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Humanities-Driven STEM— Using History as a Foundation for STEM Education in Honors

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Abstract: Humanities have traditionally played a limited role in STEM education, yet their natural connections may be used to enrich academic understanding and student experience. Authors explore their mutuality by presenting an interdisciplinary curriculum, Humanities-Driven STEM (HDSTEM). Unlike other iterations of blended disciplines, HDSTEM provides students with abilities and knowledge to go beyond the acquisition of soft skills toward humanistic, often artistic, creative problem-solving and innovative thinking. A pilot HDSTEM course offered through the first-year experience program is described. Authors outline its development, implementation, outcomes, and evaluation, positing humanities at the forefront as the impetus and lens for contextualizing STEM research and discovery. Challenges and implications for future development beyond first-year experience are presented.

Keywords: multidisciplinary practices; interdisciplinary education; teaching teams; curriculum planning; National Endowment for the Humanities

INTRODUCTION

Institutions of higher education have long recognized the benefits of a multidisciplinary approach in pedagogy, research, and curriculum. Students choose a discipline, they take most of their courses within that discipline, and they take a few courses from other disciplines. The courses outside their discipline provide the "multi" in the multidisciplinary approach. However, we posit that this type of multidisciplinary approach is flawed. While students get exposure to topics outside of their discipline, it is up to them to connect the dots, draw conclusions, and determine why a class or discipline outside of their focus is relevant to their proposed course of study. They may have no idea how these topics prove even remotely important to their education and ultimately useful to their chosen profession. Science, technology, engineering, and mathematics (STEM) students often remark, when taking something like an art history course, "I have to take this course to graduate." This type of comment speaks to the perceived divide between the sciences and the humanities elucidated by C. P. Snow in his 1959 Rede Lecture at the University of Cambridge, later published in expanded form as the well-known book *The Two Cultures and The Scientific Revolution* and a second volume, *The Two Cultures: And A Second Look* (Snow, 1963). The Disraeli-esque "impassable gulf" between the sciences and the humanities is a constructed one. Snow's observation that the accusation leveled by humanists against scientists as uncultured was hypocritical since very few humanists could explain the laws of thermodynamics or the relationship between mass and acceleration. Snow criticized the British emphasis and investment in humanities education in the nineteenth century as having hindered the scientific and technological prowess of the nation as compared to the more even-handed, equitable focus on both the sciences and humanities in the United States and Germany that led to their primacy in the Second World War. Snow is not wrong in his assertion, but one might argue that during the Cold War, especially with the advent of the Space Race, the United States tilted the balance heavily toward STEM fields as employment, practicality, and pragmatism began to heavily influence secondary and higher education. Snow's second book introducing the possibility of ameliorating some of the divide and breaking down the silos—along with works such as Kuhn's *The Structure of Scientific Revolutions* (1970), Brockman's *The Third Culture: Beyond the Scientific Revolution* (1995); and Gould's *The Hedgehog, the Fox, and the Magister's Pox* (2003)—allows space for an HDSTEM pedagogy. However, while philosophically scientists and humanists may agree that walls must be torn down and welcome signs posted along the borders, very little has been done to create a borderland where the arts and humanities and STEM fields might inspire and inform one another.

The challenge for higher education and honors programs/colleges is to engage STEM students more holistically by demonstrating to them explicitly why arts and humanities courses outside their discipline will fundamentally inform their identities as scientists and engineers, emphasizing their humanness in that process and confirming the role that empathy and ethics play in understanding the responsibility of both scientist and science, inventor and invention. To meet this challenge, the Texas Tech University (TTU) Honors College has developed interdisciplinary team-taught courses that use the humanities as a foundation and integrate STEM concepts and principles. This approach has been coined Humanities-Driven STEM (HDSTEM).

