A view from the trenches: Arts as an institutional requirement

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Abstract

Life has become infinitely more complicated, time increasingly precious and society increasingly visual. In higher education we seem to be doing more with less, producing greater amounts of data to support the validity of the work and courses are quantified by the value placed upon by assessment. In this vein, a voice from the trenches calls for a conversation regarding art and its place in the Core Curriculum of our institutions. The definition of "the arts", culture and its place within the institution of higher education implies attitudes and values which may need to be viewed from different perspective.

The hierarchy within "the arts" established through perceptions, stereotypes, bias, and economics creates an uneven playing field as we are forced to vie for crumbs left within a Core experience. As artists and proponents of the arts, we, ourselves, tend to "take for granted", if not undervalue the dynamics inherent within our specific disciplines and specializations. We fail our students, institutions and future generations when the linkages between sciences, technology, art and design in today's world are not clear. We should employ the arts as a foundation for building experiences which will allow us to nurture "life-long learners" who are able to view challenges and situations with a more analytical and creative eye.

Introduction

I fully recognize what I propose is controversial in the traditional academic mindset. I also recognize at institutions of higher education, there are always limitations, challenges and in most cases an extended process before change takes place. However, if we are truly concerned with the education of our students and the development of science and technology, we need to take action. This dialogue has taken on a sense of urgency between artists and scientists with a staggering explosion of literature on the inter-relationship of the disciplines since the late 1990s. This explosion in itself underlines a renewed recognition of the connection between the disciplines as well as the impact of art upon the ability to discover, to interpret, and to explore concepts based upon the visual experience, symbols and the final step of language.

I come to this with an unusual cross-over for an institution of higher education. As a result, my perspectives have become more specific and my passion for what I am about to propose more intense. I was a professor of theatre; I am a costume designer and currently professor of art teaching and coordinating the Visual Foundations course, teaching museum studies, fashion and style.

For two-and-a-half years, I had the opportunity to be the Coordinator of the Core Curriculum at the University of Nevada, Reno. I have always felt that at a university level we should be creating a greater interdisciplinary integrity and not just saving it for a "capstone" or senior experience. In many ways I feel like I am probably preaching to the choir, perhaps because of this I will take us out on a limb with an artistic perspective on our core curriculum. This later experience has greatly informed my feelings about the core curriculum or general education fine arts requirement... I teach and have predominantly taught in the trenches of the fine arts component of the core curriculum—and have lived in a basement most my academic career. Let me state from the outset that I am fully aware that what I am about to propose will possibly shake the foundations of our history and traditions courses and in addition pose staffing challenges. However, the conversation needs to begin among the faculty and administration who exercise control our core curricula.

Life has become infinitely more complicated, time increasingly precious and society increasingly visual. The definition of "the arts" and their place within the institution of higher education imply attitudes and values which may need to be viewed from a different perspective—viewed from an active voice rather than a passive or audience voice.

Too often the hierarchy within core committees and their power base possess certain perceptions, stereotypes, and biases which create an uneven playing field as we in "the arts" are forced to vie for crumbs left within a core experience. As artists and proponents of the arts, we ourselves tend to "take for granted" our work, if not undervalue the dynamics inherent within our specific disciplines and specializations. Universities are also under increasing pressures to increase the science requirements, in credits, in scope, and in rigor in an attempt for students to gain equal footing in the world. With a limited number of requirements in general education, it

is difficult to find a balance. We fail our students, institutions and future generations when the linkages between science, technology, art and design in today's world are not made clear to our students.

In higher education we continually seem to be doing more with less, and forced into producing greater amounts of data to support the course validity in order to quantify their value in order to satisfy the required assessment. It is in this vein, a voice from the trenches calls for a conversation regarding art and its place in the core curriculum of our institutions. We should employ art, art history and its sister arts as a foundation for building experiences which will allow us to nurture "life-long learners" who are able to view challenges and situations with a more creative analytical eye.

