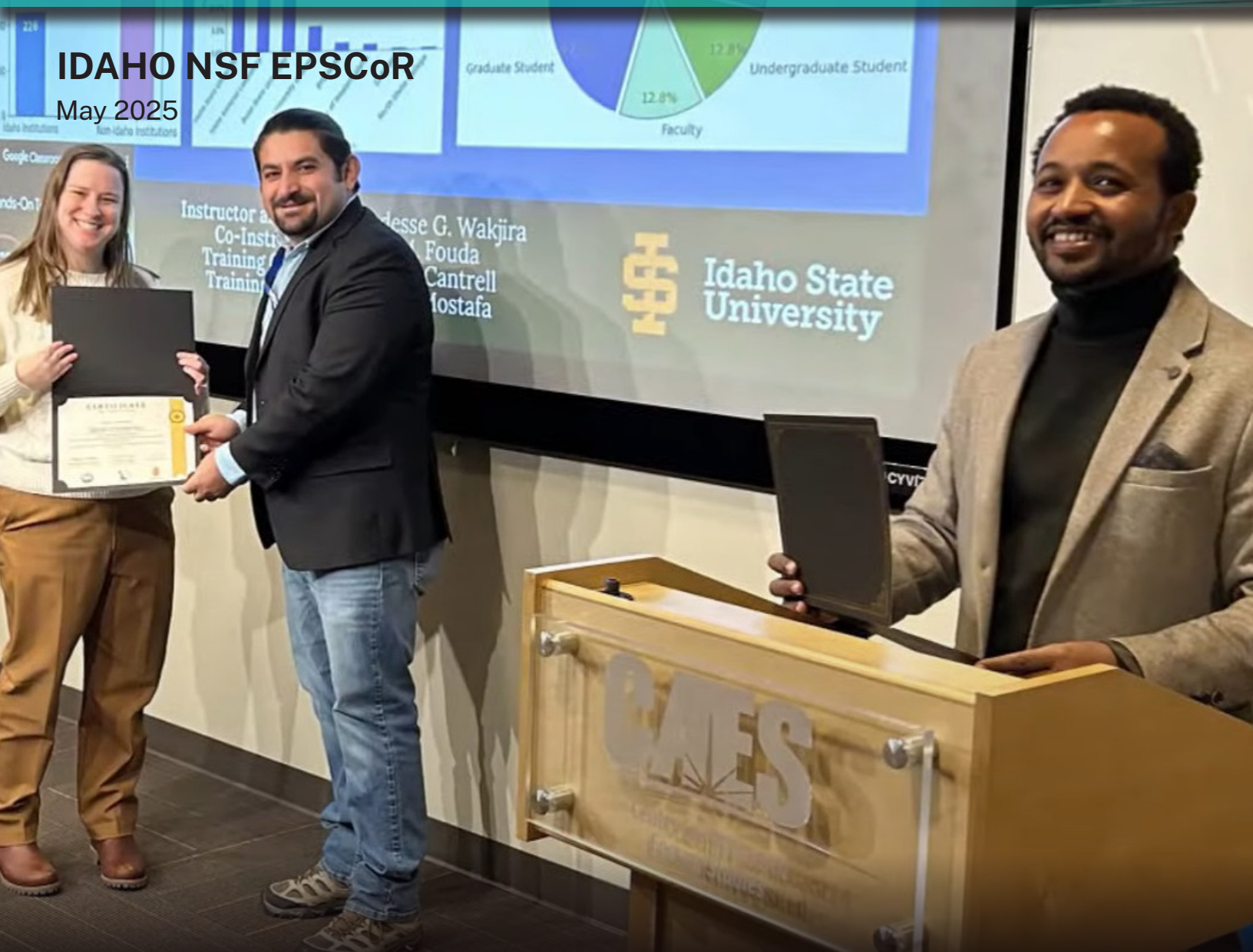


# the RESEARCHER

IDAHO NSF EPSCoR

May 2025



Lead Investigator, Tadesse Gemedo Wakjira, CAES Researcher in ISU's Department of Civil and Environmental Engineering; and Co-Investigator, Mustafa Mashal, Associate Director of CAES, present a certificate of completion to workshop participant, Sarah Creasman (Idaho National Laboratory), during ISU's Applied Artificial Intelligence for Engineers training.

