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The Importance of Humanities in a Career-Focused Educational Environment

Geoff D. Zylstra
Jill Belli
Candido Cabo
Sean P. MacDonald
Robin Michals
Anne Marie Sowder
Christopher Swift
New York City College of Technology, USA

ABSTRACT

The humanities have the potential to enhance STEM curriculum in career-oriented professional degree programs. As part of a larger college-wide initiative to develop interdisciplinary curricula, the National Endowment for the Humanities (NEH) awarded a grant to New York City College of Technology to explore the relationship between the humanities and career-focused degree programs in STEM departments. This article describes the design and implementation of coursework that bridges the curricular divides between humanities disciplines and technical or career-focused disciplines by bringing the humanities to bear on science and technology-oriented courses. Specifically, the humanities served to improve technical skills for students in STEM-oriented professional degree programs.

Keywords: Career, Education, Humanities, Interdisciplinary, Professional, Skills, STEM

INTRODUCTION

This article addresses ways that the humanities and STEM disciplines, when connected to each other, improve the acquisition of technical skills for students in career-oriented professional degree programs. Focusing on the humanities as conceptual frameworks that foster ways of thinking, communicating, problem solving, and organizing information, faculty at New York City College of Technology designed curricula integrating humanities into STEM courses that focused on career training. While colleges and universities divide themselves into schools and departments that tend to separate disciplines focused on language, theater, art, history and philosophy from career-focused professional programs, these seemingly disparate parts of college education, when brought together, do support each other (Skorton and Bear, 2018). Through the development of this interdisciplinary curriculum, faculty at New York City College of Technology demonstrated that humanities improved the technical skills of students in their STEM courses. In computer science classes, they wrote more effective code. Architecture students designed spaces in more nuanced ways. Students studying photography utilized lighting and framing to more effectively convey meaning. The incorporation of humanities into STEM coursework strengthened curricula and led to enhanced outcomes for students.

The Turn Toward Skill

The importance placed on workforce development is a broader curricular turn happening in public education across United States colleges and universities in the twenty-first century. The philosophical and curricular underpinnings of public college education increasingly prioritize technical skills, jobs and careers for students, and have moved away from principles such as citizenship and democratic participation that have historic roots in disciplines such as literature, history and philosophy. Public colleges and universities now focus on graduating their students with skills to compete in the twenty-first-century workforce.

Historically, public education in the United States emphasized democracy and citizenship. Horace Mann, an early nineteenth-century school reformer who became Secretary of Education in Massachusetts in 1837, argued that, “education should be universal, non-sectarian, free, and that its aims should be social efficiency, civic virtue, and character” (Compayre, 2002/1907, p.26). For Mann, a broad-based public education created republican citizens who could efficiently participate in a democratic society; skills and careers had little to do with producing republican citizens. Sentiments that linked public education to citizenship and democracy guided public education until the end of the twentieth century and were frequently presidential talking points during the Cold War era. For example, President Truman’s Commission on Higher Education directly linked college education to democracy through the report “Higher Education for American Democracy.” After describing several goals for higher education, all of which

connected education to democracy and public affairs, the Commission posited that, "Education is the foundation of democratic liberties. Without an educated citizenry alert to preserve and extend freedom, it would not long endure" (United States, 1947). While the Cold War context for Truman's Commission on Higher Education differed from Mann's, which bridged early American political sentiments and the burgeoning industrial era, the idea that a generalized public education underpinned democracy remained into the late-twentieth century (Nussbaum, 2010).

In the twenty-first century, rhetoric surrounding public education has shifted to that of skills, employment, and economic pathways into the middle class. The Obama administration talked of "building American skills" through higher education and emphasized the relationship between college and jobs (The White House, 2014). Writing about "The American Graduation Initiative," a federal educational program housed in the Department of Labor, Obama announced, "It's time to reform our community colleges so that they provide Americans of all ages a chance to learn the skills and knowledge necessary to compete for the jobs of the future" (Obama, 2009). The Trump administration continued the emphasis on skill and workforce development through the June 15, 2017 executive order focused on "Expanding Apprenticeships in America" (The White House, 2017). The Biden administration launched an "initiative to support career-connected learning and increase job pathways for young Americans." This initiative, entitled "Raise the Bar: Unlocking career success," focused on building bridges between K-12 education, college, and career (U.S. Department of Education, 2022). In the twenty-first century, an emphasis on skills and careers has usurped democracy and civic virtue as the political priority of public higher education in the United States. The turn towards skill has led to new ways of using humanities in college and university education, and at New York City College of Technology faculty utilize humanistic ideas to increase technical skills in their students.

