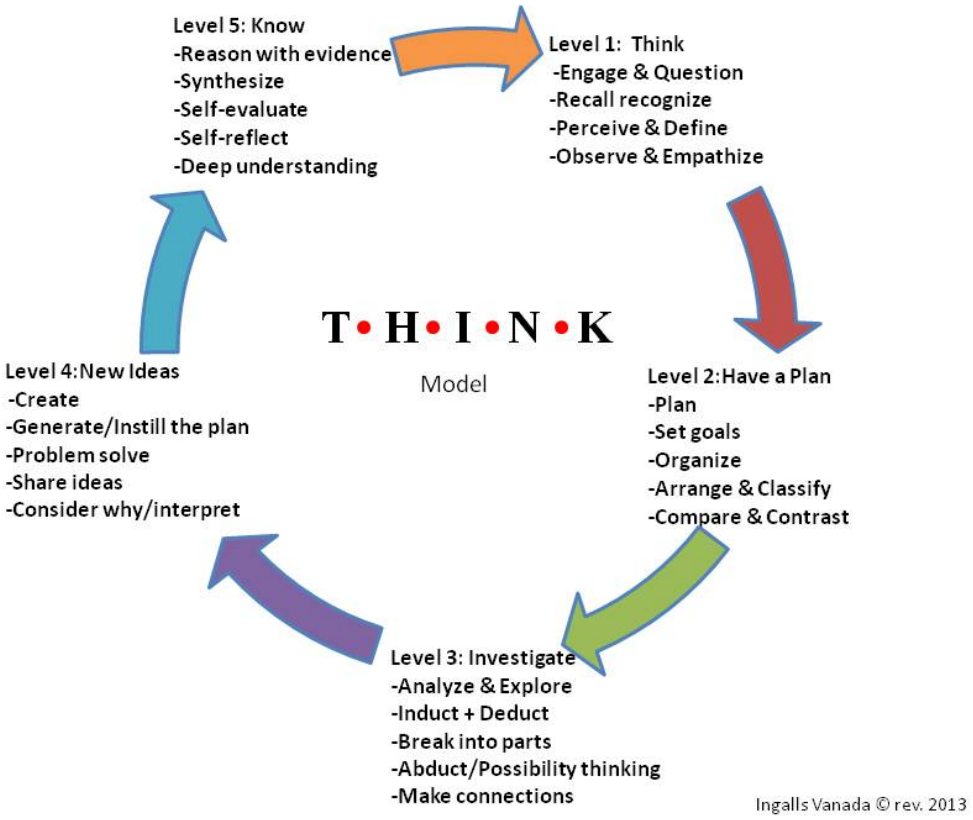

Figure 5: The T-H-I-N-K Model (Ingalls Vanada, 2011, revised 2013)

The T-H-I-N-K model is tied to cognitive research that merges the kind of knowledge to be learned (Anderson & Krathwohl, 2001), depth/complexity of knowledge (DOK) being used (Webb, 2005), and design thinking models in art education (Burnette, 2005). As with six key components of the design thinking process developed by the Hasso Plattner Institute (Carroll et al., 2010), the T-H-I-N-K model is not intended to be hierarchical in nature, although originally in a linear format (Ingalls Vanada, 2011). The revised format more adequately represents the cyclical and complex nature of art and design thinking. Sometimes the processes fold back upon themselves or operate in tandem.

Data Results

When all sub-tests of the matrix of assessments for balanced thinking were factored and compared against a classroom's level of learner-centeredness, an important finding emerged. A statistically significant positive correlation (.935 at the .05 level) existed between an art classroom's rank of learner-centeredness and students' balanced or quality thinking (*Table 1*: Correlations). Findings from this study led to the recognition that classrooms ranking higher in learner-centeredness (inquiry, self-direction, and connection-making) correlated with students' higher balanced thinking. Classrooms ranking lower in learner-centeredness had lower balanced thinking scores.

		LEARN	RANK
Total Scores	Pearson Correlation	.973(*)	.935(*)
	Sig. (2-tailed)	.005	.020
	N	5	5

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 1: Correlations of Total Scores with Learner-centeredness Rank and Rank Scores

Quantitative, correlational analysis of research Question Two addressing students' self-perceptions regarding their learning and thinking in the classrooms of this study, also led to a significantly positive relationship between the Myself-As-A-Learner scale (MALS, Burden, 1998) and classroom scores for learner-centeredness (.933 at the .05 level).

Report and Discussion

The results of this study highlight the importance of learner-centered practices in art and design classrooms and overall; it suggests that student's balanced thinking can be noticeably different, inferably improved, in classrooms that embrace balanced, learner-centered instruction. The study reveals how learner-centered pedagogies and environments in visual art are important for developing balanced thinking, and it contributes to a call for continued research in art classrooms toward overall student achievement (Burnette, 2005; Burnette & Norman, 1997; Winner & Hetland, 2000).