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### Andy Kliskey

## LETTER FROM THE DIRECTOR

The I-CREWS Track-1 project is in the exciting transition from Year 1-2 research capacity, relationship, and engagement building at a broad level to now developing more focused engagement, research, education, and workforce development efforts. This issue of the newsletter highlights numerous excellent examples of this transition and build-out of focused efforts.

The Boise Treasure Valley site article provides an overview of one of our deep-dive study sites by Kendra Kaiser, the other two sites being at Coeur d'Alene Reservation and Fort Hall Reservation. With Year 1 I-CREWS Seed grants being awarded in summer 2024 we have an article on the successes of one of these Seed awards, "Training Students and Researchers in the State of Idaho on Applied Artificial Intelligence for Engineers within the I-CREWS Framework," led by Tadesse Wakjira. With an important aspect of the research capacity building in I-CREWS being centered on Tribal Nation capacity we have an article on the "(Re)connecting with the 6R's," workshop series that to date has supported two virtual workshops and recently an in-person workshop at ISU, led by Liz Redd and others. These workshops are situating the foundations for respectful and reciprocal engagement that is central to I-CREWS' emphasis on community engagement. Samantha Ross's article on "Exploring AI-Assisted Qualitative Research with ChatGPT" is a vital contribution to efforts in I-CREWS to interweave qualitative knowledge and data with modeling efforts. The article on "Building the I-CREWS Data Hub: Making Data Work for Resilience" by statewide I-CREWS Data Manager Sanaz Salati hones in on the essential role of data and information as a connector for interweaving across the I-CREWS project. And the article by Miranda Striluk and Bill Ebener on the evolving



Community of Practice highlights the important connections for education and workforce development with Idaho's 2- and 4-year colleges. Please read and enjoy these excellent examples of I-CREWS activity.

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*This material is based in part upon work supported by: The National Science Foundation under grant number OIA-2242769. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.*  
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*Unless otherwise noted in feature byline, articles and features in this publication are written by Sarah Penney-Jackson with editing and content contributions by EPSCoR administrative team.*

## I-CREWS Research

### Boise Treasure Valley, an I-CREWS Study Site

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*by Kendra Kaiser, Director, Idaho Water Resources Research Institute*

The Treasure Valley Study Site team is moving forward on a variety of I-CREWS efforts aimed at addressing long-term sustainability challenges facing the state of Idaho due to the ongoing increase in population, development, and industry. These efforts have included stakeholder engagement, modeling and characterization of the Treasure Valley system.

In the fall, the team hosted its first focus group to bring local experts together to talk about energy and water topics of interest to the local community. The focus group gathered representatives from various sectors, including energy providers, water resource managers, industrial users, government agencies, and representatives of indigenous communities. Participants noted that while hydropower is a key example of the Energy-Water nexus in southern Idaho, industrial growth, technological advancements and economic shifts in the Treasure Valley will likely be a major driver in the future of the Energy-Water nexus there. Reflections on the cultural significance of water beyond utilitarian uses emphasized the need for a deeper

understanding of how changes to these interconnected systems impact different communities. While direct feedback loops are often the focus, sustaining shared values requires collaborative approaches that recognize diverse perspectives, ensuring that ecological health and long-term sustainability remain central to decision-making.

This focus group built on another local event that happened in the fall - the Treasure Valley Water



*Kendra Kaiser, Director, Idaho Water Resources Research Institute, presenting to the Greater Boise Recreationalists Group on water resources in the Treasure Valley.*



Summit. The Treasure Valley Water Summits have been organized bi-annually by Ada County since 2022 to bring water experts together from across the region. This was a great opportunity for I-CREWS engagement through a team of interdisciplinary researchers from the University of Idaho, Boise State University, and the Internet of Water that were implementing an NSF Convergence Accelerator project to both better understand complex water resource challenges and build water literacy by communicating with diverse stakeholders. The primary outcome of this meeting, and associated engagement over the past year was an article in “The Water Report” that summarizes some of the key challenges and opportunities in water resources management in the Treasure Valley.

