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Breaking Down Walls to Creativity through Interdisciplinary Design

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This article describes initial success in developing an interdisciplinary studio for teaching collaborative creativity and design, with faculty from multiple departments co-teaching and co-mentoring interdisciplinary student groups engaged in social innovation. The rationale for developing this studio has been to prepare students for the kind of interdisciplinary creativity that will be essential to their careers post-graduation. Some have argued that universities are becoming increasingly irrelevant; the author argues for the critical role of universities in preparing students for successful integration into the innovation economy. To meet this challenge, we need to evolve as institutions and individuals in how we teach and conceptualize the creative design process.

Introduction

Higher education has increasingly been judged unnecessary, as commentators cite examples of successful ungraduated entrepreneurs, point to rising tuition costs, and ask whether people really need to go to college (Anderson, 2012; Stephens, 2013). That a former United States Secretary of Education has asked if college is worth it (Bennett & Wilezol, 2013) is evidence that the matter is receiving consideration. Most of the critics base their arguments on a perception that college education provides little additional value over the free learning available via the Internet, MOOCs, and open educational resources. Because university instruction often emphasizes transmission of information and knowledge—the lowest levels of Bloom's taxonomy (Anderson, Krathwohl, & Bloom, 2001)—these critics may be right.

The uncomfortable truth for many educators is that we are no longer uniquely valuable as sources of information, insight, and knowledge. That does not mean that higher education should discontinue its role in society. It just means our role must change. Traditionally universities have had the important job of creating new scientific knowledge through research. In the future, higher education must also see the importance of creating new knowledge, innovations, products, and ideas through its teaching as well. No longer will it be sufficient for universities to be places where students come to *receive* knowledge. For higher education to survive, we need to develop campuses where students come to produce and create. This focus on creativity and innovation will be the key to providing value to future students, thus keeping higher education relevant.

The Innovation Economy

The important role of creativity and innovation in our society should not be surprising. In 1950 J. P. Guilford, in his presidential address to the American Psychological Association, argued that "psychologists have seriously neglected" the study of creativity (p. 44). He envisioned "thinking machines" (computers) completely changing the nature of society because "eventually about the only economic value of brains left would be in the creative thinking of which they are capable" (p. 36). We see a partial fulfillment of that vision now, as a third of jobs in the United States (and growing)

require creativity (Florida, 2012), and as CEOs of the most successful companies are focusing on agility, experimentation, and innovation (IBM, 2016). "Creativity at all levels and across different types of jobs is increasingly necessary," Zhou, Hirst, and Shipton (2012) argued, "to deal with the velocity and frequency of change" (p. 80). We have in effect become an *Innovation Age*, and while previous calls within the instructional design community have been to renovate educational systems for the information age (Reigeluth, 1992), we now need to expand our thinking about how we can effect change in educational systems to support the innovation age.

While Guilford may have foreseen the critical role of creativity in the modern economy, he did not expect the increasingly necessary role of collaboration in innovative thinking. Because most current problems are too big to be solved by one person or even one disciplinary point of view, we are increasingly seeing the important role of interdisciplinary thinking in business because often the "right knowledge to solve a problem is in a different place to the problem itself, so interdisciplinary innovation is an essential tool" (Blackwell, Wilson, Street, Boulton, & Knell, 2009, p. 3). Also "while it may be more romantic to believe in lone geniuses and flashes of insight, truly exceptional innovation is a team sport" (Satell, 2016, para. 22). It's time for education to catch up by breaking down the barriers between disciplines on campus and promoting more interdisciplinary teaching, design, and research, as these are necessary skills our students must learn.