1. Life has become infinitely more complicated, time increasingly precious and society increasingly visual.

How does a person know the world? How do people interpret the pervasive visual imagery which surrounds them? In particular, the Visual Arts often forces us to look deeper and ask different questions in order to ask the questions, we must be able to see and interpret the images which surround us, images that have been chosen for us by media or advertising. To take this further, culture impacts interpretation, the historical memory is often visual—the captured image, the drama of confrontation, and associations with what we were wearing at a given point in time. Students today are bombarded by symbols and visual short hand, but that does not necessarily result in an increased accuracy in how they look at the world, what cultural differences they perceive. Nor do they exhibit methods of incorporating the skills or the process of interpretation into work or career-related areas of their life.

Visual expression makes use of scientific principles of perspective, space, line, form and the vibration of color and sound create an interpreted image. This visual expression then precedes language. Hence, visual literacy can be defined as the ability to understand and produce visual messages. Giving our students insights and abilities to evaluate and create visual messages through an understanding of the visual arts becomes increasingly important with the ever-expanding proliferation of mass media in society. As more and more information and entertainment are acquired through media (such as television, film and internet), the ability to think critically and visually about the images presented becomes a crucial skill. Encouraging students to develop concepts in the visual expression of an idea is a skill that develops with use and practice. It is in the act of doing, by moving through the visual communication skills and patterns involved in creating art, that students learn how to read and comprehend the visual image and the inherent subtext.

The term "Visual Literacy" was first coined in 1969 by John Debes, one of the founders of the International Visual Literacy Association. In 1969, he offered the following definition of the term:

> "Visual Literacy refers to a group of competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences. The development of these competencies is fundamental to normal human learning. When developed, they enable a visually literate person to discriminate and interpret the visible actions, objects, symbols-- natural or man-made, that he encounters in his environment. Through the creative use of these competencies, he is able to communicate with others." [1]

The vast majority of students, if not citizens of the world, go through the barrage of experiences which define life with blinders. "Seeing comes before words. The child looks and recognizes

[1] Visual Literacy site: http://www.ivla.org/org_what_vis_lit.htm

before it can speak."[2] We are discovery our place in the world by defining our relationships to the images we comprehend. We seek to know the world through images and the emerging patterns. Berger expresses an inherent disconnect between the intellectual comprehension of our world and the images which impact that understanding and our emotional connection to the place, our world. "Each evening we *see* the sun set. We *know* that the earth is turning *away* from it. Yet the knowledge, the explanation, never quite fits the sight."[3] A foundation in the visual arts encourages that student to learn to explore the wonder and variety of world around them. It demands they actually learn to see and decipher the details which create the images which surround them.

> "Looking at the world is not a passive event. It is a response to a felt physical environment. Neuroscientists believe we are born with a capacity to make out specific aspects of form, of height and depth, even of gravity, and a deal of our visual acquisition is then derived from touching things, literally at first hand. As the infant develops he begins to establish internal maps of the world and, having experienced touch, he develops a way of imagining how that world must feel, even when he is just exercising his visual system. Seeing becomes therefore a kind of believing. Indeed, seeing need not involve vision at all." [4]

Students then must be able to engage in the process which takes them through a visual interpretation into the creative expression of an idea or concept, whether in art or science, and finally into a theoretical understanding of a problem or issue. "Visual representations are crucial for scientific discovery and understanding physical reality."[5] The visual interpretation or representations which express a concept offer a perception of an invisible world created with the power of the imagination and vision. Art presents us with dynamics of our world which we recognize intuitively and on deeper levels of understanding. The perceptions and representation

[2] John Berger, *Ways of Seeing*, (London: Penguin Books,1972), 7.
[3] Ibid., 7.
[4] Sian Ede, *Art and Science*, (London: I.B. Tauris, 2005), 104.

of the invisible world are a pursuit shared by art and science. Be it in the form of words or visual images, the link between vision and conceptual understanding leads us to conclude that knowledge is stored and actively accessed in a strikingly parallel manner.[6] "Needless to say, the relationship between human senses and the world outside is a subject of breathtaking enormity—compromising the efforts of religion, science, philosophy, and art over many centuries." [7]