BACKGROUND

Before considering how STEM has been integrated within arts and humanities education with HDSTEM, we need to consider the differentiation between a multidisciplinary and an interdisciplinary approach. Multidisciplinary approaches to education are the more traditional methods used in K–12 to higher education. Disciplines are taught separately with little interaction between them (Ertas, 2011). Science classes are science classes, math classes are math classes, art classes are art classes. The general philosophy on making a well-rounded student appears to rest on the notion that if students take a set of classes that include science, math, reading, humanities, and art, they will have appropriate exposure to a variety of areas. The connections between these fields, their overlap, or even how scholars, artists, philosophers, writers, scientists, and engineers may have been inspired by one another is not central to the typical pedagogical approach in K–12 or even in higher education. In higher education especially, more focus is given to a student's major discipline (Gibbs, 2017), resulting in what many have termed the "silo effect."

Interdisciplinary approaches integrate disciplines or work in between the disciplines, removing the walls of separation. For example, the study of the production of electrical energy would cover several disciplines, all of which work together for the result of that energy production. Physics, mathematics, chemistry, and energy are needed to understand the theory and create the means for electrical energy production (Çinar, Pirasa, Uzun, & Erenler, 2016). Interdisciplinary education can be linked with similar or related disciplines within STEM, but they can also be further expanded. For example, connecting STEM approaches with arts and humanities introduced an extension beyond the theories, axioms, and theorems of the scientific fields. Approaches like STEAM (STEM with the arts), STREM (STEM with reading), STEMM (STEM with music), and STREAM (STEM with arts and reading) allow for interdisciplinary education beyond the more traditional STEM disciplines by including discussion or engagement with non-STEM disciplines. All the "STEM with" approaches include arts and humanities, and while they may offer some variety and breadth to the dissemination or communication of STEM ideas, the integration has primarily been limited to benefitting the STEM disciplines. The main purpose of the "STEM with" approach is to improve the innovative problem-solving and creativity of STEM learners (Perignat & Katz-Buonincontro, 2019) while the arts and the humanities are an elaboration technique rather than a foundation for learning and understanding content. Further, the overlapping connections are not made to back up what is distinctly taught (Sochacka, Guyotte, & Walther, 2016), leaving out the social analysis, enrichment, and advancement that the arts and humanities provide. In essence, these "STEM with" approaches have not fundamentally transformed understandings of STEM discoveries; they have not changed the ways we do STEM research, empathize with the "consumers" of innovation, nor re-negotiate the roles and responsibilities of scientists and engineers in defining what it is to better the human condition. HDSTEM proposes, by placing humanities as the driving force and context of STEM studies, to reinsert the human—human need, desire, creativity, aesthetics, play, diversion, strength, and vulnerability—back into the realm of scientific curiosity and discovery.

Interdisciplinary courses have generally been more possible in honors curricula. Often, the flexibility of honors colleges has allowed for more creative and innovative approaches to fulfill core curriculum and major requirements. Mullins (2012) details the interdisciplinary efforts at the University of Alabama-Birmingham (UAB) starting in 1983. The UAB Honors Program has implemented annual interdisciplinary courses that blend courses within and between disciplines, multiple STEM disciplines connected to each other and to the arts and humanities while meeting academic core requirements for UAB graduates (Mullins, 2012). Academic core requirements provide a good guideline for implementation of interdisciplinary courses, particularly those that broaden the focus of learning and that privilege the education of well-rounded students who can operate outside their major. This well-roundedness and breadth of reading are key to a liberal arts education but also play a role in the preparedness of students who seek to enter the workforce or who choose to pursue continued education.

In an ever-changing world, students must be able to navigate, explain, and communicate the myriad situations they will encounter after they graduate. Cundall (2012) discusses an interdisciplinary course at Arkansas State University that provides this more comprehensive approach to the current state of science by using humor as a pedagogical and methodological tool.

