The Role of the Arts in an iSchool Education

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ABSTRACT

Professional education in Information Schools is predominantly technical and based on a rational, scientific way of thinking about the world. In this essay we make the argument that experience and interaction with the arts – aesthetic experience – should play an important role in the education of information professionals. Our discussion of the role of the arts in an iSchool education is structured around three basic ideas. First, we argue that the arts offer a pathway into complementary mode of thinking and knowing that is not only highly beneficial for the technical professions, but may also be important for the development of a competitive future work force. We refer to this as an artistic mode of knowing, and we discuss both terminology and the characteristics in this section. Second, we build on the ideas of Grant and others that focus on the organizational and societal importance of collaboration among individuals with diverse specialized knowledge. We describe how the skills needed for successful interdisciplinary collaboration are increasingly drawing on both ways of knowing. Third, we argue that much of the work done by information professionals has more in common than would first appear with the work done by design professionals and creative and performing artists, and thus is amenable to the pedagogical techniques employed in those fields. We conclude by offering specific iSchool examples of arts-based pedagogy and include suggestions for incorporating these ideas into an existing curriculum.

Topics

Nature and scope of iSchools and iResearch

Keywords

arts, aesthetics, studio learning, information professionals, iSchools

1. INTRODUCTION

In this essay we make the argument that experience and interaction with the arts – aesthetic experience – should play an important role in the education of information professionals. We argue that this interaction will provide a useful and necessary complement to the more familiar rational, scientific model that currently informs iSchool professional education, and discuss the principles inherent in an arts-based approach to learning in iSchools.

Professional education in Information Schools is predominantly technical and based on a rational, scientific way of thinking about the world. Our students learn the skills required for effective librarianship, information systems development, and network administration, among others, and it is entirely appropriate that the primary focus of a professional education be on the technical knowledge and skill that professionals must master. But beyond technical competence, successful professionals also require the ability to interpret complex and ambiguous situations, interact with those expert in other forms of specialized knowledge, and constructively evaluate their own work and the work of others. These abilities call for an approach to knowing the world that complements the knowledge provided by a rational, scientific approach. This approach to knowing is characterized by intuitive understanding, emotional sensitivity, catharsis, metaphor and analogy. Bruner [1] proposes that the experience of art promotes an integrated, holistic view of phenomena that is a useful complement to analytic knowing.

We structure our discussion of the role of the arts in an iSchool education around three basic ideas. First, we argue that the arts offer a pathway into complementary mode of thinking and knowing that is not only highly beneficial for the technical professions, but may also be important for the development of a competitive future work force. We refer to this as an artistic mode of knowing, and we discuss terminology and describe this mode here. Second, we build on the ideas of Grant [2] and others that focus on the organizational and societal importance of collaboration among individuals with diverse specialized knowledge. We describe how the skills needed for successful interdisciplinary collaboration are increasingly drawn from diverse ways of knowing. Third, we argue that much of the work done by information professionals has more in common than would first appear with the work done by design professionals and creative and performing artists, and thus is amenable to the pedagogical techniques employed in those fields.

We explore these three assertions in detail in Sections 2, 3 and 4 of this paper. In Section 5 we offer a specific iSchool example of arts-based pedagogy and include suggestions for incorporating these ideas into an existing curriculum.

2. SCIENTIFIC AND ARTISTIC MODES OF KNOWING

For the past two centuries, specialized technical workers have relied on an approach to thinking and knowing derived from the scientific method of acquiring knowledge. This scientific approach has resulted in valuable technology that has allowed us to produce complex and sophisticated tools. It has created improvements in health, prosperity and standard of living that are unprecedented in human history. However, the unintended side effects of our technological revolution (e.g. potential for mass destruction, climate change, etc.) make it clear that the ability to *use* technology effectively does not necessarily evolve directly from the scientific approach to knowing that allows us to *make* technology. In this section, we briefly sketch the outlines of an approach to thinking, knowing, and understanding that we believe can serve as a highly useful complement to the scientific approach to gaining knowledge.