LITERATURE REVIEW

Discourse about the relationship between the humanities and sciences goes back to at least C.P. Snow when he presented "The Two Cultures" for Cambridge University's Rede Lecture. Snow lamented the loss of a common intellectual culture and the development of two distinct academic cultures, one focused on science and the other on humanities. Snow advocated bridging this divide (Snow, 1959). Variations of Snow's concern and attempts to bring the two cultures together have percolated through the academic world since 1959 (Bouterse and Karstens, 2015; Jacobs and Frickel, 2009). More recently, an emphasis on "hard" and "soft" skills has animated the discourse about the importance of humanities in STEM programs. Students in engineering, computer science, and other technical degree programs, learn the "hard" skills from science and technology coursework and "soft" communication and teamwork skills from their humanities classes, all

of which trains them for success in their careers (de Campos, et al., 2020; Idrus et al., 2014). Both STEM and humanities courses provide relevant training to technology-oriented students, but often remain disconnected at a disciplinary level (Skorton and Bear, 2018). The curricular work undertaken through this NEH grant connects the humanities and STEM programs at a more disciplinary level and illustrates the educational benefit of teaching humanities in STEM courses.

RESEARCH METHOD

In order to illustrate how humanities strengthen and serve a central role in the development of skills-based curricula located in professional degree programs, faculty from various disciplines at New York City College of Technology collaborated to design and teach interdisciplinary humanities modules in science and technology courses. These interdisciplinary modules use core ideas from history, literature, and theater - principally the concepts of narrative, setting and spatial theory, and metaphor and representation - exploring their application in career-oriented STEM courses. This article describes six of these interdisciplinary modules, demonstrating how humanities content improves technical skills (Carrell, et al., 2020).

A National Endowment for the Humanities (NEH) grant for faculty development, "Making Connections: Engaging the Humanities at a College of Technology," supported the construction of these interdisciplinary modules (Zylstra, 2013). In the first semester of the grant, the Faculty Fellows participated in a seminar series led by scholars who addressed ways to cross the disciplinary boundaries created by the categorization of education and knowledge into fields of humanities, sciences, and applied technology. One of the external scholars, Dr. Amy Slaton, highlighted the deep cultural roots of this disciplinary divide. Problematizing these cultural divisions can be politically complicated and disruptive because academics tend to focus on intellectual differences that make their fields unique. Committed to changing the stakes in our local context, faculty constructed the seminars to be both intellectually and personally invigorating across disciplines. Each seminar had three objectives: introduce new interdisciplinary concepts; foster relationships between faculty from different disciplines; create a lighthearted, collaborative intellectual environment devoid of disciplinary competition or judgment. These objectives prevented intellectual battles that sometimes accompany academic divisions and cross-disciplinary work. By the end of the first semester, the Faculty Fellows had engaged a variety of interdisciplinary theories and had begun to consider faculty members with whom they might collaborate (Niemelä, 2020).

During the second semester of the grant, the seminar series continued and Faculty Fellows formed cross-disciplinary partnerships with colleagues in order to introduce the humanities into science and technology classrooms. These faculty created curricular modules emphasizing the interconnected nature of the

humanities, science and technology, and worked to break down the boundaries between the humanities and applied disciplines. The core approach, that connections among the humanities, science, and technology enhance the development of skills in career-oriented programs, underpinned the success of these partnerships. These faculty partners treated the humanities as a critical part of the technical education of the students (Zylstra, 2013).

RESULTS

The modules created different types of connections among the humanities, sciences, and technology. Some humanities professors brought the idea of narrative to the design and operation of technology. Others introduced concepts of space, as defined by social theorists, to technical design majors. The concept of metaphor animated several modules as professors emphasized the importance of representation to science and technology-related fields.

Narrative and Technology

The use of narrative, sequencing events or details in a story-telling fashion that contextualizes those events, has value for many types of technological endeavors. Two of the Faculty Fellows participating in the grant employed narrative to help construct effective software or devices. A computer science professor used narrative to improve his students' abilities to write programs. A professor of environmental economics contextualized technologies that collect climate data using environmental and political narratives that enabled electrical engineering students to better understand how the design and use of electronic data collection devices play a role in decision-making about the natural environment.

