Evaluation of the WC-WAVE Track 2 EPSCoR Project

Trimester 3 Evaluation Report

April 1, 2014 – July 31, 2014

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Section 1. Executive Summary

1.1 Overview of the project

On August 1, 2013, the Idaho, Nevada, and New Mexico NSF EPSCoR projects were awarded a Track 2 EPSCoR (Experimental Program to Stimulate Competitive Research) grant for their "Western Consortium for Watershed Analysis, Visualization, and Exploration" (WC-WAVE) project. There are four components of this EPSCoR project:
Component 1: Watershed Sciences
Component 2: Cyberinfrastructure (CI)- Visualization
Component 3: Cyberinfrastructure - Data
Component 4: Workforce Development

The following EPSCoR activities were conducted between April, 2014 and July, 2014. Evaluation results of these project components are included in this report:

- Baseline Survey
- Community Surface Dynamics Modeling System (CSDMS) Training
- WC-WAVE Tri-State meeting
- Stream Flow Camp
- Undergraduate Visualization and Modeling Network (UVMN) Workshop

1.2 Summary of findings

Key findings and recommendations for project activities are listed in Figure 1. A complete description of key findings and recommendations for each project activity can be found at the end of each project activity section of this report. Overall project findings and recommendations are listed in Section 4 of this report.

Figure 1. Summary of findings of project activities

Project Activity	Key Findings	Recommendations
CSDMS	• Women comprised 44% of CSDMS participants • African Americans, American Indians, and Hispanics/Latinos were under represented • All four program components were rated *very* or *extremely useful* • Participants showed statistically significant gains for all four items related to participants' knowledge of the training's objectives, except *knowledge about input and output specifications for my model wrapping target*.	• Efforts should be made to recruit URMs as well as to encourage attendance of current students who are underrepresented minorities and/or female. • Integrate audience engagement strategies into the workshop. • Focus on the input and output targets for model wrapping and model integration challenges and solutions.
WC-WAVE May Meeting	• Most attendees were Caucasian male faculty members from Watershed Science project team. • Females and Hispanics were underrepresented. • Idaho members were underrepresented • Participants were *completely satisfied* with the cross-component discussion and *very satisfied* with the evaluation presentation. • Participants showed statistically significant gains for all three program objectives.	• Encourage more attendance and participation by female, Hispanic/Latino, and Nevada and New Mexico participants. • Incorporate more hands-on activities and match professor and student interests when assigning teams. • Consider keeping participants informed in these areas throughout the year.

Project Activity	Key Findings	Recommendations
Stream Flow Camp	• Faculty participants composed 27% of the total group, with graduate students composing 64%. • African Americans, American Indians and Hispanics/Latinos were considerably under represented. • All four program components were rated *very* or *extremely useful*. • Participants were *very* or *completely satisfied* with most logistical aspects of the Stream Flow Camp. • Participants demonstrated statistically significant increases in knowledge on all five program objectives.	• Increase outreach to encourage under-represented minority students and first-generation college students to attend Stream Flow Camp and the other field experiential activities. • Participants suggested better planning, sending information to participants in advance, creating small groups, and providing more challenging measurement work. • Send background information, educational links, and current publications on topics to attendees before the camp so they can read and prepare ahead.
UVMN	• Women composed 48% of participants • African American and Pacific Islanders were not represented. • Faculty participants comprised 52% of participants while undergraduates made up the remaining 48%. • Approximately 33% were underrepresented minorities (URM). • All program components were rated *very* or *extremely useful*. • Participants showed statistically significant increases for all seven items related to students' interest in and commitment to modeling and visualization.	• Increase participation by underrepresented minorities, especially Native Americans and Hispanic/Latinos. • Include demonstrations or examples whenever possible in each session. • Provide concrete examples for trainers of how they could incorporate the concepts and tools presented. • Share more historical, hydrological, and meteorological information about program sites with participants. • Encourage faculty to continue discussing their own research, any possible future research opportunities related to the WC-WAVE project, and potential future dissertations topics that could be related or of interest to students.

Key findings and recommendations for baseline results are shown in Figure 2**.**

Figure 2. Summary of findings of baseline survey results

Category	Strengths	Weaknesses
Demographics	• Females and Hispanic/Latinos are underrepresented. • Males, Caucasians, and Asians are overrepresented. • Overall participation was good with a 92% response rate.	• Encourage current project members to work across components to analyze and create strategies for increasing hiring and participation from women and URMs.
Component 1: Watershed Science	• Out of the three objectives, *Objective 1: Parameterize and validate watershed models* had the highest level of mean participant knowledge at *slightly knowledgeable*. • *Objective 2: Develop CSDMS (Community Surface Dynamics Modeling System) adapters for models* had the lowest mean participant knowledge at *not knowledgeable at all*.	• Promote WC-WAVE activities that will increase participant content knowledge of watershed science. • Continue to involve students in faculty mentoring and research opportunities to increase their watershed science knowledge and abilities.
Component 2: Cyber-infrastructure-Visualization	• Overall, participants rated themselves as *slightly knowledgeable* in the CI -visualization component. • The highest-rated item was *how data required by models and visualization tools are defined.* • *T*he lowest-rated item was *how Visualization Environments interface with Virtual Watershed Platform adapters.*	• Ensure all participants know that CI is an integral part of the WC-WAVE project. • Advertise CI -related activities and encourage participation by attendees from all components.
Component 3: Cyber-infrastructure-Data	• Participants rated themselves as *slightly knowledgeable* in the CI -data component. • The highest rated item was *how data are integrated within and into larger networks*. • The lowest rated area was *strategies for the acceleration of integrated watershed scale modeling.*	• Ask CI faculty to initiate a brown-bag lunch series where they discuss how CI is related to the WC-WAVE project. • Encourage attendance by all WC-WAVE project members from areas other than CI. • Allow participants to ask questions and increase their CI content knowledge.
Component 4: Workforce Development/ Education	• The item showing the highest participation had 56% participation and the lowest had 3% participation. • Between 25-59% of participants do not contribute or participate in any Workforce Development programs.	• *As overall participation in Workforce Development activities is low at the end of the baseline of the project, encourage participation by all WC-WAVE members in more activities.* • *Ensure they have access to upcoming Workforce Development activities and know how to get involved.*

General project recommendations:

1. Increase outreach and recruitment to women and underrepresented minority groups.
2. Vary formats of meetings and presentations of information.
3. Incorporate discussions of sustainability at all meetings from component to larger groups.
4. Increase the number of faculty on field experience trips.
5. Utilize one cloud-based document/file sharing system for the project that would include handouts, lecture notes, agendas, and logistics information among other items.
6. Utilize evaluation findings to improve project activity coordination and facilitation and guidance from external evaluators to develop activity objectives and evaluations.

Section 2. Introduction

2.1 Background of the project

On August 1, 2013, Idaho, Nevada and New Mexico NSF EPSCoR projects were awarded funding for a Track 2 EPSCoR (Experimental Program to Stimulate Competitive Research) project, named the Western Consortium for Watershed Analysis, Visualization, and Exploration (WC-WAVE). The consortium model significantly increases opportunities for scientific collaboration and enhances each state's ability to secure competitive funding and tackle complex watershed science research agendas. The mission of the NSF EPSCoR program is to assist the Foundation in its statutory function "to strengthen research and education in science and engineering throughout the United States and to avoid undue concentration of such research and education."[1] The NSF EPSCoR goals aim to:

- Provide strategic programs and opportunities for EPSCoR participants that stimulate sustainable improvements in their R&D capacity and competitiveness;
- Advance science and engineering capabilities in EPSCoR jurisdictions for discovery, innovation and overall knowledge-based prosperity.

The objectives of the NSF EPSCoR program include:

- Catalyzing key research themes and related activities within and among EPSCoR jurisdictions that empower knowledge generation, dissemination and application;
- Activating effective jurisdictional and regional collaborations among academic, government and private sector stakeholders that advance scientific research, promote innovation and provide multiple societal benefits;
- Broadening participation in science and engineering by institutions, organizations and people within and among EPSCoR jurisdictions;
- Using EPSCoR for development, implementation and evaluation of future programmatic experiments that motivate positive change and progression.

The three-year award funds watershed science research, CI -enabled discovery and innovation, and workforce development and education, which are part of each state's Science and Technology Plan. The project is creating a new immersive virtual reality environment that fosters "interdisciplinary discussion and creative insight into complex scientific questions" and enables "innovations that result in groundbreaking discoveries"[2] about watershed science.

[1] http://www.nsf.gov/od/oia/programs/epscor/about.jsp

[2] http://www.nsf.gov/awardsearch/showAward?AWD_ID=1329469&HistoricalAwards

Project components, goals, and objectives

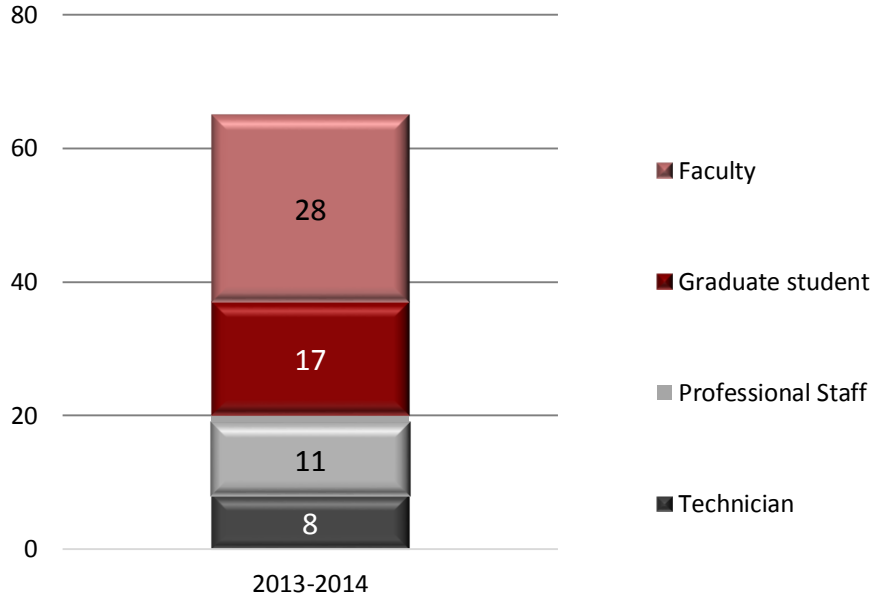
Figure 3. WC-WAVE Project Overview

WC-WAVE Project Overview	
Component 1: Watershed Sciences	
Goal	**Advance understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed (VW) framework.**
Objective 1	Parameterize and validate watershed models
Objective 2	Develop CSDMS adapters for models
Objective 3	Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services
Objective 4	Snow camp & summer institutes
Component 2: Cyberinfrastructure-Visualization	
Goal	**Accelerate collaborative, interdisciplinary watershed research and discovery by creating innovative visualization environments.**
Objective 1	Develop and deploy Visualization Environment ←→Virtual Watershed Platform adapters
Objective 2	Develop user interfaces ("front end interfaces") for the visualization environments
Objective 3	Train users on how to use the visualization environments
Objective 4	Educate graduate students on CI for watershed research
Objective 5	Disseminate results
Component 3: Cyberinfrastructure-Data	
Goal 1	**Accelerate integrated watershed scale modeling through streamlined data access, transfer of outputs and associated metadata to data management systems, visualization, model configuration**
Objective 1a	Define data required by models and visualization tools
Objective 1b	Define model and visualization too data format requirements
Objective 1c	Define model configuration options to be exposed through the virtual watershed and visualization tool
Objective 2	Define model integration workflow
Objective 3	Deploy virtual watershed data and service platform
Objective 4	Deploy data source to Virtual Watershed adapters
Objective 5	Deploy virtual watershed model adapters
Objective 6	Deploy virtual watershed to Visualization Environment adapter
Goal 2	**Enable accelerated and broad access to research products, data and metadata through integration with national networks through interoperable data services**
Objective 1	Integrate data management system with CUAHSI HIS WaterOneFlow service network
Objective 2	Integrate data management system with DataOne network as Tier 4 member nodes
Goal 3	**Streamline data intensive research through improved data management skills**
Objective 1	Provide annual data management workshops for EPSCoR researchers and their students
Component 4: Workforce Development and Education	
Goal	**Engage university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization.**
Objective 1	Develop a Graduate Interdisciplinary Training (GIT) Program
Objective 2	Develop an Undergraduate Visualization and Modeling Network (UVMN)

Project participants

Sixty four faculty, students, professional staff, and technicians are participating in the 2013-14 WC-WAVE EPSCoR project. A breakdown of project participants' roles is found in Figure 4. The majority are senior university personnel. It is expected that the number of undergraduates, graduate students, and external partners, such as educational, industry and governmental personnel will grow as this project develops.

Figure 4. Project participant roles



Project components

Figure 5 shows all of the components and activities that part are of the WC-WAVE project.

Figure 5. WC-WAVE project components

Watershed Science Research	Visualization and Data Cyberinfrastructure	Workforce Development/Education
• Hypothesis driven collaborative research activities • Model runs with students • Experiential field teaching and learning for students and faculty (Snow Camp, Summer Institutes) • Dissemination of findings and products • Planning and discussion about sustainability of research activities	• Ongoing gathering of data and model requirements and user expectations • Analysis of data and feedback to cyberinfrastructure leads on end users' needs • Workshops for faculty and students on effective use of the visualization environment and data management • Planning and discussion about sustainability of CI that is being developed	• Interdisciplinary training of graduate students (GIT) • UVMN cohort 1 and 2 • UVMN capstone event • Undergraduate modules • Diversity of participation • Planning and discussion about sustainability of activities

Project components conducted this reporting period

The following project components were conducted this reporting period:

- Community Surface Dynamics Modeling System (CSDMS) Training
- WC-WAVE Tri-State meeting
- Stream Flow Camp
- Undergraduate Visualization and Modeling Network (UVMN) Workshop

2.2 Background of the evaluation

Three types of evaluation are conducted for this WC-WAVE project: a front-end evaluation to assess program needs and assist with organization and planning, a formative evaluation to monitor implementation of the project components and provide feedback, and a summative evaluation to assess achievement of project goals and broader impacts. All three types of evaluation use a combination of qualitative and quantitative indicators.

The front end evaluation organizes the project and assesses needs. The evaluator works with the leadership team to refine the logic model, collect baseline information, conduct a needs assessment, refine outputs and outcomes, and develop evaluation instruments and data collection procedures. The evaluator(s) attend planning meetings virtually and/or in-person and works with the leadership team to align the evaluation to project components and activities as they develop.

The formative evaluation assesses the implementation and quality of project components. All participants who attend meetings, field experiences, and workshops, and take part in research exchanges complete post-evaluations to assess the usefulness of activities and to identify strengths and areas of improvement. The formative evaluation is used to identify potential problems and seek solutions early during the implementation.

The summative evaluation examines the project's overall success and benefit to participating students, faculty, researchers, and universities. Summative procedures include conducting a project baseline and post-survey of all project participants when they begin working with the WC-WAVE project and at the end of each project year. The evaluation measures participants' gains in new knowledge, research collaboration, and establishment of collaborative relationships across components and teams. The summative evaluation also assesses growth in institutions' capacity to develop networks and engage in research and education collaborations. The summative evaluation examines the project's overall success and benefit to participating students, faculty, researchers, and universities.

Guiding evaluation questions

The following guiding evaluation questions are based on the WC-WAVE project goals.

Advanced understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed framework

- What progress has been made in achieving the project's scientific benchmarks and milestones?
- How have the watershed models and adapters provided by the EPSCoR project enabled scientists to advance their understanding of hydrologic interactions and their impact on ecosystem services?

- In what way have the addition of watershed models and adapters increased the WC-WAVEs' competitiveness in this scientific field?
- How have these watershed models and adapters influenced scientists' ability to serve as experts in their fields?

Develop a comprehensive approach that leads to an increase in the number of underrepresented students who graduate from STEM degree-granting programs

- What value-added effect has this project provided for underrepresented students?

Accelerated collaborative, interdisciplinary watershed research and discovery through innovative visualization environments and through streamlined data management, discovery and access?

- What progress has been made in achieving the project's CI Visualization and Data benchmarks and milestones?
- What visualization resources have been accessed and how have they been used by researchers, faculty, and students?
- How have the visualization environments and streamlined data management, discovery and access affected the pace at which scientists can conduct hydrologic and ecosystem research?
- What long-term impacts will development of this visualization environment have on ecosystem research and discoveries?

Engaged university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization?

- What progress has been made in achieving the project's workforce development benchmarks and milestones?
- In what ways has participation in the EPSCoR programs increased participants' understanding of issues related to hydrology and ecosystems?
- What impact has participation in the EPSCoR programs had on the development and direction of participants' educational and career opportunities and choices?
- In what ways did participants' take the knowledge they acquired in EPSCoR programs and transfer it back into the classroom, university, and workplace in a meaningful, productive way?
- What value-added effect has this project provided for students and participants who are traditionally underrepresented in STEM?

Assessment Development

SmartStart has developed the following assessment instruments for the Tri-State WC-WAVE project:

- Evaluation forms for all project activities seminars, workshops, and meetings
- Project baseline/post-survey
- Pre-/Post- content survey development with program coordinators for specific activities
- Program Sustainability Assessment Tool (PSAT)

In addition to these assessment instruments, SmartStart will also assist with parts of submitted Institutional Review Board (IRB) applications for specific activities.

Evaluation forms are based on workshop and meeting agendas. Forms include rating scales of usefulness of agenda items as well as open-ended questions so participants can comment on agenda items and the overall training. Baseline/post surveys' Likert scale, open-ended, and perceived gains questions are adapted from six validated surveys.[3] Instrument development is guided by a systematic, iterative process of construct identification, creation, and instrument review or validation (Wilson, 2005). To develop the surveys, the evaluator discussed the project goals and the impact principal investigators would like participation in the project to have on participants. Next, the evaluator generated questions that address key constructs identified in the goals. Survey drafts were sent to principal investigators and program coordinators. Feedback and suggestions were incorporated into the surveys and the surveys were finalized. Questions are repeated on baseline and post-surveys to measure changes in outcome areas. Focus group and interview protocol questions are based on assessment of project goal achievement. Principal investigators provide feedback to improve all protocols.

Data collection methods and analyses

Participants complete paper or online workshop and meeting evaluation forms at the end of each workshop or meeting. Project baseline and post-surveys are posted on www.surveygizmo.com and a link is sent to project participants' email addresses. Quantitative results are analyzed using SPSS software. Results of workshop and meeting evaluations and the baseline survey are analyzed using means and response frequencies. Likert scale results of project baseline/post surveys and the research abroad experience post-survey are analyzed using paired t-tests and ANOVAs to measure gains that can be attributed to participation. All responses to open-ended questions are included in reports. Qualitative results, such as focus group and interview responses are analyzed using NVivo software to identify themes.

Evaluation components conducted during Trimester 3

The following evaluation activities were conducted during Trimester 3 of this project:

- Community Surface Dynamics Modeling System (CSDMS) evaluation (Appendix A)
- Tri-State Meeting evaluation (Appendix B)
- Stream Flow Camp: Jemez/Hiking Evaluation (Appendix C)
- Stream Flow Camp: Rio Chama/Rafting Evaluation (Appendix D)
- Stream Flow Camp: Jemez and Rio Chama Two Day Evaluation (Appendix E)
- Undergraduate Visualization Modeling Network (UVMN) Content Pre-Survey (Appendix F)
- Undergraduate Visualization Modeling Network (UVMN) Content Post-survey and Workshop Evaluation (Appendix G)
- Attended CSDMS workshop
- Attended Tri-State meeting
- Attended UVMN workshop
- Attended Jemez/Hiking field learning experience
- Attended WC-WAVE management meeting
- Participated in development of IRB for UVMN

[3] List of surveys is in the References section.

Section 3. Evaluation Findings

3.1 Evaluation of project components

A. Community Surface Dynamics Modeling System (CSDMS) Training

Background of the program

The Community Surface Dynamics Modeling System (CSDMS) workshop comprised the Year 1 Summer Institute and was held May 28-29, 2014 in Albuquerque, New Mexico. This workshop assisted students, faculty and staff in developing CSDMS adapters for the models being used by the Watershed Science component. Students and faculty from the CI Group joined the cohort of watershed science graduate students and their faculty advisors. The workshop included hands-on training for CSDMS basic model interface building and CSDMS modeling tool development and implementation. The objectives of the training were to increase knowledge about:

- Community Surface Dynamics Modeling System
- Building a Basic Model Interface
- Model integration challenges and solutions
- Input and output specifications for model wrapping target

Twenty seven respondents completed the CSDMS reflective survey. Most indicated hearing about the training through email or a professor.

Demographic description of participants

The majority of CSDMS evaluation respondents were Caucasian males as shown in Figure 6. The evaluator notes the following differences between the demographics of CSDMS attendees and participating institutions or WC-WAVE members in regard to underrepresented populations:

- Females were under represented.
- Hispanics/Latinos were significantly underrepresented; African Americans were not represented.
- American Indians/Alaska Natives were represented with respect to the comparison population

Figure 6. Demographic description of CSDMS evaluation respondents[4]

	CSDMS Respondents (*n*=27)		ID, NM, NV Comparison Population (*n*=140,181)[5]
	#	%	%
Gender			
Male	15	56%	48%
Female	12	44%	52%

[4] Percentages may not add up to 100% due to rounding.

[5] Faculty, undergraduate, and graduate students from the following institutions are included in these calculations: Idaho: Boise State University, College of Southern Idaho, Idaho State University, University of Idaho; Nevada: University of Nevada, Las Vegas, University of Nevada, Reno, Desert Research Institute; New Mexico: New Mexico State University, New Mexico Institute of Mining and Technology, University of New Mexico

	CSDMS Respondents (*n*=27)		ID, NM, NV Comparison Population (*n*=140,181)[5]
	#	%	%
Race/Ethnicity			
Caucasian/white (non-Hispanic)	16	59%	62%
Asian	7	26%	6%
Hispanic/Latino	1	4%	22%
American Indian / Alaska Native	1	4%	3%
Do not wish to specify	1	4%	-
Multi-racial	1	4%	2%
African-American	-	-	3%
Pacific Islander / Native Hawaiian	-	-	<1%
First Generation to attend college			
No	20	74%	66%
Yes	7	26%	34%[6]
Current position			**WC-WAVE project (*n*=64)**
Graduate student	18	67%	Graduate Student 26%
Faculty	6	22%	Faculty 44%
Staff	3	11%	Administration 17%
			Technical 13%

Ratings of meeting sessions

Participants (n=27) rated meeting sessions on a scale of 1-5, 1=*not useful at all* to 5=*extremely useful*. Ratings can be considered to trend towards positive or negative based on the following scale:

Extremely useful	4.21 – 5.00
Very useful	3.41 – 4.20
Somewhat useful	2.61 – 3.40
Slightly useful	1.81 – 2.60
Not useful at all	1.00 – 1.80

As shown in Figure 7, all meeting sessions were rated *very* or *extremely useful*. The *CSDMS overview* and *Basic Model Interface* were rated the highest while the *model overviews* were rated the lowest.

Figure 7. Mean ratings of program aspects

Activity (*n*=26)	Rating
Wednesday AM: CSDMS philosophy/overview	4.23
Wednesday AM: Basic Model Interface (BMI) introduction	4.23
Wednesday PM: Model overviews	3.88
Thursday AM: Supported model wrapping (*n*=25)	4.00

[6] This is the national percentage of first generation college students. The evaluator will work with project leads to identify more specific resources for future reports.

When prompted to comment on usefulness of activities, participants cited the Overview, the *Basic Model Interface introduction*, and the S*upported model wrapping*.

CSDMS philosophy/overview

- *The underlying concepts of CSDMS were explained very well. Motivations for using CSDMS were also explained very well.*
- *All of the workshop was very useful. Scott Peckham did a fantastic job of explaining the CSDMS framework from a philosophical, conceptual, and technical level.*
- *To know about CSDMS is good because didn't have any idea about this. After that to what models are using by different groups is good to know the track.*
- *Understanding the overview of CSDMS.*
- *Getting the context of how the CSDMS is intended to work was very useful.*
- *CSDMS seems applicable to watershed modeling; I had never been exposed to it before. It seems to address many major watershed modeling challenges.*
- *The overview on the CSDMS was really helpful.*
- *What was useful was to understand how CSDMS framework works because it clarifies the needs for each model to be coupled with others.*

Basic Model Interface (BMI) introduction

- *General Model Architecture and Concept.*
- *Getting into the code was pretty useful because I was prepared to start building a BMI.*
- *BMI training was fantastic, clear. I now feel I could build an interface.*
- *I really appreciated the actual code examples for simple modules, showing BMI construction.*
- *I enjoyed the description of the interfaces and the story behind the presentation. It gave me a great insight as to why he choose to go with the interfaces he choose. Explaining the code in a detailed manner helped me to understand how coding occurs with the interfaces.*

Supported model wrapping

- *Although wrapping did not occur I thought the interaction of CI with WS was very productive. I think everyone learned a lot even if they didn't realize it.*
- *Talking about which models would be coupled using CSDMS and what their needs were was most useful because it was engaging.*
- *Going through python code of example wrapped model, this may be a useful template.*

General Commendations

- *Very well organized talks, meaningful information, good amount of detail. Scott's vast experience was obvious. Thank you, Scott, for sharing some of it with us!*
- *It gives us a very clear idea of how this project want to do, and the general idea of how to realize it.*

When asked how presentations could be improved, attendees requested more participant engagement, overviews, tutorials, and breaks.

Increase participant engagement and interaction

- *The presentations were very good, maybe more interactive activities could be implemented to improve them.*
- *Getting more groups involved with other groups.*
- *Hands on activities would be great.*

Provide overviews and summaries

- *Start with an overview and continually refer to how this is relevant to audience members. Then end by indicating what take home messages we should leave with.*
- *To present in a group or those who can make people good understanding of the project will be a good option.*
- *Would be nice to have some printed documentation or hand-outs that accompanied the CSDMS talks.*
- *From time to time, make a brief conclusion from part to part of the presentation.*

Provide tutorials

- *I would spend less time on BMI variable name explanation (there seemed to mostly be push-back on those from people who will not actually be working with it anyway), and instead do a short guided tutorial building a BMI wrapper for an absurdly simple code. For instance, a handout explaining the steps plus having Scott live-code on the main screen while we co-code on our own machines. That way we're forced to engage with it a little more directly and will have a better sense of the coming issues that we may face.*
- *The breaking down of the computer science terms and code was done well. Keep coming up with ways to breakdown CS terms in simpler terms.*

- *The naming conventions seemed a bit tedious and perhaps unfitting for the particular situation.*

More regularly scheduled breaks

- *One potential improvement would be to clearly set in advance segments of presentation/lecture and times for breaks. Vastly, the audience consisted of students and faculty, used with 75-minute classes followed by 15-minute breaks. This may vary, but some regularity, like 90-minute presentation/lecture followed by a 10-minute break would be useful, and would structure better the course. As it was, breaks were random and quite unpredictable.*

Attendees noted other concepts, topics, or activities they would have liked to have seen covered, including demonstrations and specific topics.