We label this approach the artistic mode of knowing in order to emphasize its distinctness from the scientific approach, but we recognize that the label has the potential to mislead. The two ways of knowing we consider do not represent a pure dichotomy, but rather lie on a continuum, with most thinking and knowing taking place somewhere in the middle, and employing both modes in varying degrees. Our objective is to promote a mode of thinking and knowing that operates in terms of a "both-and" opportunity rather than an "either-or" choice. Art historian James Elkins is promoting a similarly holistic approach in his book entitled *The Domain of Images* where he makes an argument for an inclusive study of images, both those deemed as art and those seen as more utilitarian (such as images used in science). In fact, he devotes several pages to discussing the inadequacy of many if not all art/non-art monikers, examining (and ultimately finding fault with) a range of terms for non-art images including: scientific, nonreligious, inexpressive, non- or extra-aesthetic, utilitarian, informational, nonrepresentational, schematic and notational [3]. Ultimately he finds a distinction based on practice to be the most useful for his purposes: art images are those generally studied by art historians. Non-art images are not. We have followed a similarly pragmatic approach to clarifying our distinction between artistic and scientific ways of knowing and thinking about problems. While we continue to search for the perfect terms for these two modes, we will let these terms stand for the moment and move on to describe in more detail what each represent in terms of this research.

We begin by presenting in bullet form a series of distinctions between the two modes of knowing and thinking:

- Scientific thinking discriminates between and analyzes details. Artistic thinking synthesizes details into a single holistic pattern.
- Scientific knowing focuses on category; artistic knowing focuses on relationship.
- Scientific knowing relies on analysis; artistic knowing relies on synthesis
- Scientific knowing segregates; artistic knowing integrates.
- Scientific knowing is sequential, literal, functional, textual, and analytic.
- Artistic knowing is simultaneous, metaphorical, aesthetic, contextual, and synthetic [4].

There is a persistent but disconnected stream of research and argument that supports the need for a mode of thinking and knowing to complement the scientific model that dominates professional higher education. For example, there is growing collection of literature that recognizes the importance of arming management students with a broader range of skills in order to ensure success in a competitive market [5-8]. Business school educators are looking to the liberal arts in order to bridge the gaps in Information System education related to people-skills [9-13]. The American Assembly of Collegiate Schools of Business (AACSB), has specifically advocated the integration of liberal arts education into the business curriculum [14].

Researchers have also begun to explore the aesthetic dimension of information systems design. For example, Tractinsky [15] writes of the aesthetics of the information system design object (by aesthetics he means the common every day meeting of the term: "an artistically beautiful or pleasing appearance"). He notes that research in information systems has almost completely ignored this notion of aesthetics in order to focus on robustness and functionality, and speculates that this might be because the origins of the computing disciplines emphasize the rational model of hard science, efficiency, and utility. As information systems become more interactive and place more emphasis on visual displays, he argues that visual aesthetics should receive more research and pedagogical attention for several reasons. First, as science and technology provide products that dramatically exceed the functional needs of most humans, the aesthetic dimension becomes more important. Second, aesthetic interpretations and evaluations are often hard to overcome because they precede and influence reflective and cognitive interpretations. Finally, he argues that while some aesthetic responses are innate and relatively invariant, most are learned and depend on culture, education, and other experiences. Because they are acquired, we should focus on their education.

Bennett et al. [16], writing from a business management perspective, note the research from cognitive psychology and organizational cognition that describes human limitations in the ability to understand and represent ambiguous concepts and situations. This focus on the bounded rationality of human problem solvers [17, 18] reminds us of the importance of being able to interpretand evaluate complex, ambiguous situations holistically, by using tools other then those that are rational, and analytical. Because human rationality is bounded or limited, an aesthetic way of approaching complex, ambiguous situations may provide a number of benefits, including the ability to usefully integrate information that at first appears to be fragmented, unrelated and thus ambiguous. Aesthetic understanding can help information professionals coherently interpret ambiguous situations by illuminating the correspondences and relationships within them.

In other discussions on how to prepare college graduates for future professional jobs, the argument has often been made that today's market requires graduates to possess "cross functional" skills beyond those related to a specific professional expertise

(e.g. Business-Higher Education Forum (BHEF), 1997). Such skills transcend professional job categories, and are often missing in college graduates. The cross-functional competencies frequently identified are: leadership, teamwork, problem solving, critical thinking, global consciousness, tolerance for ambiguity, and basic communication skills (listening, speaking, reading, and writing). The need for these skills is exacerbated by the fact that the US Department of Education is forecasting a shortage of college-educated workers in United States of more than 12 million by the year 2020. The nation is on the verge of a critical shortage of workers with college-level skills. The report calls for the United States to create "a nation of learners'.

The report argues that the United States' competitive position in the world depends on its ability to educate a sufficient number of workers who are able to interpret complex and ambiguous situations, solve problems, communicate, and lead. To accomplish this, the nation needs major investments and major changes in the models of higher education that are used to prepare students for the job market.

