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RESEARCH INFRASTRUCTURE IMPROVEMENT (RII 4)
PROPOSAL DEVELOPMENT PROCESS

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
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TITLE: COMPUTATIONAL THINKING: LINKING EDUCATION PATHWAYS TO WORKFORCE NEEDS

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Computational Thinking: Linking Education Pathways to Workforce Needs

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Target Audience:

The target audience for this work consists of K-20 students, teachers, counselors (including parents), STEM education programs (both Informal and Formal), STEM researchers, university / college educators, representatives from industry and government, national laboratories, and the public at large.

Description of Activity:

In order to build a workforce capable of studying issues at the nexus of energy-water-environment, we need a better understanding of and articulation between workforce needs and the educational pathways that prepare students for the workforce. Workforce needs will be profiled using an existing framework and educational pathways aligned to the framework will be collected from NM institutions of higher education, industries and national laboratories that offer internships, and K-12 STEM-focused education programs.

Building on the "Computational Thinking in America's STEM Workplaces" project (NSF award #OCI 1057672), we will use an occupational analysis or "profile" of a computationally enabled STEM professional as a framework for mapping between educational opportunities and workforce needs. This profile, developed by national laboratory scientists, STEM researchers, product/process engineers from industry, and workforce development experts from Education Development Center, Inc., specifies the job functions or tasks, knowledge/skills, tools/techniques, and desirable behaviors of computationally enabled STEM professionals. In phase 1 we will validate the profile through interviews and online surveys of computationally enabled STEM researchers associated with NM EPSCoR and collecting case studies of how computational thinking is used by scientists and researchers at the nexus of water, energy and environment. In phase 2, after the validation process has been completed and adjustments and/or amendments to the profile are made as needed, the resulting profile will be used to gather information from New Mexico K-12 programs, institutes of higher education, STEM researchers, and industry partners.

STEM focused K-12 programs will be asked to identify the profiled tasks, knowledge/skills, tools/techniques and behaviors that students learn or are prepared for through their programs. Institutes of Higher Education will be asked to identify specific courses that teach the profiled tasks, knowledge/skills, and tools/techniques. (We expect different classes/courses will address different subsets of the profile). STEM researchers and industry partners will be asked to identify jobs /roles they seek to fill and the tasks, knowledge/skills, and tools/techniques required of persons in those roles. Taken together, this compendium of information would be used by students to inform their selection of

educational opportunities appropriate to their career path and visualize the wide range of professions that need persons with their skills; used by employers to identify sources of and assess prospective hires; and used by counselors to advise students as they construct their educational pathways. In phase 3, we will use the resulting information to do a gap analysis of educational opportunities that are missing at various levels. For example, we could identify if satellite image processing was a common need among employers but no courses that teach this topic exist in NM institutes of higher education. The profile could be used to develop internships offered by research centers or industry that provide background in topics not offered in academia. Finally, in phase 4, the collected case studies will be used to develop a poster for mass distribution that will raise awareness of the applicability of computational skills in the STEM workforce.

Relevance to Energy-Water-Environment Nexus

The proposed activity has relevance to the Energy Water Environment Nexus theme by providing a tool that can be used to develop human capacity. Computationally enabled STEM professionals are needed to address issues at the nexus of energy-water-environment. Computational methods and tools are an important part of this research because they are tools used by scientists to study and understand (and possibly mitigate) these complex systems problems. There is an increasing need for a workforce capable of understanding and applying computational concepts, methods, tools and technology to systems problems that traverse disciplinary bounds. We address this need by providing a tool that can assist students in preparing to join the computationally enabled STEM workforce.

Products/Deliverables and dissemination:

Phase 1: Validated profile of a computationally enabled STEM professional working at the nexus of energy-water-environment. (Validation will be achieved through focus group interviews and surveys).

Phase 2: Map of educational opportunities that offer preparation and training for skills listed in profile.

Phase 3: Gap analysis to determine gaps between workforce needs and educational opportunities in NM.

Phase 4: Poster using examples from case studies that raises awareness of applicability of computational skills in the STEM workforce.

Phase 5: Dissemination of products to industry, educational institutions, educational researchers, students, parents, and counselors.

Evaluation:

A front-end survey of potential users will inform the design and development of the map of educational opportunities. Surveys of representatives of the target audience, partners, stakeholders, and end-users will be administered to gather data on the value and relevance of the end-products.

Potential for matching funds: (20% match required)

We will seek matching funds from Industry (Intel, PNM, HP, and others) and private foundations.