Guided demonstrations

- *Do a short guided tutorial building a BMI wrapper for an absurdly simple code. For instance, a handout explaining the steps plus having Scott live-code on the main screen while we co-code on our own machines. That way we're forced to engage with it a little more directly and will have a better sense of the coming issues that we may face.*
- *I was hoping to have some hands-on work on BMI coding for models. Even just toy models. However, I think that would have required more time than we actually had.*
- *I would like to see a complete example of the process on plug and play two models and run them coupled under the CSDMS framework.*
- *More interactive activities with CSDMS just to help ingrain all the information involved.*
- *A simple exercise that encompasses the entire process of getting a model into CSDMS.*
- *Model Demo.*

Workflow

- *I would like to know the workflow followed by the watershed scientists in details. It will help me to understand the domain as a CI person.*

Structure and training extension

- *I would have liked more structure and an extension of the CSDMS Training so that we could start developing the BMI wrappers.*

WMT and visualization

- *More on the WMT and visualization aspects of CSDMS.*

Posting papers

- *Paper of the works can be added.*

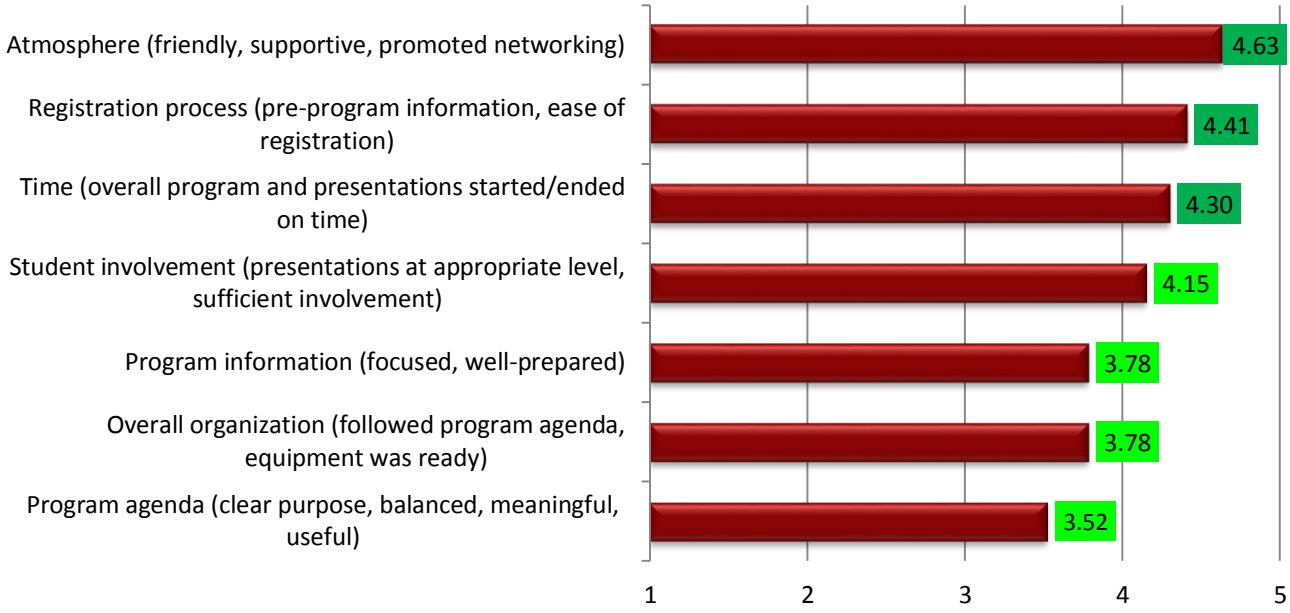
Ratings of logistics

Participants rated logistical aspects of the meeting on a scale of 1-5, 1=*not at all satisfied* to 5=*completely satisfied.* Ratings can be considered to trend towards positive or negative based on the following scale:

Completely Satisfied	4.21 – 5.00
Very Satisfied	3.41 – 4.20
Somewhat Satisfied	2.61 – 3.40
Slightly Satisfied	1.81 – 2.60
Not at all Satisfied	1.00 – 1.80

As shown in Figure 8, participants were *very* or *completely satisfied* with all logistical aspects of the meeting. The *atmosphere* and *registration process* were rated the highest, while the *program agenda* received the lowest rating.

Figure 8. Mean ratings of the logistical aspects of the training



When asked for suggestions to improve logistical aspects, participants cited the need for an agenda, airport transportation, and additional nutrition.

Program agenda

- *I found it a little difficult to follow the logistics of this meeting (e.g., location, agenda, etc.). I feel like I might have missed some informative emails perhaps.*
- *Clearer goals for the CSDMS meeting, going into and coming out of the meeting. Clarity on schedule.*
- *Want to look for more proper agenda. So that there cannot be raised any confusion.*
- *Provide a detailed agenda prior to start of conference.*

Transportation

- *Pick and drop from airport would have been nice, as well as from the hotel to UNM.*
- *Hotel in walking distance from conference rooms would be great.*
- *Provide transportation to-from airport.*

Food

- *If people are in a conference room all day, it would be great to have light snacks and caffeine of some kind in the room if not available in the building.*

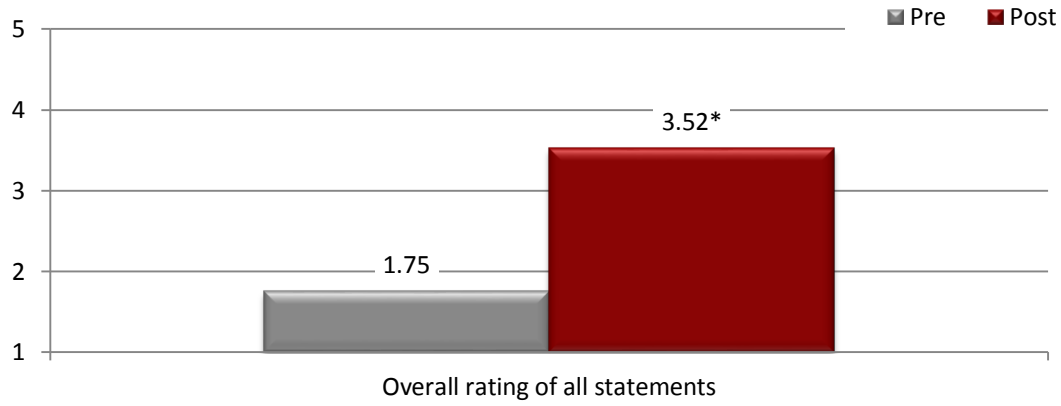
Achievement of meeting objectives

Meeting attendees (n=27) rated their level of achievement in each of the meeting objective areas on a Likert scale from 1-5, 1=*minimal* to 5=*extensive* from a reflective pre- and post-program perspective. Differences between reflective pre and post means were tested using a paired sample *t*-test. A *p*-value less than .05 is considered statistically significant. Statistically significant differences in reflective pre and post scores are indicated with an asterisk on the post survey mean. Means can be considered to trend towards positive or negative based on the following scale:

Extensive	4.21 – 5.00
Medium	3.41 – 4.20
Low	2.61 – 3.40
Some	1.81 – 2.60
Minimal	1.00 – 1.80

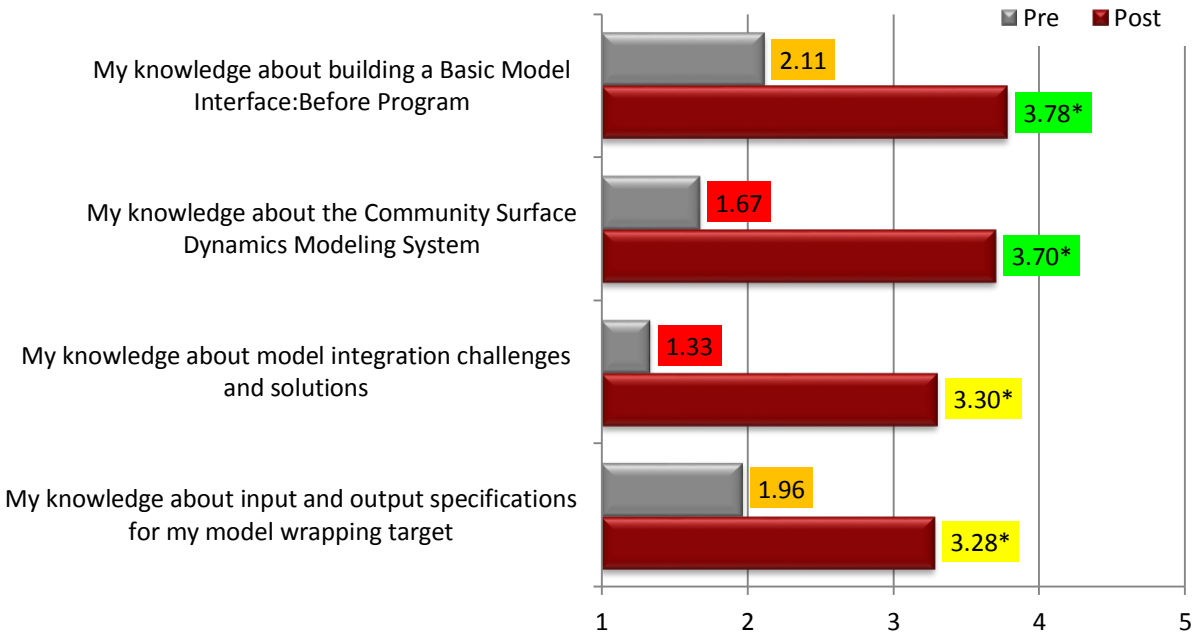
Overall, meeting attendees demonstrated statistically significant gains in their knowledge and understanding of the training objectives. The *t*-test results of the overall rating of all objective statements are shown in Figure 9.

Figure 9. Participants' overall perceived impact of the CSDMS training



The four knowledge items that make up the Likert scale composite were analyzed individually to show the amount of growth in each of the objectives, to assist program coordinators align future trainings with participants' needs. Attendees' mean ratings showed a statistically significant ($p < .05$) increase on the reflective pre- and post-survey for all four objectives. They expressed the greatest gain in knowledge about *the Community Surface Dynamics Modeling System*. The lowest rated item was *knowledge about input and output specifications for my model wrapping target*. Results are displayed in Figure 10.

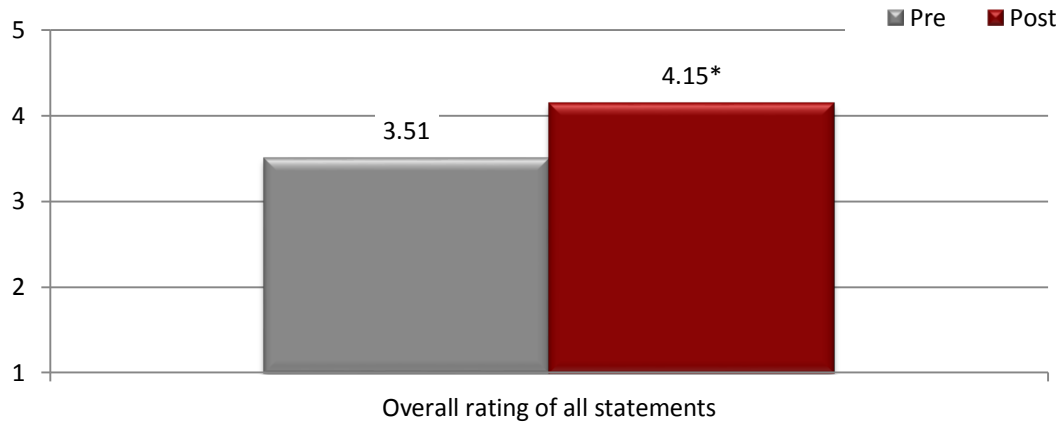
Figure 10. Mean ratings of achievement of each program objective



Participants' interest in studying STEM

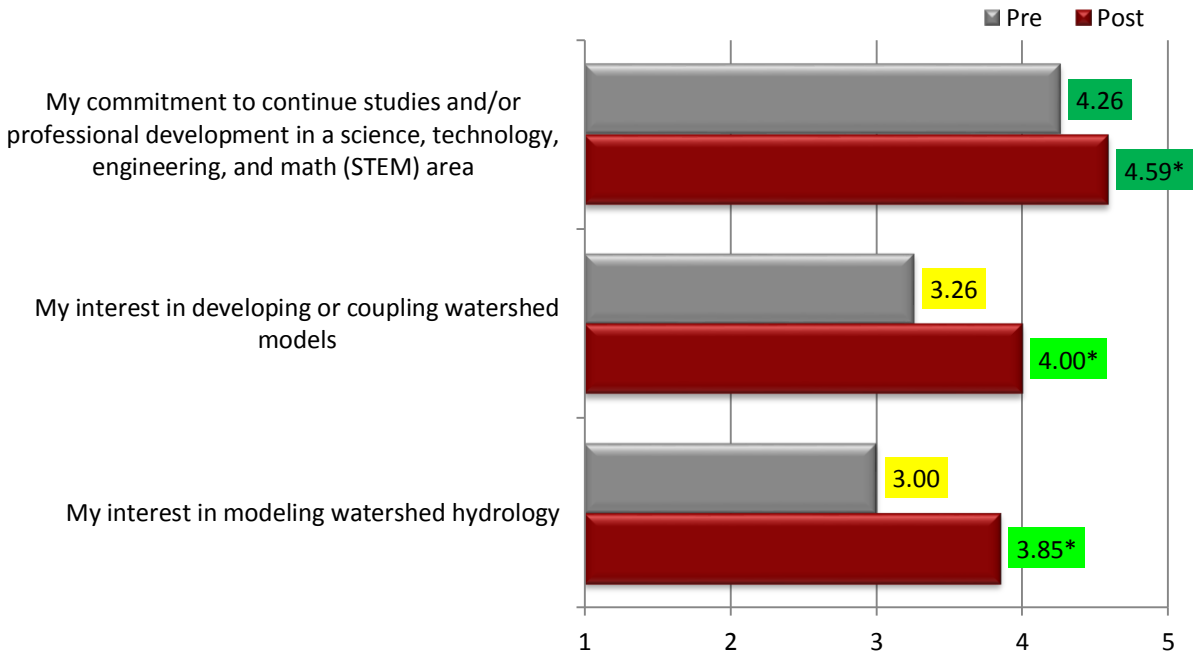
Results of CSDMS participants' ratings of their interest in and commitment to studying STEM are shown in Figure 11. Participants demonstrated statistically significant gains in their interest in and commitment to study STEM.

Figure 11. Participants' overall interest in and commitment to studying STEM



The three STEM science interest statements were analyzed individually to identify areas of strength and weakness. Mean ratings showed a statistically significant increase from pre- to post-survey statements for all items. Results are displayed in Figure 12.

Figure 12. Participants' interest in and commitment to studying STEM



Gains from attending

Attendees listed the two most important things they gained from attending the meeting, with most noting increased knowledge and understanding regarding CSDMS. They also indicated gains in overall knowledge of other models and their applications, and cognizance of projects others are working on.

Increased familiarity with CSDMS

- *How it (CSDMS) operates and how it can be incorporated into the CI-Data components of the project.*
- *Gained some insight on CSDMS, how it works and how it can be a part of the project.*
- *Understanding the concepts behind CSDMS and how they are implemented.*
- *Context and purpose, with the issues and difficulties inherent in the process.*
- *New perspective on potential CSDMS-related projects.*
- *Which models can be incorporated with CSDMS.*
- *Increased perspective in what CSDMS is.*
- *Have learned about CSDMS framework.*
- *I gained an understanding of CSDMS.*
- *Knowledge of how CSDMS works.*
- *Deeper knowledge of CSDMS.*

Increased knowledgeable of modeling applications

- *I learned that there are good solutions to integrating watershed models of which I had not been previously aware.*
- *The complexity to make a decision on which model is more suitable to be coupled with other.*
- *Understanding of immediate challenges for getting my target model wrapped.*

Familiarity with different models

- *Get familiar with different models.*
- *All the models currently going on.*

BMI

- *Understanding of BMI.*
- *(gained an understanding of) BMI interface.*

Good interaction/communication

- *Interactions between CI and WS were very positive from what I could see.*
- *Good communication between states and disciplines.*
- *Collaborations with several faculty and students.*

Better understanding of current modeling projects

- *Knowing what certain people are doing within that particular group.*
- *Understanding the project on watershed.*

Scott Peckham, main workshop presenter

- *Meeting Scott Peckham and knowing he could help our project with experienced advice if needed.*

Attendees identified how they would implement what they have learned from the meeting, with most planning to apply the information towards their research and projects or unable to answer because they are determining the feasibility of implementation.

Incorporation into current research/projects

- *I will be working with the tri-state team to implement the interdisciplinary modeling course and hopefully incorporate CSDMS as part of the student projects for that class.*
- *I will study the CSDMS wiki more extensively to find out how can it be integrated with the project.*
- *If appropriate I will work on wrapping a model so that it can be coupled using CMT.*
- *We will use a lot of newly acquired knowledge in our demo projects.*
- *I'll try to implement this in my current watershed research.*
- *I will work on implementing a CSDMS compatible model.*
- *I will be more mindful when programming.*
- *To get into model and focused on paper.*

- *The CS-DMS training was well presented although could use more time and practice, I may use CSDMS models in my future projects.*
- *I am interesting in using CS-DMS and adding a model to its repository if it is worthwhile for my graduate research.*

CSDMS development
- *We are hiring a programmer that will be involved with CSDMS development. This meeting was helpful in gaining perspective on how/who to hire and what kinds of experience and skills they will need and will use on the job.*

Unsure of current application
- *I am not sure that this is applicable to my model because my model is not open source and CSDMS is intended for open-source models. However, by broadening my horizons I still found this training beneficial.*
- *Not sure yet...*

Attendees indicated their next steps after attending the program. Most intend to apply the modeling information toward current and future projects, along with collaborations with developers and colleagues.

Continuing/implementing projects and research involving various models
- *Continue plans to hire EPSCoR-funded software developer and bring them up to speed on CSDMS and the related components of the virtual watershed project.*
- *Work on research and implement a coupled CSDMS model in the near future.*
- *I am just getting started. I need to create a mesh for my model.*
- *Continue with my watershed research using ParFlow model.*
- *Start some exploration of the different models.*
- *Develop BMI.*

Collaborative projects
- *The next step is to keep communication with the demo project team in order and get more involved in it.*
- *Continue to work with model developers to modify the code to comply with BMI.*
- *Collaborate with my colleagues to complete project demos.*
- *Coordinate with model developers to build BMI.*

General
- *To take everything I learn and use it.*
- *Learn more.*

- *This was a good workshop and very helpful.*
- *Presentation was very useful*
- *All presentations were great and very informative.*

Key Findings and Recommendations for Community Surface Dynamics Modeling System (CSDMS)

Key findings and recommendations are listed below for demographics and CSDMS program components.

Demographics

Women comprised 44% of CSDMS participants and the majority of attendees were Caucasian. Additionally, 26% of participants were the first in their families to attend college. Graduate students made up two-thirds (67%) of attendees. Two respondents were from an underrepresented minority group. Females, American Indians, and Hispanics/Latinos were under represented. African Americans were not represented.

Efforts should be made towards the recruitment of URMs as well as to encourage attendance of current students who are underrepresented minorities and/or female.

Program components

All four program components were rated *very* or *extremely useful*. The *CSDMS overview* and *Basic Model Interface* were rated the highest with comments expressing appreciation for the CSDMS overview and the Basic Model Interface examples. The *model overviews* were rated the lowest of all components.

Integrate audience engagement strategies into the trainings. Provide tutorials where needed (for example during BMI coding) and incorporate adequate break times so participants are given time to rest and return ready to re-engage with the material. Additional topics requested for future events include:

- *Guided demonstrations*
- *Training extension*
- *WMT and Visualization*

Logistics

Participants were *very* or *completely satisfied* with all logistical aspects of the training. The *atmosphere* and *registration process* received the highest ratings, while the *program agenda* received the lowest rating. Suggestions for improvement discussed the agenda and transportation.

Some participants were confused by the training's logistics and agenda. Consider e-mailing the agenda to all participants in advance of their arrival and provide printed copies at the start of the training. Participants requested providing round-trip airport transfers in addition to either transportation from the hotel to the training or a hotel that is within walking distance of the training's location.

Program Impacts

Program Objectives

Participants showed statistically significant gains for all four items related to participants' knowledge of the training's objectives. They showed the largest gain in knowledge about *the Community Surface Dynamics Modeling System*. The lowest rated item out of the four was *knowledge about input and output specifications for my model wrapping target*. Although participants showed a large increase in knowledge on the reflective pre/post survey, *model integration challenges and solutions* received a low rating.

Focus on the input and output targets for model wrapping and model integration challenges and solutions.

Interest in Watershed Science and/or STEM Careers

Participants showed statistically significant gains for all three items related to participant interest in STEM/ watershed science. The largest gain was for *interest in modeling watershed hydrology*. The item showing the smallest gain was *commitment to continue studies and/or professional development in a science, technology, engineering, and math (STEM) area*.

Encourage faculty to share their personal career trajectories and give participants more opportunities to ask career questions and understand how STEM fits into their career interests.

B. Tri-State Meeting

Background of the meeting

Faculty, program administrators, and students involved in the WC-WAVE project attended the Tri-State Meeting on May 29, 2014 at the Museum of Natural History and Science in Albuquerque, NM. The state of New Mexico organized the meeting, taking the lead on agendas, planning, and facilitation. The objectives of the meeting were to:

- Increase knowledge of progress that has been achieved in Year 1.
- Increase knowledge of Year 2 project plans.
- Increase knowledge of project integration plans.

Demographic description of participants

Faculty, graduate students, project administrators, and evaluators (n=32) attended the WC-WAVE Tri-State Meeting. Of those who attended, 26 completed the evaluation form for a response rate of 81%. The majority of respondents were Caucasian males. Three indicated being an underrepresented minority. The highest percentage of respondents came from New Mexico (38%). Results are shown in Figure 13. The evaluator notes the following differences between Tri-State meeting attendees and comparison demographics.

- Females were underrepresented.
- Hispanics/Latinos were considerably underrepresented.
- African Americans and American Indians were represented with respect to the comparison population.
- Participants from Idaho were underrepresented while NV and NM were well-represented.

Figure 13. Demographic description of the WC-WAVE Tri-State Meeting attendees[7]

	Tri-State Meeting Respondents (*n*=26)		WC-WAVE comparison population[8] (n=140,181)
	#	%	%
Gender			
Male	15	58%	48%
Female	11	42%	52%
Ethnicity			
Caucasian	17	65%	62%
Asian	6	23%	6%
African American	1	4%	3%
American Indian	1	4%	3%
Hispanics/Latinos	1	4%	22%
Pacific Islander/Native Hawaiian	-	-	<1%
Do not wish to specify/other	-	-	2%
First Generation to attend college			
No	17	65%	66%
Yes	9	35%	34%

[7] Numbers may not add to 100% due to rounding

[8] Includes faculty, graduate students, and undergraduate students from Boise State University, Idaho State University, College of Southern Idaho, University of Idaho, Desert Research Institute, University of Nevada, Las Vegas, University of Nevada, Reno, New Mexico Institute of Mining and Technology, University of New Mexico, New Mexico State University, NSHE project administrators.

	Tri-State Meeting Respondents (*n*=26)		WC-WAVE comparison population[8] (n=140,181)
	#	%	%
Current position			**WC-WAVE project (*n*=64)**
Faculty	8	31%	Faculty 44%
Master's student	5	19%	Graduate Students 26%
Enrolled in PhD program	5	19%	Administration 17%
Staff/Administration	4	15%	Technical 13%
Ph.D. candidate	3	12%	
Future Ph.D. student	1	4%	
Project Team (n=26)			
Watershed Sciences	13	50%	31%
Cyberinfrastructure:Data	8	30%	20%
Cyberinfrastructure: Visualization	3	11%	20%
Administrator	-	-	16%
Workforce Development	2	8%	13%
Institutions			
Idaho			
University of Idaho	2	8%	
Boise State University	2	8%	
Idaho State University	3	12%	
Idaho Total	**7**	**27%**	**44% (28 members)**
Nevada			
University of Nevada, Reno	5	19%	
University of Nevada, Las Vegas	3	12%	
Desert Research Institute	1	4%	
Nevada Total	**9**	**35%**	**28% (18 members)**
New Mexico			
University of New Mexico	7	27%	
New Mexico Institute of Mining/Technology	3	12%	
New Mexico Total	**10**	**38%**	**28% (18 members)**

Ratings of meeting sessions

Participants (n=24) rated meeting sessions on a scale of 1-5, 1=*not useful at all* to 5=*extremely useful*. Ratings can be considered to trend towards positive or negative based on the following scale:

Extremely useful	4.21 – 5.00
Very useful	3.41 – 4.20
Somewhat useful	2.61 – 3.40
Slightly useful	1.81 – 2.60
Not useful at all	1.00 – 1.80

As shown in Figure 14, all meeting sessions were rated *very* or *extremely useful*. *The cross-component discussions* were rated *extremely useful*, while the evaluation group exercise was rated *very useful*. The survey had an additional session for participants to rate, *individual component meetings*. However that session was not held, so participants skipped that item on the survey.

Figure 14. Mean ratings of Tri-State Meeting Sessions

	Rating
Cross-component discussions	4.33
Evaluation group exercise/presentation	3.96

When asked how the meeting sessions could be improved, participants made suggestions regarding communication, hands-on activities, advanced preparation, and assigning students, faculty, and other participants to teams.

- *More well-played activities, increased direct communication from faculty to students, less communication that excludes students.*
- *Can be more hands-on.*
- *The question we had for our evaluation exercise was for a future event, therefore it seemed to lack relevance for the exercise.*
- *Preparation (i.e. directed reading/review) prior to the discussion evaluation would improve.*
- *Professor familiar with my project goals should be on my team.*

In addition, participants commented on positive aspects of the meeting, including redirecting the afternoon plan and meeting with demonstration groups.