We propose that an arts based approach to professional education can provide one such alternative model. Engagement with the arts as a method for gaining understanding can help to address this gap. Bruner [1] identifies four aspects of the experience of art that hint at the potential benefits of this approach:

- ***Connectedness*** – interaction with the arts can generate a synthetic response that helps one bridge the gaps between seemingly disconnected experiences in order to discover a cohesive view of the world.
- ***Effort*** – interaction with the arts requires work, work that often demands departing from habitual and literal ways of looking at things.
- ***Conversion of impulse*** –art can provide boundaries and forums for the experience of seemingly uncontrollable instincts or impulses, thus allowing for their exploration and understanding in ways that would be otherwise proscribed or inhibited.
- ***Generality*** – interaction with the arts often creates a shock of recognition that provides an expanded view of the known

These forms of understanding involve comprehending at a deep level, in ways that lie outside the linear, analytic mode of scientific method. By providing opportunities to students that will allow them to experience these dimensions of knowledge, we can enable them to more successfully tackle socially complex and ambiguous problems. These are precisely the types of problems that they will likely encounter in the real world of organizational life.

3. THE ARTS AND INTERDISCIPLINARY COLLABORATION

Our second argument stems directly from increasingly frequent opportunities we see at the iSchool at Syracuse University. Occasions for interdisciplinary collaborations within the school, within the university and across the wider academic community, as well as potential partnerships with industry, are springing up with great regularity. These opportunities cast a spotlight on the need to provide our students with a diverse set of problem-solving tools to help them build a strong and flexible set of critical thinking skills that will enable them to take part in these innovative initiatives. Many of these opportunities involve working with colleagues in disciplines closely aligned with the information field, such as computer science and business. However, many are bringing us in contact with partners from the humanities. Additionally, we have observed that many of the work environments our students are entering upon leaving our school are increasingly driven by diverse teams that include members from a range of technology, design and marketing fields. The longevity of this trend is supported by Grant's [2] argument that organizations exist to provide integrating routines that allow individuals with diverse specialized knowledge to collaborate effectively.

Learning to participate in successful collaborations involves gaining so-called "people skills," including developing methods for resolving conflict and acquiring the ability to articulate and defend one's own ideas to people not necessarily sharing the same background or vocabulary. Exposure to the arts, as a complement to technical training, can give our students great advantage in these areas. Education in the arts, including literature, fine art and music, often focuses on 1) developing tools of empathy, 2) increasing awareness of the diversity of the human experience, 3) honing methods for reading subtext and nuanced meaning, and 4) cultivating an ability to interpret ambiguity from a number of vantage points.

All of these skills are desirable, if not in fact necessary, in collaborative work groups. Specifically, as we will discuss further, exposure to a studio art working and learning environment provides students with the opportunity to explore diverse expressions and creative solutions in a group setting. When these situations bear the most fruitful results, students struggle through their own attempt to express themselves while simultaneously interpreting and evaluating the work of their peers. The interdependence of studio cohort members can become one of the most generative aspects of the studio art experience. Rich stimuli in the form of artistic content can provoke discussions engineered to teach intellectual skills and studio-based learning can provide an opportunity to try out these new intellectual tools in a hands-on communal environment. The marriage of theory and practice that marks much arts-based learning has the potential to enhance the ability our students to work successfully in collaborative situations.

We reinforce this argument by presenting two concrete examples of opportunities for collaboration that would be greatly enhanced by providing participating students with exposure to the types of skills gained through experiences with the arts.

Colleagues at the iSchool at Syracure have been advocating the creation of a profession devoted specifically to the support role that information professionals play in enabling people to make the most of new technologies. Referred to as a "cyberinfrastructure facilitator," one of the main responsibilities of this position is to advocate for and enable the use of cyber-based systems, tools, and services within any context, be it financial services, education, the arts or sciences. Obviously a large part of this vision is ensuring that the information professional has adequate communication skills and a full understanding of the needs and culture of the community that he or she is serving. We believe that arts-based experiences in the classroom can provide students with a forum to hone these skills and learn how to process diverse perspectives.

