Maker Competencies and the Undergraduate Curriculum

How might academic library makerspaces impact undergraduate student learning? This is the question that The University of Texas at Arlington (UTA) Libraries, in collaboration with University of Nevada–Reno's (UNR) DeLaMare Science and Engineering Library, want to answer by exploring best practices that broadly incorporate cross-disciplinary, transferrable (transdisciplinary), maker-based competencies into the undergraduate curriculum.

To this end, we request $49,915 from IMLS in the form of a Planning Grant in the Community Anchors project category. A Community Anchors Grant is relevant to this work because academic library makerspaces are uniquely situated as anchors for interdisciplinary teaching and learning. We routinely collaborate with faculty representing a wide cross section of academic disciplines and we provide discipline-neutral spaces and services that encourage interdisciplinary collaboration among students.

Statement of National Need

The National Association of Colleges and Employers (NACE) Job Outlook 2016 reports that companies seek new employees with transdisciplinary skills such as teamwork, problem-solving, adaptability, creativity, entrepreneurship, and risk taking. It also states that the bachelor's degree is the preferred degree for a majority of positions employers seek to fill, but that employers have difficulty finding applicants who possess both a subject-based bachelor's degree and transdisciplinary skills.

Academic library makerspaces are uniquely suited to fill this pedagogical gap in the undergraduate curriculum. Similar to how academic libraries deployed information literacy initiatives across the curriculum, their makerspaces are now positioned to foster learning opportunities for students to gain transdisciplinary skills like the ones listed by NACE. Specifically, our interests lie in exploring ways these learning opportunities can be scaffolded into the undergraduate curriculum and measuring their impact on student learning.

Although there have been a few explorations of the general learning that occurs in makerspaces (Sheridan, Litts, Brahms, Jacobs-Priebe, & Owens, 2014; Litts, 2015), little has been done tying student learning in makerspaces to subject-based learning outcomes or measuring student learning. And yet, a 2014 Library Research Service survey reported that 41% of respondent libraries currently provided maker-related activities and an additional 36% intended to begin doing so in the near future.

Most literature about maker-based education focuses on K–12 STEAM education, not higher education. Maker-based curriculum has relevance throughout academia when considering transdisciplinary skills such as the ability to manage projects or work in interdisciplinary teams. Our project will test maker competencies that impart transdisciplinary skills in a broad cross section of undergraduate programs, including non-STEAM disciplines in the social sciences and humanities.

Project Design

UTA Libraries, working with a multidisciplinary team of faculty, have created an early-stage set of maker competencies that can be mapped to subject-based learning outcomes. UNR Libraries also work with faculty across various disciplines to integrate maker-based projects into their courses. This Planning Grant will fund the identification of three additional academic library makerspaces that are exploring similar programs and that are willing to become pilot test partners with UTA and UNR. With them, we will test the effectiveness of our early-stage competencies and investigate methods to measure student learning.

UTA Libraries has launched a national survey that will help identify academic libraries currently integrating their makerspaces into undergraduate coursework. When selecting partners, we will look at schools large and small, geographically diverse, and with varying student demographics. UTA is a large urban university with Hispanic-Serving Institution

status and is the fifth-most internationally diverse campus in the U.S. UNR is a midsized land-grant institution. We will identify partners from other regions that substantively differ from our demographics in order to represent a diverse cross section of academic library makerspaces.

Once we identify a pool of prospective partners from the survey data, project investigators will visit them to observe their makerspaces and to interview librarians and faculty involved with curriculum-makerspace integration. During the site visits we will inquire specifically about strategies for 1) tying maker activities to course work, 2) determining expected outcomes, and 3) measuring student learning. Once the site visits are concluded we will identify and secure three partners from this pool.

Performance Goals

Partner institutions will gain commitment from two faculty members each (8 total) to participate in pilot tests. UTA will have three faculty members participate, making a total of 11 faculty. When identifying prospective faculty for the pilot, we will look for support from a wide range of subject faculty, including fields not usually considered relevant in maker-based education such as social sciences and humanities.

Outcomes

Librarians and faculty at each institution will collaboratively revise course assignments to align maker competencies with their course learning outcomes and to develop assessment strategies that measure student learning. Partners will receive funds to purchase consumable materials for use in their pilot assignments. Pilot faculty will receive stipends for work required to revise course assignments.

Once the pilot has concluded, we will assess the efficacy of our early-stage maker competencies through feedback from involved librarians and faculty, and assessment of student learning. As part of our evaluation plan, we will survey each librarian and faculty participant in accordance with IMLS Performance Measurement Goals. We will use this new knowledge to revise our early-stage work and draft best-practices for broad implementation.

National Impact

We will share the findings of our pilot nationally through the UTA Libraries website. We will provide individual case studies of each undergraduate course where early-stage maker competencies were tested. The case studies will include course descriptions, learning outcomes, and maker competencies that map to those outcomes. Additionally, we'll document assessment techniques for measuring student learning for each case study, specifically gauging transdisciplinary skills. Finally, we will include best practices for implementing the competencies more widely.

We also plan to share our findings by presenting a white paper at the International Symposium on Academic Makerspaces. ISAM has the potential to play a major role in how makerspaces are deployed in academic settings. At this stage, we will also be poised to begin presenting nationally and publishing in academic journals.

Successful completion of this Planning Grant will position us to submit an IMLS Project Grant application for implementing maker competencies into the broadest cross section of undergraduate curriculum. For the widest dissemination of our findings, the Project Grant would help us establish national professional development opportunities and develop a clearinghouse website of maker literacies information, such as lesson plans and assessment tools spanning all subject disciplines.

Key Personnel

- Martin Wallace, Maker Literacies and Engineering Librarian, UTA, (PI)
- Katie Musick-Peery, Director of FabLab, UTA
- Gretchen Trkay, Department Head for Experiential Learning & Undergraduate Research, UTA
- Tara Radniecki, Engineering Librarian, University of Nevada, Reno

Estimated Budget

We request $49,915 in funding:
- Multiple site visits and conference travel: $16,400
- Academic faculty stipends: $17,850
- Materials for all 5 institutions: $3,000
- Indirect costs: $12,665