Commendations

- *Thank you for letting us redirect afternoon plan.*
- *Liked meeting with demonstration groups.*

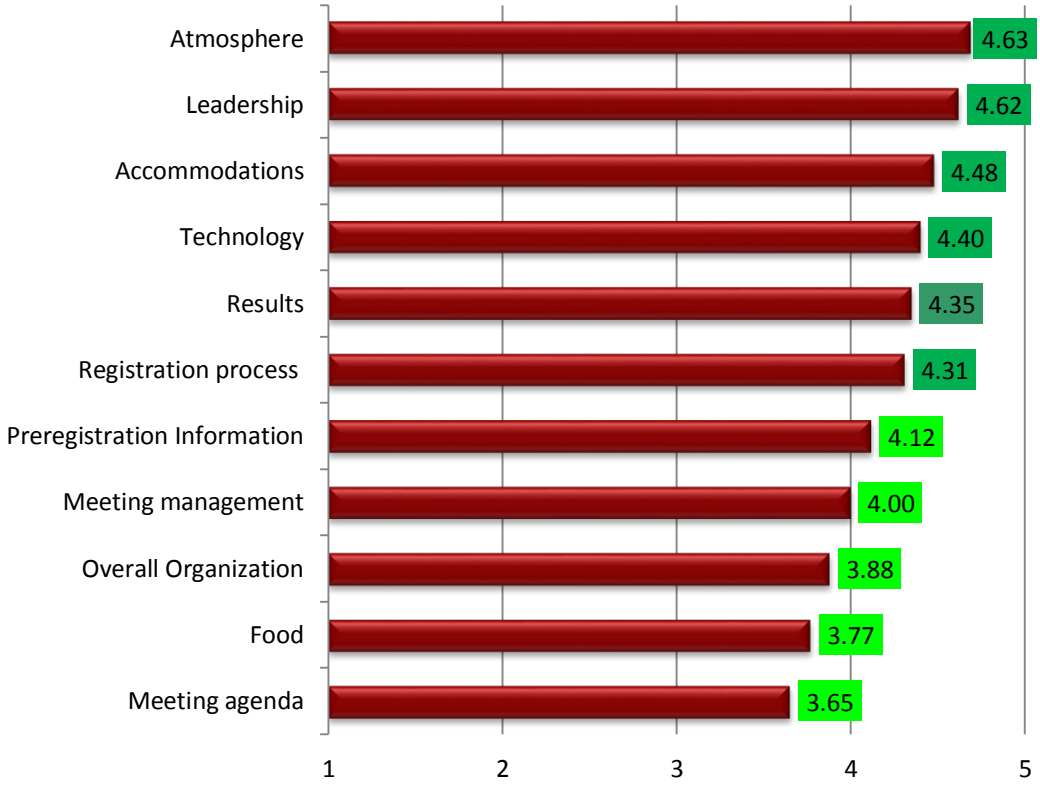
Ratings of logistics

Participants rated logistical aspects of the meeting on a scale of 1-5, 1=*not at all satisfied* to 5=*completely satisfied*. Ratings can be considered to trend towards positive or negative based on the following scale:

Completely Satisfied	4.21 – 5.00
Very Satisfied	3.41 – 4.20
Somewhat Satisfied	2.61 – 3.40
Slightly Satisfied	1.81 – 2.60
Not at all Satisfied	1.00 – 1.80

As shown in Figure 15, participants were *very* or *completely satisfied* with all logistical aspects of the meeting. The *atmosphere* and *leadership* were rated the highest, while *the meeting agenda* received the lowest rating.

Figure 15. Mean ratings of the logistical aspects of the meeting



When asked for suggestions to improve the logistical aspects, participants requested hosting the meeting at the hotel, specific food preferences, and improving the meeting agenda.

- *Would have been nice to have been walking distance between hotel and meeting space so that we didn't have to work out rides. (Conversely, it was a chance to network).*
- *Trying to get enough blocks in same hotel.*
- *Have the meeting at the hotel location.*
- *Avoid traveling by bus or carpool.*
- *Transportation.*
- *Improve food quality or allow lunch on your own.*
- *Would be nice to have fruit for breakfast.*
- *Do not skip the afternoon coffee.*
- *Continued support for responsive structure for meeting (as we did today) is helpful.*
- *Maybe a clear time table can be given in beginning.*

Suggestions to improve the Tri-State meeting

To improve the overall meeting, participants suggested scheduling specific breaks and sessions, selecting dates earlier, assigning individual responsibility, and incorporating additional options on the evaluation form.

- *Have the day split in specific sessions, with breaks clearly indicated evenly 90-120 minutes or so.*
- *Pick the dates a little earlier.*
- *Need to allocate particular actions to individuals.*
- *More discussion needed.*
- *The evaluation forms don't include responses for those of us not on a team. Maybe I am in a unique situation?*

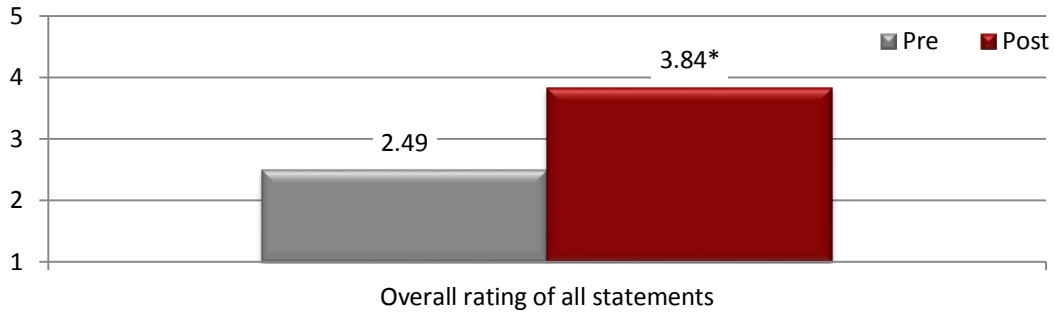
Achievement of meeting objectives

Meeting attendees rated their level of achievement of each of the meeting objective on a Likert scale from 1-5, 1=*minimal* to 5=*extensive* from a reflective pre- and post-program perspective. Differences between reflective pre and post means were tested using a paired sample *t*-test. A *p*-value less than .05 is considered statistically significant. Statistically significant differences in reflective pre and post scores are indicated with an asterisk on the post survey mean. Seventeen participants completed the pre-survey and twenty-six completed the post-survey. Means can be considered to trend towards positive or negative based on the following scale:

Extensive	4.21 – 5.00
Medium	3.41 – 4.20
Low	2.61 – 3.40
Some	1.81 – 2.60
Minimal	1.00 – 1.80

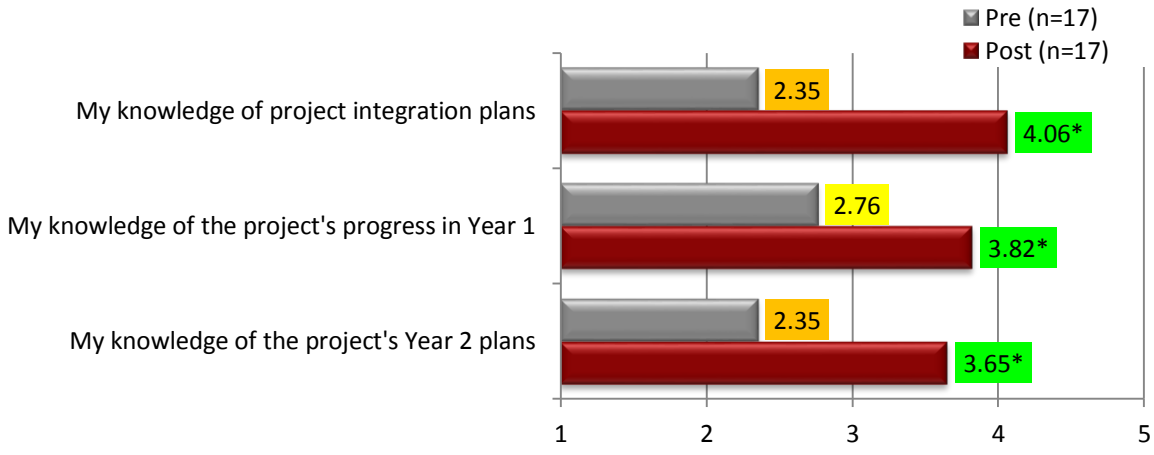
Overall, meeting attendees demonstrated statistically significant gains in their knowledge and understanding of the meeting objectives. The *t*-test results of the overall rating of all objective statements are shown in Figure 16.

Figure 16. Participants' overall perceived impact of Tri-State Meeting



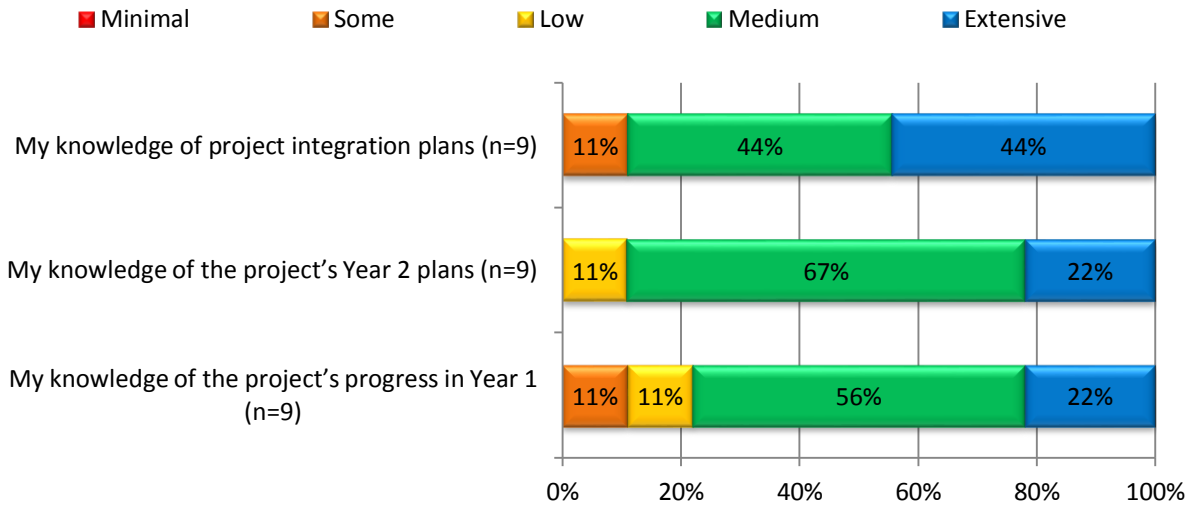
Overall, meeting attendees demonstrated statistically significant gains in their knowledge and understanding of the meeting objectives. The *t*-test results of the overall rating of all objective statements are shown in Figure 17.

Figure 17. Mean ratings of achievement of annual meeting objectives



Results were further broken down to show the percentage of attendees who rated objectives in each of the rating categories. Most participants experienced a *medium* to *extensive* increase in their knowledge of the project's integration, Year 1, and Year 2 plans. Results are found in Figure 18.

Figure 18. Mean ratings of achievement of each annual meeting objective, by rating category



Key Findings and Recommendations for the WC-WAVE Tri-State Meeting

Key findings and recommendations are listed below for the demographics, meeting sessions, logistics, and achievement of program objectives. Approximately half of the WC-WAVE project's participants attended the Tri-State Meeting. Of those who attended, 81% completed the evaluation form.

Demographics:

Most attendees were Caucasian male faculty members and members of the Watershed Science project teams. Females and Hispanic/Latinos were underrepresented. Idaho members were underrepresented compared to the Tri-State Comparison group while Nevada and New Mexico members were well-represented.

Encourage more attendance and participation by female, Hispanic/Latinos, and Nevada and Idaho participants.

Meeting sessions

Participants were *completely satisfied* with the cross-component discussion and *very satisfied* with the evaluation presentation. Participants suggested better communication, more hands-on activities, and assignment of professors to teams that match student interests.

Overall participants were satisfied with both sessions. Encourage faculty to increase their direct communication with students. Incorporate more hands-on activities and match professor and student interests when assigning teams.

Logistics
Participants were *very* to *completely satisfied* with all logistical aspects of the meeting. The *atmosphere* and *leadership* received the highest ratings while the *meeting agenda* received the lowest rating. Participants suggested having the hotel and meeting locations within walking distance of one another or at the same place to avoid transportation issues, made food suggestions, and requested the meeting time table in advance.
Plan the meeting at or near the hotel to minimize transportation issues. Distribute the meeting time table in advance or post it online.

Meeting objectives
Participants showed statistically significant gains for all three program objectives. The largest gain was for the *project's integration plans* and the smallest gain was for *knowledge of the project's progress in Year 1*.
Participants showed large gains for knowledge of the project's progress in Year 1, Year 2, as well as the project's integration plans. Consider updating participants in these areas throughout the year.

C. Stream Flow Camp

Background of the program

Following the conclusion of the Tri-State Meeting, a two-day Stream Flow Camp was held on May 30-31, 2014 in the Jemez Valley in New Mexico. The camp was organized and facilitated by Dan Cadol, Assistant Professor of Hydrology at the New Mexico Institute of Mining and Technology. Participants enrolled in either the Jemez Research Field Experience/Hiking Day, the Rio Chama Field Experience/Rafting Day, or both. On May 30, participants traveled to the Jemez Valley for the Jemez Research Field Experience/Hiking Day where they hiked Jemez Falls and the Valles Caldera and measured surface water discharge. That evening, they either concluded their Stream Flow Camp experience and returned to Albuquerque, or continued for the second day where they were joined by new participants. On May 31, participants attended the Rio Chama Field Experience/Rafting Day where they rafted the Rio Grande to take multiple flow and turbulence measurements. In total, 18 participants attended the Jemez Research Field Experience/Hiking Day, with 15 or 83% completing the Hiking evaluation; 4 participants attended the Rio Chama/Rafting Day, with 4 or 100% completing the evaluation; 8 participants attended both the Jemez and Rio Chama Field Experiences/Hiking Day and Rafting Days, with 3 or 38% completing the evaluation. The Stream Flow Camp's specific objectives are to increase participants' understanding of and skills in:

Jemez Research Field Experience

- Measuring the instantaneous discharge of a small stream
- Developing and use a rating curve relating stage to discharge
- Measuring and conceptualize groundwater-stream flow interactions

Rio Chama Research Field Experience

- Monitoring discharge, dispersion, & turbulence
- Measuring the instantaneous discharge of a large stream

Demographic description of participants

Faculty and graduate students participated in the WC-WAVE Stream Flow Camp held in the Jemez Valley located near Albuquerque, New Mexico. The demographic description of the attendees shown in Figure 19 represents information collected from the registration list and the evaluation form. Of the 22 participants, the highest percentage came from Nevada (46%) even though the highest percentage of WC-WAVE members is from Idaho (44%). The gender and ethnic makeup of the participants differed according to their days of participation in Stream Camp. The participants who completed only one day were majority female, however those who completed both days were majority male. Both Jemez/Hiking participants and Jemez and Rio Chama/Hiking and Rafting participants were predominantly Caucasian. The Rio Chama/Rafting participants were evenly composed of Caucasians and Asians. Ph.D. candidates showed the largest participation for both individual days while those participating in both days were evenly split between Ph.D. students, Masters students, and faculty. Almost all participants found out about the camp through either e-mail or a professor. The evaluator notes the following differences between Stream Flow Camp attendees and the demographics of participating institutions or WC-WAVE members:

- Hispanics/Latinos were underrepresented for the Jemez/Hiking day and were not represented for the Rio Chama/Rafting day or both days combined.
- American Indians and African Americans were represented
- The percentage of members from each state is not representative of WC-WAVE project membership; fewer people from Idaho attended Stream Flow Camp relative to the project membership list, while the states of Nevada and New Mexico were well-represented.

Figure 19. Demographic description of Stream Flow Camp evaluation respondents[9]

	Jemez / Hiking (*n*=15)		Rio Chama/ Rafting (*n*=4)		Both Jemez and Rio Chama (*n*=3)		Stream Flow Camp Grand Total (*n*=22)		ID, NM, NV Comparison Population (*n*=268,627)[10]
	#	%	#	%	#	%	#	%	%
Gender									
Male	7	47%	1	25%	2	67%	10	45%	48%
Female	8	53%	3	75%	1	33%	12	55%	52%
Ethnicity									
Caucasian/White (non-Hispanic)	8	53%	2	50%	2	67%	12	55%	54%
Asian	3	20%	2	50%	1	33%	6	27%	5%
American Indian or Alaska Native	1	7%	-	-	-	-	1	5%	6%

[9] Percentages may not add up to 100% due to rounding.

[10] Faculty, undergraduate, and graduate students from the following institutions and tribal colleges are included in these calculations: Idaho: Boise State University, College of Southern Idaho, Idaho State University, University of Idaho; Northwest Indian College, Eastern Idaho Technical College, North Idaho College; Nevada: University of Nevada, Las Vegas, University of Nevada, Reno, Desert Research Institute, Nevada State College, College of Southern Nevada, Great Basin College, Truckee Meadows Community College, Western Nevada College; New Mexico: New Mexico State University, New Mexico Institute of Mining and Technology, University of New Mexico, Institute of American Indian Arts, Navajo Technical College, Southwestern Indian Polytechnic Institute, Central New Mexico Community College, Clovis Community College, Eastern New Mexico University-Roswell, Luna Community College, Mesalands Community College, New Mexico Junior College, New Mexico Military Institute, San Juan College, Santa Fe Community College, Southwestern Indian Polytechnic Institute

	Jemez / Hiking (*n*=15)		Rio Chama/ Rafting (*n*=4)		Both Jemez and Rio Chama (*n*=3)		Stream Flow Camp Grand Total (*n*=22)		ID, NM, NV Comparison Population (*n*=268,627)[10]
	#	%	#	%	#	%	#	%	%
Hispanic	1	7%	-	-	-	-	1	5%	24%
African American	1	7%	-	-	-	-	1	5%	4%
Multi-racial	-	-	-	-	-	-	-	-	2%
Native Hawaiian/Pacific Islander	-	-	-	-	-	-	-	-	1%
Do not wish to specify	1	7%	-	-	-	-	1	5%	1%
First generation to attend college									
No	9	60%	2	50%	2	67%	13	59%	66%
Yes	6	40%	2	50%	1	33%	9	41%	34%[11]
Current position (*n*=13)									**WC-WAVE project (n=64)**
PhD student	5	33%	3	75%	1	33%	9	41%	
Faculty	4	27%	1	25%	1	33%	6	27%	Faculty: 44%
Master's student	4	27%	-	-	1	33%	5	23%	Grad students: 26%
Administrator	1	7%	-	-	-	-	1	5%	Administration: 17%
Program Lead	1	7%	-	-	-	-	1	5%	Technical: 13%
Institutions									
Idaho									
Boise State University	2	13%	-	-	-	-	2	9%	
Idaho State University	1	7%	-	-	-	-	1	5%	
University of Idaho	1	7%	-	-	-	-	1	5%	
Idaho Total	**4**	**27%**	-	-	-	-	**4**	**18%**	**44% (28 members)**
Nevada	1	7%	-	-	-	-	1	5%	
Nevada System of Higher Education	3	20%	2	50%	-	-	5	23%	
University of Nevada, Las Vegas									
University of Nevada, Reno	2	13%	1	25%	1	33%	4	18%	
Nevada Total	**6**	**40%**	**3**	**75%**	**1**	**33%**	**10**	**46%**	**28% (18 members)**
New Mexico	1	7%	-	-	-	-	1	5%	
Earth Data Analysis Center, UNM									
NM Institute of Mining and Technology	1	7%	-	-	1	33%	2	9%	
University of New Mexico	3	20%	1	25%	1	33%	5	23%	
New Mexico Total	**5**	**33%**	**1**	**25%**	**2**	**67%**	**8**	**36%**	**28% (18 members)**

Ratings of Program components

Participants rated workshop activities on a scale of 1-5, 1=*not useful at all* to 5=*extremely useful*. Responses to open-ended questions are listed in following the table. Ratings can be considered to trend towards positive or negative based on the following scale:

[11] This is the national percentage of first generation college students. The evaluator will work with project leads to identify more specific resources for future reports.

Extremely useful	4.21 – 5.00
Very useful	3.41 – 4.20
Somewhat useful	2.61 – 3.40
Slightly useful	1.81 – 2.60
Not useful at all	1.00 – 1.80

As shown in Figure 20, all program components were rated *very* or *extremely useful*. For the May 30 Jemez/Hiking day, the East Fork session received the highest rating while that of Jemez Falls received the lowest. The May 31 Rio Chama/Rafting day only had one session that received a mean rating of *very useful*. Participants explain their ratings in their responses to open ended questions below.

Figure 20. Mean ratings of Stream Flow Camp's program components

Activity	Rating
May 30: Soda Dam pullout: Volcanic and geothermal history of the Jemez Mountains (*n*=18)	4.00
May 30: Jemez Falls: Hike, measure discharge (*n*=17)	3.94
May 30: East Fork Jemez: Hike, measure discharge and water table gradient (*n*=17)	4.35
May 31: Rio Grande: Raft, take flow and turbulence measurements (*n*=7)	3.86

Useful aspects of the Stream Flow Camp

Participants cited the collaboration, lessons, field site visits, and measurement and hydrology experience as the most useful aspects of Stream Flow Camp.

Jemez Research Field Experience

- *Important to see the watersheds being discussed for modeling and visualization to put the work in proper context and inform collaborations. I observed very good conversations between students and faculty from different states discussing technical issues and exploring research ideas. This format facilitated discussion and collaboration.*
- *I thought that the outing was helpful in building relationships between the graduate students and between student and faculty/administrator. I am sure the content was also useful but I did not get a chance to participate in much of the instruction. It was overall a very pleasant day.*
- *Collaboration among peers and faculty was very useful.*
- *Understanding the volcanic and geothermal areas in the Jemez Mountains was very useful to know and get an idea of what geothermal means.*
- *The lessons given during these trips were helpful to me. I gained more insight on watersheds.*
- *It was useful and interesting to know the salt dilution gauging.*
- *I thought this was a great attempt at a learning opportunity. Many did benefit.*
- *It's very useful just to see the field sites that we are modeling.*
- *Getting the scale and nature of the processes and being able to pair this with what we saw in the field was really beneficial in setting the context for the hydrology and morphology of the stream channel.*
- *Getting to know the area.*
- *Getting to see the tools in action. And to discuss why the measurements may not be completely accurate.*
- *Everything was useful.*

Rio Chama Field Research Experience

- *Got hands on experience of velocity measurements in an actual river.*
- *Learn what the limitation on real measurement is.*
- *Getting immersed in hydrology-related topics. Experience directly being on water.*
- *Familiarizing area because it increases knowledge of state streams.*

Both Jemez and Rio Chama Field Research Experiences

- *Talking with faculty during hikes who work in the location, gained site specific information.*

Less useful aspects of Stream Flow Camp

Participants also commented on areas they felt were less useful. For the Jemez/Hiking day, some critiques included not having assigned professors to small groups, stopping too much, and only using and demonstrating the more basic measurements. For the Rio Chama/Rafting day, a participant felt flow measurements were overly used. Participants also would like more specific hydrological and geological information about the area.

Jemez Field Research Experience

- *More coordinated instruction may have been helpful. Although there was instruction, not everyone that was there participated. Many went into the separate directions, exploring each stop. There was only one instructor so it was impossible for him to teach to all. Maybe have attendees assigned to groups with instructors and they stay with those groups.*
- *It was not useful to have so many stops, it would have been a better learning experience if the focus was on one area and completing a full process of measuring discharge.*
- *Basic field measurements....not advanced enough.*
- *Everything was very useful, there was nothing that was mentioned that was not useful.*
- *Not sure there was anything specific that was not useful.*

Rio Chama Field Research Experience

- *Flow measurements are pretty basic and overly used in training in general.*

Both Jemez and Rio Chama Field Research Experiences

- *Lack of general information on the area as far as geology, hydrology, hydrogeology, climate, etc.*

Suggestions for Improvement

Stream Flow Camp received mostly positive feedback, however participants did share ideas to improve the experience. Some of the suggestions included the following: using smaller groups for the Jemez/Hiking day; providing a measurement handout; and distributing a map and printed data for both days.

Jemez Field Research Experience

- *Soda Dam did not have "Volcanic and geothermal history of the Jemez Mountains" because the group was late. "Jemez Falls: Hike, measure discharge" was a hike and lunch, there was no measuring because of time. "East Fork Jemez: Hike, measure discharge and water table gradient" this would have been very useful if better planned out. I feel like this was a fun trip not field work.*
- *Maybe some pre-information, like maps of the areas and descriptions so if the explanations don't get done the out of town visitors will have a chance to know why we stopped there. Diagrams of how the measurements will work.*
- *Everything was great. Maybe smaller groups to get the information out in smaller amount of people than a large crowd (group).*
- *Make measurements and data gathering more interesting and advanced.*

Rio Chama Field Research Experience

- *The water table and turbulence measurements did not get covered well, maybe a handout could have been included so that students could read it during downtime.*
- *Organization and more specialized field trips.*
- *We can separate people into groups and do the measurement.*

Both Jemez and Rio Chama Field Research Experiences

- *Having a map and some printed out data would have been useful.*

Suggestions for additional topics and activities

Participants proposed other topics they would like to see included in a future Stream Flow Camp. They included cyberinfrastructure, water table measurements, and model development for the Jemez/Hiking day; a measuring station visit for the Rio Chama/Rafting day; and assigning a measurement handout for both days.