Narrative and Problem-Solving in Computer Science

For many years, the computer science programs at New York City College of Technology used a standard programming language, Visual Basic, in the college's Problem Solving (PS) curriculum as the context for teaching and learning computer programming concepts and skills. Three complications arose from this approach: first, students experience difficulty translating word problems into computer algorithms; second, most problems proposed to students emerge from mathematics and accounting curriculum, and students at New York City College of Technology lack rigorous math preparation from high school; third, the syntax of computer programming languages often overwhelms first-year students and the obscurity of the programming language distracts students from solving the problems. These complications often resulted in low passing rates and high student attrition (Cabo and Lansiquot, 2014).

To solve these problems, professors from Computer Science and English began using *Alice,* a three-dimensional programming environment that allows student to learn computer programming concepts through the creation of

animations and video games (*www.alice.org*). Prior to constructing the module for the NEH grant, these professors had conducted a large study involving 1,621 students and six different instructors, over a period of six years, showing that the introduction of *Alice* in the curriculum of a PS course increased the passing and retention rates in the course by about 8% (from 70% to 78%) in comparison to the traditional Visual Basic-based PS course (Cabo and Lansiquot, 2014). More importantly, the *Alice*-based PS course did not result in a weaker preparation of students for subsequent advanced computer programming courses.

For the NEH grant the two professors created an interdisciplinary module with the goal of incorporating narrative elements from the previous study in all sections of the PS course. The English professor facilitated this module in two class periods. In the first class the English professor presented students the general elements of plot and drama through Aristotle's *Poetics* and Sophocles' *Oedipus Rex*, and discussed the use of plot and drama in modern videogame narratives (Mayer, 1989). In the second class period students received guidance for the development of characters and videogame narratives. Building on the process of story creation, students individually developed background stories for a video game, writing a three-page narrative that included a protagonist and antagonist and mapped their stories onto the steps of the hero's journey (Campbell, 1949). Students subsequently answered questions such as: Who is the target audience for the videogame? Why should the player care about the protagonist? Finally, students pitched their stories to the class, and the class democratically selected the four or five best stories for further development.

Teams of students used the selected stories for production of a video game prototype using computer programming in *Alice*. Every team delivered a project design document and a video trailer, which they presented to the class at the end of the semester. *Alice* helped students acquire procedural and object-oriented computer programming concepts and skills. Studying literature enabled students to develop engaging stories, which translated to the development of computer programming skills necessary for the production of the video game prototypes. The narrative module provided students taking the PS course with skills to create and write engaging stories, and to integrate writing and narrative elements in all sections of the PS course (Cabo and Lansiquot, 2016).

The efficacy of the narrative modules was assessed by comparing the performance in computer program writing between a control group (n = 182 students) and a group exposed to the narrative modules (n = 202 students). Five different instructors taught these sections in back-to-back semesters. The results indicate that the incorporation of narrative modules in PS courses enhanced performance in computer program writing by varying degrees, ranging from 3% to 13% across sections taught by four instructors. However, there was an 11% decrease observed in sections taught by one instructor (Cabo and Lansiquot, 2016). These results show that integrating narrative elements in PS courses helps students develop computer programming skills, which is consistent with earlier research

(Cabo and Lansiquot, 2014). Overall, this bolsters the overarching concept that integrating humanities elements, such as narrative and storytelling, into technical courses can aid students in developing "hard skills," such as computer programming, within those courses.

Using Satellite Technology to Write Environmental Storylines

Interdisciplinary teaching collaborations that introduce students of one discipline to the concepts, knowledge and methods of inquiry of other disciplines, are designed to encourage students to envision how they might incorporate other disciplinary perspectives into their own course research projects (MacDonald, 2018). Such a collaboration between an economics and an engineering professor enabled electrical engineering students at New York City College of Technology to situate remote sensing technologies used to study global climate change patterns into a broader environmental and economic context. Introducing students in an Electrical Engineering Technology course that focuses on satellite technology to the diverse methodologies of economic analysis encouraged them to identify how subtle changes in satellite technologies that are used to transmit data about the Earth, can meaningfully inform environmental policy. The broader humanistic context for the data, the story surrounding the numbers, created a feedback mechanism that enabled engineering students to design more specific technologies.

