Jupyter Notebooks and the UW-IT JupyterHub Pilot
Jupyter Notebooks and JupyterHub give users access to computational environments and resources without the hassle of installation and maintenance tasks.

Jupyter Notebooks are web-based interactive computational environments that are pre-provisioned with course material.

Students connect — each to their own copy of the environment — and develop content as directed, often writing short segments of code.
The UW-IT Service

> UW-IT sets up a Docker container for instructors to integrate alongside JupyterHub.
  
  (Alternatively, instructors can provide and configure their own Docker container.)

> Each student enrolled in a course receives access to a Jupyter notebook.

> UW-IT runs the infrastructure at no cost to instructors.
Jupyter Notebooks in the Classroom

> Strong potential as a teaching tool for both specific course content and programming languages
  > Flexibility for instructors and students
  > Accessible coding environment to learn and utilize Python

> Highly relevant for investigations in applied academic research
Pilot Study Goals

1. Determine support issues that would need to be addressed for a campus-wide rollout
2. Identify pedagogical challenges/opportunities related to integrating Jupyter notebooks in the classroom

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<thead>
<tr>
<th>Winter 2020</th>
<th>1 early adopter</th>
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<tr>
<td>Spring 2020</td>
<td>6 participants from 3 departments</td>
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<td>Term</td>
<td>Name</td>
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<tr>
<td>Winter</td>
<td>David Shean</td>
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<tr>
<td>Spring</td>
<td>Sarah Tuttle</td>
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<td>Mario Juric</td>
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<td>Nicole Kelly</td>
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<td>Lutz Maibaum</td>
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<td>Alexandra Anderson-Frey</td>
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<td>Chad Curtis</td>
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<td>Civil and Environmental Engineering 498/599</td>
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<td>Spring</td>
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Assessment Methods

- Winter 2020
  - Pre- and post-interview with instructor
  - Class observation
  - Post-quarter student survey

- Spring 2020
  - Pre- and post-interviews with instructors
General Findings

> The service was well received by instructors and students; both noted ease of use and Jupyter notebooks’ power as a learning tool.

> Winter 2020:
UW-IT successfully supported an edge case requiring complex setup and high level of resources.
- Level of individual support required by UW-IT with such a case is not currently scalable to multiple instructors.

> Spring 2020:
Standard setup worked seamlessly for multiple instructors.
Findings: Engagement & Interaction

> Use of Jupyter notebooks and JupyterHub during class contributes to engaging and interactive learning spaces.
  - Students were able to follow instructor and test code in their own environment and at their own pace.

> Jupyter notebooks work well for remote learning.
  - Students worked together on coding problems in synchronous Zoom break-out rooms during class and asynchronously through other communication channels (e.g., Slack, email).
  - Some features in Zoom (e.g., remote control) may even offer pedagogical advantages over a computer lab for in-class learning.
Findings: Student Learning

> Students appreciated a greater focus on course content and programming skills, instead of focusing on technology setup.

> Students appreciated the opportunity to directly apply their course learning to real-world research questions and projects.

  – Jupyter notebooks are excellent supplements for portfolios since they include example code and highlight writing and communication skills.
Findings: Instruction

- Jupyter notebooks were easily adapted to a flipped classroom model.
  - Instructors pre-recorded lectures and used course time for peer collaboration and troubleshooting within notebooks.

- Common options allowed instructors to convert their notebooks to slide decks, streamlining lecture preparation.

- Instructors were able to write custom scripts to seamlessly integrate JupyterHub file directories with GitHub repositories.
  - Instructors can host data and code in GitHub and push updates to student directories.
Considerations

> Instructors may want to choose their feedback and grading tools based on individual course learning objectives.
  > Common Solutions: Canvas integration, GitHub, syncing student-instructor directories, nbgrader

> More advanced JupyterHub instructors with custom and/or complex needs may require admin privileges to add needed packages or manage resources.

> As with all remote learning, students’ internet quality and stability is a potential issue when accessing cloud environments.
Interested?

> UW-IT is currently signing up faculty for Fall 2020

> Service is open to all UW instructors using Jupyter notebooks in a course

> Go to IT Connect to learn more: https://itconnect.uw.edu/learn/tools/research-tech/