Abstract

Applying a Mathematical Approach to Learning in the Visual Arts

Introducing art theory into an interdisciplinary, digital art and multimedia design program in a mathematics and computer science department can be more than a small challenge. Overcoming the common conception that art is subjective and therefore “anything goes” is a large part of the challenge. A solution to the problem comes, surprisingly, from a mathematical approach. I will discuss the steps of this problem-solving approach and the effective benefits this teaching method has had in the classroom and on the individual student.

I. The Opportunity

For several years my approach to teaching studio art courses has been using traditional art materials, pen and pencil, brush and paint, plaster and clay, to mention a few. For my own continued growth, I began taking courses from a computer science department, courses which taught software that could be applied in art and design. I was puzzled that in these courses instruction was being given only in the use of the software, without any requirements in applied art theories or design methods. I recognized an opportunity that was being missed. At this same time I was teaching an art appreciation course for La Salle University and I happened to have a conversation with the director of the art history program. I was informed that La Salle University had also recognized the opportunity to combine interdisciplinary coursework. A unique program had recently been developed at La Salle University which crossed the disciplines from several departments, including art and computer science. I was invited to apply for a position as a faculty member. The interdisciplinary program, Digital Arts and Multimedia Design (DArt Program), was housed in the Mathematics and Computer Science Department and I soon found myself, an artist, in the midst of mathematicians and computer scientists.

I was soon to learn the uniqueness of La Salle University's Digital Arts and Multimedia Design Program. I searched for other colleagues who were themselves in similar situations, colleagues who might have already broken ground and paved the way. I was only able to locate approximately half a dozen programs in the United States which were similar in nature. Since then, the number of interdisciplinary programs such as the DArt Program at La Salle University has grown to be so many that I do not have to look

beyond this same region to locate the same number of a half dozen or more. As a result, in the early stages of our program we were breaking exciting new ground, experiencing for ourselves the joy of discovery as well as learning some of the pitfalls.

II. The Problem

When I first began teaching in the DArt Program at La Salle University, most of the students expressed a desire to be web designers. The students were more technically-based and understood that they might need to know a little bit about art to put together a well designed web page. A small number of students in the program identified themselves as artists and had come to this unique program hoping to hone their art abilities and add computer skills to their repertoire, thereby satisfying requirements and pressures from home and hoping to insure a better job future.

I began teaching art to the computer science student, the art student, the undecided but curious student, and a few students from other disciplines such as business and communications. My thoughts were to approach art from a pragmatic and theoretical level. There would be assigned readings from the required text, *Design Basics*,[1] followed by a discussion focusing on one particular element of art and one or two principles of design. The requirements for each assignment would focus on the application of one art element and one or two design principles from the reading and discussion. I requested a classroom outside the computer lab one day a week, allowing the students the opportunity for a hands-on experience using basic art materials, usually paper, pen and pencil. I was

[1] Lauer,D & Pentak, S. (2000).*Design Basics* (5th ed.). USA: Harcourt Brace College Publisher.

concerned with the rapid speed at which imagery is created on the computer and wanted to avoid losing the student in the "magic" of the process with an outcome that would direct the focus away from art theory. It was my intention to slow the physical process of making images in the early stages, thus allowing focus on the application of the art elements and design principles. Once in the computer lab, a demonstration was given using the software, Adobe Photoshop and Illustrator, in the same manner I would have taught the student to use turpentine, linseed oil, paint and brushes. Assignments were loosely defined allowing the student a wide breadth to achieve the best possible individual creative results. Next the classroom critique was introduced, requiring verbal application of the visual language of art theory. Lastly, the student would be required to submit the digital artwork in print format in a simple mounting to encourage quality craftsmanship in presentation. A physical demonstration was presented preparing the student for the requirements of mounting the project.

During the first few semesters the overall outcome of the students' completed projects was less than satisfactory. I had taught students at various institutions in traditional art courses with abilities ranging from the serious student artist, to the recreational painter, to the novice. The work that was now being turned into me from the digital art classes came in as average to below average work with only a few exceptions. Craftsmanship was well below average and students were having a difficult time understanding why the grade they received was not that of an A or a B.[2]

[2] I should note at this point, I apply the grade of C to average work.

It was often mentioned to me by students that all of their friends liked their artwork and they could not understand why I did not “like” their work. When grading, I made notations on the back of each student’s project. I would point out the successful aspects of the image. I would address information that needed improvement. If necessary I would offer an explanation regarding the art element or design principles that were not applied correctly or were not incorporated at all. What I found most disturbing was a student’s presumption that I did not like the work. By assigning an attitude of like or dislike, the student could then assume that the conclusions I had reached while grading the projects were subjective. Subjective was another word which had been used often by the students. In the classroom I followed up on the idea of subjective likes and dislikes in art. I explained that at the basic level of design there are correct methods for creating successful compositions. Once more I would touch on the lectures and reading that had preceded the assignments.

I was finding it difficult to help the students understand the basic theory behind the artwork. I had never been challenged in this way before, not in any of the other art courses which I had taught. Was this simply an experience from which I had been uniquely spared, or was it connected to the circumstances of the interdisciplinary nature of the program? I was perplexed but determined to find a solution.