Another good example of the type of multidisciplinary project that would benefit from students well-versed in arts-informed learning is an initiative led by Michael McAllister, Director of Innovation and Design at the School of Art and Design within the College of Visual and Performing Arts (VPA) at Syracuse. He is advocating for the creation of a multimedia design center on campus that will enable students to get hands-on experience solving real design problems within the Syracuse community. In response to specific needs within the local community, such as education, outreach to underrepresented groups within the city, and small business/entrepreneurial startup programs, students will propose, develop and, importantly, implement large-scale multimedia projects. The program intends to bring together VPA students with those from the iSchool, as well as business, media and public policy areas. By partnering with VPA, we would provide our students with the chance to propose, facilitate and implement technology-driven solutions to an array of real world information problems.

The contributions that our information students could make to these projects are significant, not to mention the value that they would get from participating. But in order to make the most of these experiences, we need to make sure that we are teaching them the skills necessary to communicate and function within these diverse teams. We should not neglect our responsibility to make sure our students are properly prepared to fully participate in innovative programs like this, both while they are here at the iSchool and after they graduate.

In fact, we argue that many of the skills that are needed to take full advantage of opportunities like these are very successfully taught by utilizing the studio-based approach (described below) that advocates peer interactions, critical thinking, thoughtful and thought-provoking experimentation and openness to alternative solutions. These are also the same skills that many of our students will need when they enter the work force and find themselves working in multidisciplinary teams tackling similar problems.

4. THE CYCLE OF PROFESSIONAL WORK

Our third argument is that the work processes of technical professionals have much in common with those of design professionals and creative and performing artists. As a result, pedagogical approaches that have been found effective in education for the arts can also have a role in the education of iProfessionals. And just as the arts are becoming increasingly experimental and digital, so also are the information professions. For example, the iProfessional of the future may have to do much more than write a memo, a report, or make a standup presentation in order to communicate effectively. As professional communication increasingly gravitates to "new media," skills for professionals may come to rely increasingly on what we refer to here as the artistic mode of knowing and thinking.

While organizations strive for a controlled and predictive state of operation, they also demand innovation and invention as a means to increase resources and ultimately gain advantage. By recognizing that iProfessionals require the ability to use both creative thinking and scientific rigor when confronting challenges, a technical education informed by arts-based practice can benefit both individuals and organizations.

Generalizing across many technical professions (e.g. librarianship, information systems design, software engineering, medicine accounting, engineering, etc.) Figure 1 illustrates four generic dimensions of professional work: production, performance, interpretation, and critique. Technical professionals may cycle iteratively through all fours stages in projects where they have heavy involvement, or may participate in one or two stages where their collaborative contribution is more peripheral.

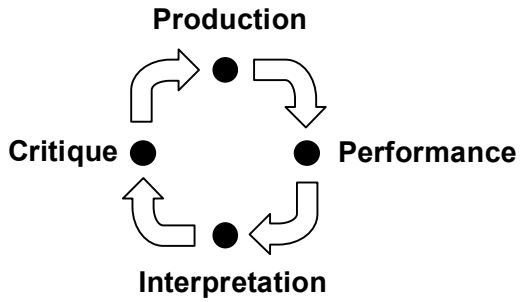

Figure 1. Cycle of professional work

Production includes creation of professional artifacts. Software engineers write programs. Systems analysts and engineers create designs and specifications. Accountants create financial statements. And professional workers of all types create professional correspondence, proposals, requests for proposals, reports, and many other graphical and textual artifacts.

Performance in the iProfessions includes explicit role-based activities (e.g. interviewing to elicit requirements by reference librarians and system analysts) and also ubiquitous performances common to all professional work,(e.g. attending/conducting meetings, interviews, presentations, etc.).

Interpretation occurs whenever professionals are called upon to make sense of ambiguous situations, and to understand what is going on in times of uncertainty. Each technical profession has its own set of analytical tools, based on the rational, scientific model to assist in this task. (e.g decision trees to aid physicians in diagnosis, representational tools used by systems analysts to understand and model systems) But we argue that the rational, scientific ways of knowing that each profession brings to its field of focus are necessary, but not sufficient when interpretation involves complex human and organizational contexts.

Critique involves the ongoing professional responsibility to evaluate the production and performance of self and others, and to make judgments about the professional value of such work. Each profession has developed rational tools to assist in this process of evaluation (e.g cost-benefit analysis, scoring models). Nevertheless we hear again and again that such evaluation tools are not always sufficient to fully evaluate products and performances in situations of high ambiguity and uncertainty, and where costs and benefits are strategic or less tangible.

It is perhaps easier to see the commonalities between professional and artistic production and performance due to the ubiquity of

professional artifacts and presentations. But the less obvious similarities in the areas of interpretation and critique may prove to be the more important because they involve skills central to professional judgment, skills that are more elusive and difficult to teach.