Jemez Field Research Experience

- *I would like to know more of what topics would be helpful to the CI side.*
- *We did not see water table measurements.*
- *Getting into applications of flux towers/weather stations, short course on model development of any kind/any software.*

Rio Chama Field Research Experience

- *The measuring station visit should be included.*

Both Jemez and Rio Chama Field Research Experiences

- *The water table and turbulence measurements did not get covered well, maybe a handout could have been included so that students could read it during downtime.*

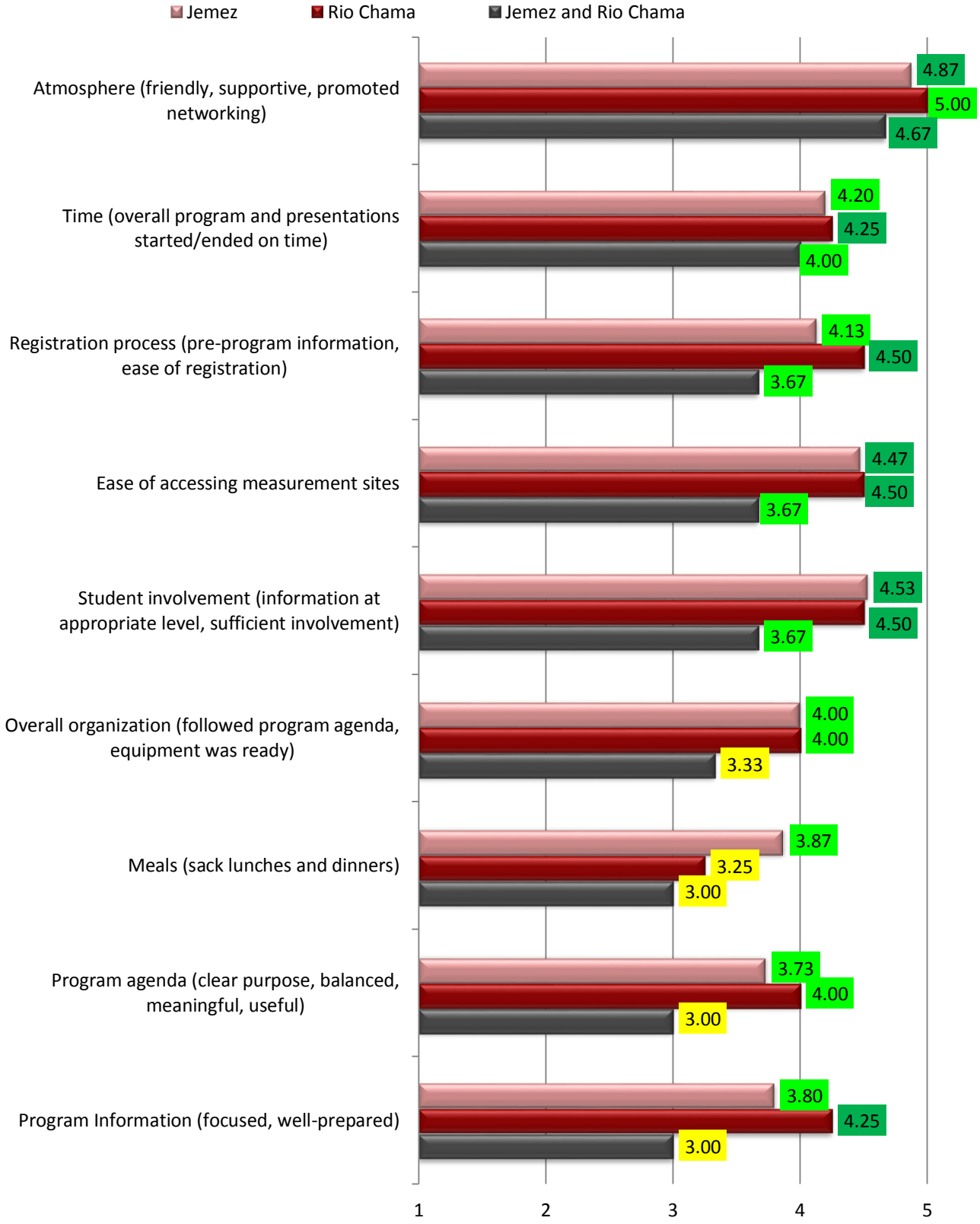
Ratings of logistics

Participants rated logistical aspects of the program on a scale of 1-5, 1=*not at all satisfied* to 5=*completely satisfied*. Ratings can be considered to trend towards positive or negative based on the following scale:

Completely satisfied	4.21 – 5.00
Very satisfied	3.41 – 4.20
Somewhat satisfied	2.61 – 3.40
Slightly satisfied	1.81 – 2.60
Not at all satisfied	1.00 – 1.80

As shown in Figure 21, participants were *very* or *completely satisfied* with most logistical aspects of Stream Flow Camp. The Rio Chama Research Field Experience had the most highly-rated items, while the *atmosphere* was the highest rated item across both days. The lowest rated item for the Jemez/Hiking day was the *program agenda*; for the Rio Chama/Rafting day, the *meals* were the lowest rated item. Participants who attended both days rated all logistical items lower than participants who attended only one day. Participants explained their ratings in their responses to open-ended questions below.

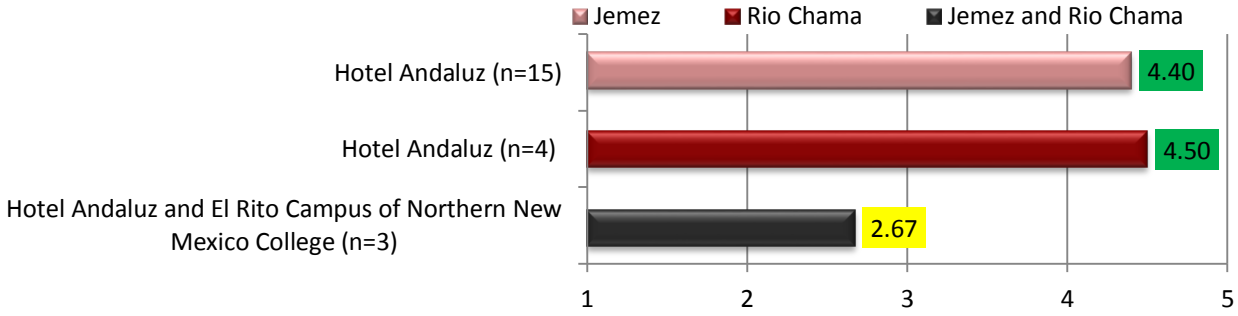
Figure 21. Mean ratings of the logistical aspects of the Stream Flow Camp



Accommodations

Participants on the individual Jemez and Rio Chama Research Field Experience days were *completely satisfied* with the Hotel Anadaluz. However, participants who attended both days and stayed at both the Hotel Anadaluz and the El Rito Campus were only *somewhat satisfied* with their accommodations, suggesting participants were less satisfied with the El Rito Campus. Results are shown in Figure 22.

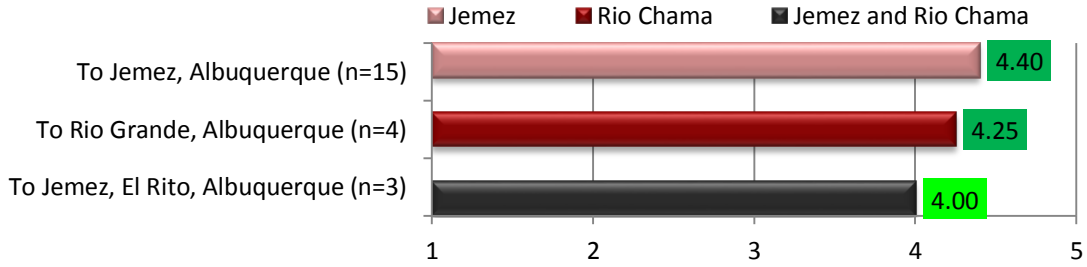
Figure 22. Mean ratings for Stream Flow Camp accommodations



Transportation

Participants were *very* to *completely satisfied* with the transportation. The Jemez transportation received the highest rating, while the transportation provided to two-day participants received the lowest rating. Results are shown in Figure 23.

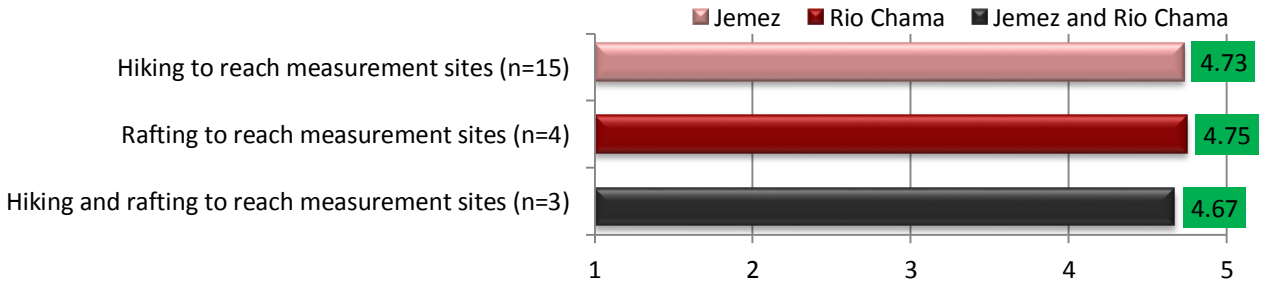
Figure 23. Mean ratings for Stream Flow Camp transportation



Comfort level reaching measurement sites

As shown in Figure 24, all participants were *completely satisfied* with the comfort level required to reach the measurement sites. The difference in ratings between the days was slight, suggesting the hiking and/or rafting required for participants to reach the measurement sample sites were comfortable.

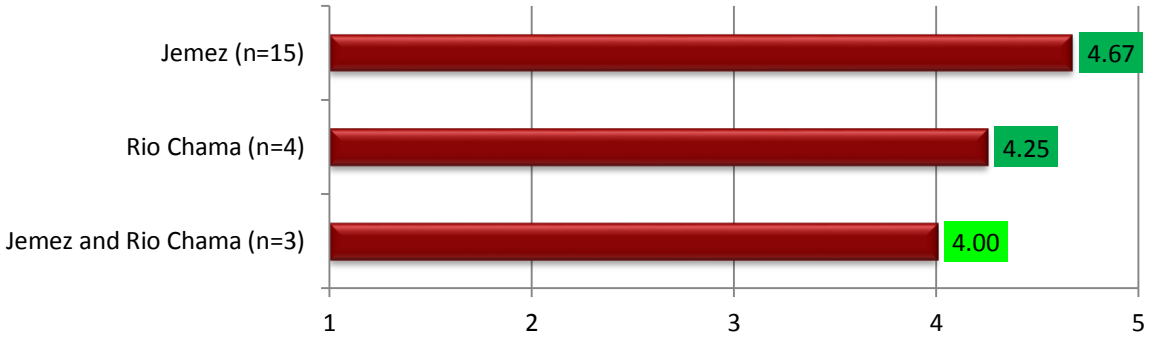
Figure 24. Mean ratings for Stream Flow Camp comfort levels



Overall enjoyment

Participants rated their enjoyment of the camp with a Likert Scale rating (1=not enjoyable at all; 5=very enjoyable). The individual day participants found the experience *very enjoyable* while those who attended both days found it *enjoyable*. Results are shown in Figure 25.

Figure 25. Stream Camp participants' overall enjoyment



Suggestions for improving the Stream Flow Camp

Participants suggested a few improvements to the Stream Flow Camp including assigning instructors to small groups, creating goals and being organized, as well as providing breakfast and improving lunch.

Jemez Field Research Experience

- *In order to engage a greater majority of the group, attendees should be assigned to small groups with their own instructors at each site. This will keep people from wandering off, taking pics, etc. and more engaged in the instruction. (BTW, I was one of the wanderers. I did not understand the importance of staying with the instructor.)*
- *Yes, develop clearer goals in program.*
- *Just to be organized to cover all topics.*

Rio Chama Field Research Experience

- *Breakfast better be offered, and food for lunch can be improved.*

Impact of Stream Camp on participants

Participants rated the impact of participating in Stream Flow Camp in two areas:

- Achievement of Stream Flow program objectives
- Interest in and commitment to studying watershed science

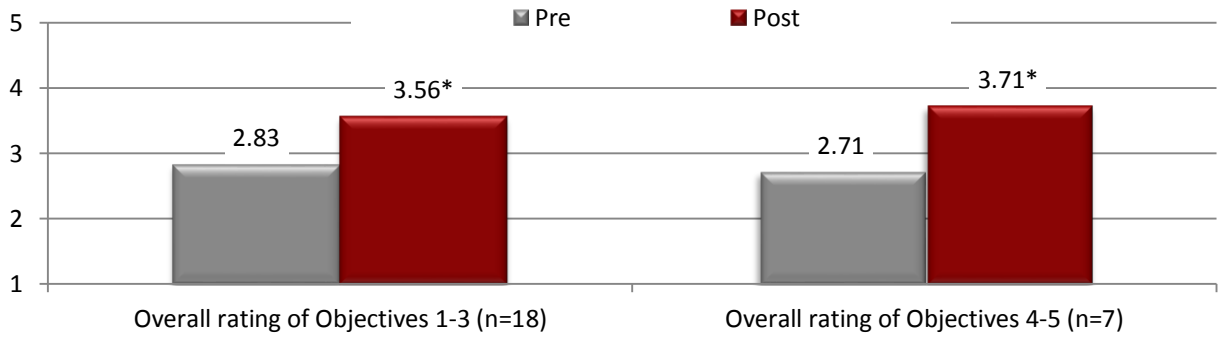
Participants rated these areas on a Likert scale from 1-5, 1=*minimal* to 5=*extensive* from a reflective pre- and post-program perspective. Differences between reflective pre- and post-means were tested using a paired sample *t*-test. A *p*-value less than .05 is considered statistically significant. Statistically significant differences in reflective pre and post scores are indicated with an asterisk on the post survey mean. Means can be considered to trend towards positive or negative based on the following scale:

Extensive	4.21 – 5.00
Medium	3.41 – 4.20
Low	2.61 – 3.40
Some	1.81 – 2.60
Minimal	1.00 – 1.80

Achievement of program objectives

Figure 26 shows the program objective ratings for Stream Flow Camp. Program objectives 1 through 3 were rated by those who attended the Jemez Research Field Experience and program objectives 4 and 5 were rated by those who attended the Rio Chama Research Field Experience. Participants who attended both days rated all program objectives and their ratings are included in the composite and individual mean ratings for the respective days. Both the Jemez and Rio Chama Research Field Experience participants demonstrated statistically significant overall gains in their achievement of program objectives indicating that participation in the Stream Flow Camp Snow Camp program had considerable impact on their knowledge of how to take stream measurements.

Figure 26. Mean ratings of overall achievement of Stream Flow Camp objectives



The five objective statements that make up the Likert scale composite were separated by the activity components and analyzed individually to show the amount of growth in each of the specific knowledge and skill areas so that program leaders can better align future programs with participants' needs. Participants' mean ratings show a statistically significant increase from pre- to post-survey statements ($p < .05$) for all statements. The *ability to use flow tracers to monitor discharge, dispersion, and turbulence* showed the largest gain while the *ability to measure and conceptualize groundwater-stream flow interactions* and *measure the instantaneous discharge of a large stream* showed the smallest gains. Results are displayed in Figures 27 and 28.

Figure 27. Mean ratings of achievement of Jemez Field Research objectives 1-3

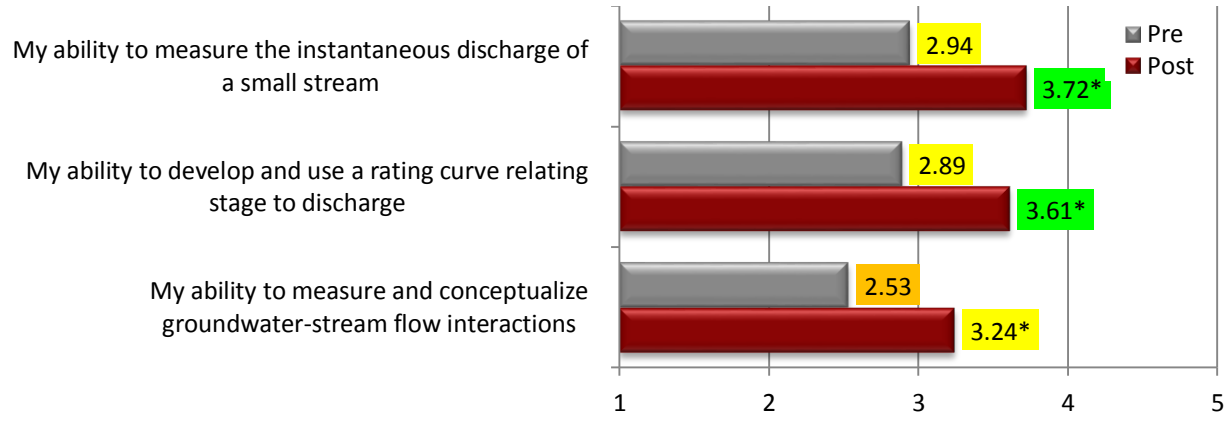
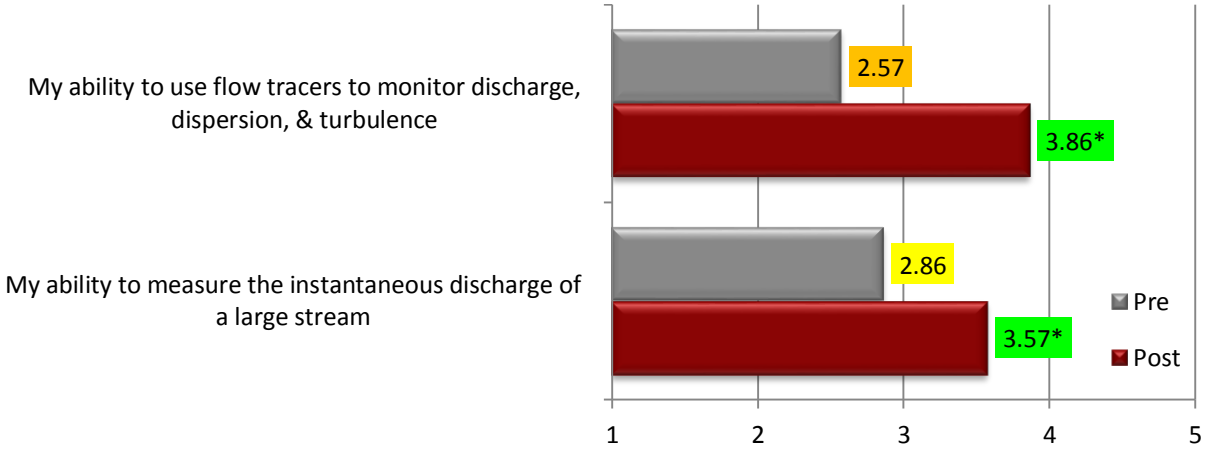


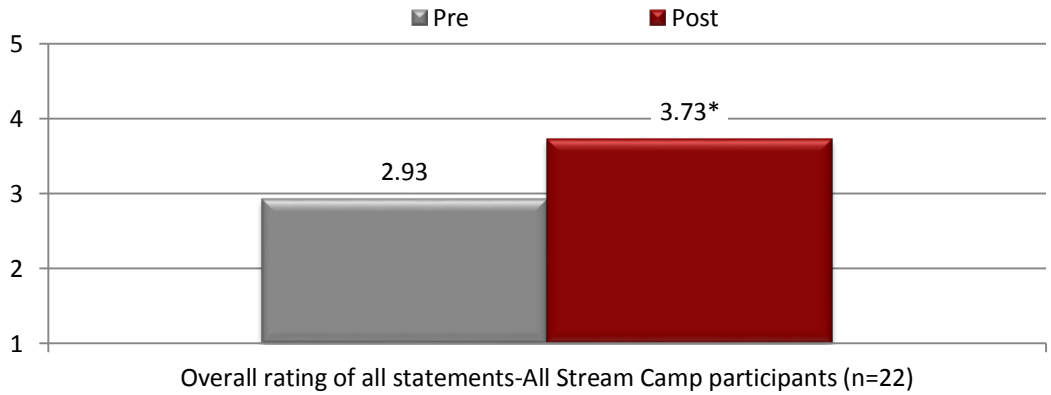
Figure 28. Mean ratings of achievement of Rio Chama Field Research objectives 4-5



Participants' interest in and commitment to continuing studies in watershed science

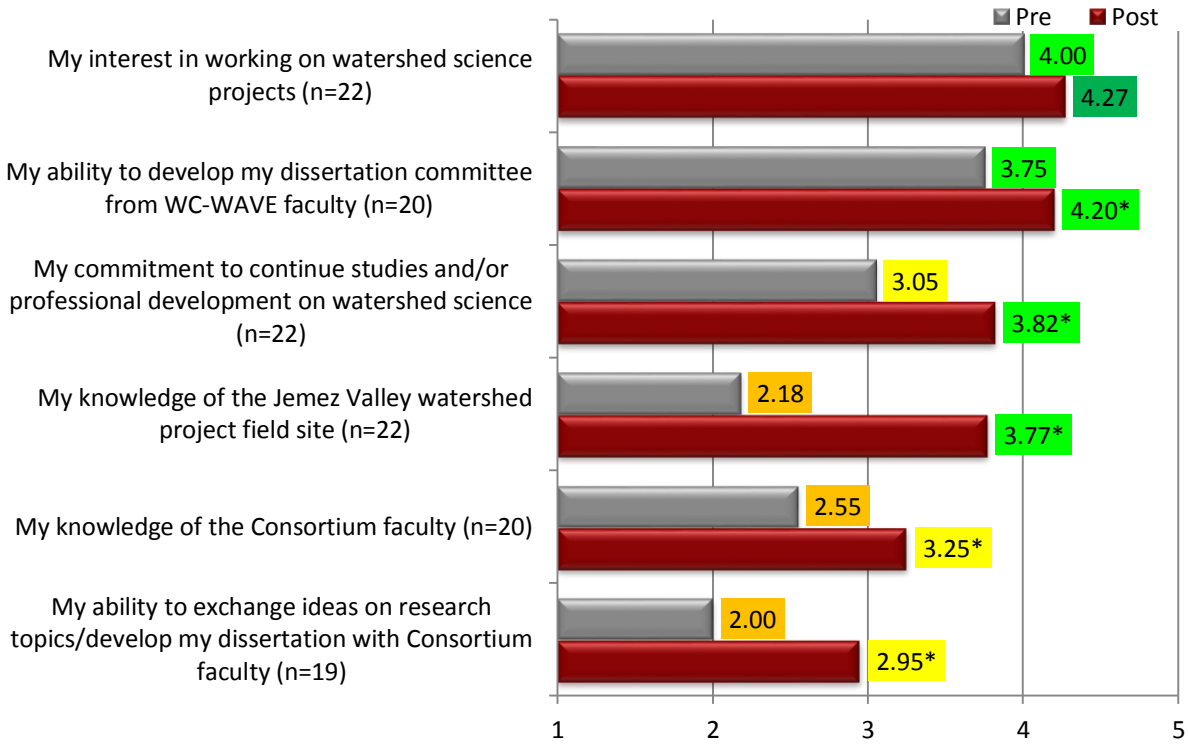
Figure 29 shows all Stream Flow Camp participants' ratings of their interest in and commitment to watershed science. Overall, participants demonstrated statistically significant gains in their interest in and commitment to study watershed science.

Figure 29. Participants' overall interest in and commitment to watershed science



The six watershed science career interest statements were analyzed individually to identify areas of strength and weakness. There were increases for all six items. Mean ratings showed a statistically significant increase from pre- to post-survey statements for all items except *my interest in working on watershed science projects*. However, it was approaching significance (p=.056) and was the highest rated item. Results are displayed in Figure 30.

Figure 30. Stream Flow Camp participants' interest in and commitment to studying watershed science



Overall learning

Participants explained the two most important things they gained from attendance at Stream Flow Camp. They cited their interaction with other faculty and students, and increased knowledge of the Jemez watershed, the overall WC-WAVE project, and participants' backgrounds.

Jemez Field Research Experience

- *I interacted with people I would have not approached in a formal conference setting. Attaching names with faces.*
- *Understanding of Jemez Springs conservation and the networking with other WC-WAVE members.*
- *The opportunity to collaborate across project components was essential.*
- *To know more about the Jemez Valley watershed research and the research group. To know a new method for gauging discharge in a river.*
- *Greater knowledge of the Jemez watershed and related research as it relates to the goals of WC-WAVE.*
- *Greater familiarity with the Jemez River and watershed.*
- *Really just better knowledge of the Caldera and a small amount of interaction with faculty that were there.*
- *Greater knowledge of the background and expertise of the participating graduate students and faculty.*
- *Greater comfort level with consortium faculty, and a more subtle understanding of each faculty member's expertise.*
- *Knowing more about the project with other students in the program especially with the watershed group, very informative.*
- *I have gained a more in depth understanding of watershed modeling and the overall project.*

Rio Chama Field Research Experience

- *Potential collaborations with several professors and students working on similar projects in the same location.*
- *Knowledge of areas and further development of relationships.*
- *Meeting and getting to know better many project collaborators.*
- *Know group better.*
- *Getting to know the actual watersheds.*

Plans to utilize or implement knowledge and skills

Participants plan to use the Stream Flow Camp knowledge they learned by working to meet WC WAVE goals, continuing watershed work, and possibly networking in the future.

- *This activity will help me to put other project related planning discussions in context, which will help us as a team to make better decisions in meeting the WC-WAVE goals.*
- *I will be using everything I learned to understand the needs of the project. I will be using my knowledge to ask question to help clear any further confusion.*
- *The Jemez watershed will be my primary study site, so information I have gathered and concepts learned during camp will be incredibly useful for my research.*
- *It would be nice to implement the salt dilution gauging to a small rivers or creeks.*
- *Any insight gained will be used in model development as appropriate.*
- *I am not a scientist. I am part of the WFD team. This trip helped me to better know the participants and their roles. I now know who to contact regarding watershed in NM. It was a wonderful outing and educational for those who participated fully.*
- *We'll apply a lot of newly acquired knowledge to our project developments and demos.*
- *Use new knowledge in field work to understand in situ processes.*

Participants' next steps

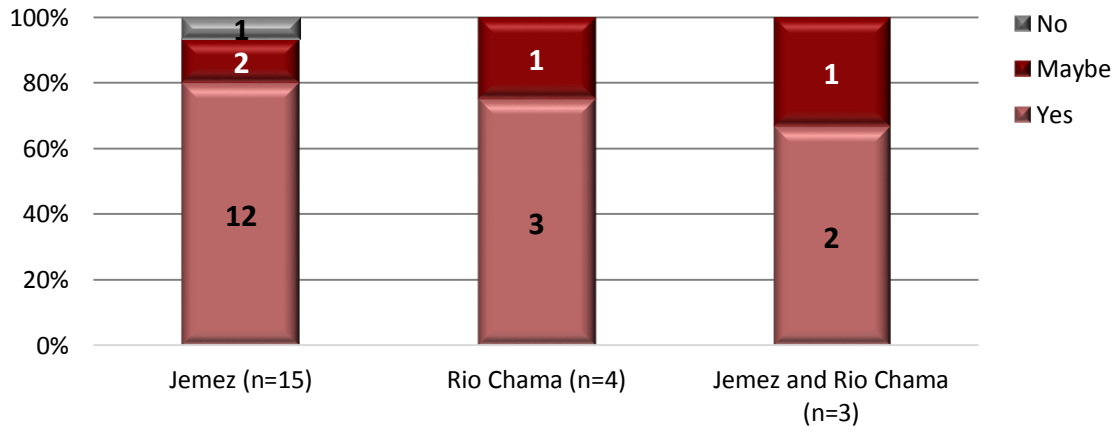
As next steps in watershed science or the WC-WAVE project, participants noted they will continue to participate in the WC-WAVE project, and advance their watershed and Ph.D. work.

- *Attend WC-WAVE planning meetings, contribute to discussions of WC-WAVE approaches to meeting goals.*
- *I will apply lessons learned from this outing to those we host in our state.*
- *To continue working on the WC-WAVE project.*
- *My next step is to get more information about the watershed group to get a clearer understanding of their project goals and objectives.*
- *I will continue to lead the watershed science component of the project.*
- *Continuing with my watershed research modeling.*
- *Continue with my PhD research. (2)*
- *Continue PhD research and continue developing relationships.*
- *Will collaborate closer with project participants from the 3-State Western Consortium.*
- *Continue to attend.*

Repeat attendance

Participants rated their likelihood to attend the camp again next year (1=Yes; 2=No; 3=Maybe). All participants indicated they will or might attend the camp next year except one participant on the Jemez Research Field Experience day. Results are found in Figure 31.