What we know through various studies is that various types of knowledge interact, support and feed each other. For example, musical expression, the playing of instruments, and the execution of this art form increases math skills and vice versa. The art and science of music are intertwined. The University of Michigan has an orchestra composed completely of members of the staff and faculty of the life sciences. What we know through various studies is that there are different kinds of learners—visual, tactile---and that learning is enhanced by giving the students opportunities to experience the power of each sensory avenue of learning. Instead, we continue to pursue the one-size-fits-all approach, creating one science course for all, one math course for all disciplines and lecturing about creativity. Why do we persist at the college and university level to ignore the visual component of our world when we also know that:

- Good architecture doesn't happen without solid grounding in mechanics, engineering and math
- Good design is intertwined with math
- Ceramic artists need chemistry for creating glazes and colors
- The physics of light and color is imperative for lighting designers
- Geometry is vital for pattern drafting

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[5], Arthur I. Miller, *Insights of Genius: Imagery and Creativity in Science and Art,* (Cambridge, Massachusetts: MIT Press. 1996), 408.
[6] Ibid., 283.
[7] K. C. Cole, *The Universe and the Teacup: The Mathematics of Truth and Beauty*.

- Current occupations call for creative problem solving; ways of thinking outside the box by forming different conceptual approaches, changing roles

II. Instead of approaching visual competencies as a necessity of survival in the world today, we in the academy continue to lump all forms of "the arts" together. Perhaps it is time to separate the attitudes and values of the active experience, the deeper values of the collaborative nature of the arts and the values of the visual arts from the strictly passive approach (audience appreciation).

At the University of Nevada Reno (UNR) our students need to meet a three-credit fine arts requirement chosen from a menu of twenty-some courses essentially chosen by the Core Curriculum Fine Arts Subcommittee in 1985. (As we all know, change and re-visiting policy do not come easily in academic institutions.) The bulk of our approved institutional offerings, give students a look at the arts through historical surveys, *i.e*. larger lecture courses, translating into greater FTE and placing the student in a passive role. As Core Coordinator, I found that UNR is typical of most institutions of higher education in that we lump the arts together—the fine, the visual, the practical and the performance arts of theatre, music, dance and art and art history. What follows is a portion of the statement which informs students of the value and goals of this three-credit course.

Mission of Fine Arts Courses

University of Nevada Reno

These core courses assist students in recognizing and comprehending the crucial role the arts play in shaping our experiences in, and understandings

(New York, NY: Harcourt Brace & Co, 1997), 39.

of the world. The array of offerings in this area enables students to investigate either academic or practical approaches to the various forms and meanings of artistic expression. Classes cover a range of historical periods, media, and cultural milieus. Taken as a whole, these courses are designed to:

- *Enable students to discern the ways in which the arts function as a means to explore, affirm, or celebrate individual and group identity*
- *Provide insight into the history, diversity, and creativity of the world's cultures*
- *Develop writing and verbal skills for critical explorations into the drive for all individuals and cultures to understand and express identity through dance, music, theatre, or visual media*
- *Structure outlets for students to engage in creative expression*
- *Encourage cross-cultural understanding and interaction*

The Core fine arts requirement is designed to foster habits of creative and disciplined thinking by teaching students to think, read, and write critically and effectively in the area of the arts disciplines. The imaginative conception and expression of the patterns of human experience through the fine arts are explored. The importance of cultural heritage and traditions can be explored through study and experiences in the arts. Courses in the fine arts aim to develop an awareness of the place which culture takes in society and within each person's individual life. Students may learn through

> *the standard lecture and discussion mode; through small group discussions, through listening to or viewing recorded works of art; through attendance at live concerts; through viewing works of art through slides, films, videos, cd/dvd, and exhibits; through talking with live musicians and artists brought to the classroom; and through actual contact with dancers, plays, performers, and musical works. Intrinsic to all of these activities is the writing of papers, where students are expected to pay attention to both content and style.* [8]

This statement begs the question. We aren't expecting too much, are we? Are we even introducing our students to the real value and integration of visual literacy or the creative process? My question is: how do we honestly expect one course to encompass the spirit of the arts when we don't expect it in the humanities or the sciences? How do we expect students to develop creative problem solving skills for life or a career in the sciences, when in most cases the written work, the lecture and the teaching techniques require only passive involvement on the part of the student? Are we really attempting to instill an understanding of, or experience with, the power of the creative spirit or demanding involvement with methods of problem solving or communication from a thrice-removed perspective? In such situations, most students do not begin to understand collaboration or the importance of concept as they are given the direction, the marching orders, often with little reason. Consequently, the initiative to plummet to the depths of an idea in order to communicate more clearly an idea in a visual or performance context is non-existent.