The value of the approach adopted in this module is reflected in a number of arguments for the inclusion of social science and humanities perspectives in STEM education (Szu and Yu, 2017; Fawzia and Karim, 2024; Coyle, et al. 2006). Hynes and Swenson (2013) observe that while “engineers apply mathematics and science knowledge in their work…(they) navigate a wealth of social science and humanities knowledge and skills in the engineering and design of solutions” They point to an essential foundation of engineering – that the end product should be “useful to people” (p.3).

For the engineering students participating in this module, synthesizing and transferring knowledge across disciplinary boundaries and placing the technology into a broader storyline gave them a comprehensive understanding of data collections technology. As a result, students visualized how the technical study of satellite data transmissions connected with a wider range of information about climate change and the development of policy.

To establish some background for an understanding of the issue of climate change policy and its connections to the subject matter of the Remote Sensing course, the economics and engineering professors began with an overview of the historic storyline of CO_2 emissions over the last century. This description of CO_2 included the ways it enters the atmosphere, graphics showing the plant and ocean sources that absorb and store CO_2, the distinctive growth trend in concentrations globally since 1960, and emissions totals from the five largest CO_2 emitting nations over the last fifty years. This overview then enabled students to place engineering and data collections technology into the broader narratives of environmental

change and policy development. By situating data into historical and geographic narratives, students were able to recognize the meanings provided by the data obtained from satellites (Yıldırım and Selvi, 2016).

After placing the satellite data relaying measures of ocean surface temperatures, soil composition, climate patterns, levels of various greenhouse gas emissions, and other data (NASA, 2015 and 2016) into narratives of change, the class explored existing and proposed climate policies with the goal of evaluating and critiquing the relationship between policy and historical changes to carbon-based climate change (Atkinson and Hackler, 2010). When studying policy, the class examined how agencies such as the National Oceanic and Atmospheric Administration, the U.S. Department of Energy, and the Environmental Protection Agency played a central role as both repositories of climate data and as institutions that prepare extensive scientific research reports that inform policy.

Through this exercise, students were able to make important connections between the technological sources of data and the formulation of policy--between remote sensing instruments that collect data and the significance of that data to policy making organizations. Students discovered that these data collection devices are not only intricately designed sets of circuits, but also critical data sources used for formulating and writing environmental policy. The narrative approach presented in this module guided students to make the step-by-step connections between the technical aspects of their study of remote sensing instruments and the recognition of how these scientific and technological mechanisms play a vital role in the crafting of environmental policy.

Producing Spaces and Crafting Settings

Two Faculty Fellows constructed modules emphasizing concepts of social space. Specifically, these faculty focused on how the organization of social spaces produces certain kinds of interactions, and how, in turn, through the occupation and use of public and private environments people can reinscribe space with new meanings, ideologies, and purposes. According to Henri Lefebvre and other theorists, space is never neutral: the act of occupying and functioning in social spaces reifies value systems (Lefebvre, 1974/1991). In turn, the design of a particular architecture, landscape, or streetscape reinforces values onto the individuals who occupy or pass through that space. Because architects play such an important role in shaping the spatial experiences of people's lives, these two Faculty Fellows brought humanistic ideas about space from the study of literature and drama or performance into architecture courses at New York City College of Technology. These modules introduced architecture students to spatial practices enacted by performance artists, writers and activists who highlight the social experience of urban space.

Designing Happiness: Considerations of Well-Being in an Architectural Technology Course

Emphasizing rhetorical and ethical considerations of well-being, the good life, and the happy city, an English professor brought humanistic conceptions of space and setting into an upper-level Urban Design course for students pursuing a Bachelor's degree in Architectural Technology. Co-taught by two Architectural Technology faculty members, the course synthesizes urban planning, architectural design, environmental sustainability and historic preservation. The interdisciplinary module focused on site-specific projects in New York City, and culminated in a team project that conceptualized and designed buildings for hypothetical clients who requested buildings responsive to the preexisting local context.

A variety of interdisciplinary and theoretical perspectives informed the design of this module. The English professor's scholarship explores the rhetorical, ideological, and pedagogical consequences of society's renewed interest in promoting happiness, and she placed this phenomenon in conversation with utopian studies. She worked to present the idea that rhetorical, conceptual, and creative values underpin the choices architects make when they design spaces, and that these design choices contribute powerfully to the contours of social relations.