The Universities of the Future

What will keep future students coming to campus, in person or virtually, in the era of MOOCs and freely accessible open education? It will not be to hear another lecture that can't be skipped, rewound, or sped up to meet their needs. Instead it will be (1) to learn creative/ design thinking, (2) to work on interdisciplinary teams, and (3) to have a safe opportunity to have authentic experiences where failure brings fewer consequences and where experienced faculty can mentor and provide feedback. To be relevant, universities need to embrace their "third mission" of fostering creativity (and some argue, economic development), in addition to research and teaching (Etzkowitz, Webster, Gebhardt, & Terra, 2000).

As Florida (1999) argued, in contrast to the worries about universities becoming irrelevant, "The university becomes more critical than ever as a provider of talent, knowledge, and innovation in the age of knowledge-based capitalism" (p. 68). However, universities must change their focus and curriculum to become this talent provider. As higher education faculty, are we ready to meet this challenge? To put aside our presentation slides and engage in mentored interdisciplinary design experiences with our eager students?

Current Interdisciplinary Collaboration in Higher Education

Many elite universities have already acknowledged the need to emphasize creativity, design, and innovation for their students. My analysis of the top 50 U.S. universities listed in the *U.S. News and World Report's* ranking in 2014 found that 31 offered an undergraduate or graduate degree in innovation and/or design. Another seven universities offered a minor in innovation or an innovation related certification program. At least 47 of the top 50 universities had an innovation-related center or other innovation program.

While some focus on innovation and creativity was apparent in this list, what is missing are interdisciplinary efforts. Interdisciplinary work is challenging, particularly for universities, where there are unique, well-defined cultures and traditions within each discipline. However, we must in higher education break down these disciplinary walls. We already know that group innovation can benefit from teams representing diverse perspectives. Cognitive diversity, for example, can increase the number of new ideas within a group (Paulus, 2000). Reagans and Zuckerman (2001) completed a network analysis of 224 research and development teams, finding communication ties that cut across demographic boundaries significantly improved creative productivity (see also Baer, 2010). However, more important than demographic diversity within the group is "diversity of the mind" (Mostert, 2007), including diversity in skills, knowledge, and thinking patterns (West, 2009)—the kind of diversity that comes from interdisciplinary collaborations.

Interdisciplinary work in the academy is not new—concerning research, Metzger and Zare (1999) stated, "Interdisciplinary research is a mantra of science policy" (p. 642). As interdisciplinary research has gained in popularity on university campuses since the 1970s (Lattuca, 2001), "interdisciplinary" journals have become popular (see *http://bit.ly/Interdisciplinary Research* or search *interdisciplinary* in Google Scholar Metrics). Rhoten and Parker (2004) attributed the increasing popularity of interdisciplinary research to "the scientific complexity of problems currently under study" (p. 2046) that necessitate the collaboration.

However, interdisciplinary teaching is much less prevalent. For example, a Google Scholar search using the phrase *interdisciplinary research* with *college*, *university*, or *higher education* produced 388,000 hits. The exact same search with the phrase *interdisciplinary teaching* replacing *interdisciplinary research* produced only 11,400 hits. This seems curious because the same reasons given for needing interdisciplinary research are also true for teaching. In our teaching we train students to solve the kinds of problems they will encounter in their careers, and many of the work problems that our graduates will encounter will be too large and complex to be solved by the knowledge from one discipline, and thus they will often be working on interdisciplinary teams (particularly within the field of instructional design).

When we are attempting to teach our students how to be creative, interdisciplinary knowledge becomes even more critical, as new innovations often emerge on the boundaries of disciplines. For example, how could NASA's Jet Propulsion Laboratory benefit from working with an origami artist? On the surface, it seems like none at all—the disciplines are too different. But through working with mechanical engineers, they discovered that origami could solve some of the most perplexing problems related to astronomical work: how to get large items compact enough for launch (Hollingshead, 2013).

Similarly, many innovative design companies such as IDEO (IDEO, 2016) and W. L. Gore ("W. L. Gore and Associates," 2016) have long valued the importance of interdisciplinary teams for fostering innovation. Interdisciplinary work is already seen as essential in many industries—it is time for higher education to realize our mandate to prepare students to work in these types of careers.