[8] Visual Literacy site: http://www.ivla.org/org_what_vis_lit.htm

Based upon the significant ties art and science share in relationship to the process of discovery and investigation, the need to see closely and respond to the world around the students and the work of others, and the fact that both disciplines build upon the work of those who come before, as educators and policy makers we should be seriously considering the addition of art courses to help support the development of both our future scientists and artists. Through the use of process in the work of communication, be it a physical discovery involving the principles, dynamics and movement within our world, or the realized expression of political, social or emotional response, there is an attempt to make visible the inner nature of expression and its comprehension of a world while attempting to reach higher goals and establish higher aspirations for society as a whole. Leonardo daVinci is heralded as one of the first artist/scientists. His new art was based on the science of space, perspective, plane, surface and geometry.

In 1910, the abstract movement began a conversation, exploration and practice which integrated the energies, principles and understandings of art as linked to the sciences.
In 1913 as Russian poets and artists were in dialogue, the scope of interpretation included all visual images and the impact of rules examined. The essential belief was that "In the creation of anything, even rules, the creative process is lively." [9] The ultimate work of the artist is to insure the interpretation of that energy and its inner meaning, its inner emotions and feelings. In a world where we have ceased to see and/or interpret the images around us, students need to actively engage in process. The conscious process of creation involves order and logic even in what would appear to be the most random of choices. The use of the scientific tools of perspective, the understanding of the physics of light in relationship to the human eye,

[9] Patricia Railing, "The Art of the Word and the Graphic Letter." *From Science to Systems of Art*, (East Sussex: Artist Bookworks, 1989), 71.

implication and interpretation allow the artist to underline the work, bringing focus to a visual concept.

In order to prepare our students for the demands of the 21st century, I suggest we increase the number of arts credits required of our students to the minimal equivalent of the science requirement, which at present in our case is two science courses, one with a lab and one without, and require a visual arts studio-driven course and an arts course based in performance/presentation. (The core science requirement is proposed to be increased to three courses in the sciences in order to obtain equity with the three courses required in Western Traditions.)

The studio and/or visual foundations provide our students with an opportunity to integrate the activities of both hemispheres of the brain, to see, to create a vision, developing creative thinkers and problem solvers. Likewise, students need to experience the levels of collaboration and teamwork necessary in the performance side of the arts. We need to require more of our students, not less, by providing those opportunities to synthesize material, ground concepts, provide opportunities for problem solving and analysis by establishing standards and exhibitions open for all to view. We need to expect more creative and experiential involvement from our students within the arts requirements.

I suggest we encourage a different perspective and expect the fine arts requirements to engage directly in the exploration of the creative spirit. There must be a hands –on component included as part of the experience. Recognizing that we both teach and learn in different sensory ways, we begin to use the concept and the powerful tool of play, and to teach process and development of ideas, problem solving skills and perspectives. As artists we learn that when dealing with ideas and concepts there are many alternatives. No one solution is perfect. It may

be necessary to paint over an idea with different colors or throw it out all together and find other images which communicate with greater intensity or recognition. The fact is that in the visual arts students actually engage in process and, like professional artists, must make decisions constantly and adjust to the process of continually examining alternatives toward choosing one which will work best. Artists need to be able to "turn on a dime," "improvise," investigate different possibilities. This idea is vital to the experience of ALL students if for no other reason than to acquaint them with the concept of alternate scenario..... "If I do this, this, this, or this will happen, *etc*."

What the visual arts can teach in terms of discipline and practice is impossible to duplicate in other disciplines. In the process, artists learn to deal with implications of unprofitable research. Students need to develop practices that allow them to integrate all their faculties and sensory awareness into practices which allow them to pursue deeper learning. Students need to become willing to explore what is perceived of little value or effort to others. Both artists and scientists must acknowledge the integration of cultural issues into the work and incorporate different critical understanding into their work. Art inherently teaches an interest in communication and places a respect and value upon creativity and innovation which create new perspectives. Equally important to artists and scientists is the acknowledgement of what it demands of them to work at fringes of discovery and realization. Our students need to learn as artists the ability to understand both worlds of creating and using technologies. As global citizens, we also need to learn to communicate as artists do by expressing, comprehending and coping with the cultural ramifications of their work in a world dominated by media and images.