5. APPLYING AN ARTS-BASED APPROACH TO LEARNING IN I-SCHOOLS

At this point we introduce a practical example of how arts-related practices can be integrated into an existing iSchool curriculum. We divide methods for incorporating the arts into iSchool pedagogy into two categories: *content approaches* and *process approaches*. In future work we will discuss how to incorporate arts related content such as novels, poems, paintings or music as stimuli for discussion into professional courses. Examples of this type of augmentation to standard business school curricula can be found in the literature [10, 11, 13]. For this paper, however, we have selected a process-oriented strategy that introduces principles of studio art learning into a technical education classroom.

Teaching practices commonly used in studio and performance-based pedagogy can unlock a broader spectrum of experiences for iSchool students, without compromising other aspects of their education. In fact, educators in a range of professional and technical fields have sought to make use of studio-based techniques in the classroom [19-21]. By tapping into these practices, iSchool educators can discover new methods for improving people skills and creating more flexible thinkers.

Studio learning environments focus on idea generation, production and critique. It is common for problems assigned to students to be ambiguous and equivocal. A student is expected to create, present and defend their work in front of the class. The class is then expected to provide thoughtful and constructive criticism to help improve the idea. During discussion and evaluations, there is often there no "right" answer. Students take turns presenting what they have created and offering critique of the work of others. Much of the learning is done "out in the open," within a setting that provides a shared environment for mistakes, inventions and questions. This setting provides students with opportunities to see multiple solutions, within a concentrated timeframe. Potential solutions can be evaluated in real time.

Returning to the cycle of professional work, at each stage, the specific art-based principles can be introduced via a studio approach:

Production
Exploit communal discoveries
Be aware of iterative and incremental progress
Utilize visibility

Performance
Establish ownership
Exercise repetition
Observe results

Interpretation
Consider group and individual perspectives
Encourage tolerance for ambiguity
Explore multiplicity of meanings

Critique
Dialogue
Compare and contrast interpretations
Determine goodness of fit
Enable change and adaptation

As an example of how a studio-based approach can be applied to an iSchool curriculum, we present an adaptation of a current undergraduate course regularly offered by our school: IST444 Information Reporting and Presentation. An informal survey of the curricula of other iSchools shows that many include a similar course, designed to introduce students to basic concepts related to successfully presenting information within a business context, in both oral and printed form [22]. Recognizing the sheer volume of information that the average professional handles in a typical work environment, this course provides students with tools, strategies and experience in making presentations with skill and competence. The course is designed to cover basic graphic design skills and software, and to provide regular opportunities for 3 to 5 minute oral presentations. Students delivery speeches, create information graphics, evaluate and discuss examples of printed and digital information.

With the permission of the IST444 professor of record, Susan Bonzi, we have reviewed the course syllabus and identified opportunities to align this class with the four stage cycle of professional work presented above. A studio-based iteration of the course, as described below, will be piloted in the fall of 2008 by the second author.

A typical instantiation of IST444 might follow a schedule similar to the one shown below (see Table 1), with individual and group presentations occurring throughout the semester. Notably the course is designed to introduce specific key concepts and provide introductory exposure to common graphics software. As such, the course takes a linear approaching, tackling each topic in sequence. The cumulative effect for students is exposure to all of the objective skills and techniques related to information presentation and reporting.

The IST444 course is well suited to incorporating a studio-based approach. Currently, students work in small groups to create profiles for fictional businesses and each group is expected to generate materials for their company during the course of the semester. Instruction in public speaking is an important aspect of the course and these mock businesses provide content for a series of oral presentations that emulate real-world business situations. Concurrently, graphic design issues related to creating business documents such as resumes, letterhead and business cards are discussed. The class is structured to allow significant time for individual and group oral presentations while concurrently introducing information presentation guidelines and basic instruction in software such as Adobe Creative Suite and Macromedia Flash.