I attempted to make lectures more clear and to direct the language and understanding of the theory during class critiques. I implored students to read the assigned chapters. In the hands-on demonstrations I stressed the art elements and the

correct applications of the design principles. During the computer lab demonstrations I would cover the ways in which the elements and principles could be correctly applied. Critiques offered yet another opportunity to guide the students in the direction of good composition. Still, most of the assignments came in at or below average and the students' grades were reflecting this trend.

At the end of the semester, the students "graded" the course and me in their student evaluations. Several students expressed frustration, even anger. Please allow me for a moment to revert back once more to the days when I taught traditional studio art courses. My course evaluations were exemplary. Once the return of my course evaluations was even accompanied by a letter from the Dean at one of the schools for which I taught, congratulating me on the level of success I achieved in the classroom. But now, teaching art in a Mathematics and Computer Science Department, I was not in my traditional realm and I found myself at a loss as to how I could help the interdisciplinary student reach the understanding that the art of basic design is not subjective. It was suggested to me by a computer science colleague, with all good intentions, that I write out each assignment, listing a step-by-step process which the student could follow thereby insuring each student's success on the assignment. I envisioned "How To" books, dot-to-dot projects and coloring books with thick black lines functioning as barrier warnings to the user of the crayon. I did not believe this was the right solution for a creative outcome but feared it would result in look-alike projects which offered little to no exploration or expression from the student.

III. The Solution

One evening, while discussing my dilemma with friends, one of those friends, who, is now in management and formerly a nuclear engineer, suggested that if I am teaching in a mathematics and computer science department, why not take a mathematical approach. Assign the problem and require the student to show the work they did to accomplish the solution to the problem, the same method as would be accomplished in a mathematical equation. The discussion continued as we searched for ideas in which the student could physically prove their solution. What would that proof look like? What form would it take? We conjectured that a written paper could be turned in with the visual solution to the problem giving an explanation supporting the theory behind the conclusion. Of course! All the written explanations of supporting theory which I had been giving on the back of the graded assignments would now come from the hand of the student. It would become the student's responsibility to prove their visual conclusion and explain why it supports the art theory which was required in the assignment.

IV. The Proof

With the very next assignment, I required a simple, one page written paper with an explanation proving the theory behind the visual solution. The paper was to be handed in with the artwork. I anticipated the struggle the students might face with the responsibility of proving the art theory shifting from teacher to student. During lectures, the class critique, and from the reading assignments, I suggested that any notes that could be taken would be a helpful aid validating their visual solution. I would point out a piece

of information in class critiques about a particular art element or design principle that could specifically be used in the paper.

Assignments were turned in and the visual solutions were still of average caliber. Only a few students had been able to write a paper with some information supporting the theory proving their visual solution. What I generally read instead, were papers describing process and opinion. An opening paragraph would repeat the nature of the assignment, followed by a few more paragraphs describing the functions of the software that had been used and/or the reasons why they liked their image hoping to convince me that I should "like" it too. The disconnection between their understanding of art theory and their visual solution was glaring. This was the information I had been seeking. I had found a missing link in the learning process and pinned down an area where the coursework could be improved.

Armed with this new information, I was now hopeful that I could lead the student to the understanding of the theory behind art. I was convinced that continuing the practice of the written paper, showing and proving the theory, would be the catalyst in solving the problem. I next applied restrictions to the writing of the paper. The words I, me, and my, could no longer be included in the paper. I hoped this restriction would help to eliminate sentences describing process such as; "I used the software package Photoshop to make my art." "I used the brush tool." "I applied a blur filter." I also hoped to eliminate opinion statements such as; "I like my artwork because it makes me feel good." "I had a lot of fun making this art." "I didn't like this project." I was

looking for explanations of art theory such as; “The grouping of the geometric shapes demonstrates the principle of balance in the image.” “Repetition of the directional, curvilinear lines creates rhythm and motion.” “Overlapping the larger object in front of the smaller object and placing it near the bottom of the composition contributes to the illusion of space.” Even though examples such as the ones I just gave had been offered on several occasions, students were unable to apply this information to their visual image. I continued on this path presenting continuous reminders during lectures and pointing out information that would be appropriate in their papers. I gave verbal examples specific to their individual work during critiques.

The papers began to improve and much to my delight, so did the artwork. The students and I learned that the written paper could not prove the theory behind the artwork if the student had not correctly applied art theory to the imagery. Therefore, if the answer is incorrect, the proof cannot be correct and vice versa.

V. The Results

With the beginning of each fall semester and the entry of interdisciplinary students into courses teaching traditional art theory in digital media, in a program housed in a mathematics and computer science department at La Salle University, I repeat the process described above. I watch as the student struggles to apply the written and verbal theory to a visual solution. This is an abstract process with a chasm seemingly as large as the Grand Canyon for some students to cross. I hold a firm belief that much like playing a musical instrument, notes and measures can be taught with varying degrees of success

depending on the student's natural ability and determination. But every student can be taught to read music and apply fingers to the proper keys, even if tone deaf. Not all students should seek music as a profession but they can gain an understanding and knowledge of music. And so it is with the application of visual art elements and design principles. There are students in the DArt Program with natural talent and intuition who can learn the verbal language of art and who are given the tools necessary to control and apply their natural abilities. There are also students who will not seek art as their chosen profession but will leave the course with a better understanding of the theory behind art and an ability to appreciate, communicate with, and value artistic members of a team and artists within their community. The solution to the challenge of teaching art in an interdisciplinary program with the goal of helping the student to succeed was reached by using an interdisciplinary method through a mathematical approach.