An Opportunity for the Field of Instructional Design

Instructional designers have the opportunity to lead this evolution towards interdisciplinary collaborative teaching in higher education. We commonly refer to our field as a "meta-field" (Hill *et al*., 2004) because we are integrated with other disciplines. An essential competence for instructional designers is to work with subject matter experts, evaluators, programmers, artists, and writers. Perhaps for this reason, researchers have found collaboration skills to be the second most requested category in instructional design job postings (Sugar, Hoard, Brown, & Daniels, 2012).

Instructional designers also have the benefit of frequently being in university positions where they can influence teaching on campus, as members of a faculty center, college administrators, or faculty. Because we understand (a) teaching and learning, (b) interdisciplinary collaboration, and (c) design processes, opportunities for us to influence the teaching of interdisciplinary design in higher education are tremendous. That does not mean there will not be challenges, as roadblocks to reform seem synonymous with higher education, but the benefits to overcoming these roadblocks, I believe, will be worth the efforts and risks.

Our Story: Developing a University Interdisciplinary Design Studio

For the past four years we have been striving to put this vision of interdisciplinary, design-focused teaching into practice at Brigham Young University. We began by building connections across campus among faculty who shared an interest in promoting the teaching of creativity and design. In 2012 Taylor Halverson and I formed the Creativity, Innovation, and Design Faculty Group and later launched a Website to capture our collaborative efforts (see *http://innovation.byu.edu*).

We picked the name for our group strategically in order to accommodate faculty from all disciplines on campus who were teaching similar skills but under different names. While month-to-month attendance varied, over 40 faculty joined our listserv and participated as their schedules permitted.

At first, our group met monthly during lunch to learn what kinds of courses we each taught, how we approached our research, and what activities we were Sponsoring on campus. We began discussing the potential of an interdisciplinary design center, where faculty and students from multiple departments could work together on creative projects too big for one discipline alone. The challenge was space—as it often is. If any one college hosted this design center, could it feel welcoming to other disciplines coming as visitors to the space? Could it truly be interdisciplinary if any one college owned the space or the budget? As one member of our group expressed, we needed an "academic Switzerland"—a truly neutral location where "everyone would feel equally not at home" in order to promote equality among the disciplines participating.

In 2013, the senior associate university librarian began coming to our meetings and asked how the library could further our efforts. In the 21st Century, the role of university libraries is shifting rapidly (MacWhinnie, 2003), as book circulation is dropping dramatically and scholarship is accessed online. Thus, our library was exploring how they could best contribute to teaching and learning on campus. Through our discussions, they offered up space on one of their floors for a prototype design-focused classroom. In true startup form, the classroom was created by pushing aside some of the book stacks, and filling the room with surplus furniture, temporary walls, and as many whiteboards as we could fit. This teaching space was strategically located in a corner of the floor, next to three breakout rooms for student groups and a smaller closet room for storing supplies. After only a couple of weeks of remodeling, our interdisciplinary design center was born.

Also in prototype form, the criteria for what kinds of classes would be allowed in the new space emerged through discussions and iterative collaborative writing with a steering group, advised by a council of college deans and department chairs. We sought enough flexibility in our criteria to allow for creative new courses to be taught in this experimental space, but also enough structure to establish a culture reflecting a different kind of teaching. We did not want instructors using the space to teach the way we had always done it before. This was designed to be something new and different. In developing criteria for using the space, we settled on the following guiding principles:

1. Courses must be focused on design and projects, not dominated by lecture.
2. Courses must be designed to be interdisciplinary ideally with faculty and students from multiple departments participating.
3. Courses should focus on social innovation, which aligned with our university's mission.
4. Courses should involve library personnel integrated into the projects and courses effectively. The library was not interested in simply leasing space, but in being an active partner.