Figure 31. Participant rating of likelihood to attend Stream Flow Camp next year



Key Findings and Recommendations for Stream Flow Camp

Key findings and recommendations are listed below for demographics and Stream Flow Camp program components.

Demographics

The demographics for each day varied slightly. Women were well-represented for both individual days but underrepresented for those who attended both days together. The majority of attendees were Caucasian. Three of the individuals who completed the ethnicity section of the evaluation form indicated they were underrepresented minorities. Faculty participants composed 27% of the total group, with graduate students composing 64% of total participants. Additionally, there was a strong showing of first generation college students (40%) in comparison to the national average. African Americans and American Indians were represented, and Hispanics/Latinos were considerably under represented.

Increase outreach to encourage under-represented minority students and first-generation college students to attend Stream Flow Camp and the other field experiential activities. This may include doing focused outreach to racial/ethnic-based student groups and providing mentoring to more under-represented and first generation college students.

Program components

All four program components were rated *very* or *extremely useful*. The *East Fork Jemez* session was the highest rated while the *Rio Grande* received the lowest rating. Participants cited faculty-student collaboration, and exposure to area and hydrologic lessons, field sites, and measurement tools as the most useful aspects of the sessions. They also noted the disorganized instruction, numerous stops, and more basic measurements as areas that were less useful. Participants suggested better planning, sending information to participants in advance, creating small groups, and providing more challenging measurement work as areas where the Stream Flow Camp can improve.

Overall, participants were very happy with all four sessions. A few minor changes would improve participant satisfaction. Send information in advance to participants so they can prepare. Create small groups based on interests and assign related faculty to them. Have more challenging measurement assignments ready for participants who request them.

Logistics

Participants were *very* or *completely satisfied* with most logistical aspects of the Stream Flow Camp. Participants gave the highest rating to the *atmospher*e across both days and the lowest rating to the Jemez *program agenda and the Rio Chama meals*. Participants who attended both days gave lower ratings to all items and the lowest ratings to the *meals, program agenda,* and the *program information*. In order to improve the logistics, participants suggested assigning instructors to small groups, setting clearer goals, organizing to ensure coverage of all topics, improving lunch and including breakfast.

Provide a clear program agenda in advance. Ensure instructors are organized and prepared to cover all topics. For two-day participants, consider using a hotel other than the El Rito Campus.

Program Impacts

Program Objectives

Participants demonstrated statistically significant increases in knowledge on all five program objectives. The *ability to use flow tracers to monitor discharge, dispersion, and turbulence* showed the largest gain. The smallest gains were for *ability to measure and conceptualize groundwater-stream flow interactions* and *measure the instantaneous discharge of a large stream*. To increase participants' understanding of flow interactions and the discharge of a large stream*:*

- *Send background information, educational links, and current publications on topics to attendees before the camp so they can read and prepare ahead.*
- *Have a better ratio of watershed science faculty to students and possibly assign specific faculty to specific groups of students.*

Interest in Watershed Science and/or STEM Careers

Participants' levels of interest in watershed science was separated by whether they attended the Jemez Research Field Experience, the Rio Chama Research Field Experience, or both days together. For the overall mean composite of all statements, the Jemez Research Field Experience participants showed a statistically significant increase in interest in watershed science. The largest gain was for Rio Chama's participants' *ability to exchange ideas on research topics/develop my dissertation with Consortium faculty* while the smallest was for Jemez participants' *interest in working on watershed science projects.* Overall, while items related to interest in and commitment to watershed science were rated highly, participants showed less knowledge of Consortium faculty and dissertation development with the faculty.

Provide students more opportunities to develop connections with faculty to discuss:

- *Future research opportunities*
- *How they can develop long-term projects and/or relationships*

D. Undergraduate Visualization and Modeling Network (UVMN)

Background of the program

The UVMN provides professional development for faculty and students from Primarily Undergraduate Institutions (PUIs) in the three consortium states. The UVMN program is an opportunity to engage diverse students in undergraduate research and cyberinfrastructure-enabled education and has three major components: the Summer Workshop, Module Development/Implementation, and an On-going Virtual Community. The Summer Workshop was held in Albuquerque, New Mexico from May 29-31, 2014 and focused on modeling and visualization, utilizing Google Earth to create GIS content and to develop a watershed model among other learning activities. The program activity facilitators were Haroon Stephen[12], Assistant Professor of Civil Engineering, University of Nevada, Las Vegas; Melvin Strong, Senior Researcher in Earth and Planetary Sciences, University of New Mexico; and Donna Delparte, Assistant Professor in Geosciences at Idaho State University.

There are three UVMN program objectives:

1. **Increase participants' knowledge of and proficiency with various modeling and visualization tools and resources presented in the UVMN workshops.**
   - Ability to create and handle KML/KMZ files
   - Ability to model and visualize surface hydrology
   - Ability to learn about open source GIS and free GIS data
   - Basic GIS knowledge
   - Use of ArcGIS
   - Knowledge about data to create 3D models, terrain models and orthomosaics
   - Knowledge about techniques to create 3D models, terrain models, and orthomosaics
   - Use of Google Earth
   - Hydrological modelling
   - Creating Virtual Tours
   - Use of Microsoft Kinect
   - Structure from Motion
   - Use of aerial drones

2. **Increase participants' skills in the integration of modeling and/or visualization in undergraduate science, technology, engineering, mathematics (STEM) courses at primarily undergraduate institutions.**
   - Increase ability to create and handle KML/KMZ files
   - Increase ability to model and visualize surface hydrology
   - Increase ability to learn about open source GIS and free GIS data
   - Increase knowledge about data to create 3D models, terrain models and orthomosaics

3. **Increase participants' interest in and commitment to continue studying modeling and visualization**

[12] Dr. Stephen had a family emergency and was unable to attend. While he participated in the planning of the UVMN, he did not attend the workshop and Sajjad Ahmad taught and facilitated his portion of the workshop.

Demographic description of workshop participants

Graduate and undergraduate students and university faculty (n=21) from the three states and from the four WC-WAVE components participated in the WC-WAVE UVMN Summer Workshop held at the University of New Mexico campus in Albuquerque. The demographic description of the attendees shown in Figure 32 represents information collected from the registration list and the evaluation form. Of the 21 attendees, the highest percentage came from New Mexico (60%) even though the highest percentage of WC-WAVE members is from Idaho (44%). The majority of UVMN Workshop evaluation respondents were Caucasian males. Thirty three percent of the individuals who completed the ethnicity section of the evaluation form indicated they were underrepresented minorities. The evaluator notes the following differences between UVMN attendees and the demographics of participating institutions or WC-WAVE members:

- Females were underrepresented
- Hispanics/Latinos were underrepresented; African Americans and Pacific Islanders were not represented.
- The percentage of members from each state does not match the WC-WAVE project membership; fewer people from Idaho and Nevada attended the UVMN workshop as compared to the project membership list.

Figure 32. Demographic description of UVMN Workshop evaluation respondents[13]

	UVMN Workshop Respondents (*n*=20)		ID, NM, NV Comparison Population (*n*= 268,627)[14]
	#	%	%
Gender			
Male	11	55%	48%
Female	9	45%	52%
Ethnicity			
Caucasian/White (non-Hispanic)	12	60%	54%
Asian	1	5%	5%
American Indian or Alaska Native	4	20%	6%
Hispanic	3	15%	24%
African American	-	-	4%
Multi-racial	-	-	2%
Native Hawaiian/Pacific Islander	-	-	1%
Did not specify	-	-	1%
First generation to attend college			
No	8	40%	66%
Yes	12	60%	34%[15]
Age			
18-25	3	15%	
26-32	3	15%	
33-40	5	25%	
41-48	5	25%	
49-56	2	10%	
57-64	1	5%	
65-72	1	5%	
School year (undergraduates only)			
Freshman	1	11%	
Sophomore	5	56%	
Junior	2	22%	
Senior	1	11%	
Current position			WC-WAVE project (n=64)

[13] Percentages may not add up to 100% due to rounding. Not all workshop participants completed an evaluation, which is why the N for this section differs from the N in the demographics.

[14] Faculty, undergraduate, and graduate students from the following institutions and tribal colleges are included in these calculations: **Idaho**: Boise State University, College of Southern Idaho, Idaho State University, University of Idaho; Northwest Indian College, Eastern Idaho Technical College, North Idaho College; **Nevada**: University of Nevada, Las Vegas, University of Nevada, Reno, Desert Research Institute, Nevada State College, College of Southern Nevada, Great Basin College, Truckee Meadows Community College, Western Nevada College; **New Mexico**: New Mexico State University, New Mexico Institute of Mining and Technology, University of New Mexico, Institute of American Indian Arts, Navajo Technical College, Southwestern Indian Polytechnic Institute, Central New Mexico Community College, Clovis Community College, Eastern New Mexico University-Roswell, Luna Community College, Mesalands Community College, New Mexico Junior College, New Mexico Military Institute, San Juan College, Santa Fe Community College, Southwestern Indian Polytechnic Institute

[15] This is the national percentage of first generation college students. The evaluator will work with project leads to identify more specific resources for future reports.

	UVMN Workshop Respondents (*n*=20)		ID, NM, NV Comparison Population (*n*= 268,627)[14]
	#	%	%
University Faculty	1	5%	Faculty 44%
College Faculty	3	15%	Graduate Students 26%
Community College Faculty	7	35%	Administration 17%
Undergraduate Student	9	45%	Technical 13%
Institutions			
Idaho			
College of Southern Idaho	2	10%	
College of Western Idaho	2	10%	
Idaho Total	**4**	**20%**	**44% (28 members)**
Nevada			
Nevada State College	1	5%	
Sierra Nevada College	2	10%	
Western Nevada College	1	5%	
Nevada Total	**4**	**20%**	**28% (18 members)**
New Mexico			
Luna Community College	1	5%	
Navajo Technical University	2	10%	
University of New Mexico-Valencia	2	10%	
Mesalands Community College	2	10%	
New Mexico Highlands University	2	10%	
New Mexico Tech	1	5%	
Southwestern Indian Polytechnic Institute	2	10%	
New Mexico Total	**12**	**60%**	**28% (18 members)**

As shown in Figure 33, eleven faculty attended the UVMN workshop and responded to the post-survey. Faculty represented a wide array of disciplines, mostly in the STEM fields and also represented a wide variety of research fields. Only three participants had prior experience teaching one of each of the topics presented (Geographic Information Systems (GIS), Cartography, and Computer modeling/statistics). Their research areas include:

- Alternative Energy
- Education
- Environmental
- Learning
- Pre-engineering
- Renewable Energy
- Soils
- Stream Ecology
- Volcanology
- Water Quality

Figure 33. UVMN Faculty experience

UVMN Faculty attendees' teaching experiences (*n*=11)		
	#	%
Number of Years Teaching (faculty only)		
One	1	9%
Two	1	9%
Three	3	27%
Four	1	9%
Nine	3	27%
Ten	2	18%
Department		
Engineering	2	18%
Geology	1	9%
Math/Biology	1	9%
Natural Resource Management	1	9%
Natural Sciences	1	9%
Physical Sciences	2	18%
Science and Technology	3	27%

Ratings of program components

Participants rated workshop activities on a scale of 1-5, 1=*not useful at all* to 5=*extremely useful*. Responses to open-ended questions are listed following the table. Ratings can be considered to trend towards positive or negative based on the following scale:

Extremely useful	4.21 – 5.00
Very useful	3.41 – 4.20
Somewhat useful	2.61 – 3.40
Slightly useful	1.81 – 2.60
Not useful at all	1.00 – 1.80

As shown in Figure 34, half of the program components were rated *extremely useful* and half were rated *very useful*. *Google Earth and Overlays*, *Developing Course Modules*, and *Gigapan Data Collection* were the highest rated sessions. The *Structure from Motion* received the lowest ratings, suggesting an area for improvement. Participants explain their ratings in their responses to open ended questions below.

Figure 34. Mean ratings of the UVMN Workshop program components

Activity	Rating
May 29: Introduction to Hydrology and Hydrologic (Watershed) Modeling	4.05
May 29: Google Earth and Overlays	4.55
May 29: Weather Models and HYSPLIT	4.20
May 30: Gigapan Data Collection	4.45
May 30: Hacking the Kinect	4.15
May 30: Structure from Motion	3.80
May 30: GPS data collection and import	4.25

Activity	Rating
May 31: UAS Flight demonstration	4.05
May 31: Additional Classroom Visualizations	4.40
May 31: Developing course modules	4.55

Participants described additional concepts, topics, or activities they would like to have seen covered. Responses included more GIS, GPS demonstrations, software, a laser scanning demonstration, more classroom and real-world examples, and drones.

- *I would have liked more GIS, but with the change in instructors, I know that wasn't possible.*
- *GIS combining GIS with other tools. More watershed stuff.*
- *Where to find relevant maps online, capabilities of GIS.*
- *More watershed modeling ArcGis.*
- *QGIS.*
- *GIS.*
- *Taking very accurate GPS readings was mentioned. I would like a demo of techniques and equipment needed for that.*
- *The workshop was very informative and interesting. Just a few more days to get more familiar with the software and capabilities.*
- *A demonstration of laser scanning would have been helpful in understanding the difference in the data quality between an open source (Skanect) and a paid for model.*
- *Some concrete examples of how these technologies have been used in the classroom.*
- *I wish more time had been taken with the classroom visualizations. Seemed rushed.*
- *I would have liked to see more possible real life scenarios on how we can be true PIONEERS and save the most important resource, water.*
- *More information or time spent on drones.*

Areas to reduce

Participants made recommendations for topics to not cover again and topics to add. They requested less time on UAS, Kinect, and drones. Additionally, participants asked that instructional pace be slowed down and more time overall for learning the programs presented and spent on software demonstrations.

- *Sometimes, it felt like we were trying to fill time and I could have used a little less discussion on the various types of UAS, especially since we won't likely be able to afford most of them. It was fun to see the types, but we didn't need as much detail about the more expensive options.*
- *The UAS stuff seemed silly to include for financial reasons.*
- *Learning all the different software was great, but I think it would have been more useful if we worked on fewer and actually learned them better. I know that now it is up to me to work on them so that I do not forget, but even downloading them to my personal computer has been a challenge.*
- *Less time spent on Kinect, and playing with project momento (less hands on, just a little hands on, and examples with technical concepts instead).*
- *A little less time on drones since there are only some practicalities of them due to cost and regulations.*
- *The instructor was often clicking in programs faster than I could follow and take notes. I got lost in following the instructor sometimes.*
- *The hydrology and watershed modeling seemed out of place and not very useful. Too technical for a one-session workshop with such a diverse audience.*
- *A little more time on learning these programs. (2)*

Areas to include

Participants requested more lab space, workbooks, concurrent lessons, information on the target audience, improved network, GIS, social aspects of education, and information on

water loss.

- *The lab space was OK, but I think a computer lab or different rooms - mix it up a bit. We spent 2.5 days in basement lab - worked but could have been better.*
- *Workbook/notes - I'm old school; but I like to have material in front of me.*
- *Maybe think about doing concurrent lessons, information came across in 3 basic categories - modeling, visualization, and teaching with visualization. I would have liked more modeling- others may have wanted more of other stuff. If sessions were laid out in this format could allow this diverse group - Hydrologists to pre-vet students - to focus more.*
- *As a total novice - I would like to have some kind of a "level" reference; i.e., this hydrology is targeted for freshman v seniors, etc.*
- *We had a lot of network trouble, but I don't know if that can be addressed using offline software. May be as good as you can do with 30 people accessing the same sites simultaneously.*
- *A GIS component would have been helpful in understanding accuracy and precision in mapping data.*
- *The program was implemented well. However, I did think that we were going to learn a bit of GIS.*
- *Talk about the social aspect of education, and how to make education successful. Yes, science is important, but to succeed in this project, we need to understand student bodies too.*
- *It was all really great, I just think to cut out less important demonstrations and make it more hands on and deliver info on how we can actually tackle a global problem, water loss.*
- *More hands on demonstration with other software that can be used in an Intro to Engineering class.*

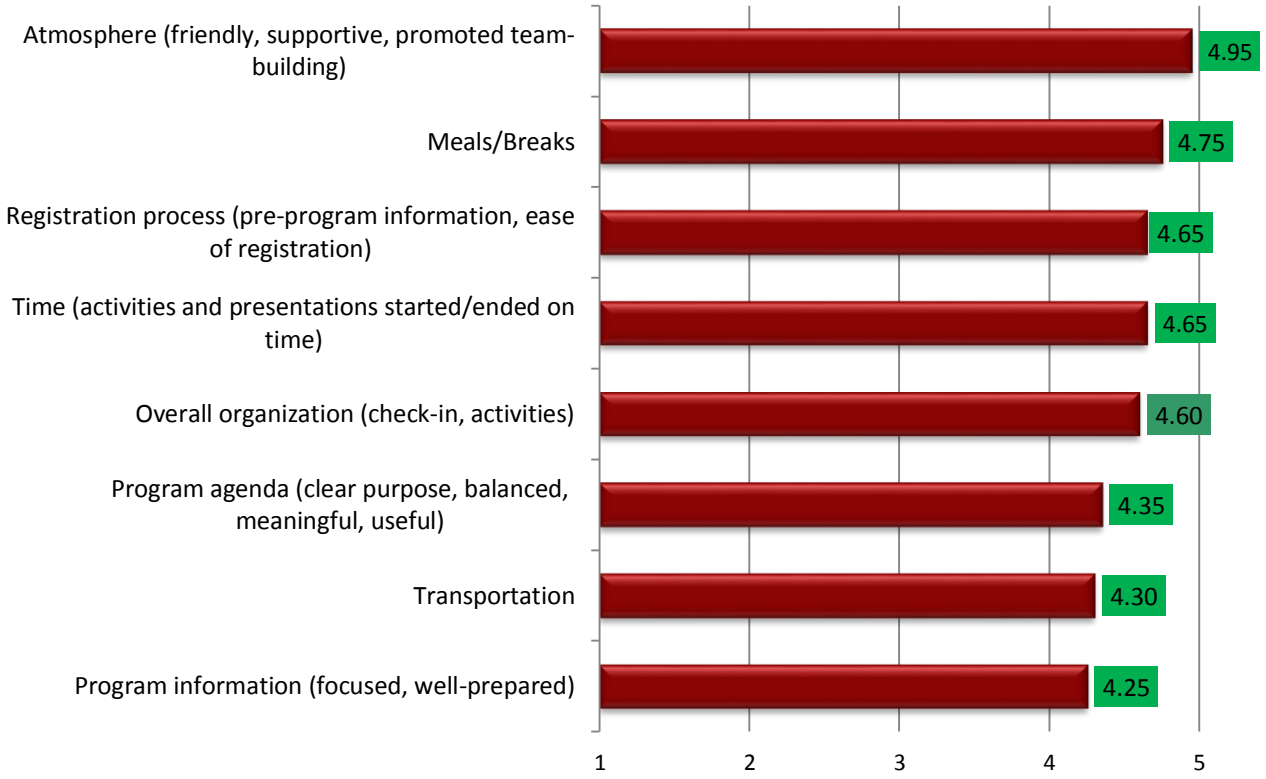
Ratings of logistics

Participants rated logistical aspects of the program on a scale of 1-5, 1=*not at all satisfied* to 5=*completely satisfied*. Ratings can be considered to trend towards positive or negative based on the following scale:

Completely satisfied	4.21 – 5.00
Very satisfied	3.41 – 4.20
Somewhat satisfied	2.61 – 3.40
Slightly satisfied	1.81 – 2.60
Not at all satisfied	1.00 – 1.80

As shown in Figure 35, participants were *completely satisfied* with all logistical aspects of the UVMN Workshop. The *atmosphere* received the highest rating while the lowest ratings were in the areas of *transportation* and *program information*. Participants explain their lower ratings in their responses to open ended questions below.

Figure 35. Mean ratings of the logistical aspects of UVMN



Suggestions for improvement

When asked how the UVMN workshop logistics could be improved, participants cited improved transportation, a convenient hotel location, food option information, inclusion of faculty/student meeting times and breaks, as well as planning ahead.

- *Maybe think about using a van to bring people around, worked to get ourselves back and forth but van would allow for field trips, little more flexibility with what we did/could do.*
- *The transportation seemed a little awkward, but that's a function of location.*
- *Hotel within walking distance of workshop activities would have been nice.*
- *It would have helped to have some of the local eateries highlighted in a map so that we knew what our options were for the meals we had on our own. I really appreciated the morning snacks since we didn't have very good breakfast options at the hotel.*
- *There are 9 faculty, 3 per state - set aside some time for faculty to get together and discuss their ideas/project - develop those collaborations - so these groups can think as units/almost teams... and do the same for students.*
- *A few more breaks during a session would be helpful. At least take a minute to stretch or get a bottle of water or walk down the hall.*
- *Got the sense sometimes that it was not clearly laid out ahead of time. This is probably because it was the first time through. Was still great but could be even better with quality of information and instructors.*
- *Had a schedule conflict between UAS demo and a parade, but that is hard to avoid!*

Impact of UVMN on participants

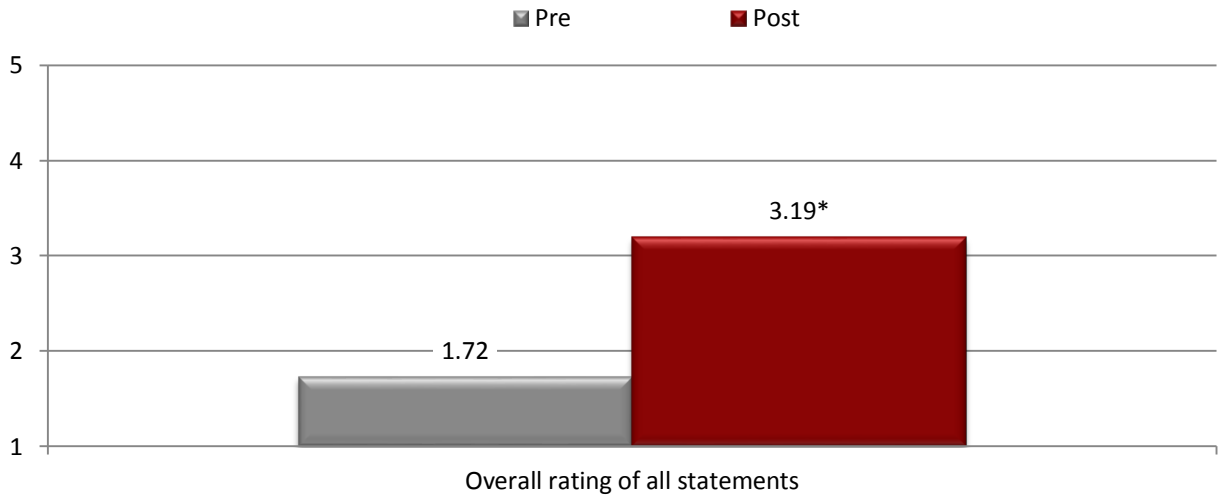
Participants (n=18) rated the impact that participation in the UVMN workshop has had on them on Objectives 1-3: Content knowledge, skills, and interest in modeling. On future surveys, Objectives 1 and 2 will be assessed separately.

Objective 1 - Increase participants' knowledge of and proficiency with various modeling and visualization tools and resources presented in the UVMN workshops.

Objective 2 - Increase participants' skills in the integration of modeling and/or visualization in undergraduate science, technology, engineering, mathematics (STEM) courses at primarily undergraduate institutions.

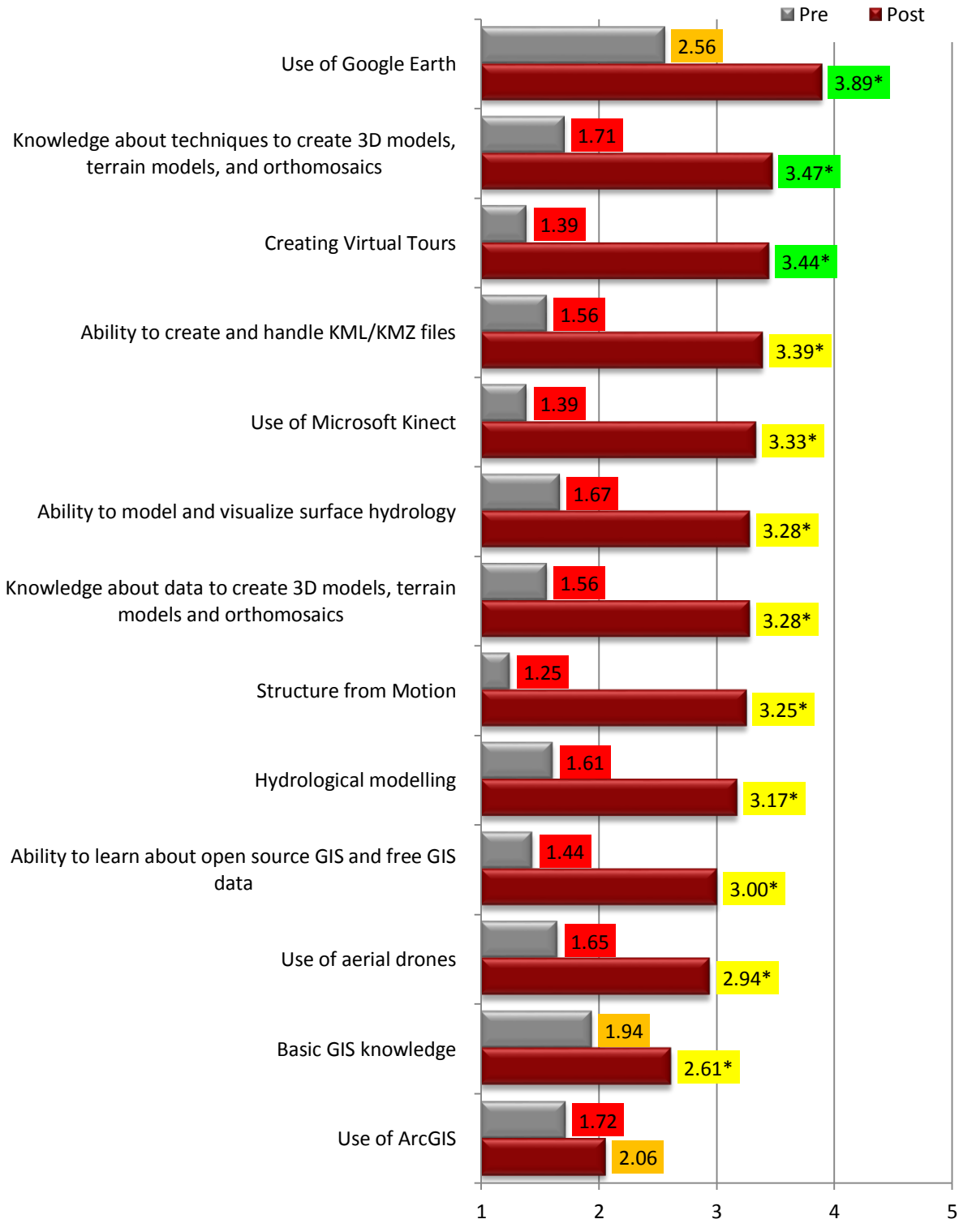
The UVMN workshop participants' pre and post overall ratings of their perceived proficiency in the thirteen content-knowledge and skills are shown in Figure 36. They demonstrated statistically significant overall gains in their achievement of objectives indicating that participation in the workshop had considerable impact on their knowledge and skills of modeling and visualization.