Not only are artists becoming increasingly responsible for the dissemination of scientific knowledge—its content, agendas, possibilities—but Stephen Wilson in the Information Arts

also proposed that the artist is an active partner in determining the direction of research through not only the creative work but also the theoretical writing of artistic critique. "Research is the search for the future. Science and art are major forces in contemporary society. They must both contribute to the shaping of the future."[10]

> "…Goethe formulated his theory that the color on a surface is caused by a pattern of black and white lines and spots; different colors result from different rations of the black and white elements. If Goethe had not had a reputation as an artist, his color theory would have been tossed into the dustbin of science along with countless other laboratory mistakes and false hypotheses, but instead gallons of ink have been spilled trying to make sense of it."[11]

III. The hierarchy within the Core often creates an uneven playing field, as the arts are forced to vie for crumbs left within a core experience.

Perceptions regarding traits/ stereotypes of artists: sanity or insanity, love and/or passion of the work—doing it for free, with no space and no equipment, yet expecting to meet OSHA standards, and being grateful to whatever crumbs come to the table for space, faculty, and support—and best of all --- art happens; art requires no concept or thought; it takes no effort; there are elves who do the work. How naïve or blind are we? Do we not recognize the essential nature of personal qualities we build through the arts as collaborators? According to a 2003 survey conducted by the National Association of Colleges and Employers, the qualities employers considered the most valuable are: Communication skills and integrity (4.7), Team work (4.6), interpersonal motivation/ initiative (4.5).[12] (The scale is based upon a five point scale with 5 the highest.) All of these are inherently built through both the performance and studio arts.

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[10] Stephen Wilson, *Information Arts*, (Cambridge Massachusetts: MIT Press, 2002), 877.
[11] Lynn Gamwell, *Exploring the Invisible: Art, Science, and the Spiritual*. (Princeton: Princeton University Press. 2002), 25.
[12] Journal of Career and Technical Education Site: http://scholar.lib.vt.edu/ejournals/JCTE/v19n1/ricketts.html

I suggest that at levels of higher education, we begin to use art, design, theatre, dance and music as ways of integrating the humanities and the sciences creating a stronger interdisciplinary approach to literacy, collaboration and creative problem solving. Most k-12 systems are forced to drop the arts exploration in order to increase math, science, reading and writing competencies. At the university level, I suggest we stop re-treading remedial k-12 competencies and focus on using the visual and performing arts as a foundation of interdisciplinary learning.

Lasting impressions and understandings are imparted to students when the teaching faculty provides integration of arts, humanities, sciences and technology. For example one assignment might be to ask students to explore the market value of the work of an artist in a particular period compared with the dynamics, resources and economics of the society today. It is up to us who understand the creative process, practical demands and historical understanding--to elevate expectations of students by creating scenarios which force them to recognize the integration of art and science, economics and technology. "We will find that at the moment of creativity, boundaries dissolve between artists and scientists, as they have done often in art and science in the twentieth century'[13]

"Today we find the compartmentalization of modern life that has relegated art and science to separate corners and has become not only unsatisfying from an intellectual standpoint, but also unworkable from a practical one. Increasingly, the need to integrate the knowledge and applications of seemingly discrete disciplines is asserting it self."[14] Santa Fe, New Mexico with its emphasis on the arts and home to some of the finest scientific minds in the world, home to the Los Alamos National Laboratory and the Forum for Science and Art, is at the forefront of this growing recognition of need to integrate that approach with science and art. The process,

[13]Miller, *Insights of Genius*, 378
[14]Zimmerman, N., "Creative Trinity", *Santa Fe Trend*, 7-1 (Summer 2006), 80.

discovery and products of art and science share language-- beauty, elegance, viewpoints, symmetry, balance, coherence, unity, volume and energy, and space. "Recognition that both disciplines deal with energy, space in the adaptation and transformation of –not just materials, but thinking exploring, developing and refining visual images and metaphors. And, and increasingly, scientists and artists are teaming up to produce projects that foster greater understanding of those overlapping worlds."[15]