The English professor began the module with a seminar focused on discussions of Charles Montgomery's 2013 book *Happy City: Transforming Our Lives Through Urban Design*. The initial class session introduced the notion of creating the "happy city" and presented the possibility of designing for well-being. Students explored how designed spaces and places produce psychological, social, and behavioral effects on their inhabitants, and influence how people feel and interact with one another and the environment. After introducing *Happy City*, the professors organized case studies of both Industry City in Brooklyn and the city of Somerfield, Massachusetts. Using census data from Somerfield, students looked for the implementation of well-being in the city's policies by studying how planners responded to new census questions that focused on happiness. The English professor used this case study to raise questions about the relationship between happiness and urban design, asking about city services, government involvement in design, and conflicts between individual and communal well-being.

Building on these considerations, the class then examined a museum exhibit at the Museum of Modern Art (MoMA) entitled "Uneven Growth: Tactical Urbanisms for Expanding Megacities." This exhibit focused on rising inequality in highly populated cities and addressed issues such as scalability, affordable housing, homelessness, urban renewal, gentrification, consumerism, and depletion of natural resources. The exhibit offered a particularly interesting convergence for an urban design class re-imagining a specific site within one of the "megacities" listed in the exhibit (New York, Istanbul, Rio de Janeiro, Mumbai, Hong Kong, and Lagos), providing examples of how architectural solutions can address urgent

crises such as overpopulation, scarce resources, and rising inequality (Museum of Modern Art, 2017).

In all aspects of the module, the importance of design to social relations superseded the treatment of building aesthetics devoid of people. It encouraged students to use humanistic thinking, to view themselves not just as architects but as citizens and rhetoricians, and to design for human possibilities. This humanistic approach to architecture foregrounded how design weilds power and conveys ideology. Students leaned how the buildings and cities architects create reflect values that have real-world impact and far-ranging implications for the well-being of their inhabitants. The architecture students responded enthusiastically to humanistic considerations of emotion, well-being, and value in their largely technical field. The module empowered the students to see themselves as creators of meaning and to link architectural work with social and cultural issues. This collaboration among professors in the English and Architectural Technology departments increased student awareness of architecture as a humanistic and social discipline in which architects impact emotions, experiences, meaning, and well-being with their designs.

Performing Architecture

Continuing the focus on space as a social product, a performance studies professor from the Humanities Department developed a module that elucidated the interdisciplinary connections between theater and architecture. In this module, he collaborated with a professor from the department of Architectural Technology, and explored abstract spatial theories familiar to both fields: enclosure, movement, direction, technology, and audience. For an upper-level Architectural Technology course, they analyzed the spatial aspects of theater performances in order to generate isometric and 3D design models relevant to architects. The humanities professor provided architecture students with opportunities to understand space from the non-specialist, or user's, perspective, rather than from the perspective of a trained designer or urban planner. In this vein, he assigned readings from Jacques Racière (2009) and Bernard Tschumi (1996) to help the architecture students consider space as a social construction—symbolic, reusable, and part of wider networks of power, action, and belief (de Certeau, 1980/1984, pp. 98-99).

Working over five two-hour class periods, these professors presented theoretical concepts to the students in the first hour of class, followed in the second hour by applying these concepts to the architectural design of everyday space. For example, these professors presented the Belfast, Ireland enactment of "Kaleidoscope" to the students, asking them to utilize what they saw in the performance in an architectural project. "Kaleidoscope" is a site-specific, participatory performance that breaks down urban divisions and hierarchies by engaging residents in a multi-sensory, narrativized movement through the spaces of the city (Prime Cut Productions, 2013). This interactive dramatic performance contextualizes Belfast as a site of colonialism, religious division, and violence,

paying particular attention to the ways in which these historical events spatially encoded the city. One architecture student, impressed by the political history of Belfast and the "way people experienced the space through theatrical street interventions," explained that "space itself might be performed in diverse scales, such as time vs. distance, or time vs. direction, or velocity vs. time." After watching the performance, students diagramed public spaces based on the social uses of spaces that they observed in the performance.

Through the performance module these two professors introduced students to novel ways of seeing and experiencing space, and the new curriculum supported students' imaginative exploration of projects, while meeting the objectives of the department. The Architecture professor commented that the "module sharpens the students' ability to work with abstraction and enhances their understanding of mapping and diagramming. The module adds value in three important ways: conceptually, graphically, and in terms of increasing reading and verbal skills." By facilitating the transition from theory to praxis, architecture students used intersections of the disciplines to create spaces that better consider the users (Dwyre and Perry, 2015).