Figure 36. Mean ratings of overall achievement of UVMN content items that assess knowledge and skills



The thirteen objective statements that make up the Likert scale composite were analyzed individually to show the amount of growth in each of the specific knowledge and skill areas to help program coordinators better align future programs with participants' needs. Participants' mean ratings show a statistically significant increase from pre- to post-survey ($p < .05$) for all statements except *use of ArcGIS*. The two items showing the largest gains were *creating virtual tours* and *structure from motion*. Results are displayed in Figure 37.

Figure 37. Mean ratings of self-reported proficiency levels of UVMN content items that assess knowledge and skills



Pre-/Post- Content Survey Results

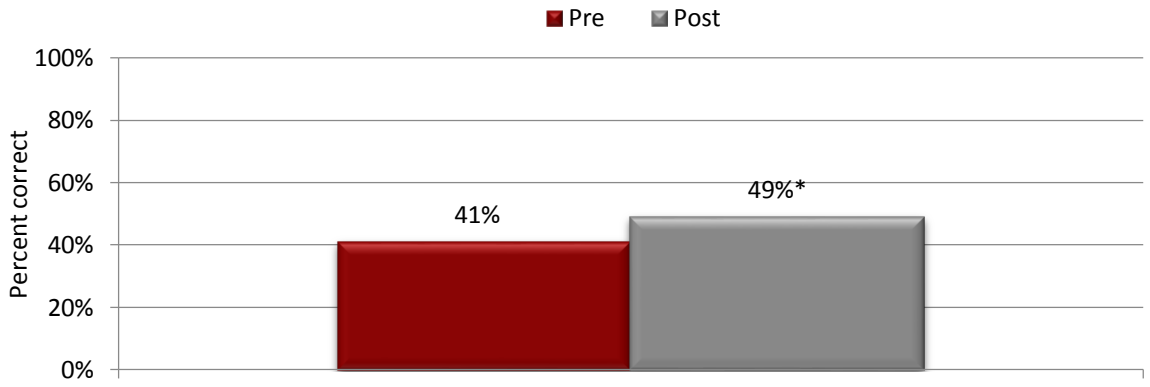
The pre-/post- content survey was developed by the three UVMN workshop facilitators over several iterations to assess actual gains in knowledge and skills. The content questions specifically measured growth in visualization and modeling knowledge acquired at the workshop. The external evaluators uploaded the survey questions into the survey dissemination program and distributed to workshop participants and also followed up with participants if they had not yet completed the survey. The pre-survey was sent electronically to all participants in advance of the UVMN workshop and was completed between May 22-31, 2014. The post-survey was completed between May 31-July 7, 2014.

The following categories of information were represented on the survey.

- Cartography
- Scientific Method
- Modeling
- Contour Analysis
- Visualization
- Gigapans
- Unarmed Aircraft Systems
- Measurements
- LiDAR
- Geographic Information Systems (GIS)

The percent of correct responses on the pre- and post- content survey reported by all participants is shown in Figure 38. Participants' knowledge increased significantly in all knowledge and skill areas.

Figure 38. Respondents' percent of correct responses on the content pre- and post-survey



The evaluator analyzed the ten content and skill topic areas that are included in the composite individually to show the amount of growth in each of the specific topics so program coordinators better align future programs with participants' needs. Results are shown in Figure 39. Questions and responses are grouped by topic. Students' scores generally increased from pre- to post-survey.

As shown in Figure 39, results indicate an overall knowledge increase of 10 percentage points between the pre- and post- surveys. Workshop participants' knowledge increased on eight areas and showed no change on two areas.

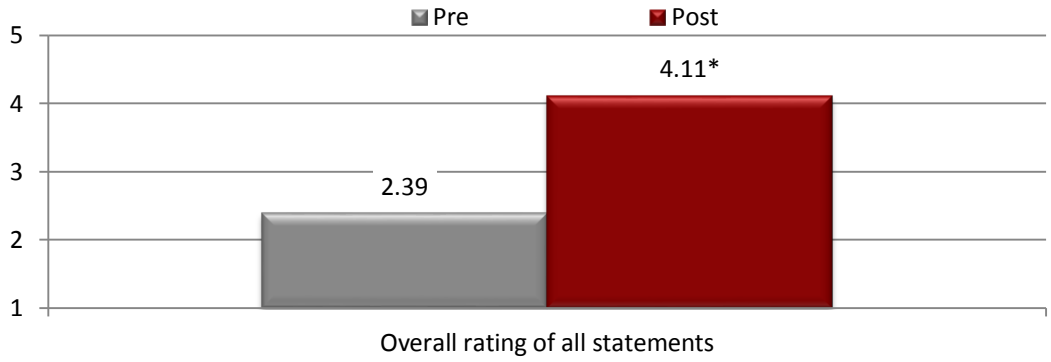
Figure 39. Undergraduate Visualization and Modeling Network content survey results

Overall percentage point gains	% Correct Pre	% Correct Post	Change in percentage points
Cartography	62%	65%	+3
Scientific Method	60%	73%	+13
Modeling	40%	50%	+10
Contour Analysis	0%	0%	0
Visualization	75%	75%	0
Gigapans	42%	56%	+14
Unarmed Aircraft Systems	56%	82%	+26
Measurements	65%	75%	+10
LiDAR	17%	37%	+20
Geographic Information Systems (GIS)	39%	44%	+5
Average Scores	**46%**	**56%**	**+10**

Objective 3 - Increase participants' interest in and commitment to continuing studies in modeling and visualization

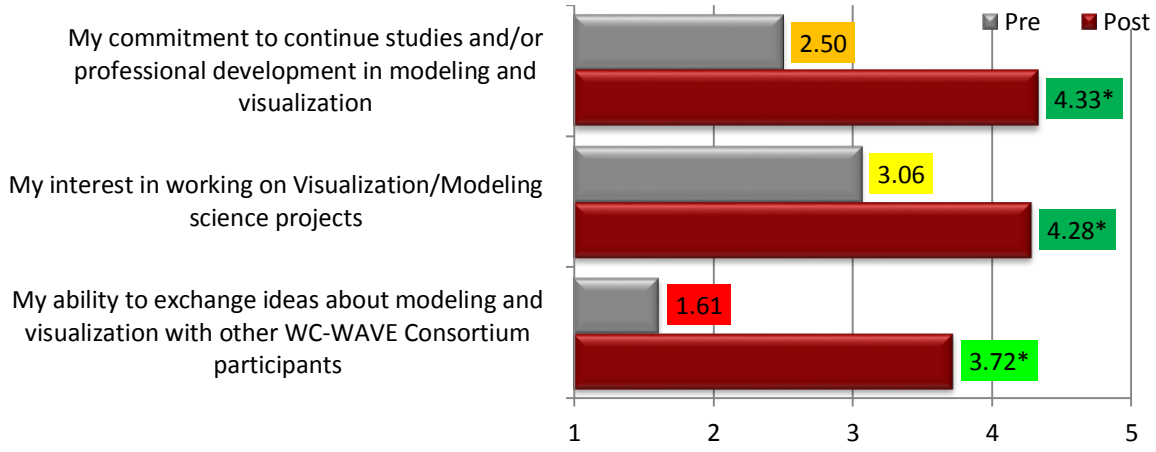
Results of UVMN Workshop participants' ratings of their interest in and commitment to modeling and visualization are shown in Figure 40. Overall, participants demonstrated statistically significant gains in their interest in and commitment to modeling and visualization.

Figure 40. Participants' overall interest in and commitment to modeling and visualization



The three modeling and visualization interest and commitment statements were analyzed individually to identify areas of strength and weakness. The largest increase was *my commitment to continue studies and/or professional development in modeling and visualization*. The smallest increase was for *knowledge of the Jemez watershed project field site*. Mean ratings show a statistically significant increase from pre- to post-survey statements for all items. Results are displayed in Figure 41.

Figure 41. Participants' interest in and commitment to studying STEM



Likelihood of implementing UVMN Workshop learning

Participants responded to the likelihood of implementing their UVMN Workshop learning in their research or instruction on a Likert scale from 1=*extremely unlikely* to 5=*extremely likely*. Seventeen out of eighteen participants (94%) rated themselves *extremely likely* to implement the UVMN Workshop learning while one participant (6%) would *likely* implement it.

Participants explained how they will use or implement what they have learned in the workshop. Many will incorporate their learning into their teaching or research or access Google Earth and other software when in need of additional tools.

Teaching

- *The many web sites that we were introduced to can be used in intro level courses. I can create homework assignments and exam questions that require students to research these sites and develop graphs and other visual representation of their answers.*
- *I would like to bring hydrologic modeling into my Intro to Engineering course and will also use some of the online tools that were shared to help my students see what we're discussing so the concepts will stick a little stronger in their minds.*
- *I plan on incorporating many of the visualization applications in my classes, and I plan on building a virtually enhanced sandbox.*
- *I would like to become more familiar with the software and use it to teach others at my home institute to show them what I have learned.*
- *I will more than likely use the Google Earth visualization plug-ins for my cartography class and introduction to GIS.*
- *Plan is to implement watershed model in my Hydrology class and possibly for student research.*
- *Use visualization tools in many intro classes.*
- *In modelling better education techniques.*

In-class learning

- *In one class we calculate runoff by hand. I will now incorporate the HEC model to compare with the calculations. My student partner and I will use ICE to develop virtual tours of our watershed area.*

Research

- *I just think if we actually can get information and be set up in places where we can do valuable research about how we can save.*
- *We are developing a simulated Martian landscape and will use small UAS to fly over, photograph and model the landscape. We will also use the Kinect to remotely model sample objects using robots.*

- *I can definitely use the virtual tour and gigipan for my research sites to better present what I am doing and finding.*

Use Google Earth

- *I will definitely be using the Google Earth a lot more. I would like to use the Kinect and SfM more too.*
- *We will introduce students to the websites and software that we learned about in the workshop, and have them use these sources of information to create models, do research, and explore the uses of technology that is available to us!*

Access to more tools

- *Every time something comes up having to do with environmental science, I now have far more tools to utilize in my research and even general conversation and finding day to day answers.*
- *I'm starting on the SfM immediately in a cadaver class this summer and will be sharing this info with another STEM Institute of K-12 teachers from around the state later in June and August.*
- *Will use the websites illustrated in my class.*
- *Work towards developing visualizations - 3rd priority.*
- *Map chemicals.*

Participants' next steps in watershed science and/or STEM

Participants indicated their next steps related to watershed science and/or STEM studies and research. Many look forward to collaborating in the future or developing class activities. In addition, student participants will continue working on their degrees while faculty participants will conduct research.

Collaborate

- *I can now collaborate with faculty and provide sound ideas and recommendations. Have a basis to support research to provide such sound ideas and recommendations.*
- *I plan on visiting with the faculty at Sierra Nevada College to check out their sandbox, and to ask for space at WNC to install a similar sandbox.*
- *I will contact Dr. Sajjad Ahmad and have him check our proper operation of the HEC runoff model in our teaching module.*
- *I will collaborate more with other faculty and will start to create modeling or visualization modules so that I can carry them to multiple courses.*
- *Collaborate with instructors to choose software and hardware to implement in class.*
- *I can now collaborate with Army Corps on projects.*
- *Start collaborations.*

Continue studies

- *I am currently working on my Masters in Geographic Information Science and Technology at the University of Southern California. I hope that I can take some of these ideas and apply them to my thesis.*
- *Working with faculty to improve the science department, while continuing my education and research in the environmental science field.*
- *Well, I plan to continue my studies in Env Science, and relay all this information to my Env Science professors.*
- *I plan to earn a Bachelor's degree in Natural Resources.*
- *Learn HEC-GeoHms. Learn ArcGIS.*

Conduct research

- *I now know specifically what (SfM) and how (Kinect) to begin my own visualization research and applications within my own institution because of connections (Donna D.) at nearby institution (BSU).*
- *I also plan to utilize some of this information to conduct my research project.*
- *I would like to help plan a project around the course we had learned.*
- *Develop watershed models for creeks by my campus.*

Class implementation

- *My student partner and I are going to develop lab and homework assignments for my 200 level course. We also plan on going out to my research sites and take pictures to create the 3-D models using project memento.*
- *I need to practice using the software before developing classroom activities.*

Create computer models

- *I want to make some computer models of watersheds, and dig more into the HEC-HMS and GIS software.*

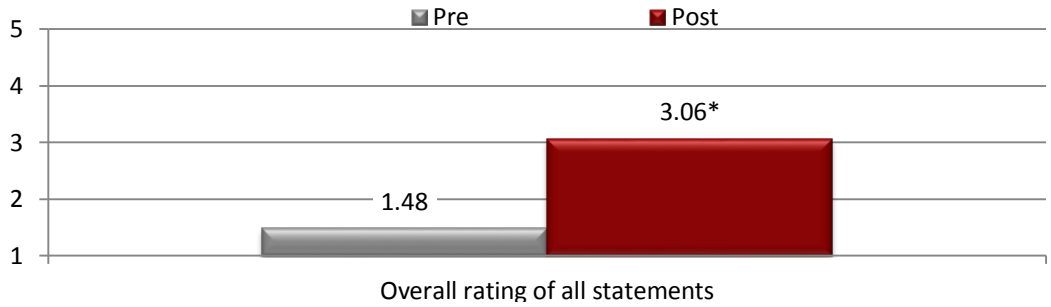
Advertise class

- *I also plan to advertise however possible the STEM 100 class that is now open for registration on our campus, to use my connections with fellow students and faculty to help make this class and the students who participate successful!*

Overall learning

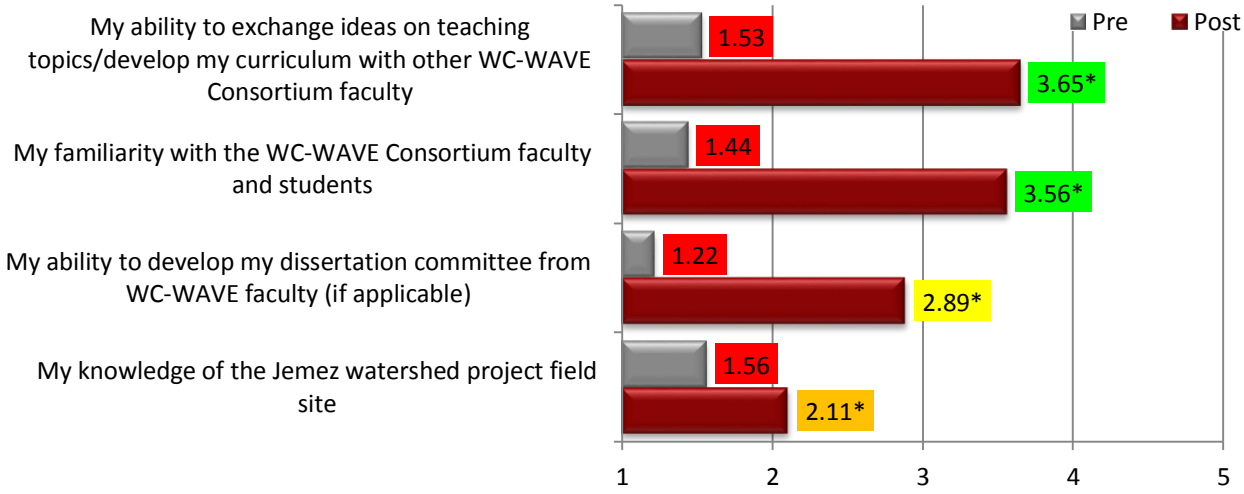
Results of the participants' ratings of their overall learning are shown in Figure 42. Participants demonstrated statistically significant gains in their overall learning.

Figure 42. Participants' overall learning



The four overall learning statements were analyzed individually to identify areas of strength and weakness. The largest increases were seen in *My ability to exchange ideas on teaching topics/develop my curriculum with other WC-WAVE Consortium faculty* and *My familiarity with the WC-WAVE Consortium faculty and students*. Mean ratings show a statistically significant increase from pre- to post-survey statements for all items. Results are displayed in Figure 43.

Figure 43. Participants' overall learning by construct



Participants each explained the two most important things they gained from attendance at the UVMN Workshop. They noted exposure to *teaching tools*, *hands-on experience*, *networking opportunities*, *various data collection software*, and *3D model creation*.

Exposure to teaching tools

- *The learning the variety of tools that are out there, and what ones have been proven to be most helpful in teaching and learning. There are so many great undiscovered tools popping up all of the time. It can be challenging to find them, let alone figure out how they work. There is so much data out there, and it is great to learn how to gain access to it and utilize it.*

- *I also regained my excitement for modeling and visualization and the lists of links that we received will really help me spread the word to my faculty and help them expand on this in their classrooms as well.*
- *Great ideas for easy to use visualization programs readily available to me and student. The idea for a 3D enhanced sandbox!*
- *Support to develop teaching/research tools.*

Hands-on experience

- *I gained hands on experience that will benefit me for a lifetime! I also gained valuable research and internship time that will greatly help me in the future.*

Networking

- *Connection to specific WC student and faculty - I now have a committed relationship and beginning collaboration with 2 real people. My student is now able to connect with EPSCoR because of some real and realtime relationships with other faculty and students.*
- *The ability to meet everyone and get to know them better.*
- *The networking with other, like-minded individuals was terrific!*
- *Start to develop collaborative groups/teams/ideas that plug me into professional groups outside my college - professional development.*

Data collection/open software

- *I did not know all this free software was available and I did not know how to use it. Now I can work on my own on small projects until I learn it well and then apply it to my teaching and research. I can see how it will enhance my research but I am still struggling on coming up with ideas for teaching, especially my upper level courses.*
- *I have learned how to use Google Earth, Microsoft Ice, Photosynth, HMS, and other software to collect data.*
- *And second the open software that can be utilized.*

Google Earth

- *Using Google Earth and Google Earth's external plug-ins. There is a lot of information that can be used in visualizing data for the Earth. Google has produced a very extensive and open source method of allowing people to develop more information.*
- *The many uses of Google Earth, and the ability to use it as a platform for other websites such as climate viewer. The amount of information is almost overwhelming, but absolutely useful in a classroom setting of any kind!*

Kinect

- *I loved the Kinect! My professor has already decided how this would be useful in the classroom, to scan body parts and possibly create 3D printed objects.*

Web-based data lecture

- *The final lecture on use of web-based data in the classroom.*

Gigapan visualizations

- *Use of the HEC runoff modeling Gigapan Visualizations.*

Creating 3D Computer Models

- *Creating 3D computer models of landscapes to print out in 3D. This will be highly valuable in studying study areas.*

Positive attitude

- *Motivation, a re-generation of hope!*

Applications to projects

- *SfM from aerial photos and SfM from Kinect sensor will both apply directly to SIPI's NASA Mars project.*

Program participants shared the following with the facilitators:

- *This was an amazing opportunity. I thoroughly enjoyed it, learned a lot, and feel privileged to be able to attend and work with a wonderful group of people. Communication is often a problem in any industry, and this greatly improves that among scientists. Being part of this collaboration makes me happy to be involved the scientific world, and I look forward to continuing relationships.*
- *I am very pleased that I participated in the workshop. By the end, I think most people were tired and ready to be done, but it was energizing to see some of the options available to us and to be reminded of things I already knew and had forgotten to bring into the classroom. I look forward to the possibilities of using this material in future courses!*
- *I think this is a great opportunity for faculty from PUI schools to get support to improve what they do with research and teaching. I appreciate this opportunity and thank the organizers for putting this together. Really looking forward to working on this project!*
- *I really enjoyed the workshop! My brain is still processing the information. I can see a use for each and every aspect of what we learned, not just in STEM classes, but other classes I have attended while in college.*
- *Everything was taken of and it seemed to me to run smoothly. I enjoyed the topics covered and will be using them and informing my instructors of them so they can utilize it too.*
- *I really enjoyed the workshop and the interfacing time with the other collaborators. I think that this is the most innovative program for producing curriculum for future teaching.*
- *Good job! Kept everything timely, entertaining, and captivating. Should really have good tech support for such a training though! I think everything was perfect - housing and class location and total travel time to/from NM - just right. Thanks.*
- *Overall I thoroughly enjoyed this internship! It was great and will be very useful in the future!*
- *I would like to say thank you to EPSCOR for this opportunity. Thank you.*
- *Thanks for the experience and information!*
- *I really enjoyed the workshop.*

Key Findings and Recommendations for UVMN

Key findings and recommendations are listed below for demographics and UVMN program components.

Demographics

Women composed 48% of participants. Additionally, 62% of participants were the first in their families to attend college which is almost twice the national rate. The majority of attendees were Caucasian. Approximately 33% were underrepresented minorities (URM). Caucasians and Native Americans were overrepresented while Hispanic/Latinos were underrepresented. African American and Pacific Islanders were not represented. Faculty participants comprised 52% of participants while undergraduates made up the remaining 48%. Sixty percent of participants came from New Mexico, which is over double the project membership from that state. Both Idaho and Nevada were underrepresented with respect to their representation in the WC-WAVE project.

Increase participation by underrepresented minorities, especially Native Americans and Hispanic/Latinos. Increase publicity and outreach in other states to ensure more representative geographic participation.

Program components

All program components were rated *very* or *extremely useful*. *Google Earth and Overlays, Developing Course Modules,* and *Gigapan Data Collection* were the highest rated components while the *Structure from Motion* received the lowest rating. One of the UVMN leads was

unexpectedly absent and so sessions were modified by the stand-in workshop coordinator/faculty member. Participant comments suggested incorporating more demonstrations and examples while decreasing the time spent on specific programs.
Include demonstrations or examples whenever possible in each session. Provide concrete examples for trainers of how they could incorporate the concepts and tools presented. Consider re-allocating time to best meet the needs of participants.

Logistics
Participants were completely satisfied with all logistical aspects of the workshop. The *atmosphere* received the highest rating and *program information* received the lowest rating. Participants asked that organizers improve the transportation, hotel location, food options, and time.
Consider transportation issues as well as hotel and meeting locations when making reservations. Ensure that locations are conveniently located and that transportation options are planned out ahead of time. Consider highlighting neighborhood food options on a map to help familiarize participants. Provide time for students or faculty to meet separately and add in more breaktime.

Program Impacts
Objective 1: Knowledge of and proficiency with various modeling and visualization tools and the integration of modeling and/or visualization
Objective 2 - Increase participants' skills in the integration of modeling and/or visualization in undergraduate science, technology, engineering, mathematics (STEM) courses at primarily undergraduate institutions.
Participants showed a statistically significant increase in overall achievement of knowledge, proficiency, and integration of modeling and/or visualization skills. Statistically significant gains were found for twelve out of the thirteen individual items that assess knowledge and skills. The largest gains were in *creating virtual tours* and *Structure from Motion*. The smallest gain was for the only non-statistically significant item, the *use of ArcGIS*.
Increase time spent on ArcGIS or consider presenting the material differently if there is a lack of time, e.g. follow-up with a webinar, handouts and materials distributed, etc.

Objective 3: Interest in modeling and visualization
Participants showed statistically significant increases for all three items related to their interest in and commitment to modeling and visualization. The largest gains were for *commitment to continue studies and/or professional development in modeling and visualization*. The item showing the smallest gain was *interest in working on Visualization/Modeling science projects*.
Encourage faculty to continue discussing their own research, any possible future research opportunities related to the WC-WAVE project, and potential future dissertations topics that could be related or of interest to students.

Overall learning
Participants demonstrated statistically significant gains for all four items related to their overall learning. The largest increases were in *ability to exchange ideas on teaching topics/develop curriculum with other WC-WAVE Consortium faculty* and *familiarity with the WC-WAVE Consortium faculty and students*.

Encourage continued communication between UVMN participants through web-based meet-ups and dedicated social network sites to maintain the relationships and connections between participants.

<u>Incorporate recommendations from external evaluators in the planning processes regarding evaluation and survey development</u>

The evaluation must be aligned with program objectives. Program coordinators/facilitators were unable to agree on objectives prior to development of the evaluation form.

Program coordinators and activity/workshop facilitators must communicate consistently and often with external evaluators. The external evaluators will assist with developing program objectives as needed in close collaboration with coordinators/facilitators.

3.2 Achievement of project goals

There are two ways which the external evaluators measure achievement of project goals: the baseline survey and the progress reported on benchmarks and milestones tables.

Baseline survey

The baseline survey is based on the WC-WAVE project's goals and objectives. To develop the surveys, the evaluator discussed the project goals and the impact principal investigators would like participation in the project to have on participants. Questions are repeated on baseline and post-surveys to measure changes in outcome areas. The survey was developed over many iterations and adapted from a review of the literature and other validated surveys that measure similar constructs. Survey drafts were sent to principal investigators. Feedback and suggestions were incorporated into the surveys and the surveys were finalized. As part of this group process, the project leaders determined the baseline survey should assess:

- Demographics
- Implementation of project
- Progress made towards achievement of project goals

The purpose of reporting baseline levels is to inform project leaders of areas of strength and weakness within their project. This enables leaders to focus on developing areas of weakness and align project activities with participants' needs.

Project benchmarks and milestones

Component leads developed objective/benchmark and milestone tables for each component and track completion of identified milestones annually. Results are reported after each component area in the following manner. Within each component, multiple objectives/benchmarks are listed that are used to measure progress and are numbered in the left-hand column. The milestones in the next columns describe activities that need to be completed to show adequate progress toward meeting the benchmark each year. The percentage of each Year 1 milestone that has been completed is shown in the right-hand column. Milestones are color-coded:

Green: 100% complete
Yellow: In progress but less than 100% complete
Red: No progress, need to be deleted, or moved into a later year's milestones.

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Baseline survey response rate

The baseline survey link was emailed to the 64 project participants on April 4, 2014 and 59 participants had completed it by May 13, 2014. The response rates was 92% and is shown in Figure 44.