In January, we held a virtual Treasure Valley site update to share what we have learned with other I-CREWS teams. In addition to these and other engagement activities, the Modeling team has been moving forward with compiling various data sources for developing and training a machine learning model of future population growth and associated water demand in collaboration with other I-CREWS teams. The postdoc working with

the Characterize team, Katie Murenbeeld, has been processing spatial social, climate (specifically snow water equivalent), and energy source data to create archetypes of the Energy-Water Nexus within a social-ecological-technological systems (SETS) framework for Idaho. She is also in the process of obtaining a data mining license from Newsbank to complete a text analysis of Idaho newspaper articles related to water and energy issues. We are excited that the Alternative Futures team has a new postdoc, Mitchell Meads, that will be working across teams to understand drivers of resilience in the energy-water nexus and incorporate our understanding into the co-development of the alternative futures scenarios.

This spring, the Treasure Valley site will be implementing a cross-team coordination plan to bring these pieces together to identify questions at the Energy-Water Nexus of relevance to the Treasure Valley to ensure that community perspectives and needs are integrated into the ongoing modeling efforts, to support the Alternative Futures team in engaging with local stakeholders, and coordinating with the Characterize team to identify how research in the Treasure Valley ties into efforts across the state.

## I-CREWS Research

### ISU Researchers Provide Hands-on Training on Applied Artificial Intelligence and Machine Learning

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In 2024, the I-CREWS Project awarded Seed Funding projects as part of the effort to invest in new opportunities as well as pursue high impact, potentially transformative research and educational projects.

Its principal objective is to create a mechanism to catalyze new research related to the I-CREWS research, particularly Energy-Water (E-W) Systems. The term Energy-water (E-W) Systems refers to the intersection between the systems, consisting of the physical infrastructure, data/information/knowledge, the people, laws and policy, as well as the fuel and water that flows or is in reserve. This includes interdependent power and water systems tied to the physical infrastructure for generation, transmission, distribution and use of power and water along with governance and management practices, knowledge flows, and effects on end users.

During year-one funding period, a team from ISU, led by Tadesse Gemedo Wakjira, Center for Advanced Energy Studies (CAES) Researcher in ISU’s Department of Civil and Environmental Engineering, designed a Seed Funding project that provides engineers with expertise in applied artificial intelligence (AI) to develop innovative solutions to complex challenges and optimize resilience and sustainability in energy and water systems. Other members of the team included Co-Investigators Mostafa Fouda, Associate Professor, and Jared Cantrell, Lab Manager and Research Engineer, from ISU’s Department of Electrical and Computer Engineering.

The project was designed to address a significant gap in current educational offerings that focus on practical AI applications tailored explicitly for engineering students and researchers. In addition, current research

and training often emphasize theoretical model development but lack the practical applications of these models. This deficiency hinders the practical implementation of AI solutions in real-world scenarios.

Implemented in Spring 2025, the effort included comprehensive and hands-on training in applied AI for engineering students and researchers across Idaho, including Idaho State University (ISU), Boise State University (BSU), University of Idaho (UI), and Brigham Young University-Idaho (BYUI) as well as researchers from Idaho National Laboratory (INL) and Center for Advanced Energy Studies (CAES). A total of 226 participants attended the training, either in person or online via Zoom. Participants included faculty, researchers, graduate students, undergraduate students, staff, and others.

The training, which served students from all levels of expertise, provided practical examples and applications of AI in energy and water systems with the I-CREWS framework, as well as other engineering domains. Participants engaged in workshops that emphasize the development and deployment of AI frameworks into practical tools, which bridges the gap between theoretical models and real-world applications.

The training ran for two months, with sessions held twice a week. The curriculum included comprehensive training, covering both conceptual lessons and practical hands-on experience. Participants actively used Google Classroom to ask questions and receive answers from instructors, fostering continuous learning beyond the sessions.

