Title of Proposal
The Open Shape Learning Object Repository: A Hybrid 3D Object and Open Educational
Resource Repository

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Session Type (select one)
o Panel
x Presentation

Abstract
Oregon State University Libraries & Press have initiated the Open Shape Learning Object
Repository Project, which aims to provide 3D objects to the open educational resource
community by explicitly tying together 3D objects (renderable and printable models) and
curricular elements. The aim of this repository model is to facilitate the use of 3D models and
fabrication in the classroom at multiple levels of the curriculum.This project addresses the lack
of cross-over between existing learning object repositories and 3D object repositories, and
provides a guiding model for how repository systems and projects can facilitate bringing 3D
modeling and fabrication into the open education community. Information packages served
from our repository contain a renderable or printable 3D model (or set of models) along with a
set of curricular elements that help contextualize the model(s) in the learning environment.
We discuss the inception of the repository project, the results of a number of pilot projects,
and our plans for future development.

Conference Themes
Select the conference theme(s) your proposal best addresses:
x Supporting Open Scholarship, Open Science, and Cultural Heritage
o Managing Research (and Open) Data
o Integrating with External Systems
o Re-using Repository Content
o Exploring Metrics and Assessment
o Managing Rights
o Developing and Training Staff
o Building the Perfect Repository

Keywords
3D models, learning objects, institutional repositories, non-traditional formats

Audience
Potential audience members include: repository managers, open education advocates, open educational resource managers and producers, faculty and university administrators interested in emerging pedagogies

Background
Visualization of concepts, processes, or artifacts can be particularly challenging in an instructional environment. In some domains, placing tactile materials into the hands of students is a long-standing practice to help with visualization (e.g. chemical model sets in organic chemistry classes, replica projectile points in archaeology classes), but these are often expensive or may not be suited to specific applications. In other domains, this type of tactile interaction has not been a major part of curricula due to cost, skill, and time barriers around creating or applying tactile materials for the classroom environment. Over the past few decades, data visualization (including 3D modeling and rendering) has been increasingly incorporated as a new mode of education, especially in STEM fields.

Online collections of 3D model files make 3D printing more accessible to novices lacking software skills needed to create the models. Existing online, open, and free collections such as Makerbot's Thingiverse, Autodesk's 3D Models, and Sketchup's 3D Warehouse are some of the more well-known and trusted -- there are many more. While these large collections include some models that can be used in education, it is difficult to winnow out those models that are best used in educational settings. Searching these collections, one is more likely to find, for example, a model for a cell-phone case, than a model that illustrates a physical or mathematical concept. There are some selected collections of educational 3D models, such as Smithsonian's (http://3d.si.edu/) X 3D and Nasa's 3D Models (http://nasa3d.arc.nasa.gov/), but these collections generally lack broadly applicable curriculum associated with the models, requiring the user to develop curriculum independently.

At the OSU Libraries' 3D printing service point, a particularly compelling point of interest has come from faculty who would like to use our fabrication tools as elements of a broader curriculum. Our work to support these faculty has revealed high demand and interest in a repository of 3D objects associated with curricular elements. We initiated discussion with a number of faculty to generate content on a pilot basis in late 2014 and early 2015. The goal of these pilot projects was to leverage existing infrastructure in the OSU Libraries & Press, specifically our repository ecosystem and our 3D printing services, to provide a repository for 3D Learning Object Packages. Information packages served from the repository contain a renderable or printable 3D model (or set

of models) along with a set of curricular elements that help contextualize the model(s) in the learning environment. Curated models are print-proven to ensure a quality, fabricatable end-product and are stored in standard open formats (where possible) to allow widespread use and modification. Library faculty work with academic faculty generating the learning objects to ensure that curated curricular elements are sufficiently generalizable for uptake by other faculty and instructors.

Presentation content
This presentation will cover our pilot program for an Open 3D Learning Object Repository and our plans for expansion in the future. We'll discuss the impetus for the development of the repository, the overall workflow(s) for use of the repository, and three to four specific use-cases for the repository including. These use-cases include development of printable models for visualization in undergraduate-level mathematics, models for biological and environmental engineering education, and a set of archaeological models usable at multiple levels of the curriculum. Our merging of the 3D Repository model with the Learning Object Repository model is unique and will be of interest to those who work with repositories in either of these domains.

The presentation will not, largely, be a discussion of 3D Printing services or makerspace services, though these necessarily influence and are tied to the content of the presentation.

Conclusion
This presentation will present a unique combination of repositories (the 3D repository community and Learning Object repository community) aimed at facilitating the use of 3D models and 3D printing in the classroom at multiple levels of the curriculum. We believe this model is important to the future of open repositories given the parallel rise of, but apparent lack of cross-over between, the open education community and the maker community. Our project addresses this lack of cross-over and provides a guiding model for how repository systems and projects can facilitate bringing 3D modeling and fabrication into the open education community.