The arts, both studio and performing, have the power to open the door to scientific, economic, philosophical, and historical worlds which relate a clear sense of the cultural values, and the ways in which science and art become building blocks for advancements. Leonardo daVinci employed an integration of perspective, geometry and mathematics to raise art and architecture to new heights. Science and art were considered to be closely associated fields of inquiry. He invented flying machines and diving suits, and explored new dynamics in engineering and architecture. During the Enlightenment music was studied within mathematics, and the ancient belief in the relationship between sound and color. Social reformers of the 1850s "encouraged all classes, from manual workers to the educated elite, to study natural science as a healthy recreation that would develop their powers of reasoning."[16] During the 1860s, music was explored in relationship to its visual context. The current gulf did not always exist. At the level of higher education, where was the point we lost the importance of these connections which are supported by clear historical understandings?

As academics, we need to cease the provincial, narrow-minded, territorial, ego and power driven disciplinary divisions and recognize that there are goals, values and language shared by both the visual arts and science.

[15]Ibid., 84.
[16]Gamwell, *Exploring the Invisible: Art, Science, and the Spiritual*, 54.

Both:

- value the careful observation of their environments to gather information through the senses
- value creativity.
- propose to introduce change, innovation, or improvement over what exists
- use abstract models to understand the world
- aspire to create works that have universal relevance.
- work with abstract symbols
- push limits of technologies—inventing, synthesizing in order to push beyond the boundaries. [17]

If we are to strengthen the foundation of our future scientists, they need to explore visualization, representation and the abstract through the studio experience. Art is a place to question and innovate amid diverse ideologies, perspectives. By nature, the artist, through the artistic experience, is willing to take the leap into unknown imagined worlds and to ask questions of humanity. These leaps are critical to potential and future exploration of science.

V. We need to deal with the pressures of higher education for data to support the validity of courses and the value of creative work which must be "quantified" –i.e. assessment.

[17] Wilson, *Information Arts*, 18.

I suggest we all—science and the humanities -- take a page from the studio arts and require students to:

- Deal with problem formulation, inquiry, context and conceptualization.
- Learn to work through ideas, play, and experiment and be willing to throw out what doesn't work, or have the courage to "paint over it with different layers, different colors and different materials. In this way, place ideas, synthesized into a conceptual realm which requires execution, craftsmanship and presentation in a physical and intellectual forum.
- Present viable work for everyone to see
- Constant assessment in visual arts or performance classes—each session requiring participation, creating not necessary great artists, –but students who see the necessity of participation, and a willingness to experiment, grow and play. Critical thinking, analysis, and communication will improve.

In other words: Require Portfolios—both hard and digital copies—a useful skill for each and every student in order to provide a:

- Demonstration of abilities,
- Sense of organization of materials and process,
- Demonstration of visual and presentational skills,
- Encapsulation of academic and research strengths
- Ability to use critical thinking
- And showcasing of technological competencies

We need to expose our students to the studio arts that they might understand elements of creative activity, consideration of choices and the ordering of the reality.

IV. Generally, as artists, we tend to undervalue the dynamics inherent within our specific disciplines and specializations. We use but tend not to "broadcast" the linkages we know exist between sciences, technology, art and design.

For great scientists such as Galileo, Ernest Mach and Albert Einstein a thought could not be separated from its visual essence, its "idealization or abstraction of existing physical conditions. "Visual imagery is usually essential for scientific advance."[18] Social history, economics and politics are indelibly linked to the relationship which exists between science, art and multiple levels of dialogue with its practitioners, critics and philosophers. Gamwell builds a strong case Germany and Russian developed "the conceptual basis for both the art and the science from Kant to Einstein…a powerful vision of unity of nature" in *Exploring the Invisible.*[19] Entwined relationships between art and science in the late 19th and 20th centuries were critical in creating shifts in discovering new views of the world. "These shifts in art coincided with increased abstraction in physical theory accompanied by transformations in intuition."[20]

At its most practical level and as a random generalization from an artist who has always lived in a basement, it seems to me that on the whole we undervalue creative problem solving, creative use of materials, use of research and historical understandings, and implications of the technology between facets of our lives. Students engineers taking a theatre fine arts course, walk into the costume shop and exclaim "What, you use AutoCAD?" We should be instilling within

[18]Miller, *Insights of Genius*, 313-314.
[19]Gamwell, *Exploring the Invisible: Art, Science, and the Spiritual*, 10.
[20] Miller, *Insights of Genius*, 380.

students that in moving from the second to the third dimensions, there are shared insights, technologies and demands of craftsmanship across the disciplines.

