Make the Grade: Integrating Making into the Higher Education Curriculum

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Learning outcomes for the session

1. Identify models of assignments that teach making skills along with course learning objectives.
2. Choose methods for encouraging and supporting faculty members to create these assignments.
3. Assess/build assignments using maker competencies and learning objectives.

The TEC Lab at Miami U Middletown

- Wandering/temporary since 2014; permanent location since 2016
- Impetus: innovation and hands-on focus
- Open to all disciplines
- Providing access, space, and guidance
- Added course-specific tools that others could use
- Seeking uses by courses to help guide our development

"46% of colleges and universities provide makerspaces.

EDUCAUSE Horizon Report: 2019 Higher Education Edition

What is a makerspace for?

- Exploration
- Skills acquisition
- Prototyping / product creation
- Innovation
- Exposure to technologies/processes/experiences
- Opportunities for collaboration

- People, means, and activities - focus is crucial (Hira and Hynes, 2018)

Inspiration and questions

- Faculty: how to use the makerspace with their students?
- Library staff: where to find applicable models for assignments?
- Curriculum-integrated making in K12 education: lessons for higher education?
- Maker Literacies project: is this a model for connecting competencies with learning objectives in courses?

Why have making assignments?

- Greater focus/more time spent than with one-time activity
- Application of prior knowledge
- Hands-on experience
- Increase students' interest and engagement
- Marketing the makerspace
- Justifying the makerspace

Learning theories

- **Constructionism** (Seymour Papert)
  - Making knowledge by actively creating and sharing an object (physical or digital)
  - Meant to work in various disciplines and across disciplines
- **Experiential learning** (David Kolb)
  - Cycle: learning comes from reflecting on and analyzing concrete experiences, which leads to planning out future experiences

Independent making vs. class assignment

- “Classic” making = individual guided by and/or collaborating with other makers
- Does assigning someone to make something still count as “making?”
- Can we define making? (Thomas and Besser, 2017)
- Fluid definition = interdisciplinary collaboration
- Informal and formal learning: self-directed, mediated, cross-disciplinary (Curry, 2017)

Two kinds of making (Blackley, et al., 2017)

Traditional

- Create own communities
- Choose materials
- Self-planned, unique products
- Might be mentored
- Might evaluate
- Might understand underlying science or concepts

Targeted learning activity

- Organized into groups
- Provided with materials
- Shown a finished object and challenged to create their own
- Mentored (but not instructed)
- Guided in evaluating
- Made aware of underlying science, etc.

Maker assignments in higher ed courses

- Making/makerspace-focused courses
- Courses with one (or more) making assignments
- Single class activities or semester-long
- Varying complexities of projects
- Teamwork
- Many disciplines represented
- Interdisciplinary opportunities

Sample maker assignments

- Lawrence University Makerspace for Engaged Learning - Makerspace Assignments by Subject
- University of Texas Arlington Maker Literacies - Lesson Plans
- North Carolina State University - Makerspace Instruction Support
- Maloy and Edwards (2018) - four courses
- Fields and Lee (2016) - creative assignments combining programming and objects
  - Individuals sharing with group; iteration
  - Created rubric for products, self-reflection

What can higher ed learn from K12?

- Lesson planning (Gerstein, 2018)
- Making curricular alignments and planning assessment (Oliver, 2016)
- “Interlocking literacies” (Bolkan, 2018)
- Blackley, et al., 2018 - full fledged project
- Importance of professional development for teachers to prepare them to offer making assignments

A middle and high school experience

- Elizabeth Forward School District (PA):
  - Innovative spaces and equipment
  - Expanded classes and curriculum
  - Shifts in student experience
  - Intentional inclusion of all students
  - Freedom to fail - teachers and students
  - Assessment focused on process rather than product

(Trahan, et al., 2019)

Maker competencies

- University of Texas Arlington Maker Literacies - Maker Competencies
- Remake Learning Competencies
- International Society for Technology in Education (ISTE) Standards
- Create your own

Maker Competencies - UTA

1. Identify need
2. Analyze problem
3. Explore solutions
4. Operate safely
5. Assess tools and materials
6. Produce prototypes
7. Utilize iterative design
8. Develop project plan
9. Assemble team
10. Collaborate effectively
11. Employ knowledge management
12. Apply knowledge gained beyond project
13. Be mindful of diversity and inclusion
14. Understand legal issues
15. Pursue entrepreneurial opportunities

How to use competencies/literacies

- Identify assignments to use - assess what an assignment includes - consider where students can grow
- Create assignments - use competencies as building blocks for what students should gain from/encounter in an assignment
- Grade/assess assignments - use competencies to form rubrics for assessing students' work (Wallace, 2017)

Maker assignments with competencies

Technical Writing

Introduction to Digital Media

Makerspaces - help create assignments

- Faculty learning communities (sponsor/host)
- Grants/funding
- Professional development workshops
- Guiding faculty to sources for model assignments
- Helping faculty match up making options to learning objectives

Makerspaces - supporting assignments

- Scheduling space/equipment for class use
- Student assistance - scaffolding learning
  - Group instructional sessions - maker information literacy sessions
  - Individual consultations
  - Mixture of formal, non-formal, and informal activities to build skills (Einarsson and Hertzum, 2019)
- When and where is making taking place?

Sample support options

Tips/Suggestions for Teaching a Class at the Makerspace - University of Wisconsin

Makerspace Course Development/Faculty Learning Communities - UNC Chapel Hill

Innovative Teaching with Makerspace Technology Grant - Temple U

TEC Lab - Supporting assignments

- Makerspace can be reserved for classes / also have mobile makerspace - lend equipment
- Connections between new equipment and class assignments - laser cutter and Digital Art
- One-off projects for many courses (creating symbolic items for speeches, Box Project, ENT projects)
- Led to first FWC to increase awareness of making and connecting making to course assignments

TEC Lab - Faculty working community

- Short-term faculty learning community
- Funded by Miami Regionals Center for Teaching and Learning
- Two versions:
  - Fall 2016
  - Spring → Fall 2019
- $200 in professional development funds (plus opportunity to propose publication in volume edited by library staff members)

FWC Projects

- Organizational Communication - construction project accessories, marketing videos, and promotional materials
- Criminal Justice - 3D printed furniture for a nightclub layout (planning to reduce crowding)
- Geology - groundwater/water supply models to show understanding of a water contamination scenario

FWC Projects (cont'd)

- Creative Writing - synesthesia sculptures to represent students' stories; goal: spur discussion and help student develop stories
- Small Business Innovation - small groups will develop and prototype products (practicing design thinking)

All five to be implemented in Fall 2019, assessed, and shared with the MU Regionals community.

So, how to proceed with integrating makerspaces into the curriculum?

- Work with faculty to create new maker assignments and share existing ones
- Seek funding and collaborations to offer professional development/FLCs
- Build on workshops/demos to scaffold student skills
- Research: assess impact of maker experiences on learning
- Maintain multiplicity of purposes for the makerspace, but don’t neglect connections to courses

Higher ed making: “untapped potential”

1. Connect making to mission
2. Longitudinal making
3. Cross-organizational making
4. Expanding making into non-technology areas

Charles Schweik, Inside Higher Ed (May 15, 2019)

Questions?

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Link to slides: https://tinyurl.com/mira19make

Sources consulted