Humor and laughter, universal emotions and reactions, can provide multiple perspectives that cross the disciplinary lines between philosophy, psychology, biology, neuroscience, medical science, literary studies, and sociology. This interconnectedness through satire, irony, and humor provides a means to engage and develop open-minded, multi-skilled students and prepares them with an understanding of disciplinary depth and interconnections (Cundall, 2012). Brock (2008) also discusses an interdisciplinary course, The Sun: Earthly and Heavenly Reflections, which uses the sun as the central theme and primary focus. This Eastern Kentucky University course attempts to humanize the sciences by blending them with English, history, philosophy, and religion, positing that science literacy can be gained in a humanities context (Brock, 2008). A common, perhaps unorthodox, theme like humor or the sun provides many entry points into discussing and engaging a variety of fields and disciplines.

Blended disciplines, or subfields, can provide an arena for an innovative pedagogy as well. Biochemistry, the blend between biology and chemistry, allowed Williams (2012) and his team to introduce an interdisciplinary course at Western Kentucky University that is project-based and tasks biology and chemistry students with examining a disease from different perspectives: clinical, biological, chemical, historical, and societal. Having to engage with multiple and multi-layered interventions to understanding disease challenges pre-health professional students in the course to make connections with real-world problems in the health industry (Williams, 2012). While not explicitly labeled a biochemistry or microbiology course, a course titled "The Coming Plague," an honors course at the University of North Dakota, brings together historical and cultural perspectives on epidemiology while detailing scientific advancements to combat the spread of disease (Carmichael, 2008).

Beyond meeting core requirements, discussing common themes, and detailing the possible intersections of seemingly unrelated fields, interdisciplinary courses can also be developed as writing intensive or communication literacy courses, thus providing the all-important teamwork and the interpersonal and communication skills so valued by graduate and professional schools and employers. Charpie and Shea (2006) detail a syllabus for a course titled "Science and Writing" at Southern Connecticut State University where students critically analyze language and writing about the sciences. Courses like these offer students the opportunity to experiment with different tones and timbres of technical writing, scientific writing, popular/digital/social media writing, and academic writing for a broader audience. Along the same lines, Wiegant, Boonstra, Peeters, and Scager (2012) detail team-based learning that is centered on complex writing assignments.

DEVELOPMENT AND IMPLEMENTATION OF AN HDSTEM PROGRAM

To increase the connectedness of interdisciplinary learning, the TTU Honors College piloted the HDSTEM program with its first-year students in 2017. Interdisciplinary teaching and courses are a mainstay of the TTU honors curriculum, which has offered previous and current Integrated Science courses that expose non-majors to the sciences and illustrate the connections between disciplines (Wilhelm, 2008). HDSTEM uses the arts and humanities as the driving force, language, and lens in the classroom while homing in on the role of STEM advancement and implications in different historical moments. By making arts and humanities the foundation of HDSTEM courses, students (both STEM and non-STEM) are taught how STEM is not a set of silo-ed, non-human, or de-humanized fields but rather is driven by a need for deeper understanding of the human condition in order to improve or benefit or discover the world in which we live. With HDSTEM, students must not only think critically about what has driven history forward (or backward as the case may be) and how scientists/engineers and their works have contributed to that process of thesis/antithesis/synthesis, but they are also encouraged to consider their education beyond career training in order to contextualize the links between disciplines and the eventual breakdown of disciplinary barriers. This agenda speaks directly to the honors college's dedication to a modern liberal arts approach that brings together the classic trivium and quadrivium even as it expands to include the hard sciences and new fields in technology, business, engineering, health, culture, and politics.

In fall 2017, the honors college piloted the first course for the HDSTEM program—War, Machine, Culture, and Society: History and Engineering in the Second World War—within the honors First-Year Experience (FYE) program. This course has been offered in three fall terms, 2017–2019, always team-taught by a historian and an engineer. The course explores how history, literature, philosophy, and cultural studies can drive the teaching and framing of engineering concepts, providing a structured approach for teaching scientific and engineering concepts in a humanities-based context. The Second World War pushed humans to their extremes, from their most courageous and hopeful to their most destructive and hateful. This historical backdrop, juxtaposed with the developmental processes of transitioning from high school to university, provided an ideal framework in which to assess students as they negotiated educational identities and empathy. Questions that they considered included: How do we negotiate progress, technological advancement, scientific knowledge, and the rhetoric of propaganda with ethical questions of compassion, tolerance, courage, and integrity? How do we understand who we are as human beings, what our responsibilities are to one another, and how connected and disconnected we are from each other?