How Representation can Help On-the-Job Performance

Elaborating on the praxis theme developed by the humanities professor who brought theatre into an architecture class, two other faculty fellows designed modules that used representation to provide students with everyday on-the-job skills. Representation is typically conceived as an abstraction of a more tangible source--the sign of a referent or the vehicle to a tenor, for example--and less important to students of technology than studying the physical operation of a device. However, the creation of meaning, whether through technology or in the management of technology, often needs to be taught at the same time that professors teach students to construct or operate that technology. In the following two modules, photography and construction management professors used representation to better prepare students at New York City College of Technology for their careers.

Moving beyond the Literal: Using Metaphor in Photography

In 1985, having the skill to prepare paste ups and mechanicals, physical manipulations of images, could win a job applicant an entry-level position in the communication design profession. By 1990, the same applicant needed the ability to use Quark or other desktop publishing software. In 1995, after further technological changes, entry-level communications design positions demanded basic HTML skills. Today, neither Quark or HTML are particularly useful in communications design. The pace of technological change in the communications design fields requires faculty to think expansively about skills and abilities that will help students not just the year that they graduate but 10 and 30 years beyond graduation. Considering this problem, a communication design professor designed

a module for her Advanced Photography Studio that uses poetry and art history to help students compose photographs that contain layers of meaning.

In Advanced Photography Studio, an upper-level elective, students produce the staples of commercial photography: product shots, still lifes, and portraits. Within the overall curriculum, the course supports portfolio development for students. Ideally, the third and fourth-year students enrolled in the course use the imagery they produce to construct portfolios they will present to prospective employers. The quality of this portfolio determines if graduates secure employment in the field. The objectives of this course simultaneously address meaning-making, conveying ideas and emotions through image creation, and technical elements of the profession such as lighting design and framing. However, in this course, technical flaws do not generally mar student work. Students easily learn the technical aspects of lighting design trough online tutorials. Instead, literal and clichéd thinking tarnishes student work and limits the development of their portfolios.

To motivate increased creativity and innovative thinking in photography, the professor designed an interdisciplinary module to improve her students' ability to interpret images and subsequently create meaningful imagery. She used poetry and art history to explore metaphorical themes that students subsequently applied to photography. Beginning communications students tend to take photographic imagery at face value. When analyzing photographs, students identify the subject matter in the image but have difficulty interpreting the intention or message of the photographer. Students know a heart shape connotes love but cannot often make the leap from simple and clichéd symbols to more subtle or elaborate representations. Few students in Advanced Photography Studio can interpret a melting ice cream cone as symbolic of the disappointments of childhood. By studying representations present in poetry and historical images, students honed interpretive skills that enabled them to become more effective at creating images that used not only content but also lighting and framing to convey layers of meaning.

To start the module, the professor introduced a central metaphor from the history of photography to the class in the first week. "Mirrors and Windows*"* is a well-known photography exhibit, curated by John Szarkowski, at the Museum of Modern Art in 1978. This exhibit presents viewers with the thesis that photographs operate as either mirrors reflecting the photographer or windows opening to the world outside. The class read portions of the catalog essay by Szarkowski and wrote short informal thought pieces in which they identified particular photographs as mirrors or windows and defended their assertions. All students in the class easily recognized this pre-defined metaphor and used it to make distinctions between images, allowing them to interpret images in less literal ways (Szarkowski, 1978).

The next step encouraged students to create a visual image in a set style that conveyed a pre-defined metaphor. In week four of the semester, the class examined seventeenth and eighteenth-century Dutch still life painting, classic

examples of the use of metaphor in the visual arts. Sometimes called "vanitas," these paintings include meticulously rendered imperfect fruits and flowers that artists used to evoke life cycle and human mortality (Ojeda, 2020). The following week, students worked in groups to create their own vanitas themed photographs. The students who struggled with this assignment simply imitated the form of the vanitas. These students reproduced the paintings in photographic form without touching upon the driving metaphors of life and mortality. The most successful group grasped the metaphor of mortality behind the vanitas tradition and composed a photographic image that juxtaposed dead flowers with several brilliantly orange clementines. In the subsequent critique of this image all the students recognized this photograph as the strongest response to the assignment.