Figure 44. Baseline survey completion rate

Year	Number Requested	Number Completed	Return Rate (%)
2013-14	64	59	92%

Demographic description of baseline survey respondents

Over half of respondents are white and male and slightly less than one half are faculty members as shown in Figure 45. The Universities of Idaho and New Mexico are the most represented institutions, accounting for almost one half of respondents. The evaluator notes the following differences between the demographics of project participants and the tri-state comparison population in regard to underrepresented groups:

- Females are underrepresented
- Hispanic/Latinos and African Americans are underrepresented
- American Indians were represented with respect to the comparison population

Figure 45. Demographic description of Baseline Survey participants[16]

	Baseline Participants (*n*=59)		ID, NM, NV Comparison Population (*n*=140,181)[17]
	#	%	%
Gender			
Male	33	56%	48%
Female	26	44%	52%
Race			
White (non-Hispanic)	41	69%	62%
Asian	9	15%	6%
Other[18]	4	7%	-
Hispanic	3	5%	22%
American Indian or Alaska Native	2	3%	3%
Black or African American	-	-	3%
Multi-racial	-	-	2%
Pacific Islander or Native Hawaiian	-	-	<1%
Role			WC-WAVE project (*n*=64)
Faculty/University academic researcher	27	46%	Faculty 44%
Graduate student	13	22%	Graduate Students 26%
Professional Staff	15	25%	Administration 17%
Undergraduate student	3	5%	Technical 13%
Ambassador	1	2%	
Institution			
Idaho			
Boise State University	5	8%	
College of Southern Idaho	2	3%	
Idaho State University	5	8%	**44% (28 members)**

[16] Percentages may not add up to 100% because percentages were rounded to whole numbers.
[17] Faculty, undergraduate, and graduate students from the following institutions are included in these calculations: Idaho: Boise State University, College of Southern Idaho, Idaho State University, University of Idaho; Nevada: University of Nevada, Las Vegas, University of Nevada, Reno, Desert Research Institute; New Mexico: New Mexico State University, New Mexico Institute of Mining and Technology, University of New Mexico
[18] "Other" includes 1 Jewish and 3 who did not wish to specify

	Baseline Participants (*n*=59)		ID, NM, NV Comparison Population (*n*=140,181)[17]
	#	%	%
University of Idaho	14	24%	
Idaho Total	**26**	**43%**	
Nevada			
Desert Research Institute	3	5%	
Nevada System of Higher Education	2	3%	
University of Nevada, Las Vegas	3	5%	
University of Nevada, Reno	7	12%	
Nevada Total	**15**	**25%**	**28% (18 members)**
New Mexico			
New Mexico Institute of Mining and Technology	4	7%	
New Mexico State University	1	2%	
University of New Mexico	13	22%	
New Mexico Total	**18**	**31%**	**28% (18 members)**
Year of Entry into Project			
2013-14	47	80%	
2014-15	11	19%	
2015-16	1	2%	

Baseline level of achievement of project goals

Respondents' baseline levels of goal achievement and progress made on annual milestones are listed below by project goal.

For components 1-3, participants rated their knowledge on a scale of 1-5, 1=*not knowledgeable at all* to 5=*extremely knowledgeable*. Ratings can be considered to trend towards positive or negative based on the following scale:

Extremely knowledgeable	4.21 – 5.00
Very knowledgeable	3.41 – 4.20
Somewhat knowledgeable	2.61 – 3.40
Slightly knowledgeable	1.81 – 2.60
Not knowledgeable at all	1.00 – 1.80

Component 1: Watershed Science

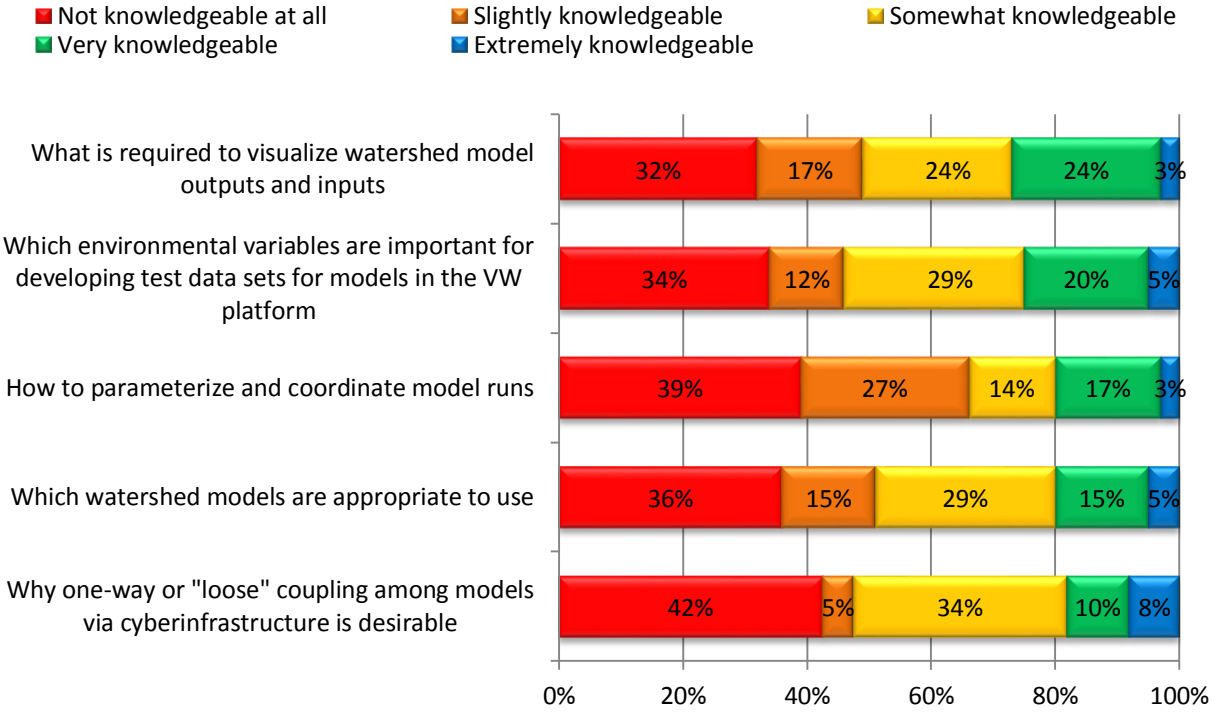
Goal 1: Advance understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed (VW) framework.[19]

The objectives include:

1. Parameterize and validate watershed models
2. Develop CSDMS adapter for models
3. Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services
4. Snow camp and summer institutes[20]

Responses for Objective 1 were analyzed by category as shown in Figure 46. While all areas have room for growth, the one with most potential for growth is *why one-way or "loose" coupling among models via cyberinfrastructure is desirable*.

Figure 46. Mean ratings of knowledge of Objective 1 statements, by rating category



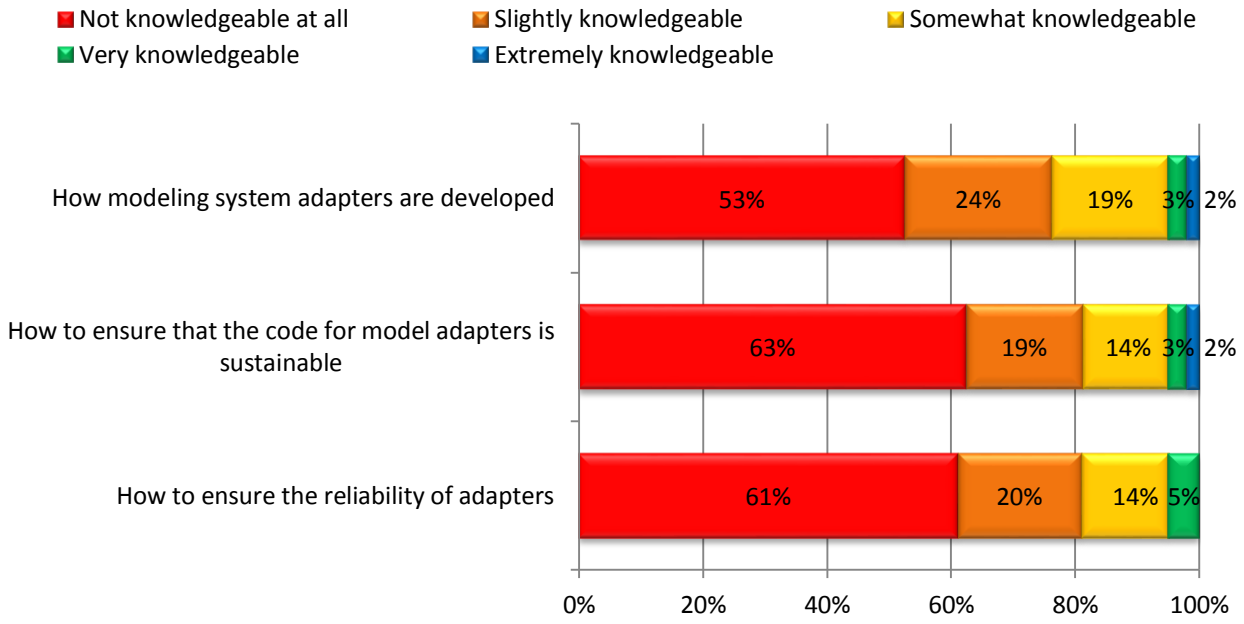
Objective 2: Develop CSDMS (Community Surface Dynamics Modeling System) adapters for models

Responses for Objective 2 were analyzed by category as shown in Figure 47. The area with the most potential for growth is *how to ensure that the code for model adapters is sustainable* followed by *how to ensure the reliability of adapters*.

[19] http://westernconsortium.org/uploads/20%20Page%20Proposal%20-%20WC-WAVE.pdf

[20] Baseline survey questions regarding snow camp and summer institutes are reported in the Workforce Development component, which coordinates the field experience activities.

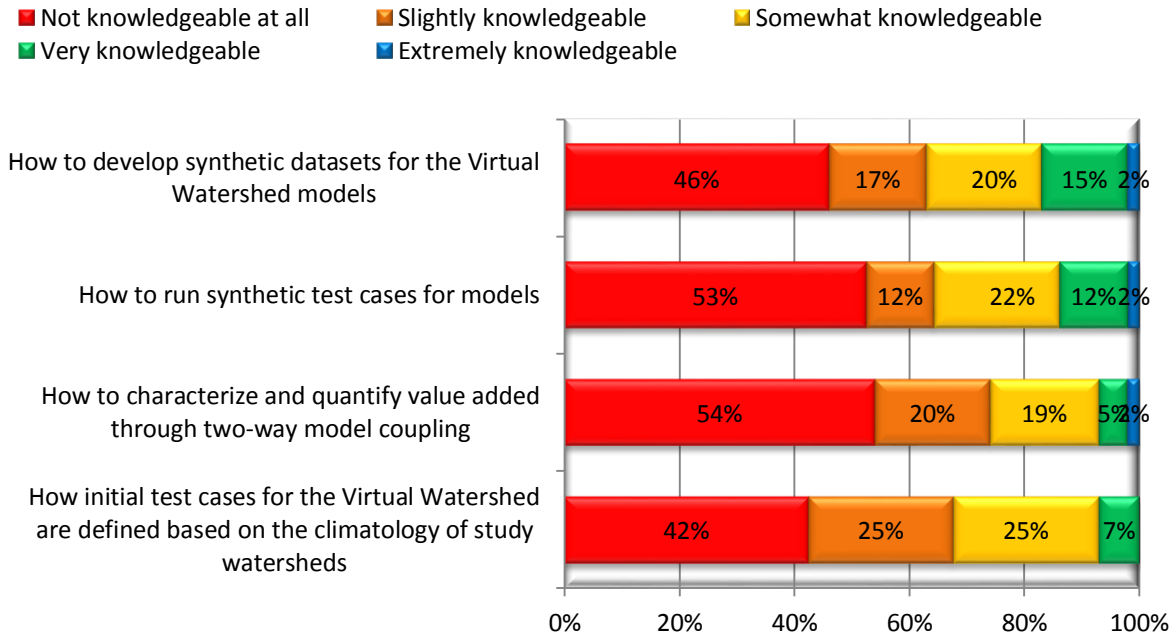
Figure 47. Mean ratings of knowledge of Objective 2 statements, by rating category



Objective 3: Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services

Responses for Objective 3 were analyzed by category as shown in Figure 48. The two areas with the most room for growth are the following: *how to run synthetic test cases for models* and *how to characterize and quantify value added through two-way model coupling.*

Figure 48. Mean ratings of knowledge of Objective 3 statements, by rating category



Progress made towards achievement of Component 1 project benchmarks and milestones

Results

The project lead in charge of achieving Component 1 also reports progress on each objective/benchmark as a percentage of objective achieved. These are also color-coded as the following:

Green: *on track to reach benchmark*
Yellow: *working towards benchmark*
Red: *not on track to reach benchmark.*

According to these results, the component is on track on two out of four milestones. Two Component 1 milestones are on track to meet identified benchmarks while the other two show 10-20% completion. Figure 49 displays a summary of progress made towards Year 1 objectives/benchmarks.

Figure 49. Achievement of Goal 1 Project Benchmarks and Milestones

Component 1: Watershed Sciences		
Goal: Advance understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed (VW) framework		
Objectives/Benchmarks	Year 1 milestones	Year 1Milestones % Complete
1. Parameterize and validate watershed models	Models were reviewed and seven selected for development. Model outputs and watershed inputs were conceptually mapped and shared with CI. Required forcings and boundary conditions were identified, particularly those common to different models. We expect to have each model calibrated in test watersheds by August 2014.	100% complete
2. Develop CSDMS adapters for models	A presentation was provided to the WS team by CSDMS lead developer, Scott Peckham. The summer institute, which will take in NM in May 2014, will provide CSDMS training by Scott Peckham to WS and CI faculty and graduate students with the primary goal of learning how to develop adapters that are specific to particular models.	20% complete
3. Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services	Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services, 10% complete. The initial test cases have been defined based on climatology of study watersheds. Synthetic datasets will be developed in year 2.	10% complete
4. Snow camp & summer institutes	Snow camp and summer institutes (part of WFD objectives and discussed in more detail within WFD results)	100% complete
Average completion rate for component[21]		**58%**

[21] As reported by project leads to project administrators

Component 2: Cyberinfrastructure-Visualization

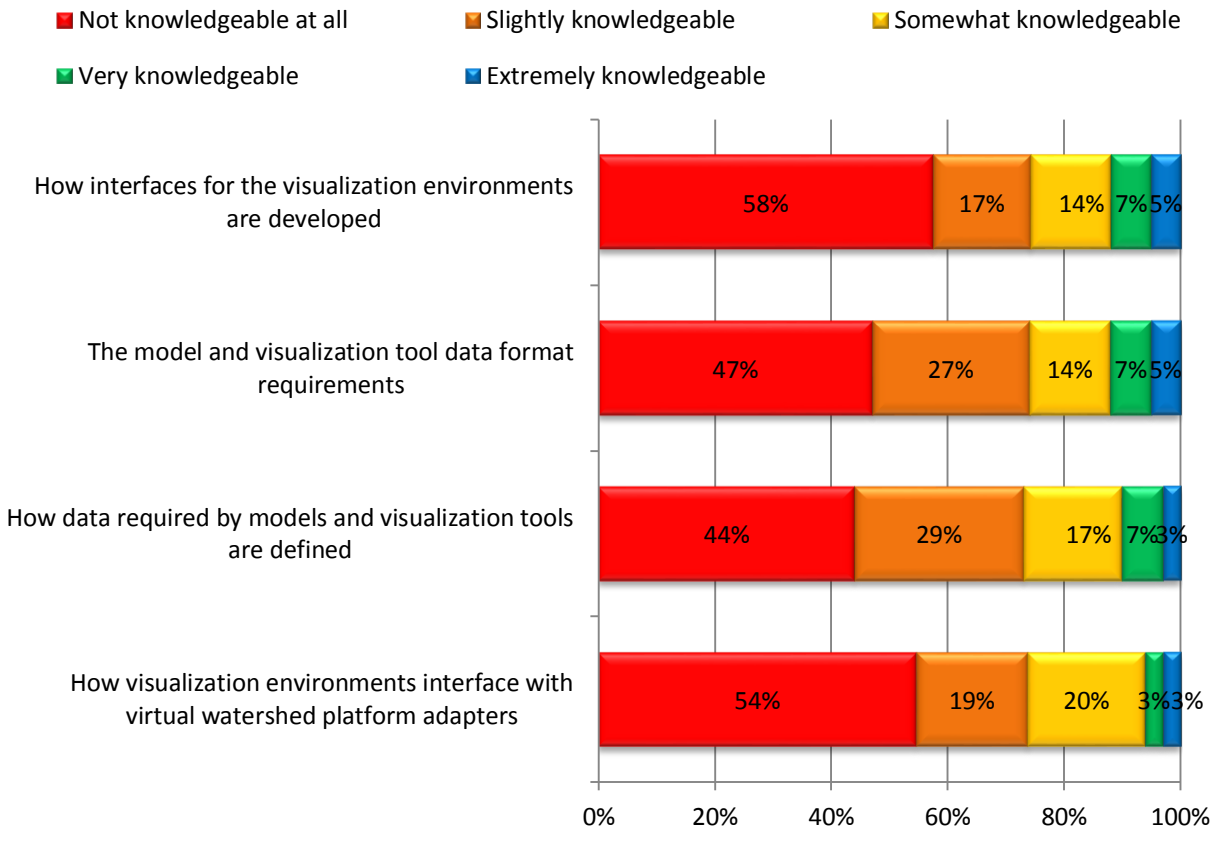
Goal 1: Accelerate collaborative, interdisciplinary watershed research and discovery by creating innovative visualization environments. [22]

The component's objectives are to:

1. Develop and deploy visualization environment
2. Develop user interfaces
3. Train users on how to use the visualization environment
4. Educate graduate students on CI for watershed research
5. Disseminate results

Results were analyzed by category as shown in Figure 50. Participants showed the highest percentages of *very* or *extremely knowledgeable* for *how interfaces for the visualization environments are developed* and *the model and visualization tool format requirements*. The areas with the highest potential for growth include the following: *how interfaces for the visualization environments are developed* and *how visualization environments interface with virtual watershed platform adapters*.

Figure 50. Mean ratings of knowledge of Cyberinfrastructure Visualization Component statements, by rating category



[22] http://westernconsortium.org/uploads/20%20Page%20Proposal%20-%20WC-WAVE.pdf

Progress made towards achievement of Component 2 project benchmarks and milestones

Results

The project lead in charge of achieving Component 2 also reports progress on each objective/benchmark as a percentage of objective/benchmark achieved. These are also color-coded as the following:

Green: *on track to reach benchmark*
Yellow: *working towards benchmark*
Red: *not on track to reach benchmark.*

According to these results, the component is on track on three out of six milestones. Three Component 2 milestones are on track to meet completion while the other three show 25-80% completion. One objective, *Train users on how to use the visualization environments*, has no deliverables in Year 1 of the project. Figure 51 displays a summary of progress made towards Year 1 milestones.

Figure 51. Achievement of Component 2 Project Benchmarks and Milestones

Component 2: Cyberinfrastructure-Visualization		
Goal: Accelerate collaborative, interdisciplinary watershed research and discovery by creating innovative visualization environments.		
Objectives/Benchmarks	Year 1 Milestones	Year 1 Milestones % Complete
1. Develop and deploy Visualization Environment <-> Virtual Watershed Platform adapters	Development was started in Year 1 and will be completed in Year 2	25% completed
2. Develop user interfaces ("front end interfaces") for the visualization environments	Define functional and non-functional requirements for front ends	80% complete
	Create rapid prototype of:	desktop – 100%, web, 100%,
		immersive, 50% complete
3. Train users on how to use the visualization environments	No deliverables in Year 1	
4. Educate graduate students on CI for watershed research	Hire undergraduate and graduate students and advise	100 % complete
5. Disseminate results	Submit papers and deliver presentations Several members of the CI-VIS group were involved in an NSF Science and Technology Center meeting on Forest Fire Visualization that was held at the University of Idaho – April 2014	100% complete
Average completion rate for component[23]		**53%**

[23] As reported by project leads to project administrators

Component 3: Cyberinfrastructure-Data

Goal 1: Accelerate integrate watershed scale modeling through streamlined data access, transfer of outputs, and associated metadata to data management systems, visualization, model configuration. [24]

The objectives include:

1a. Define data required by models and visualization tools
1b. Define model and visualization tool data format requirements
1c. Define model configuration options to be exposed through the VW and visualization tool
2. Define model integration workflow
3. Deploy virtual watershed data and service platform
4. Deploy data source to Virtual Watershed Platform adapters
5. Deploy virtual watershed model adapters
6. Deploy virtual watershed to Visualization Environment adapter

Goal 2: Enable accelerated and broad access to research products, data, and metadata through integration with national networks through interoperable data services.

The objectives include:

1. Integrate data management system with CUAHSI HIS WaterOneFlow service network
2. Integrate data management system with DataOne network as Tier 4 member nodes

Goal 3: Streamline data intensive research through improved data management skills.

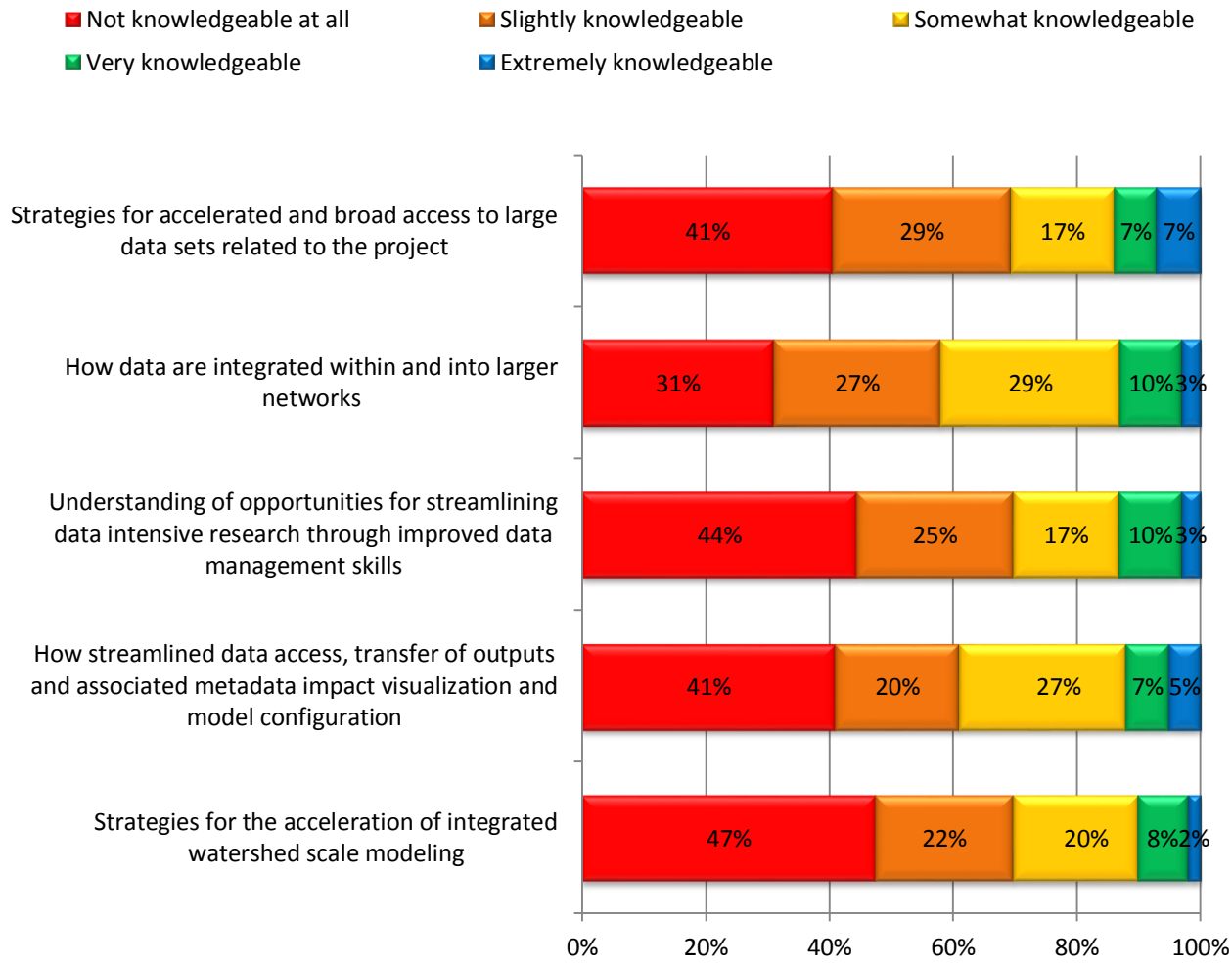
The objective is to:

1. Provide annual data management workshops for EPSCoR researchers and their students

The individual items were analyzed by category in Figure 52. The item with the largest percentage of participants feeling *very* or *extremely knowledgeable* was *strategies for accelerated and broad access to large data sets related to the project*.

[24] http://westernconsortium.org/uploads/20%20Page%20Proposal%20-%20WC-WAVE.pdf

Figure 52. Mean ratings of knowledge of Goals 1, 2, and 3 statements, by rating category



Progress made towards achievement of Component 3 project benchmarks and milestones

Results

The project lead in charge of achieving Component 3 also reports progress on each objective/benchmark as a percentage of objective/benchmark achieved. These are also color-coded as the following:

Green: *on track to reach benchmark*
Yellow: *working towards benchmark*
Red: *not on track to reach benchmark.*

According to these results, the component is on track on one out of eleven milestones. One Component 3 objective is on track to meet identified milestones while the other ten show 10-90% completion. One objective, *Deploy virtual watershed to Visualization Environment adapter*, has no deliverables in Year 1 of the project. Figure 53 displays a summary of progress made towards Year 1 objectives.