During the semester, students learned about the "total war approach" in which home front and war front became interchangeable. Advances in technology and warfare illustrated how engineering can alter the physical and chemical landscape. Students learned how society grappled with difficult engineering decisions, such as the ethics of applying knowledge gained from unethical, immoral beliefs and practices or considering the impact of scientific/engineering discoveries applied in unconventional or unintended ways. In the first third of the course, students examined the combined historical, environmental, and technological preconditions of WWII, including contextualizing WWI and the interwar period; they examined (1) the design and manufacture of war technologies; (2) changes to soil, air, and landscape due to gas warfare, entrenchment, and the ecological price of a war of attrition; (3) the U.S. context of the Great Depression and American isolationism; and (4) the European context of ultranationalism. Next, students explored the ways that fascist and Nazi regimes employed new technologies and inventions for mass dissemination of propaganda and populist messaging as well as the methods by which these parties manipulated "scientific" knowledge to their own ends of racism, nativism, eugenics, and ultimately genocide. Students also discussed the socioeconomic and political contexts and how these contexts influenced the engineering problems that resulted such as the conversion of factories originally designed to serve basic societal needs into those that assembled weapons and war materials. In the final section of the course, students studied the aftermath of the war, including the engineering of the military-industrial complex in the U.S. and the many technical, technological, and environmental problems associated with rebuilding Europe. Students ended the course by linking these engineering problems with the socioeconomic, cultural, ecological, and political consequences of WWII, including the consumer boom, suburbanization, permanent militarization in the U.S., the Holocaust, Cold War divides, the end of imperialism, and economic consolidation in Europe.

RESULTS AND DISCUSSION

In the three fall semesters that War, Machine, Culture, and Society: History and Engineering in the Second World War has been taught, the breakdown of declared majors has included 47% science, 40% engineering, and 13% arts and humanities. The racial/ethnic and gender diversity of the class has been impressive as 46.7% of the students have included underrepresented minorities or women. To date, 70 students have enrolled and successfully completed the course.

The class has encouraged students to question how they approach their education and asks them to consider the interconnectedness between STEM and the humanities by challenging conventional discipline-based learning. An analysis of the course evaluations, student interviews, and surveys have shown an overwhelmingly positive reaction. On course evaluations, over 96% of students "strongly agreed" that the course was a valuable learning experience, and the other 4% "agreed." A typical comment pulled from the course evaluations mentioned the impact of understanding how history and the humanities can be connected to STEM areas and how the humanities often define the human need for scientific and technological advancement.

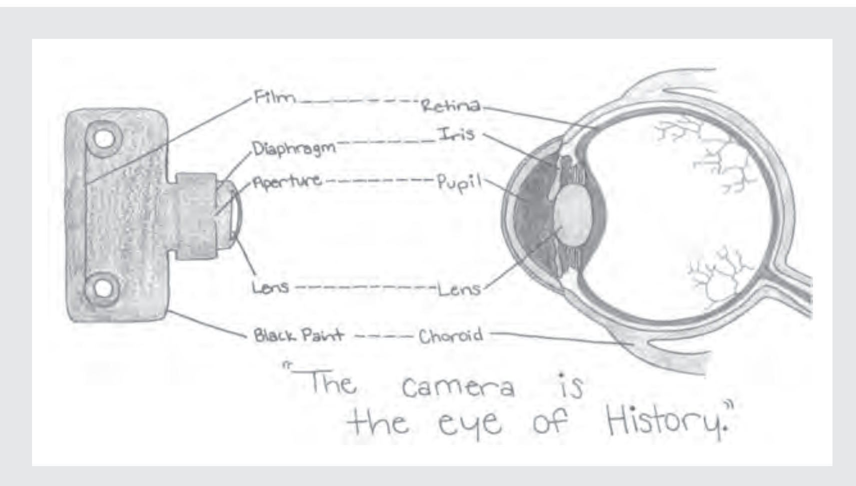
While many factors can skew course evaluations, from expected grades to instructor preference, the validity of the result that the course was a valuable experience is bolstered by voluntary surveys and interviews. One interview participant stated, "I didn't think there were any connections between humanities and engineering, those are two different things . . . those two subjects, you wouldn't think they co-mingle, but they actually do in how you build it." Another interviewee remarked, "[HDSTEM] tries to show the science wouldn't exist without the history or the history wouldn't be this way if the science wasn't there to back it up . . . we're encouraged to think like an engineer, but also as a historian."