The capstone project was designed in alignment with the I-CREWS initiative and was successfully completed by the participants. The final graduation ceremony was held at three locations: CAES, Idaho State University (ISU), and Boise State University (BSU). Participants were awarded certificates of completion during the graduation ceremonies. A total of 150 participants joined Google Classroom and benefited from the materials and resources provided.

Since 2018, Idaho EPSCoR has awarded just under \$2 million to 22 Seed projects around the state. The two projects recently awarded in 2024 are part of the category focused on Convergence Research and Education, which includes projects that are driven by a specific and compelling problem and demonstrate deep integration across disciplines.



*Tadesse Gemeda Wakjira, CAES Researcher in ISU's Department of Civil and Environmental Engineering presents during training on Applied Artificial Intelligence and Machine Learning.*

## 6R's Workshop Provides Training on Native Engaged Research

In the Spring of 2025, Idaho State University hosted a series of workshops titled, “(Re)connecting with the 6R’s,” which builds on the 2022 (Re)Cultivating and (Re)Newing Reciprocal Research workshops. The three-part series utilizes the 6R’s (Respect, Relationality, Responsibility, Representation, Relevance, Reciprocity) framework for exploring the dynamics, logistics, and practical considerations of conducting or engaging in collaborative research with, in, and by Native Nations.

The series, which was funded by the NSF EPSCOR I-CREWS award, took place through both Zoom and in-person workshops, and culminated with an in-person event in Pocatello and Fort Hall, Idaho. Participants were able to participate in field trips to Fort Hall, Indian Rocks, and Lava Hot Springs followed by dinner and cultural demonstrations.

With over 20 colleges and universities represented in attendance as well as over 15 Tribal nations represented, the workshops provided training to over 100 participants working in institutional settings, as well as community researchers and practitioners. Participants were able to gain knowledge on ethical

and respectful research relationships in support of mentoring and more impactful research and how to apply 6Rs concepts in home communities, departments/universities or workplaces..

One of the series organizers, Liz Redd, Assistant Professor/Director of ISU’s American Indian Studies Program, stated that participants really seem to be engaging meaningfully and learning. Participants were able to gain knowledge on ethical and respectful research relationships in support of mentoring and more impactful research and how to apply 6R’s concepts in home communities, departments/ universities or workplaces. “This reinforces my own mentality that I am capable and should be confident in my experiences and expertise as an Indigenous scholar and professional,” noted one participant, “but also to recognize the standards I should have for myself as a researcher to improve and grow more closely to these practices to maintain ethical research.”

Reflecting on how participants could use new knowledge to make changes in their own research or work, one participant emphasized the importance of





building trust when asked how they plan on making changes in their own research/work, emphasizing how past harms have had a negative impact on current practices. They stated “there are still damages to be dealt with every day, and as an outsider we must remember that trust building is not a one-and-done action but an ongoing practice.”

The workshops were a way to create a space for institutions, Tribal partners, agencies, and other community members to come together for conversations on ethical research practices. When asked what the most important thing that they would take from this workshop, one participant noted that the workshop was “a great reminder that research can be so healing and empowering for our communities when done in a good way.”

In support of the I-CREWS focus on community engagement, the workshop series will continue in spring of 2026 with two virtual meetings and an in-person meeting in Coeur d’Alene. In 2027, two virtual meetings will be held as well as an in-person meeting in Boise, ID. The locations correspond to community partner sites of the I-CREWS project. If you were unable to attend any of the sessions, the recorded keynote addresses and additional resources are available at the website, “[recultivating-and-renewing-reciprocal-research.com](http://recultivating-and-renewing-reciprocal-research.com).”



