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# Collaborative Research: Improving Student Learning in Hydrology & Water Resources Engineering by Enabling the Development, Sharing and Interoperability of Active Learning Resources

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# Data Management Plan

**Types of Data:**
*Educational Content and Hydrologic Data:*
The HydroLearn platform will include a set of learning modules that are composed of various file formats and data types (e.g., spreadsheets, word-type documents, CSV files, text files, screencasts, tutorials, etc.). The modules will also contain various hydrologic datasets such as time-series datasets, geospatial datasets, time-space varying gridded datasets. We will also create mechanisms to access these datasets through HydroShare platform, and community data providers such as NASA and the USGS National Water Information system.

*Project Evaluation Data:*
Quantitative and qualitative data will be collected via different mechanisms, including surveys, staff interviews, adopter interviews and document reviews to provide feedback to the design team as they continually refine the activities and materials, strengths and challenges of implementation, and perceived impacts of the HydroLearn resources.

**Data Access and Sharing:**
We will post the project propagation and dissemination data on the project website. This includes sets of candidate learning objectives, rubrics and scoring schemes, number of faculty using HydroLearn and its resources to develop or adopt modules. The data will be updated at least four times a year. If there are any privacy, confidentiality, or intellectual property issues associated with customer discovery process, these data will be subjected to the IRB process and handled consistently according to IRB policies.

All participants in the project will publish the results of their work. Papers will primarily be published in peer-reviewed journals and/or conference proceedings. Primary data and other supporting materials created or gathered in the course of the work will be shared with other researchers upon reasonable request and within a reasonable time of the request.

**Quality Assurance:**
The project staff will review the evaluation data before release to ensure that the qualitative and quantitative data are properly coded, analyzed, and labeled for any future use.

**Data Standards:**
Hydrologic data in HydroLearn will make full use of existing and emerging standards for sharing environmental datasets. For example, for geospatial datasets, we will use existing Open Geospatial Consortium (OGC) standard interfaces such as Web Map Services and Web Feature Services. HydroLearn will also provide standard HTTP access to content and other resources.

**Policies for Data and Research Products:**
The overall goal of HydroLearn is to promote collaboration and sharing of educational, resources, tools, contents, and modules that support active-learning in undergraduate hydrology and water resources education. We leverage our own earlier and ongoing NSF supported environments of HydroShare, Tethys and HydroViz. Users of HydroLearn (faculty members) can access and share modules and customize them to their own needs. The platform design will allow for inter-module dependency discovery and provide automatic linkage between dependent or related modules, allowing users to reference already published modules and further leverage the collaborative nature and extensibility of the platform. HydroLearn will also allow sharing learning modules between content creators and will enable users to provide feedback, report problems, and suggest changes on modules created by others. HydroLearn will provide faculty content developers with the choice to create private contribution of content, if needed, and then decide when to make them accessible to others. Proper authentication and access control will be fully integrated within

HydroLearn, HydroShare and Tethys. All educational content contributed through HydroLearn will include appropriate attribute information as necessary.

As a general policy, all source code developed by this project will be created using an open development model. This will enable us to coordinate our development activities across multiple Universities and engage developers and contributors from outside of the immediate project team who wish to contribute.

**Plans for Archiving Data:**
As stated above, adopters and users of HydroLearn will contribute their own content and resources within HydroLearn to better enable collaboration and reproducibility of learning material.

HydroLearn will serve as the primary archival mechanism for module content, tools and resources contributed by the project team and external users. During the development and early deployment phases, the project will use the Chameleon Cloud Platform, a configurable experimental environment provided by NSF for community cloud research, to host the development tools and run experimental and test case scenarios. In the long-term and past-project deployment phases, we plan to use the public cloud (e.g., Amazon EC2 or Microsoft Azure) to host HydroLearn for full public use. We will develop appropriate interfaces that enable content archived in HydroLearn to be indexed by other cyberinfrastructure established in coordination with hydrology community organizations (e.g., CUAHSI Water Data Center).

**Ethics and Privacy:**
The evaluation plan will be submitted for review by the Institutional Review Board at the University of Louisiana at Lafayette. An informed consent will include language to ensure that all participants understand that these data are being generated for the purpose of sharing with the research community. Data from this project are unlikely to pose a risk for disclosure; however, to further protect participants, data will be de-identified before long-term storage.