Work artifacts in the form of reflective journals, interdisciplinary assignments, and course projects have shown students recognizing the connection between the humanities and STEM. Along with this recognition, students were creative in crossing disciplinary lines. When asked to reflect on class discussion, readings, and assignments, some STEM students chose to communicate their reactions, digestion of knowledge, and intellectual ponderings through artwork, poems, and personal statements within the journal entries. Figure 1 depicts the journal entry for an engineering student after a discussion of photography and propaganda used during WWII.

Figure 2 was created by another engineering student and depicts a parody of the propaganda used by Mussolini. Non-STEM students discussed the formulation of Lanchester's Square Law and how it is used in casualty estimations based on the size and lethality of opposing forces; they were thus engaging with the idea of mathematical equations, statistics, and calculations in real military decisions that ultimately decided, for instance, the fate of hundreds of thousands of soldiers during WWII, who, like them, were only eighteen or nineteen years old. The initial results from students in this HDSTEM course have shown a disruption in the discipline-based thinking to which students were exposed in high school and evidence a broadening of their understanding of how connected disciplines are or could be.

The instructors of the course have also experienced a fundamental reconsideration of their pedagogical approach, teaching philosophy, and even worldview. The instructors worked together to build and develop the curriculum, and they interacted with each other during lectures, bringing different viewpoints on science and engineering and on historical contexts. Building lesson plans together and interacting both inside and outside of the classroom have changed the instructors' perspectives on their teaching approaches in their own fields. The engineering faculty member has noted more cognizance of how engineering decisions affect people and society, and he has deliberately included a greater humanities emphasis in his engineering courses. The history faculty member has included some systematic approaches and technical information in her teaching, even using problem-solving and improvement

FIGURE 1. DEPICTION OF THE SIMILARITIES OF THE HUMAN EYE AND A CAMERA



methods like the DMAIC (Define, Measure, Analyze, Implement, and Control) exercise to help her history students better understand how to deconstruct, analyze, and reconstruct historical moments. The different viewpoints have given the faculty firsthand knowledge on disciplines different from their own. The teaching collaboration has also led to educational research collaboration. An NEH Connections Planning grant to expand the HDSTEM program at Texas Tech has been awarded based on this work.

Figure 2. Student Parody of Propaganda Used by Mussolini

BEST PRACTICES

While the development and implementation of the HDSTEM program and the class War, Machine, Culture, and Society: History and Engineering in the Second World War were tailored specifically to the TTU Honors College, the initial work suggests some standard practices that can be used for setup and implementation in other programs. These practices include interdisciplinary collaboration, topic selection, team-teaching, and bookend implementation.

Interdisciplinary team-teaching and collaboration are essential for the HDSTEM approach, in which STEM is defined in the context of the arts and humanities with elaboration provided by a STEM field. This structure breaks down the typical silos that exist between arts and humanities and STEM, and it returns the conversation to pre-Cold War (and pre-Industrial Revolution) communication between different fields. The TTU Honors College is well-positioned to provide this type of collaboration because of its commitment to twenty-first-century liberal arts and to the blend of disciplines among honors college faculty. Colleges or universities that do not feature a multidisciplinary honors college can still feature collaboration by having faculty participate in college activities falling outside their discipline. For example, a faculty research club that promotes research around campus is an excellent way to learn about what is going on outside of your discipline by meeting and conversing with other faculty. Attending new faculty orientation is another possible conduit for finding teaching partners; college-sponsored events like this provide an avenue for meeting faculty outside of your discipline. Many universities have humanities centers or STEM groups that support public lectures, workshops, and/or panel discussions. Beyond sponsored activities, a direct approach is reaching out to other departments with course ideas. The key is to establish relationships outside of your discipline.

