Development of Standards Education Modules for Additive Manufacturing

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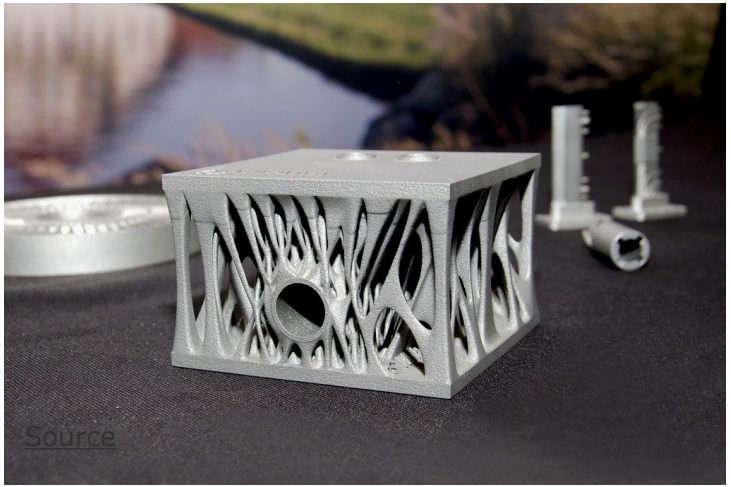
THE UNIVERSITY OF ARIZONA

How can we improve the design and production of parts manufactured using additive manufacturing?

3D Printing + COVID

Metal AM applications



About us

Name:	Hannah Budinoff	Andrew Wessman	Cholik Chan
Background:	**Department:** Systems & Industrial Engineering **Research**: Engineering design; makerspaces **Industry**: Honeywell Aerospace **Teaching**: Ugrad/grad Design for AM course	**Department:** Materials Science & Engineering **Research**: Metallurgy; high-temp alloys **Industry**: GE Additive **Teaching**: Ugrad/grad Metal AM course	**Department:** Aerospace and Mechanical Engineering **Research**: Heat transfer; Energy storage **Industry collaborators**: Raytheon, Air Force Research Laboratory **Teaching**: Ugrad/grad Intro to AM course

Our overarching goal:

To prepare engineers who can utilize technical standards to guide their use of additive manufacturing technologies

Our 5 specific objectives

01	Develop 4 e-learning modules with a total of 36 hours of content
02	Deploy each of the developed modules in one or more courses at UArizona
03	Improve students' ability to identify, locate, evaluate, and use standards for technical problems related to AM
04	Distribute e-learning modules to other institutions of higher education with guidance for they can replicate our methods
05	Disseminate project results in a final summary paper to a wide audience

Institutional resources we're leveraging

Office of Instruction and Assessment

OIA Office of Instruction & Assessment

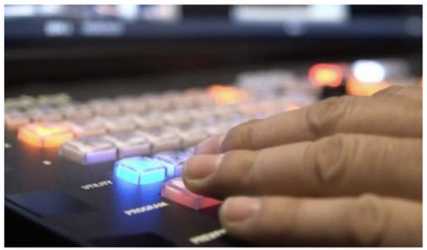
Building capacity for excellent teaching

Instructional Design Team for Digital Learning

Instructional Design

From the creation of your objectives to the refinement of a well-designed experience, our Instructional Design and Continuous Improvement teams are here to help you create an online course that is learner-driven, innovative and academically rigorous.

Learn About Instructional Design



Multimedia Production

Our team of creative professionals collaborate with instructors to create clear, cohesive and engaging student-centered content that ranges from studio sessions and on-location video production to audio recording and illustrations.