*The final session of ISU’s 6R’s training was an in-person event held in Pocatello and Fort Hall, Idaho. Participants were able to participate in field trips to Fort Hall, Indian Rocks, and Lava Hot Springs followed by dinner and cultural demonstrations.*





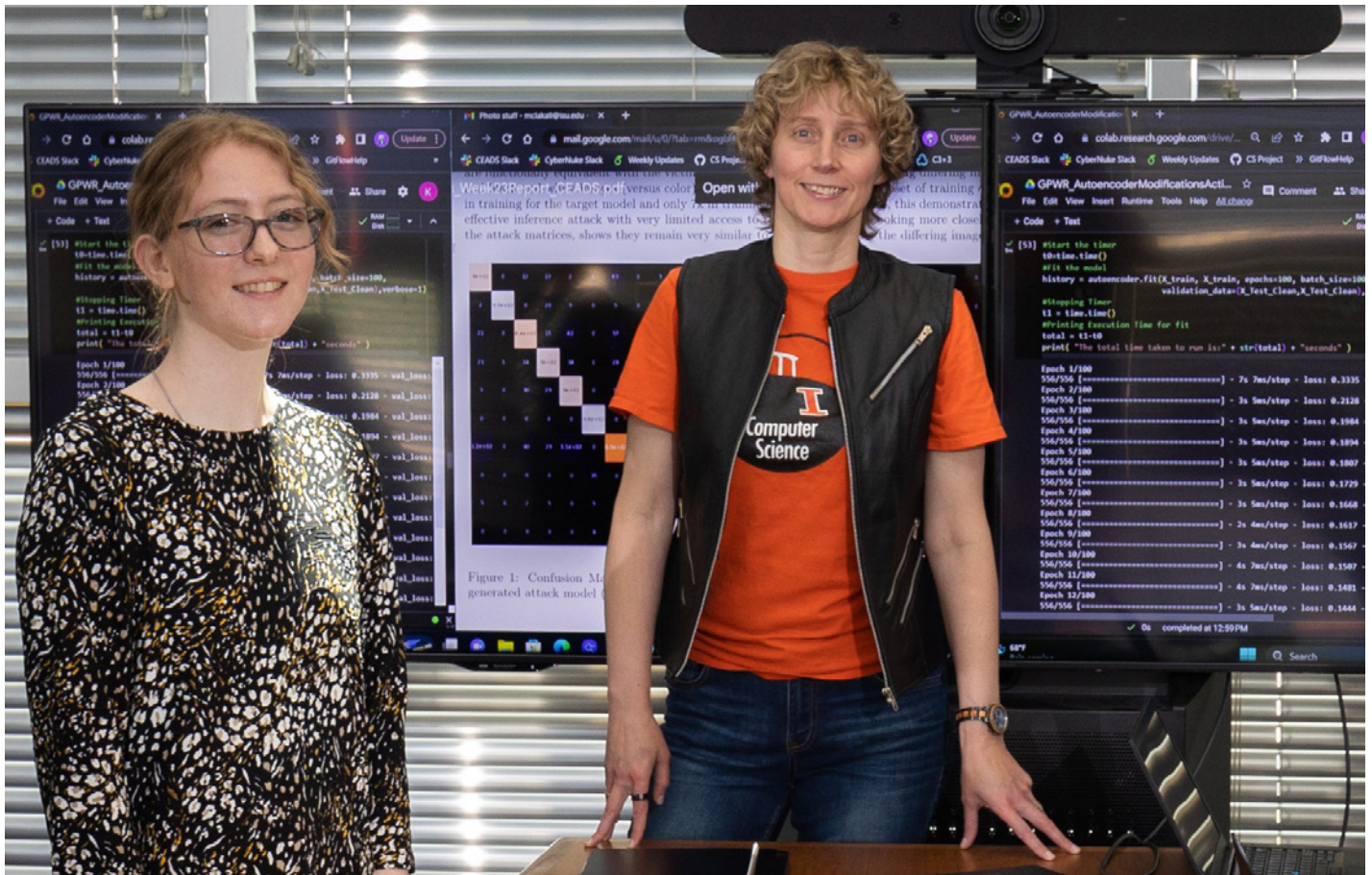
## Exploring AI-Assisted Qualitative Research with ChatGPT