Once you have found potential collaborators, finding ideas or concepts for courses can help foment or cement the partnership. The concept of a course may well be the driver in building an interrelationship. In development of the course concept, the projected student enrollment is an important consideration. For many students, an interdisciplinary course may be a novel idea, so to ensure successful class enrollment the topic needs to accomplish multiple goals: draw students in; speak to utility and practicality while also challenging those conceptions; and open doors and windows into other approaches, ideas, and concepts. The Second World War is a popular and engaging topic, so it made sense to use it as the foundation for War, Machine, Culture, and Society: History and Engineering in the Second World War. Conflicts, both military and otherwise, are promising course topics that include the man and machine relationship; engineering and scientific development; and societal conflict, tension, and stress. Other popular and trending topics include, for instance, artificial intelligence (AI); building an HDSTEM course with a philosopher and computer scientist could reach into themes such as the reason for being, the meaning of existence, freedom of thought, scientific ethics, technological relationships, and intelligent coding. AI is a topic that was covered in a pilot HDSTEM course in the TTU Honors College called "Science Fiction and Science/Technology: The Power of Science Fiction and Science/Technology: History, Literature, Film, Television, Sequential Art." Taught by an engineer and a historian of popular culture, this course engaged students in the relationships of art and literature with science and technology. Engaging topics like this have been a popular avenue for honors interdisciplinary courses (Andersen & Thorgaard, 2014; Brock, 2008; Cundall, 2012; Lòpez-Chávez & Shepherd, 2010)

The HDSTEM courses that have been implemented by the TTU Honors College have been a part of an FYE program that engages first-year students, ensures their successful transition to university life, and encourages them to think more openly and broadly about the purpose and meaning of their education. The honors college is working to bookend the FYE experience with HDSTEM courses in Summit courses, typically taken in the second semester of the junior or senior year, thus establishing a line of open thinking for students in their first year and carrying it throughout their undergraduate experience. Based on their FYE experience, students should understand the privilege of taking courses outside their disciplines and how it can be beneficial to their education and career goals. By bookending that initial introduction with the Summit experience in their final year, students will be able to reflect on their HDSTEM experience with more maturity and experience.

As with the FYE courses, Summit courses blend students from every discipline at the university, and an interdisciplinary topic of the course would allow advanced and engaged collaborative work. In their final semesters, students present mastery of the content in their discipline and can engage others with their knowledge and expertise. Moreover, the students can establish the links of the arts and humanities with STEM on their own and create diverse relationships with their classmates. By focusing on team-based projects, such as writing a novella or short story, creating a web app, making a robot, creating a piece of art, performing a concert or play, or communicating a complex scientific topic to a lay audience, the HDSTEM Summit courses would culminate in the marriage of disciplines and the value of each student's talent, knowledge, and skills. The bookend approach of HDSTEM would be a definite benefit as it would not only establish a philosophy as students begin their college education but would allow the practice and engagement of that philosophy at the end of their undergraduate careers.