Additionally, students reported that they possess more creative confidence in classrooms that are more learner-centered and support their abilities to be curious, self-directed, and invited to make connections in their learning. As students move into an increasingly complex twenty-first century world, learner-centered/constructivist classrooms—for which design thinking can be a catalyst—may help students become empowered and self-directed in their own learning. They may better possess the tools and confidence to be agents of change in the world.

Since the use of design thinking in the classroom is inherently learner-centered, the study presented emphasizes the link between the two. Connections between visual art education, balanced thinking, and design thinking are also illuminated through new creative process frameworks such as the T-H-I-N-K model, which may advance students' balanced thinking skills. Assessments that focus on the development of a balance of students' skills and dispositions provide new ways of promoting depth and complexity in their cognitive processes. Rather than assessing products alone, assessments developed such as the Overall Quality Thinking Tool (OQO) encourage teachers, as designers and guides of dynamic learning, to illuminate the process and growth of students' *thinking* and creative confidence (Ingalls Vanada, 2011).

Design Thinking: A Needed Balance

This article, as the reported study indicates, proposes that a more balanced definition of visual art and design education is needed, including more learner-centered practices. In the United States, tensions have existed between design and traditional art education, with one of the biggest barriers residing in the opinion that design education aligns with the formal principles of art and industrial modes of teaching. However, designing thinking is not "exclusively a tool for arts education, nor is it strictly technical" (Dow, 2012, p. 1), refuting claims from art educators wary of the aims of design education in the visual arts curriculum or fear that the inclusion of design processes are linked to formalistic roots and Discipline Based Art Education (DBAE) of the 1980's.

Meredith Davis (1999, p. 30) attributes the wording of educational standards referring to formal "elements and principles of *design*" to notions that design pedagogies utilize visual and spatial organization alone. Davis (p. 30) calls for contemporary art and design educators to take a leadership role against viewing design as:

> "…simply applying an aestheticized formal language to objects and environments of daily life as a means of elevating the ordinary from low to high art (e.g., a chair that challenges the boundaries of sculpture…). This is not to degrade those objects; but they represent only one aspect of design and not the issues deemed central to the problem-solving abilities necessary for success in the twenty-first century."

Researcher-teachers who have worked in both fields of design and art education find themselves disconcerted at the lack of understanding between visual arts processes, pedagogies, and that of design (Davis, 1998, 1999; Ingalls Vanada, 2011). Hokanson (2007) promotes merging visual art and design thinking for developing creativity in primary, secondary, and college classes alike. While published research on the topic of design thinking alone is mounting, scholarly work about art and design thinking as pedagogy in the visual art curriculum is still fairly limited (Bequette & Bequette, 2012; Burnette, 2005; Davis, 1999).

Design Thinking as Pedagogy

For teachers, design thinking may serve as a problem solving tool for the design challenges they face every day, from curricular planning and assessment, to creating cultures of thinking and fostering problem solving in both studio art and curricular planning. Design thinking serves as a creative and reflective tool for approaching teaching as both artist *and* designer of thinking in the classroom, for collaboration, and as a model for designing learning experiences. Art and design education teacher training programs that include a design thinking approach may answer this challenge, combining new paradigms of teaching and learning with balanced and integrated thinking, connection making, and empathic problem solving (Ingalls Vanada, 2013).

In the classroom, design thinking pedagogy encourages teachers to loosen the narrow, rigid processes of traditional learning and capitalize on the learner-centered principles of connection-making, inquiry, and self-directed learning. In such an environment, integration is essential (Marshall, 2005) as students construct knowledge through inquiry, doing to learn, making mistakes, and becoming more self-directed. A learner-centered teacher is one who makes the shift from content delivery and nice end-products to building student capacity, co-creating learning goals, and a focus on making the learning process the primary focus.

Summary

In light of 21st century aims for education that encompass broader views of student intelligence, the reported study indicates that students' overall quality of thinking should be viewed in terms of balance and that students' dispositional factors should be considered. Additionally, it suggests that static, passive philosophies of learning and knowing should be replaced with meaningful, project-based, and constructivist epistemologies which consider the importance of the social and affective facets of learning.

In this article, connections have been made between balanced thinking and the pedagogical approaches of learner-centered art and design classrooms that enable students to think and act in balanced ways. More specifically, pedagogies that include inquiry, connection-making, and self-direction are encouraged to enhance students' thinking skills within the context of critical, creative, and practical modalities. Design thinking is one such pedagogy.

As an integrative creative process model, design thinking can lead students to apply a cognitive balance of creative and practical problem solving with empathy, collaboration, communication skills, and more complex thinking. Students—particularly art and design students— in more learner-centered environments may also be better at thinking in balanced ways. More research is needed in this area. Towards a vision of fostering deep, connected, and independent thinkers, it is offered that learner-centered art classrooms that incorporate design thinking as a balanced process can better develop the overall learning capacity of students. Visual art programs, at all levels, may consider design thinking as an aesthetic, inquiry based process that can advance progressive pedagogy in 21st century education.

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