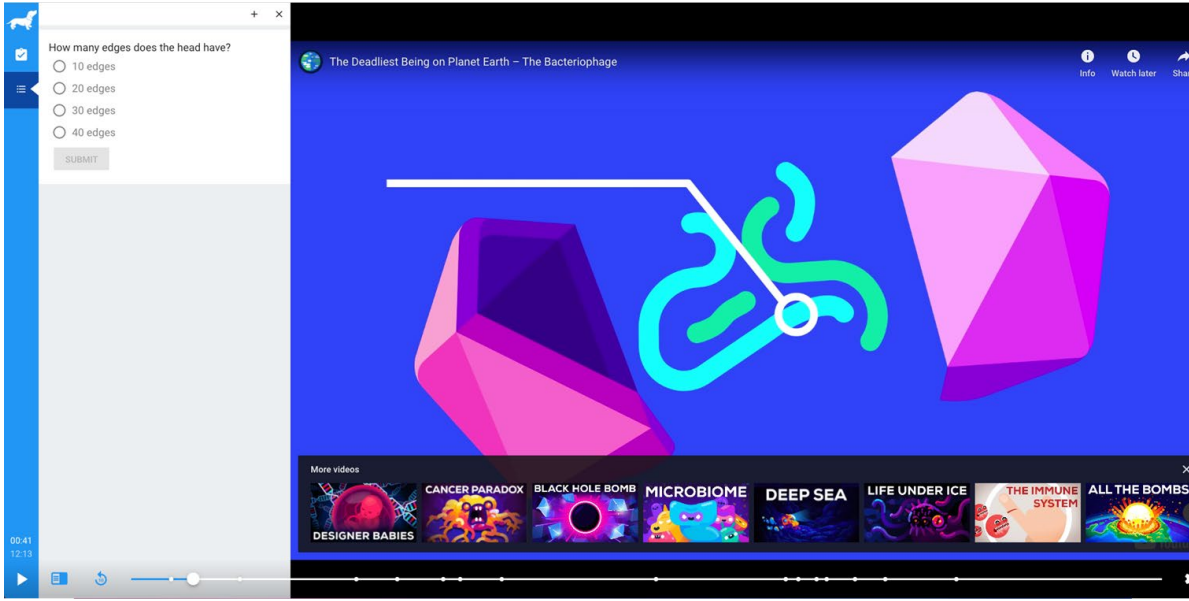
Learn About Multimedia Production

Our e-learning modules

Based in PlayPosit

Shells designed by Instructional Design Team

Each module will have professional videos + activities



External resources we're leveraging

ASTM additive manufacturing staff

Colleagues at other universities for piloting materials

Topics in our e-learning modules

Learning module focus	Topics and relevant standards
Module 1: Introduction to engineering standards	**Topics**: Standards development organizations; standard development process; How to identify and access standards; ASTM F42 committee
Module 2: Use of standards in the design-for-additive-manufacturing process	**Topics**: AM terminology; Design and data formats; AM test samples; GD&T; AM applications **Relevant standards**: ISO/ASTM52900-15, ISO/ASTM 52921-13; ISO 17296-4; ISO/ASTM 52915-13; ASME Y14.5; ISO/ASTM 52942-20
Module 3: Additive manufacturing process development	**Topics**: AM processes; AM feedstocks; Preparing and testing test specimens **Relevant standards**: F2971-13; ISO/ASTM52904-19; F3049-14
Module 4: Testing and evaluation for additively manufactured parts	**Topics**: Mechanical properties; Requirements for purchased AM Parts **Relevant standards**: ISO/ASTM52901-16; F3302-18; F3122-14; ASTM A370 - 20

Scope of 2-year project

Modules	4 online learning modules
Courses	3 courses across 3 departments at UArizona
People	150 students impacted in 2 yrs

Expanding our impact

- Currently >50 AM courses at universities
- Contact instructors to incorporate our materials in their classes
- E-learning team will export modules to be easy to import into LMS
- Start with ASU, UC Berkeley, UTEP

Spreading the word

- 10 page summary paper in Y2
- Feedback from industry at TMS Conference (Wessman)
- Share with engineering educators more broadly at annual conference for American Society for Engineering Education (Budinoff)
- Local dissemination among design faculty, COE, engineering librarian

Working towards our overarching goal:

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Thanks!

Suggestions? Questions?