By Samantha Ross, ISU Graduate Researcher

In qualitative data analysis, researchers often follow a cyclical process called thematic analysis, which focuses on engaging and reducing data to codes and constructing themes, often relying on their own interpretations and life experiences. This can be very time-consuming and tedious. Large language models (LLMs), like ChatGPT, are tools that could help researchers in this task. However, significant questions arise: Where should the AI assist and where should it stop? Is it capable, and more importantly, is it reliable? When dealing with LLMs, hallucinations are always a

concern. Hallucinations are instances where the model provides inaccurate information, often occurring when the model misunderstands context or lacks context altogether. The potential for hallucinations can be reduced but never eliminated, and they are a prime reason why LLMs still require human supervision in both research and industry settings.

As a member of Dr. Leslie Kerby's Computational and Engineering Data Science (CEADS) research group, I was brought onto the I-CREWS project to explore ways in which qualitative data could be incorporated with



ISU Graduate Researcher, Samantha Ross (left), working with Dr. Leslie Kerby (right), Associate Professor in Computational Engineering And Data Science (CEADS), work on CEADS Cyber Nuclear Machine Learning project, researching vulnerabilities in machine learning systems. Photo credit: Idaho State University



LLMs, in the hopes of being able to assist researchers in extracting meaningful insights to address the impact of climate, population, and technological change on energy-water systems in Idaho. My role within the project was to test ChatGPT's capabilities for qualitative data analysis, to explore whether it could assist researchers in summarizing, analyzing, and interpreting qualitative data.

Collaborating with my advisor Dr. Leslie Kerby, and consulting with Dr. Morey Burnham, Associate Professor of Sociology at Idaho State University, I designed and evaluated a series of experiments using different ChatGPT versions and curated prompts. ChatGPT model 4o had the best results, and it consistently generated codes and categories that aligned with those created by human researchers. Results stayed consistent across multiple trails, and hallucinations were minimal, mostly limited to small misquotations. This showed promising potential for using ChatGPT to aid in the early-stages of qualitative coding, especially on shorter documents such as interview transcripts. I also tested ChatGPT's performance on longer, more complex water policy and legislative documents. In collaboration with researchers

at Boise State University, a sample of policies and bills (often exceeding 100 pages) were analyzed. While ChatGPT could still generate helpful summaries and extract major categories, performance dropped with longer texts and hallucinations became more prevalent.

Overall, this research found that ChatGPT's efficacy in qualitative data analysis relies heavily on the length of the documents it's given, with it performing better on shorter documents, and well-designed prompts that focus the generated content by providing specificity, format, and roles for ChatGPT (e.g., "you are an expert qualitative data analyst"). This work demonstrates LLMs like ChatGPT could help reduce the time and effort needed to process large amounts of qualitative data. It could make research more efficient and accessible, especially in areas like providing quick insights into community engagement.

As researchers, it is our responsibility to approach this technology ethically and critically, ensuring human oversight remains an essential part of any AI-assisted process. The goal isn't to replace human analysis, but to enhance it.

## I-CREWS Research

# Building the I-CREWS Data Hub: Making Data Work for Resilience

*By Sanaz Salati, I-CREWS Data Manager, University of Idaho*

One of the biggest goals of the I-CREWS project is to help Idaho communities become more resilient to changes in energy and water systems. But to do that, we first need solid infrastructure — a place where the data can live, be shared securely, and actually be used across the different research teams. That's where the Energy-Water Data Hub comes in.

The Hub is being designed as a shared platform where research teams can store, access, and collaborate on data — from raw measurements and historical records to modeling outputs and visualizations. It connects the Characterization, Modeling, and Alternative Futures components of the I-CREWS project, so that information flows smoothly from one phase to the next. Ultimately, the goal is to support data-informed

decisions about Idaho's future, especially in the face of climate and population changes.

## Getting the Foundation in Place

In the first year, the focus was on building the core infrastructure to support the Hub. That included purchasing AI GPUs for the Falcon supercomputer, setting up the physical hardware, and securing an NSF Campus Cyberinfrastructure grant to improve network performance. The Falcon supercomputer is housed at the Idaho National Laboratory Collaborating Computing Center (C3).