Following this exercise of photographically modelling representation in Dutch paintings, students created their own visual metaphors in a more loosely defined structure. The professor worked with a writing instructor to develop an assignment connecting metaphor in poetry to representation in photography. The class read, discussed, and wrote about two poems, "she being Brand" by E.E. Cummings and "Coming Home, Detroit, 1968" by Phillip Levine. Each poem uses the metaphor of a man driving a car through a city but in different ways. The first, with its humorous, raunchy allusion to a sexual experience, and the second, with its mournful consideration of a city after race riots tore it apart, were both directly relevant to the students' experiences. The class easily engaged the themes in both poems and after a class discussion, students wrote blog posts comparing and contrasting how the central metaphor of driving a car worked in the two poems but also produced different meanings.

The professor then asked her students to photograph a toy car as a way of creating six images that conveyed the following: danger, freedom, fun, luxury, pleasure, and speed. When faced with a small plastic car and a blank shooting table, the students initially found this a daunting assignment. In order to successfully complete the assignment, they needed to use technical skills in order to convey emotional messages. Over a two-week period, students transformed the toy cars from literal items to objects that communicated emotion through the use of lighting, composition, and angle of view. Prepping the students for this project by reading poetry opened them to thinking more broadly about producing meaning through the presentation of the subject matter instead of assuming inherent meaning in objects. By looking at poetry first, and not photography, the class thought about conveying meaning before considering photographic technique. The ability to understand and use metaphor trains students entering the communication design field to express visual ideas in fresh ways. Effectively conveying meaning through imagery is an ability that will stay relevant as technology changes.

Representation, Narrative and Creative Problem Solving for Construction Management and Civil Engineering Students

Continuing to use the theme of representation, but applying it to a different set of workplace skills, a construction management professor developed an interdisciplinary module that helped her students practice innovative ways to handle complex on-the-job management situations. The larger objective of this interdisciplinary module was to provide students alternative paths to problem solving. Rather than confining students to the skills memorized during conventional technical classes, students developed abilities to creatively process situations and arrive at appropriate technological solutions. Construction Management and Civil Engineering (CMCE) professionals are managers and communicators who face novel social and technical situations as part of their daily work flow. Navigating collaborative as well as technically correct solutions is a critical skill set that every successful professional must possess. A strong ability to analyze a situation, build a narrative to explain it, and represent that narrative, both verbally and in writing, to other professionals achieves these outcomes (Snyder and Snyder, 2008).

The design of the interdisciplinary module for Construction Management took inspiration from the observation that, at an informal level, students capably solve construction management problems. However, students lack practice translating their grasp of problem solving into professional or academic situations (Caeiro-Rodriguez, et al., 2021). In a common class exercise, students view a still image taken from a disaster movie that shows havoc wreaked upon a badly damaged city. Students are asked simply to "respond" to the image using what they have learned as CMCE students. Over two semesters of running this exercise, students consistently responded to this informal assignment with insightful feedback about the engineering problems presented by the chaos, the unlikelihood of a full recovery, and the kinds of coordinated efforts required to rebuild the city in the aftermath of the disaster. In contrast, over the same time period, when asked to answer similar questions in a more formal paper, report or presentation, similar to what would be required on the job, students consistently responded with incomplete, unengaged work that failed to meet the content requirements. They lack the bridge skills--a set of cognitive strategies--to translate their insights and corresponding solutions into professional or academically appropriate presentations (Jackson, 2015). This interdisciplinary course integration provided these bridge skills through humanities strategies including writing, creative expression, and performance (Collins, 1996).

The module's methodology exposed students to role playing activities derived from acting exercises that encouraged students to think in terms of symbolism and narrative production. Using four class periods, the professor introduced narrative-building skills to students through responses to unfamiliar scenarios inspired by improvisational theater. In one activity, the students faced a contentious professional problem that involved design and management error, and

were asked to act out a responding position which they later justified in formal writing. In another activity, they role-played a negotiation in a *Survivor* style improvisational game in which students win by forming alliances and voting out their fellow classmates to find the culprit of an imaginary act. In these role-playing activities, students broke down the work-place scenarios into discrete parts, each of which had a distinct meaning. They responded in writing by communicating the significance of each component of the role-playing activity. Professionals in the CMCE industries must be independent problem solvers with excellent communication and decision-making skills (de Campos, et al., 2020). Past attempts at similar exercises without the focus on humanities techniques exposed deficiencies in education based on memorization of skills. When the course emphasized book-learning from texts, students lacked the ability to apply their learning. After focusing on narrative and representation through improvisational role playing, students more effectively organized and formally communicated technical information in a meaningful way (Hanna, et al., 2016).