There are benefits to this type of understanding and knowledge, to arts as practical, hands on, creative experiences, to problem-solving as exploration, and to production and deadlines. Through the teaching and sharing of what is demanded of a working artist in a particular discipline or field we can inform and improve collaboration and communication skills. Artists by their very nature explore various materials and technologies, creating new uses, innovative approaches, and new interpretations from floor mats to egg cartons, to patterning, to projections which become installations or theatrical scenery.

There are new programs throughout our academic institutions which realize strong inter-connectedness. A few examples are: Carnegie Mellon's Entertainment Technology Center, Purdue International Center for Entertainment Technology, University of Florida's Digital Worlds Institute, Arizona State's Arts, Media and Engineering, University of Nevada, Las Vegas Entertainment Technology. Using the arts and entertainment as a jumping off point, these programs explore automation, engineering, robotics, structure, and the magic and mystery of the visible and invisible to audiences. There are implications of the arts that reach well beyond the stage. One small example is theatre makeup. It has implication in both applied and special effects in theatre and film, but the same problem-solving has extended to the medical world of burn victims, enhancing appearance. The tools, inventions and application can be used to change and protect identity in the undercover world of the CIA and FBI.

By exploring professional and industrial linkages in the visual arts and design, it is possible to realize this partnership invests in the creative mind. On the increasingly important financial end of operations for the academy, we could walk hand in hand with business to

become active in research and development of products and technology. Finding partners who have resources and are willing to make research investments and who will buy into the creative energy of academy—in much the same research-driven purposes as science use research labs. Institutions tend to value the interdisciplinary nature of research and collaboration with industry in ways that institutions and society fail to value the contribution of the arts. Pursuing collaborative, artistic research can bring about exciting opportunities for our students to experience the value of time, money and manpower in a real world setting as well as provide students with the opportunity to "play," conceptualize and integrate the "what if's" of problem solving meeting real world needs.

VI. To see the arts as a foundation for building experiences which will allow us to nurture "life-long learners" who are able to view challenges and situations with a more creative and analytical eye.

Informal non-scientific survey, I have done surprised me with the expression from "science and engineering" types that they would have liked more arts required of them---recognizing that the creative experience, the realizations of discovery, opportunities to integrate other course work and information, and accomplishment provided great benefit. If students can embrace the benefits, why cannot we as academic leaders? We need to value the arts for teaching survival skills, creativity and creative discovery. Above all, we as educators need to be willing to accept that, and be vocal about the fact that frequently the full impact of a visual art class or a performance course or even our traditional "arts requirements" may not be understood by students 1 to 5 years after graduation. Immediate assessment is not the linch pin in determining the overall contribution of education to the lives and future of individuals who enter the ivy halls.

It is necessary to find ways to rewarding and encouraging interdisciplinary teaching and learning. After all, if institutions of higher education are truly interested in developing life long learners, the higher integration of disciplines, analytical skills and communication must be upheld. If our counterparts in elementary education can successfully integrate subject matter and discipline, it should be possible for higher education to take steps to reward this commitment by faculty who are willing exemplify such principles of discussion, analysis and research in their classrooms.

"We will find that at the moment of creativity, boundaries dissolve between artists and scientists, as they have done often in art and science in the twentieth century."[21] Kandinsky predicted that the future of art and science belonged not to those who looked only at the visible realm but to those artists and scientists "who used intuition and direct detection to explore the invisible."[22]

As leaders at institutions of higher education, let us once again begin to fully embrace the strong relationship between art and science and require in our core education the visual foundations, creativity and literacy demanded by our world in the 21st century.

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[21] Ibid. p. 378
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