We taught several retreats to train and educate dozens of faculty members in the kind of teaching we would expect in the space. We also used the space to promote activity and innovation among the students and community, as it became the home for student clubs such as the Innovation Academy and the User Experience Club. We served the community outside of the university by hosting the Girls Driving for a Difference team from the Stanford d.School, who taught two workshops on design thinking to over 50 local middle school girls. Excitement grew as word of the space and our group spread on campus, and the design space eventually received its own official page on the library's Website as part of their official offerings (see *http://bit. ly/COStudyGuide*).

Although many faculty have been excited to teach in this design studio, educational reform is never easy. Many faculty struggled with how to take courses with clearly defined disciplinary objectives and fit them to the interdisciplinary goals of our studio. Other faculty struggled with getting released from other assignments so they could have time to teach in this space. Departments struggled with how to offer the courses across multiple colleges and how to grant credit to students so these interdisciplinary experiences would count towards their degrees. The best solution we have found to date is to cross-list the courses in multiple departments, but this is a Band-Aid until we can solve the political curriculum issues.

Still other faculty, while valuing the interdisciplinary nature of our library studio, struggled to leave behind well-established studio spaces with specialized equipment in their own colleges. Some of these faculty have found success in using both—benefiting from the library studio for ideation and college-owned studios for product development.

Despite these challenges, we have also seen many successes. In one example, students and faculty from the colleges of education, fine arts, and engineering and technology collaborated to develop an augmented reality game to teach science process skills to middle school students. The story in this game was that after observing a meteor shower spew dust clouds onto earth, adults around the world begin dropping into comatose states, and the youth must figure out why they are sick, applying the scientific method to understand astronomical, neurological, and microbiological clues left behind by the adult scientists. Played out across social media as well as through the Website (*http://dustgame.byu.edu/*), this game merged physical and virtual game play while encouraging scientific thinking.

In addition to being an interesting example of an emerging game genre, this project represented the need for interdisciplinary collaboration because it was simply too big for any one discipline to complete effectively. Student artists, writers, science education majors, and programmers worked together as teams to complete the project—assisted by students from various other majors who wanted to participate just because it was fun!

In addition, this project showcased the powerful contribution that the library can make to collaborative teaching, as science librarians taught workshops on content areas the students needed to understand for their work. For those wishing to learn more about this project, as well as to see interviews from the participants about the experience of learning in this interdisciplinary studio, this short documentary can be accessed on our BYU Creativity, Innovation, and Design Group YouTube channel: *http://bitly/DUST game*.

Other courses taught in the library studio have sought to improve poverty in Paraguay (see *http://bit.ly/FundacionParaguay*) and improve children's engagement in classic literature (see *http://www.read. gov/readers/*), a project that involved the children's literature librarian as a consultant. Other courses have developed projects related to museum exhibit design, biotechnology, solutions journalism, recreation/experience design, and teaching Arabic through educational gaming.

We have also been experimenting with a different type of course in an effort to help students be ready to apply design thinking in their semester-long courses. BYU faculty have developed a one-day "Innovation Boot Camp" to teach design thinking as a one-credit compressed course that can easily fit in students' schedules. This course is typically conducted all day on a Saturday, with a design challenge that students complete as interdisciplinary groups during the week before sharing their results during a final event. This course was originally taught within the college of engineering and technology with great success (West, Tateishi, Wright, & Fonoimoana, 2012). We plan to incorporate the Innovation Boot Camp more in developing our studio, perhaps as a prerequisite for students before jumping into the semester-long design. More information on the nature and curriculum of the Innovation Boot Camp can be found on a video (*http://bit.ly/BootCampVid*) or our article on the course curriculum (Wright, Skaggs, & West, 2012).

Reflections on Our Experience

What have been our outcomes? So far, we feel quite positive. In a chapter in the *Educational Technology Media Yearbook* (Rich, West, & Warr, 2015), we described some of our findings. To date, every college at Brigham Young University has had students and/or faculty participating in the studio, except for law and nursing, and we have had several courses offered in the space every semester since Winter 2014. Students have offered suggestions for improvement, but have generally agreed with one student who said, "It is so useful, and it is so ahead as far as education goes" and another who said, "I like the work I am doing in this class the most of any class I am taking."

