Using Cloud-Based Data Analysis to Engage Students in Natural Hazards Engineering

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DesignSafe is the web-based research platform of the NHERI Network that provides the computational tools needed to manage, analyze, and understand critical data for natural hazards research.

FIVE-YEAR SCIENCE PLAN
DesignSafe-ci Vision

- A CI that is an integral and dynamic part of research discovery
- Cloud-based tools that support the analysis, visualization, and integration of diverse data types
  - Key to unlocking the power of “big data”
- Support end-to-end research workflows and the full research lifecycle
- Enhance, amplify, and link the capabilities of the other NHERI components and other natural hazards engineering research centers around the world
Education and Community Outreach

Objectives:

• Engage and train the user community
• Broaden the STEM user base
• Support K-12 education related to hazards and computing
Range of ECO Activities

• Outreach to user community
• Training webinars
• DesignSafe YouTube channel
• DesignSafe Slack online collaboration
• …
• Engaging Undergraduates: DesignSafe REU
• Engaging K-12: CODE@TACC
• Engaging K-12: Research Experience for Teachers (RET)
Common Theme: Leveraging Cloud Storage and Computing

• All of these ECO activities aim to introduce students to modern concepts of data analysis and computing in hazards engineering.

• The cyberinfrastructure, tools, and educational content are utilized to enhance the student experiences and to share related materials.
DesignSafe REU Program 2017

- Hosted 2 REU students at TACC for a 10 week research program as part of NHERI-wide REU
- Mentoring and training in scientific research to use DesignSafe as an education and analysis tool
REU: Data Curation

• Approached data curation as a research problem
• Used dataset from NHERI Wave Basin testing at OSU: “Large-Scale Laboratory Experiments of Wave Impacts on Vertical Cylinders” (CMMI-1635784)
• Tested the curation and publication pipeline
REU: Data Analysis and Visualization

• Students trained on computational science, Jupyter notebooks, and Python
• Created a basic graphical user interface using widgets in Jupyter and Matplotlib for visualization
• Basis for future generalized tool
Engaging K-12: CODE@TACC 2017

- Week long summer camp hosted at TACC
- Introduced high school students to coding and computing for natural hazard engineering
Engaging K-12: CODE@TACC 2017

Program:
• Shake table experiments and data analysis using Jupyter Notebooks
• Exchanged and archived data and notebooks in DesignSafe Data Depot

Participants and Outcomes:
• 28 students (54% minority groups; 60% no prior coding experience)
• 80% increased interest in coding and civil engineering
Engaging K-12: RET 2017

• RET Participants created and taught shake table curriculum for CODE @ TACC
• Created learning portal introduction to Jupyter Notebooks on DesignSafe
• Implemented shake table project and coding lessons at their schools during Spring 2018
• Curriculum shared via Community Data in DesignSafe
Looking Forward

• REU, CODE@TACC, and RET leveraged domain specific examples in natural hazards engineering (e.g. safety of tanks under hurricane loads; protection of buildings in seismic zones) to engage students and their educators in applying concepts of coding and cloud computing

• Ongoing ECO activities extend these efforts (e.g. 2018 CODE@TACC with residential component)

• DesignSafe-ci provides tools, resources, and a platform to support student training and share educational content
Check Out DesignSafe-ci

www.designsafe-ci.org

• Capabilities available to the global natural hazards research community—account registration is free!

Please share your feedback, ideas, experiences!

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