DISCUSSION AND CONCLUSIONS

The curricular modules described in this paper demonstrate that humanities have value in the context of career-oriented majors that emphasize technology. When professors and students treat the humanities as conceptual frameworks that foster ways of thinking, communicating, solving problems, and organizing information, then the humanities appear highly relevant and important to skills-based professional education. By incorporating humanistic inquiry and methods into courses focused on science and technology, professors can increase the repertoire of technical competencies that graduates bring from college into the workplace. The turn toward skill that emphasizes instrumental education and devalues the humanities runs the risk of siphoning real-world skills away from college graduates.

When used conceptually the humanities appear highly relevant and important to curriculum in skills-based professional programs. As shown by the interdisciplinary modules introduced into six different technology-oriented courses discussed above, the application of intellectual tools from the humanities increased students' abilities to master important components of their disciplinary curriculum. The concept of narrative proved useful to students in computer science and electrical engineering courses. Ideas about space and setting brought from theater, writing and rhetoric, and literature into architecture courses better enabled students to consider design, buildings, and cities from the users' perspectives. When professors emphasized representation and metaphor in photography and construction management students more effectively applied skills to situations they would daily encounter in their professions. The humanities improved the prospects of these career-focused students in professional degree programs.

As public education in the US turns toward skill, the fact that humanities themes and curricula will help educate students in career-focused degree programs should be part of the political conversations related to educational funding and skill-based curricular development currently happening in the US. An interdisciplinary educational environment that emphasizes the interconnections between humanities and STEM disciplines, instead of prioritizing differences, improves the skills and long-term prospects of professional and career-focused students. The turn toward skill should reflect the importance of the humanities to students who use college as an educational step to a technically-oriented career.

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GEOFF D. ZYLSTRA, PhD, is an Associate Professor of History at the New York City College of Technology. His research explores ways that technological developments related to space and social arrangements in cities. In his teaching, he uses history and theory to help students understand the social and cultural contexts of their technologically-oriented careers.
Email: gzylstra@citytech.cuny.edu

JILL BELLI, PhD, is an Associate Professor of English at the New York City College of Technology. Her interdisciplinary research bridges well-being, utopia, pedagogy, writing studies, medical humanities, nature, the occult, and grief. Her teaching incorporates these topics in composition, literature, professional and technical writing, and digital humanities courses.
Email: jbelli@citytech.cuny.edu

CANDIDO CABO, PhD, is a Professor of Computer Systems Technology at the New York City College of Technology/CUNY. He is also a member of the doctoral faculty at the CUNY Graduate Center. His research interests include computer science and engineering education and the use of computational models to understand and solve problems in biology.
Email: ccabo@citytech.cuny.edu

SEAN P. MACDONALD, PhD, is a Professor of Economics at the New York City College of Technology. Her research focuses on sustainable economic development and interdisciplinary education. Her current project studies the effects of including data collection and analysis assignments on students' quantitative reasoning skills.
Email: SMacdonald@citytech.cuny.edu

ROBIN MICHALS, MFA, is a Professor of Communication Design at the New York City College of Technology. She is a photographer who specializes in dance

and performance. Recent clients have included the Queensboro Dance Festival, the International Human Rights Arts Festival, and the Isadora Duncan Dance Foundation. Recent images have been published in Time Out, Critical Dance, The Queens Chronicle, and the Brooklyn Paper.
Email: rmichals@citytech.cuny.edu

ANNE MARIE SOWDER, PhD, is an Assistant Professor of construction management and construction engineering at the New York City College of Technology. Her research focuses on interdisciplinary modeling of successful post-disaster rebuilding efforts using archival data and reality capture techniques. Her teaching explores construction project development with emphasis on team building, professional practice, and ethics.
Email: amsowder@citytech.cuny.edu

CHRISTOPHER SWIFT, PhD, is an Associate Professor of Theatre at the New York City College of Technology. His research focuses on medieval performance and devotion practices, puppetry, and theatre architecture. His 2023 book *Ritual, Spectacle, and Theatre in Late Medieval Seville* received the Bevington Award for best new monograph in Early Drama Studies. As a teacher and mentor, he works with students on interdisciplinary performance projects that explore relationships among texts, historical technologies, and innovative uses of media.
Email: cswift@citytech.cuny.edu

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