Perhaps the best evidence that this interdisciplinary studio is working is how excited the students are to participate. One team told me that after leaving their ideas and prototypes in the studio, they came to the library the next day to see a note on the whiteboard from another student, asking them to call her so she could participate too. In my own class, where we designed scientific educational artifacts for the DUST game, a mechanical engineering student and a

technology and engineering education student who had no relationship to the content of the project participated simply because they loved participating in group creativity experiences and didn't want to leave.

Current Challenges and Opportunities

While we feel our interdisciplinary studio has been a success, we are still experiencing growing pains. The studio is not officially sanctioned by the university, which raises questions about extra courses for students that delay their graduation, thus threatening the long-term stability of inter-departmental collaborations. In short, the disciplinary walls run deep in higher education, and do not fall down overnight in a world of courses, credits, faculty loads, and justifications for faculty positions.

We are now seeking to find solutions to these challenges. A group of us have formed a committee to explore ways that collaborative courses could fulfill degree requirements for multiple majors, thus reducing the worry about increasing time to graduation. The goal of this committee is to reduce the administrative barriers to students and faculty participating in this experience. We are also seeking to expand the library studio so that larger classes can participate, but without losing the startup, non-permanent, evolutionary feel of the space.

At this point we are not sure what our library studio may become in the future, although we have high hopes that it can become a catalyst for rethinking teaching, design, and collaboration within the university. No matter what happens, it has already successfully forged new connections involving faculty, students, and departments that have opened up new channels of communications and potential opportunities for collaborative research, teaching, and design.

Recommendations for the Future

The world our students graduate into is not the same world for which the current university model was designed to prepare them. We need to innovate the educational process in higher education, which will not only better serve our students, but also keep them engaged in higher education. I also feel that incorporating more interdisciplinary collaborative design activities into our curriculum can deepen students' understanding of their own discipline, as they gain appreciation for the wisdom in other fields.

In true design thinking fashion, we feel we are still learning and evolving as we develop our interdisciplinary library studio. However, the following are some recommendations from our chapter (Rich, West, & Warr, 2015) that we feel might benefit other universities as they begin the process on their campuses:

- Departments can build small studios and integrate curriculum within the department into the studio. Alumni and professionals can be tapped as consultants and mentors in the process.
- Many interdisciplinary efforts have to start small. For example, a collaboration between only two different departments can be beneficial, demonstrating that a collaborative model can work.
- Engaging university partners helps to situate studios within a university's culture and goals. In our experience, partnering with the library has helped the library meet its goals of better supporting teaching and learning while giving a shield of legitimacy to the studio's effort.
- Engaging university administrators can help them understand why studio-based pedagogies are important. For example, we led a group of BYU leaders from various colleges on a tour of the Stanford d.School as a way of helping them see another university-based studio in action.
- These administrative leaders are also important, as they can offer a measure of "protection" for faculty exploring the messy nature of studio-based teaching; our experience has been that it is difficult to be successful the first semester, and setbacks should be expected.
- It is critical, we feel, to identify a space that the studio can own. Studio instructors need to have some flexibility within the space for moving furniture, leaving up sketches on whiteboards, and adapting the space to meet their needs. Ideally, it is beneficial to avoid having this space isolated, so that proximity to other students, courses, instructors, and visitors can foster dialogue and creative improvisation.

Interdisciplinary collaboration is not easy, because it involves working with people who see the design problem differently than we do. For this reason, diversity can sometimes have paradoxically negative effects on creativity (Bassett-Jones, 2005). However, it is only through embracing our disciplinary diversity that we can achieve the greatest creativity of which we are capable, which will increase our abilities to prepare students for success in today's innovation age.

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