The interdisciplinary collaborations, teaching, and set up for HDSTEM benefit the typically siloed, discipline-based educational approach by explicitly showing students the links and similarities between STEM and the arts and humanities, but we acknowledge that there may be major institutional challenges to the implementation of an HDSTEM program. First is the team-teaching issue, where the credit, compensation, and scheduling can be a deterrent. One problem is that the course must fit into two schedules, but this can be a minor issue depending on the teaching load and flexibility of the course's instructors. A more complicated issue is teaching credit and compensation, particularly in an honors college where both instructors are involved in the planning and lecturing for every class. Our administration has given just 50% credit to each instructor, which does not adequately acknowledge the fact that this type of engaged interdisciplinary teaching requires that each faculty member give 100% of their time, energy, thought, and wisdom. With credit comes compensation. Salaried instructors in the TTU Honors College receive assistance from the dean and provost, so the faculty can receive full credit for teaching a co-taught course, but outside of the honors college, compensation for a team-taught course is an issue because (1) the other colleges from which these faculty originate might not agree that this is a 100% effort for both instructors; (2) the system by which the university records the credit hours taught by each instructor may not allow for two faculty to receive full credit for the same course (this appears to be trivial but is a major hindrance at TTU); and (3) limited funds are available for this type of innovative approach. Additional teaching funds have been made available for the pilot HDSTEM courses in the honors college, but these funds are not permanent additions, so there is a problem with making team-taught HDSTEM sustainable. The TTU Honors College has been fortunate to obtain support from an NEH Connections Planning grant for course development stipends, and further funding is being sought through agencies such as the Department of Education and the National Science Foundation. However, the ideal is for the institution itself to support team-taught courses.

The resources of TTU and the honors college are also beneficial for instituting HDSTEM curriculum. TTU is a Carnegie-classified R1 institution and has also been recently classified as a Hispanic-Serving Institution by the Department of Education. The research emphasis, diversity, and size (1,500 students) of the honors college allow it to provide resources in the form of available instructors, funding, and students to test and implement the HDSTEM curriculum. Smaller universities and institutions may not have such resources and may be limited in either STEM faculty or arts and humanities faculty, presenting a challenge in developing and implementing team-taught HDSTEM courses. An attempt at teaching an HDSTEM course as an individual instructor could be made, but this would involve finding guest lecturers who can explain STEM or humanities concepts and interact with the lead instructor. Technology could also play a role in this interaction: live video lectures could alleviate some travel and scheduling problems with guest lecturers.

Overall, the implemented HDSTEM courses within the TTU Honors College have provided some key insights into how these courses should be carried out. Establishing the interdisciplinary relationship in the team-teaching approach and covering an engaging topic are key to the success of HDSTEM courses. Using the institution's resources and administrative capabilities to support the team-teaching approach presents challenges, but developing an understanding of the important effects of HDSTEM on students can outweigh these obstacles.

CONCLUSION

In the last decades of the twentieth century and even in these first decades of the twenty-first, disciplines in higher education have been siloed. While STEM faculty may be encouraged to collaborate or humanities centers may host discussions across the humanities, cross-collaborations between arts, humanities, and STEM faculty have been limited and rarely equal in their dynamism and perceived impact. However, the digital age and the complexity of the global workplace have forced institutions of higher education to reconsider the compartmentalization of the different disciplines. Multidisciplinary and interdisciplinary research efforts have become commonplace for scientific advancement, leading to educational approaches that have broken down barriers in the sciences, mathematics, and engineering for students. Inclusion of arts and humanities has also been explored with STEAM education although, for the most part, this inclusion has been for the benefit of

STEM by increasing innovative design and problem-solving. The TTU Honors College has proposed and implemented a change to this approach with HDSTEM. HDSTEM puts the humanities at the forefront as the impetus and lens for contextualizing STEM research and discovery. HDSTEM connects STEM to the social analysis, enrichment, and advancement displayed in the arts and humanities. The pilot course, War, Machine, Culture, and Society: History and Engineering in the Second World War, has shown the value of the HDSTEM approach and has led to further development of interdisciplinary team-taught courses like Science Fiction and Science/Technology: The Power of Science Fiction and Science/Technology: History, Literature, Film, Television, Sequential Art. The initial implementation of HDSTEM has shown an enrichment in the education of students by making authentic connections of the arts and humanities to STEM. The instructors have also benefitted by learning different course preparation and lecturing methods. Despite challenges with team-teaching credit and compensation, administrative and teaching flexibility along with possible educational research avenues can alleviate these issues. The changing focus of HDSTEM, which puts scientific and engineering discovery in the context of the humanities, provides an overall enriching educational experience for students that can be carried through their academic careers and life.

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