Table 1.Typical class structure for IST444 *Information Presentation and Reporting*

Weekly topics	Phase of professional work cycle addressed
Individual and Group Presentations *(take place throughout the semester)*	Performance, Critique
Graphic Basics	Production
Type	Production
Logos	Production
Types of speeches	Performance
Constructing a speech	Performance
Presenting a speech	Performance
Photoshop Basics	Production
Advanced Photoshop	Production
Basic Page design	Production
In Design basics	Production
Advanced inDesign	Production
Letter head, business cards	Production
Brochures	Production
Newsletters	Production
Color, Paper	Production
Resumes	Production
Charts and graphs	Production
Info graphics	Production
Concept mapping	Production
Web Page design	Production
Flash	Production

Our goal in redesigning the course offerings is to generate a more cyclical plan that iteratively guides students through the four stages of professional work:

1. *Production*– Students generate ideas and objects.
2. *Performance* Students present those ideas to their peers in a variety of formats
3. *Interpretation*– Students analyze peer presentations in a formal setting
4. *Critique*– Students evaluate the success of the presentations based on collective analysis and on their own experiences and opinions

Because the course already includes a degree of Production, Performance and Critique (see designations, Table 1), our focus is on introducing elements related to Interpretation, as well as restructuring course content to reinforce the creative cycle that underlies much studio-based course work.

Our alternate plan for the course, based on a studio approach, covers the same material over the course of the same amount of time, and exploits the power of repetition and iteration that is common to studio courses. Instead of the linear format shown above, the course could be organized as a series of iterative cycles, stepping students through the work cycle multiple times and while increasing exposure to skills of interpretation. Such a course might look something like this (Table 2):

Table 2. Example of IST444 *Information Presentation and Reporting* based on a studio approach

Topic	Phase of professional work cycle
Present yourself	
Create a profile for yourself	Production
Present a resume	Performance
Alter your resume for different jobs or situations	Interpretation
Evaluate peer resumes	Critique
Create a company profile	
Come up with an idea for a company	Production
Pitch your company to the group	Performance
Evaluate the strengths and weakness of your company	Interpretation
Group discussion	Critique
Create a brand identity for your company	
Branding and logo	Production
Run a focus group	Performance
Participate in a focus group	Interpretation
Group discussion	Critique
Present a product offered by your company	
Create an advertisement for a product	Production
Present the product to the group	Performance
Compare your product to competitors	Interpretation
Group discussion	Critique

While the specific skills and exposure to software are virtually the same as the more traditional linear approach, the iterative cycle allows students to become more familiar with the cycle itself and this integrated view of the process "in-action" will itself be a valuable tool.

We have heard from instructors who have tried this type of approach that the last two steps merge together and, in the worst cases, result in dead-end statements from students such as, "I like it." One of the challenges of adopting this approach is to maintain a distinct separation between the analysis of a presentation, be it a speech or a resume, and the ultimate evaluation of its worth within a given context. For example, a group analysis of a specific logo may reveal that half the class deems it "childish" while the other half sees it as "whimsical." Arriving at that conclusion would be achieved during the Interpretation phase of the cycle. However, when we move onto critique and we look at the company for which the logo was created, say a company that makes computer game consoles designed for adult users, we can then start to make value judgments. That is when we may conclude that a whimsical logo may be better suited than a childish one for specific reasons related to the target audience profile that was part of the initial company profile, and a discussion of how to optimize the graphic could follow.

It is also important to stress that this approach does not need to assume that students are or will be graphic designers. While students' mechanical skills with software and visual design abilities may be limited, the stress here is on process and problem solving. Many of these students will at some point in their professional careers be interacting with experts in marketing and design. One of our goals is to provide them with the vocabulary and communication skills necessary to successfully collaborate with these other professionals, in order to make the most of the expertise around them. Additionally, and just as importantly, by providing information students with insight into a creative process, we will potentially enable them to participate more fully in these partnerships, making a wider impact by bringing their knowledge of information technology into new areas.

6. CONCLUSION

In this paper we have argued that experience and interaction with the arts should play an important role in the education of information professionals, and that this interaction will provide a useful and necessary complement to the more familiar rational, scientific model that currently informs iSchool professional education. We discussed the principles inherent in an arts-based approach to learning in iSchools. We showed how the work done by information professionals is similar to the work done by creative and performing artists, and those in the design professions. Finally, we offered an example of how an iSchool course is being redesigned using these ideas.

We hope this brief account serves as a stimulus for others to consider, debate, and modify these ideas. If an arts-based approach to technical and professional education is to bear fruit, much research and development must be done. In future work we will propose research and practical agendas to carry these ideas forward. The arts are moving in new directions, and information professions are moving into unknown territory as well. As the experimental arts evolve to include digital media, computer animation, computer music, sound art, and many novel combinations [23], so also are the information professions evolving to include unexpected collaborations with colleagues from other fields and opportunities to make contributions across many social and organizational contexts. We believe that the educational approach we have outlined will prepare our students to meet these challenges.

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