Editorial

Is Design a Right-Brain or Left-Brain Activity?

Joseph McCade

Are we defining design too narrowly? Could it be that our own definition of technology is closely tied to our personal leaning style? Welby Ings (2005) challenged us to consider the critical role of creativity in design. The National Science Foundation has done much to encourage a somewhat different approach to design. From this perspective a strong case is made for the integral role of mathematics as a component of design.

I have long believed that design is a hinge pin component of doing technology. Design is the process by which those engaged in technology produce systems, products, and methods, just as inquiry is the process by which those doing science produce new knowledge about the natural world. There are at least two groups who consider design their primary purpose: industrial designers and engineers. While the two groups do not seem equally represented in the technology education profession, they are both represented enough to keep me thinking about the nature of design.

Ings (2005) is passionate about learners and technology. He is well recognized as an innovative educator (New Zealand Qualification Authority, 2002). As a former classroom teacher, I felt particularly connected to his efforts in helping students who had limited success in school find at least one place to shine. He illustrated with several examples his commitment to help those students who "do not serve the gods of literacy and numeracy" excel in the world of creative design. While he used the phrase "gods," I feel he probably means "idols." In fact, a central concept in his presentation, "trading beyond experience," suggested something about the essential role of creativity in design. He illustrated this concept with a story about one of his former students who created an amazing animated tree for the movie *Lord of the Rings*. As one might imagine, the kind of out-of-the-box thinking needed to bring such an idea to life did not make it easy for this student to fit in with the rest of the students in the

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school or its structure. I found Ing's argument that schools should be places that value students whose gifts may not fit the math and language paradigm quite compelling.

Quite a different approach to design is illustrated by the concept of "informed design." This is the product of several National Science Foundation grants, and is well represented in the New York State Curriculum for Advanced Technology Education (NYSCATE). The project is co-directed by M. David Burghardt and Michael Hacker of Hofstra University. Their definition of technological design is (2006):

> … a planned process of making design choices and trade-offs within given constraints, which leads to the development of a product, process, or system that satisfies human needs or wants. Technological design is a multidisciplinary problem-solving process involving the synthesis of many areas of knowledge and skills including technical, scientific, mathematical, societal, ethical, environmental, aesthetic and linguistic.

The example activities found on the NYSCATE Website include the careful development of knowledge and skill in prerequisite areas before the design process is used to solve a problem. Thus the idea is that design is "informed" as opposed to being the result of a guess or multiple guesses. Hacker and Burghardt value mathematics at least in part because of its frequent use in predicting the outcomes of technological endeavors. The problem of decreasing emphasis on mathematics in preparing pre-service technology teachers was puzzling to Burghardt and Hacker since the link between science, mathematics, and design was quite obvious.

I thought I had these somewhat divergent constructs concerning design neatly divided into two camps: engineering design in which mathematics and science are the cornerstones on the one hand, and industrial design in which creativity and aesthetics are cornerstones on the other. Ings threw a twist into my thinking when he pointed out that Einstein came up with the theory of relativity by imagining himself "riding on a ray of light." I was beginning to better understand the idea of "trading beyond experience." This kind of creativity can be important in solving technological problems as well as scientific and artistic challenges. Of course, the fact that Einstein expressed his theory as a mathematical formula ($E=MC^2$) just challenged my thinking a bit more. I was approaching my previous assumption (that design involves a continuum and invention is more aligned with creativity, while innovation is more aligned with mathematics and science) with growing suspicion.

In the past I wondered if individuals with a predominately left-brain cognitive style are more likely to see design as an engineering process, based upon a strong understanding of science and math. Their abilities with words, logic, and analytical thinking seem to predict that they would. Conversely, I theorize that those who see design primarily as a creative activity probably have a predominately right-brain cognitive style. Their understanding of the whole picture along with abilities in art, visual-spatial thinking, and/or visual-motor activities would seem to serve them well in creative endeavors (Connell, 2006). If thinking about Einstein confuses my neat little science and math versus art

and creativity world, then considering Leonardo da Vinci just plain gives me a headache.

I was also reminded of an experience I had several years ago in what was called a "pedagogy seminar." I was teamed up with an English professor whose specialty was the interpretation of films. Students who were taking his film course and who were education majors could also take this seminar that used his film course as a case study. The English professor and I taught the seminar together. One early seminar session was spent on learning styles. We all took a learning styles inventory which divided our group across four major characteristics. These characteristics translated to quadrants on a graph. He and I were the most divergent outliers when we graphed the results. By the end of the course I had all but forgotten the learning styles inventory and I asked the English professor which student he thought was the best student in the seminar class. I was shocked when he identified the student I considered to be the lowest achiever in the group. Correspondingly, when he asked me who I thought the best student was, he was shocked since my choice was also the student he considered the worst in the class. After a few days I began to wonder if, as instructors, our assessment of students' contributions and accomplishments might be related to learning styles. When I looked at the graph once again, the best student each of us selected was the person with the learning style closest to our own. I have always been quite comfortable with mathematics and science; consequently, it is easier for me to relate to design as an engineering endeavor than a creative endeavor.

There is not much representation in the *Standards for Technological Literacy* of the "creatively" oriented aspects of design. I think that this is a mistake, even though I feel ill prepared to guide students in these more creative activities. Not only is the aesthetic aspect of design important, the solution to several important technological problems grows out of a form of creativity not well represented by the working definition created by the standards. Logically, it seems that design is both a left-brained and a right-brained activity. Einstein and da Vinci offer proof of that. I am concerned about how to provide fair coverage and weight to such ideas as diverse as "informed design" and "trading beyond experience." Trial and error as a process is valued by one learning style another vilifies it. One group values mathematical skills as essential while the other considers them as idols. I can see that those who build bridges see design differently than those who create motion pictures. Yet, I still scratch my head when I think about how to teach design. I still offer the "informed design" website from NYSCATE as an excellent resource to my student teachers. While I feel the site is a good resource to aspiring teachers, I fear I am still repeating the mistake I made when assessing the pedagogy seminar students by defining design according to my own experience – i.e., engineering. I know I should broaden my perspective and provide some tools to help these pre-service teachers encourage creativity and value the aesthetic aspects of design. The creative aspect of even the least artistically-oriented design often involves the imagination of the designer in ways I have yet to adequately value or model.

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