The team also began rolling out tools for collaboration, such as the federated login (using Google and

Microsoft), GitHub for code management, and platforms like OwnCloud and Globus for secure file sharing. A full data needs assessment was completed across all I-CREWS teams to better understand what kinds of data would need to move through the system — and how.

## **Turning It On: Data Flow and Real Use**

In year two, things moved into action. The Characterization group began feeding data into the Hub, which the Modeling group is now using in simulations on the Falcon and Lemhi supercomputers. These results will eventually help inform scenario development by the Alternative Futures team.

We've also been working closely with Tribal and university partners to establish data-sharing agreements. A key part of that has been honoring Indigenous data sovereignty — making sure tribal data stays secure, private, and controlled by the communities that own it. We're designing technical controls to enforce those agreements, using a mix of permissions and AI tools.

There's now a public-facing webpage that shares a growing list of available statewide datasets, and we've started work on metadata and data standards to help make everything easier to find, understand, and reuse.

## **What's Under the Hood?**

Technically, the Hub is being built out in several layers. Right now, it includes:

- Secure storage via Globus and OwnCloud

- A role-based identity system (using Keycloak) that manages access by group or institution
- A searchable metadata index powered by OpenSearch that tracks both public and private datasets
- An authenticated frontend where users can log in using their institutional accounts

Several pieces are already working, including federated login, simulated search functionality, and access to Fileshares. In the current phase, we're working on loading users into the identity system, refining group management tools, indexing more data (especially with geographic info), and improving the search experience.

## **What Comes Next?**

As we keep building, the focus is on making the Hub more useful and intuitive. That includes expanding data ingestion, integrating both qualitative and quantitative inputs, and releasing portions of the system as open-source so other institutions can learn from or build on what we've done.

The Hub isn't just about storing data — it's about making data usable. Whether it's through secure sharing, real-time modeling, or future visualizations, the platform is being designed to support collaboration, inform strategy, and uphold values like transparency and ethics.

The I-CREWS Data Hub is a work in progress, but it's already laying the groundwork for how we can think — and act — together about Idaho's energy and water future.



## I-CREWS Community of Practice Engages Idaho's 2- and 4-Year Colleges

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Engaging Idaho's 2- and 4-year college educators has always been a goal of the I-CREWS project, and with the help of new leadership from Idaho's primarily undergraduate institutions, I-CREWS aims to reach students and community at a greater level.

Miranda Striluk, Assistant Professor of Biology at College of Western Idaho, and Bill Ebener, Instructor at College of Southern Idaho, have been serving as co-leads in this effort and have been working closely with the I-CREWS Education and Workforce Development team. The team is working to bring community members into discussions and exchange ideas around topics at intersections of Energy-Water (E-W) systems in relation to climate, population, and technological change.

This new "Community of Practice," also known as CoP, will work to better understand the needs of Idaho's 2-4 year educators, their students and communities, to help broaden participation within I-CREWS research, and also provide professional development opportunities related to E-W systems. They are also working to develop a framework for E-W systems literacy and align

E-W systems literacy with Idaho General Education Matriculation (GEM) competencies.

The CoP will meet formally twice a year, in the spring and fall. The spring CoP meeting time will be held on Thursday, May 15th, 2025 9:30 - 11:00 AM at the Coeur d'Alene Tribal Resort-Hotel in Worley, Idaho, during the I-CREWS annual meeting. A fall meeting will be held remotely.

In addition to the biannual meetings, CoP (lead and any interested individuals) meets monthly to inform, discuss, develop, and implement E-W systems literacy within and among I-CREWS component teams and the communities served. While this group focuses on 2- and 4-year educators, all meetings are open to interested individuals from any community or institution.

If you want to join our CoP development sessions and learn more about how to get involved, please reach out to the following CoP leads, Miranda Striluk ([mirandastriluk@boisestate.edu](mailto:mirandastriluk@boisestate.edu)) and Bill Ebener ([bebener@csi.edu](mailto:bebener@csi.edu)).

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