Figure 53. Achievement of Component 3 Project Benchmarks and Milestones

Component 3: Cyberinfrastructure-Data		
Goal 1: Accelerate integrated watershed scale modeling through streamlined data access, transfer of outputs and associated metadata to data management systems, visualization, model configuration.		
Objectives/Benchmarks	Year 1 Milestones	Year 1 Milestones % Complete
1a. Define data required by models and visualization tools		60% complete
1b. Define model and visualization too data format requirements, 60% complete		60% complete
1c. Define model configuration options to be exposed through the virtual watershed and visualization tool		20% complete
2. Define model integration workflow	Manual integration	10% complete
3. Deploy virtual watershed data and service platform	Develop data model; develop data in/out services; develop configuration services	100% complete
4. Deploy data source to Virtual Watershed adapters	Deploy CUAHSI adapter; begin development of OpenTopography adapter	70% complete
5. Deploy virtual watershed model adapters	Develop test adapter for one model based on manual integration	10% complete
6. Deploy virtual watershed to Visualization Environment adapter	No task milestones for Year 1, but ahead of schedule in testing of OGC WCS as an adapter interface.	
Goal 2: Enable accelerated and broad access to research products, data and metadata through integration with national networks through interoperable data services.		
1. Integrate data management system with CUAHSI HIS WaterOneFlow service network		90% complete
2. Integrate data management system with DataOne network as Tier 4 member nodes	ID ahead of schedule with testing of Tier 4 MN in year 1	50% complete (NM)
Goal 3: Streamline data intensive research through improved data management skills		
1. Provide annual data management workshops for EPSCoR researchers and their students	provided to NM Students – scheduling for Tri-state meeting	33% complete
Average completion rate for component[25]		**53%**

[25] As reported by project leads to project administrators

Component 4: Workforce Development

Goal 1: Engage university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization. [26]

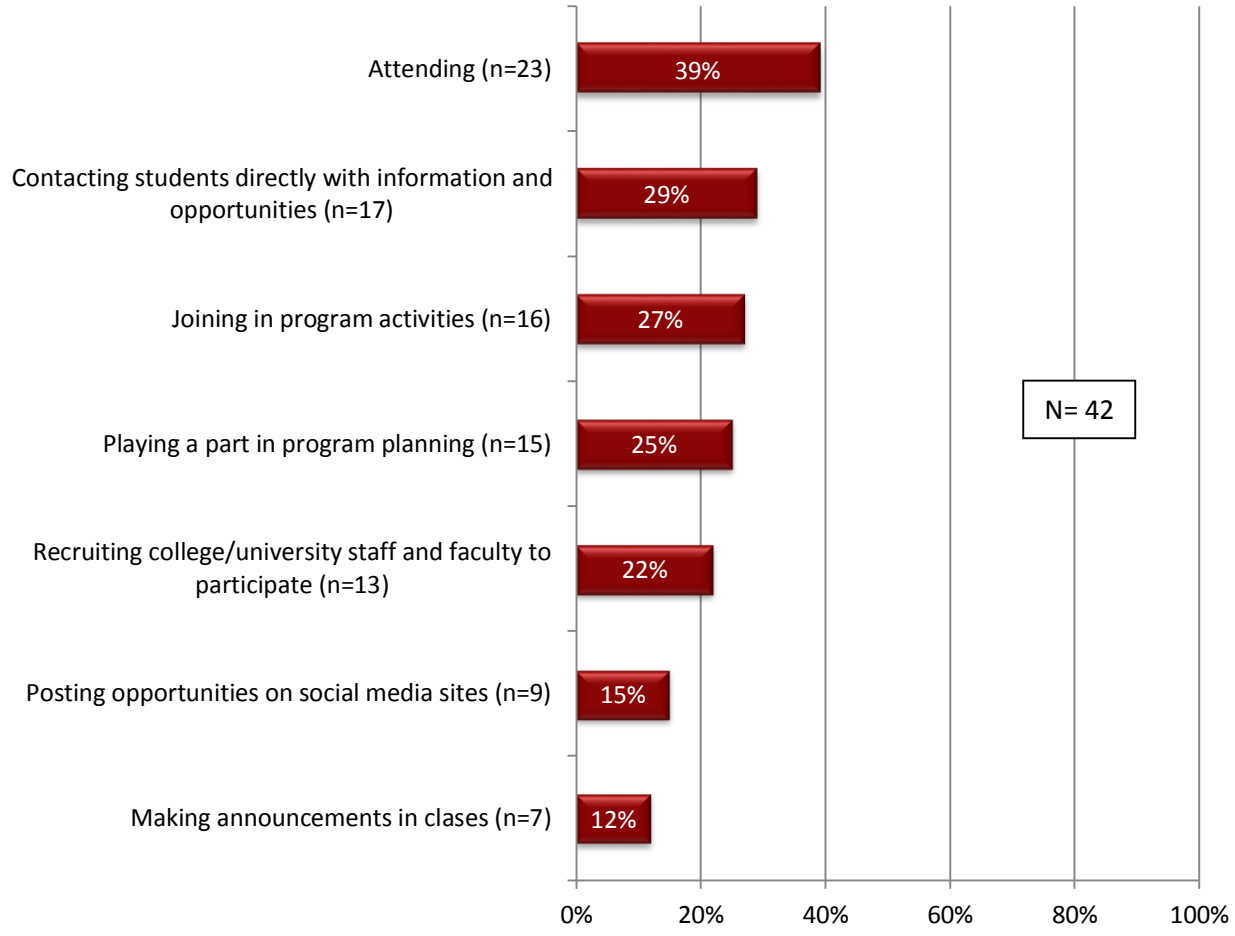
Its objectives include:

1. Develop a Graduate Interdisciplinary Training (GIT) Program
2. Develop an Undergraduate Visualization and Modeling Network (UVMN)

Participants' involvement in collaborative fieldwork activities

As shown in Figure 54, participants noted how they were involved in collaborative fieldwork activities. The largest percentages of participants said they *attend* (39%) activities or *contact students directly with information and opportunities* (29%).

Figure 54. Participants' involvement in collaborative fieldwork activities

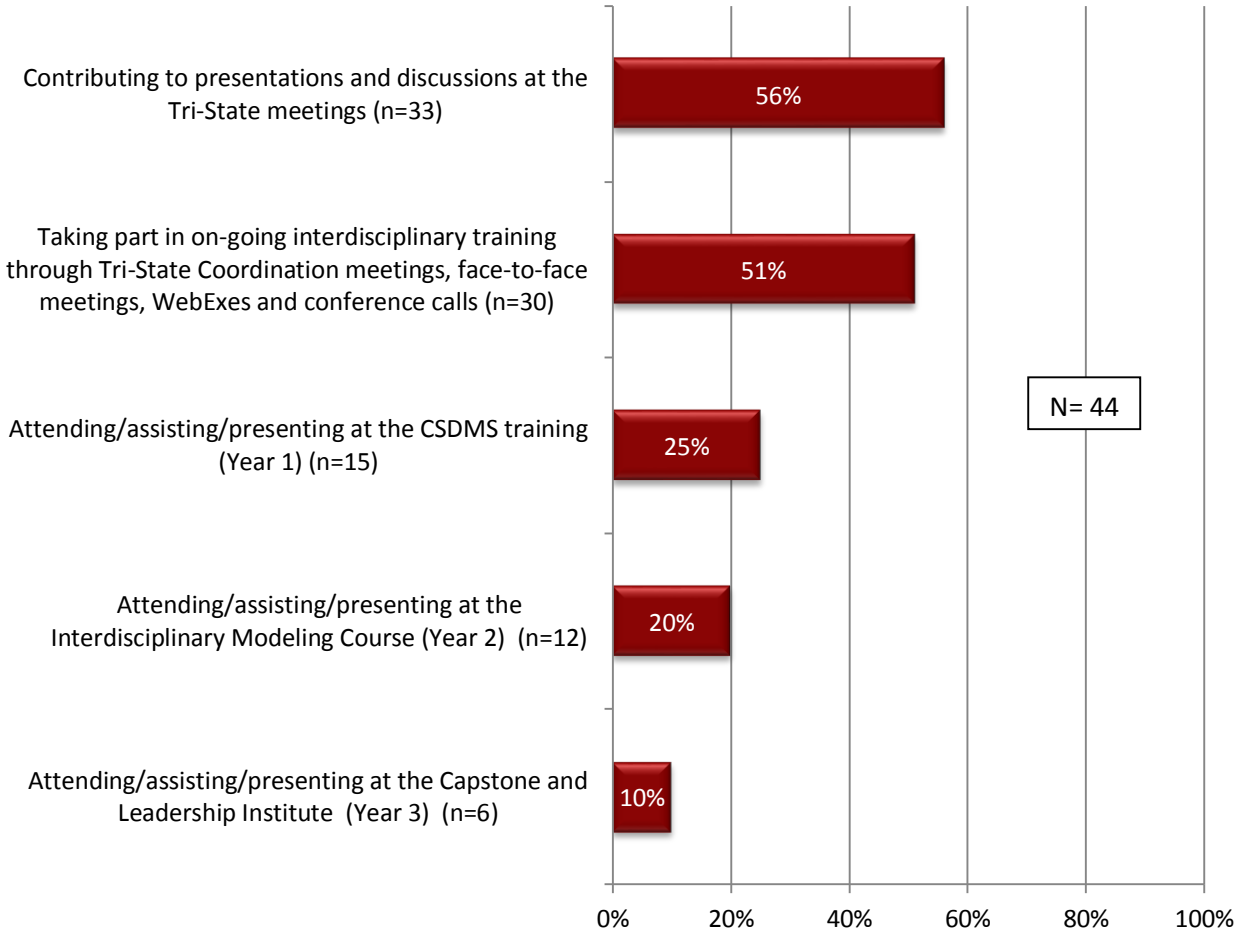


[26] http://westernconsortium.org/uploads/20%20Page%20Proposal%20-%20WC-WAVE.pdf

Graduate Interdisciplinary Training participation

Participants explained how they were involved in the Graduate Interdisciplinary Training program. The largest group of participants contributed *to presentations and discussions at the Tri-State meeting* (56%) and took *part in on-going interdisciplinary training through Tri-State Coordination meetings, face-to-face meetings, WebExes, and conference calls* (51%). Results are found in Figure 55.

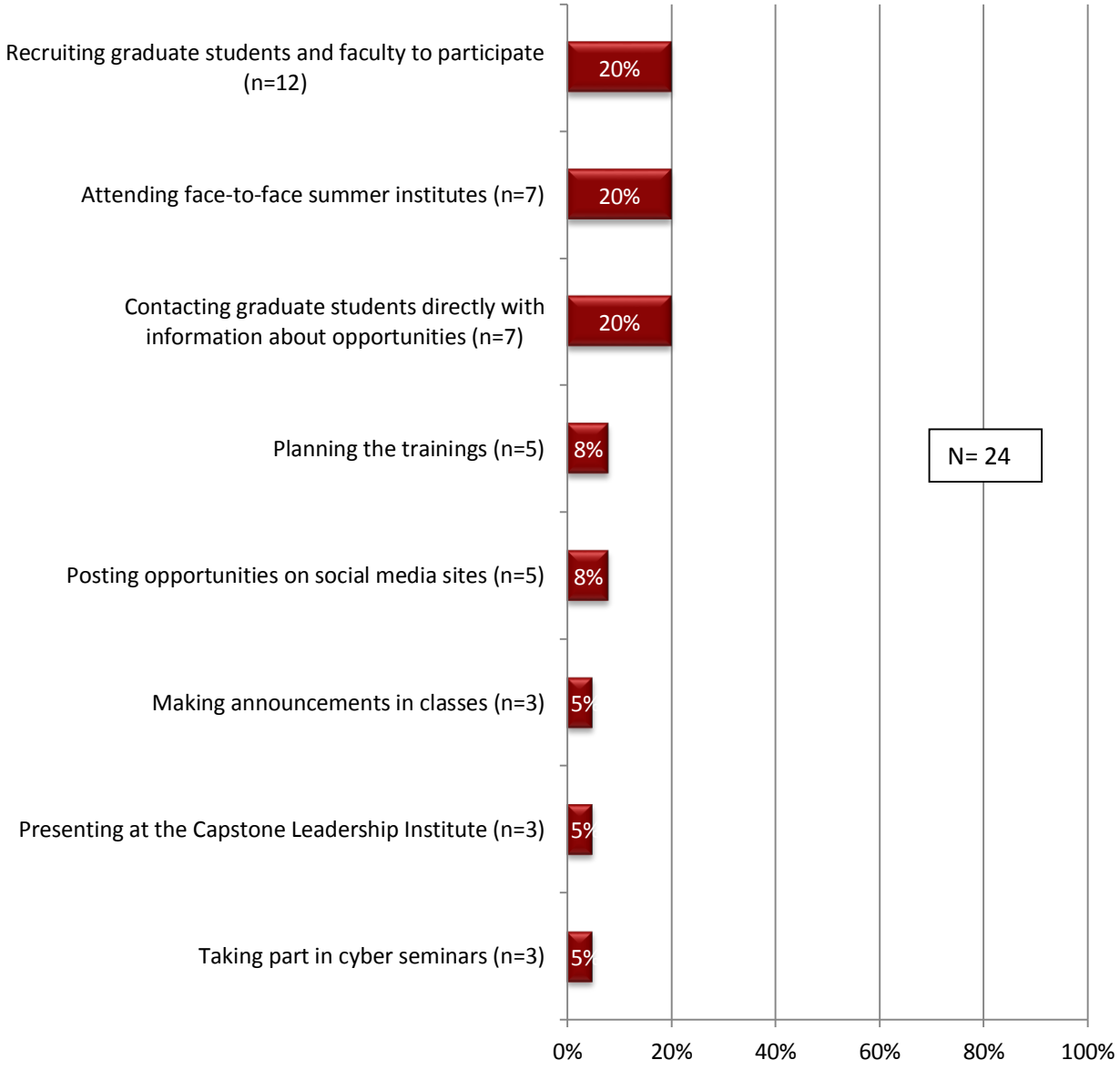
Figure 55. Participants' involvement in the Graduate Interdisciplinary Training



Capstone and Leadership Institute Participation

Survey participants noted how they participated in the Capstone and Leadership Institute. Twenty percent (20%) of respondents stated that they were involved in the following: *recruiting graduate students and faculty to participate*; *attending face-to-face summer institutes*; and *contacting graduate students directly with information about opportunities*. Results are shown in Figure 56.

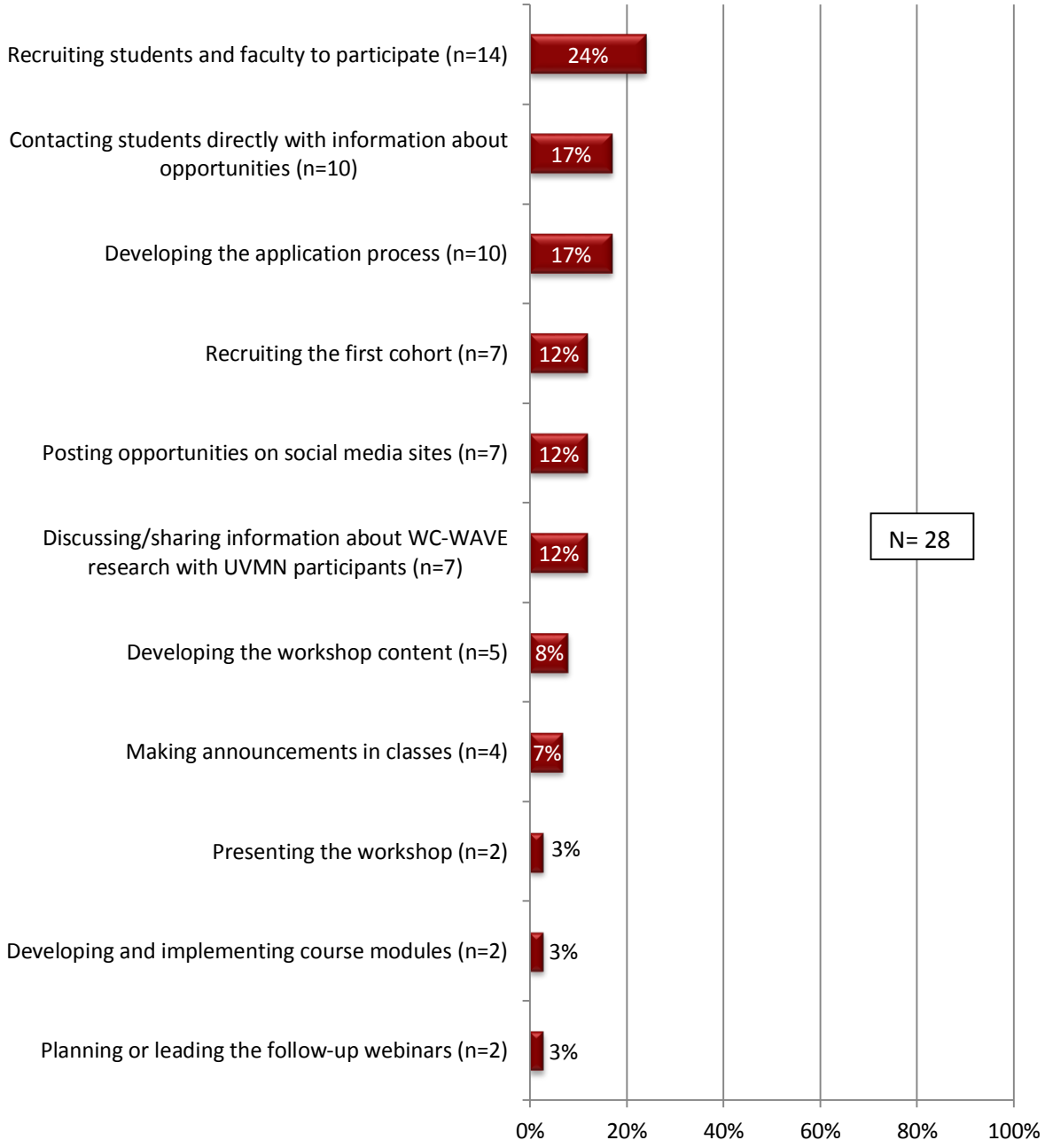
Figure 56. Participants' involvement in the Capstone and Leadership Institute



Undergraduate Visualization and Modeling Network participation

As shown in Figure 57, participants explained their involvement with the Undergraduate Visualization and Modeling Network (UVMN). Almost a quarter (24%) of participants *recruited students and faculty to participate* and 17% of participants reported *contacting students directly with information about opportunities* and *developing the application process*.

Figure 57. Participants' involvement in the Undergraduate Visualization and Modeling Network (UVMN)



Progress made towards achievement of Goal 4 project benchmarks and milestones

Results

The project lead in charge of achieving Component 4 also reports progress on each objective/benchmark as a percentage of objective/benchmark achieved. These are also color-coded as the following:

Green: *on track to reach benchmark*
Yellow: *working towards benchmark*
Red: *not on track to reach benchmark.*

According to these results, three Component 4 objectives are on track to meet identified milestones while the other two show 25-80% completion. Figure 58 displays a summary of progress made towards Year 1 milestones.[27]

Figure 58. Achievement of Goal 4 Project Benchmarks

Component 4: Workforce Development and Education		
Goal: Engage university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization.		
Objectives	Year 1 milestones	Year 1 Milestones % Complete
1. Develop a Graduate Interdisciplinary Training (GIT) Program	a. Snow Camp, winter 2014	100% complete March 2014
	b. Summer Interdisciplinary Training, summer 2014	planning 75% complete; implementation will be completed by end of Year 1
	c. Tri-State Meetings additional training, ongoing	100% on schedule
2. Develop an Undergraduate Visualization and Modeling Network (UVMN)	a. Participant application and selection, spring 2014	100% complete March 2014
	b. First workshop, summer 2014	planning 75% complete; workshop will be implemented in May 2014, before the end of Year 1
Average completion rate for component[28]		**85%**

Key Findings and Recommendations for the Baseline Survey

Key findings and recommendations are listed below for demographics and program components.

Demographics

Females and Hispanic/Latinos are underrepresented when compared to the broader project institution-based population. Additionally, males, Caucasians, and Asians are overrepresented. Two participants from Idaho and three from Nevada did not complete the survey, though overall participation was good with a 92% response rate.

[27] The UVMN workshop was conducted and completed (100%) in May, 2014 prior to the end of Year 1.
[28] As reported by project leads to project administrators

Focus on increasing the participation of females, Hispanic/Latinos, and African Americans in the WC-WAVE project. Encourage current project members to work across components to analyze and create strategies for increasing hiring and participation from these groups.

Program components

Component 1: Watershed Science

Out of the three objectives, *Objective 1: Parameterize and validate watershed models* had the highest level of mean participant knowledge at *slightly knowledgeable* while *Objective 2: Develop CSDMS (Community Surface Dynamics Modeling System) adapters for models* had the lowest mean participant knowledge at *not knowledgeable at all*.

Promote WC-WAVE activities that will increase participant content knowledge of watershed science. Continue to involve students in faculty mentoring and research opportunities to increase their watershed science knowledge and abilities. Encourage cross-component attendance at activities to build new content knowledge in a different discipline.

Component 2: Cyberinfrastructure-Visualization

Overall, participants rated themselves as *slightly knowledgeable* in the cyberinfrastructure-visualization component. The highest-rated item was *how data required by models and visualization tools are defined* and the lowest-rated item was *how Visualization Environments interface with Virtual Watershed Platform adapters.*

Ensure all participants know that cyberinfrastructure is an integral part of the WC-WAVE project. Advertise cyberinfrastructure-related activities and encourage participation by attendees from all components.

Component 3: Cyberinfrastructure-Data

Participants rated themselves as *slightly knowledgeable* in the cyberinfrastructure-data component. The highest rated item was *how data are integrated within and into larger networks* and the lowest rated area was *strategies for the acceleration of integrated watershed scale modeling.*

Ask cyberinfrastructure faculty to initiate a brown-bag lunch series where they discuss how cyberinfrastructure is related to the WC-WAVE project. Encourage attendance by all WC-WAVE project members from areas other than cyberinfrastructure. Allow participants to ask questions and increase their cyberinfrastructure content knowledge.

Component 4: Workforce Development

The activities showing the highest participation across project components were the collaborative fieldwork activities and the Graduate Interdisciplinary Trainings. For the collaborative fieldwork activities, 39% of the project participants *attended* and 29% *contacted students directly with information*.

Encourage participation by all WC-WAVE members in more activities. Ensure they are aware of upcoming Workforce Development activities and know how to get involved.

Section 4. Key Findings and Recommendations

(1) *Increase focused outreach and recruitment to women and underrepresented minority groups.*
While there have been efforts made to increase the number of participants from these groups, the increases have been incremental and have not occurred throughout all project activities. Representation from students who are the first in their family to attend college is strong in project activities from this period. Continue to outreach to and include students from this group. However, the numbers of underrepresented minorities are relatively low considering that some of the project institutions are located in areas where there are significant populations of URMs.

(2) *Vary formats of meetings and presentations of information.*
Facilitators at the Tri-State meeting in May organized the meeting by dividing the group into areas of research and interest with relatively even/equal numbers of faculty who met as groups and came back and reported back to the larger group. Feedback from meeting attendees reported that this new format was positive. Interactive meeting formats engage attendees more and can lead to more productive and dynamic sessions. This would also meet a greater variety of participant learning styles and potentially increase participant knowledge and retention of meeting information.

(3) *Incorporate discussions of sustainability at all meetings from component to larger groups.*
This would ensure that sustainability is occurring and a priority for all throughout the project. Encourage 100% response for PSAT, which will be distributed in Fall, with responses required from all project leaders.

(4) *Increase the number of faculty on field experience trips*.
There was a low number of project watershed science faculty as compared to the prior field experience. Larger numbers of faculty ensure that the objective of increased time with faculty is met. Many students also specifically requested that faculty be assigned to work with small groups during the field experiences, particularly faculty whose research interests match their own. Having a larger representation of faculty would allow for a wider variety of groups and faculty-student matches, thus further increasing student interactions and engagement with faculty.

(5) *Utilize one cloud-based document/file sharing system for the project that would include handouts, lecture notes, agendas, and logistics information among other items.*
The project utilizes different file sharing systems for different project activities and groups. However, maybe one file sharing system for all the activities that involve students would centralize all of the project information pertinent to project activities, specifically workshops and trainings. Participants commented several times to request that information for different programs and activities be made available in advance. Incorporating one cloud-based document-sharing system throughout the project would invariably meet everyone's needs. It would be easy and convenient for faculty and organizers to upload documents and provide one place for students to access and quickly download all relevant information for their activities.

(6) Utilize findings from external evaluators to improve project activity coordination and facilitation and guidance from external evaluators in developing program activity objectives and evaluations.

Analyze evaluation and pre-/post- survey results with goal of continuously improving workshops and other program activities each year.

Encourage faculty to sit together, analyze results, and discuss questions such as: Are there areas where students showed more success or difficulty? For the questions with large increases, were certain strategies implemented during instruction? For questions with no change or a decrease, how could instruction be changed in the future to increase participant knowledge?

Work with external evaluators to clarify program activity objectives so that evaluation proceeds with a clear picture of the planned activity.

Reach out to external evaluators during the program activity planning process to discuss evaluation. Program activity coordinators and facilitators can take this opportunity to clarify program objectives and ask any questions about evaluation.

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Appendix A: CSDMS Evaluation

Tri-State EPSCoR Track 2
Community Surface Dynamics Modeling System
May 28-29, 2014

Thank you for participating in the evaluation of this program. Your responses are very important. The information you provide will help to improve future programs. Please answer each question honestly and thoroughly. All responses are confidential. If you have questions about this survey please contact: Sara Newkirk, Project Evaluator, snewkirk@smartstartecs.com

Demographics -- About you
Completion of this section provides basic information to capture the demographics of NSF EPSCOR participants. NSF EPSCoR is a program of the National Science Foundation. This information strengthens future applications for funding, ultimately providing research program sustainability and growth.

1) With which gender do you identify?*
( ) Male
( ) Female

2) Select the race/ethnicity with which you most closely identify.*
( ) Asian
( ) African-American
( ) Caucasian/white (non-Hispanic)
( ) Hispanic or Latino
( ) Pacific Islander/Native Hawaiian
( ) American Indian/Alaska Native
( ) Do not wish to specify
( ) Other, please specify: _____

3) Are you a first generation college student?*
( ) Yes
( ) No

4) What is your current position?*
( ) Undergraduate student
( ) Graduate student
( ) Post doctoral fellow/researcher
( ) Faculty
( ) Industry affiliate
( ) Other, please specify: _____

Sessions

5) Please rate the following aspects of this program on a scale from not useful at all to extremely useful.*

	Not useful at all	Slightly useful	Somewhat useful	Very useful	Extremely useful	Did not attend	I was a presenter
Wednesday AM: CSDMS philosophy/overview	( )	( )	( )	( )	( )	( )	( )
Wednesday AM: Basic Model Interface (BMI) introduction	( )	( )	( )	( )	( )	( )	( )
Wednesday PM: Model overviews	( )	( )	( )	( )	( )	( )	( )
Thursday AM: Supported model wrapping	( )	( )	( )	( )	( )	( )	( )

6) Please comment on what was useful and why.

7) Please comment on how to improve the presentations or poster session.

8) What other concepts, topics or activities would you like to have seen covered?

Logistics

9) Please rate your satisfaction with the logistical aspects of this program from not at all satisfied to completely satisfied. RATING SCALE: 1= NOT AT ALL SATISFIED 3 = SOMEWHAT SATISFIED 5 = COMPLETELY SATISFIED*

	1	2	3	4	5
Registration process (pre-program information, ease of registration)	( )	( )	( )	( )	( )
Program agenda (clear purpose, balanced, meaningful, useful)	( )	( )	( )	( )	( )
Program Information (focused, well-prepared)	( )	( )	( )	( )	( )
Overall organization (followed program agenda, equipment was ready)	( )	( )	( )	( )	( )
Time (overall program and presentations started/ended on time)	( )	( )	( )	( )	( )
Atmosphere (friendly, supportive, promoted networking)	( )	( )	( )	( )	( )
Student involvement (presentations at appropriate level, sufficient involvement)	( )	( )	( )	( )	( )

10) Do you have any suggestions to improve the logistical aspects of this program?

Impact

11) Achievement of Program Objectives—Select the number that best represents your knowledge and understanding in each of the following areas before and after this training. RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Program			After Program				
	1*	4*	5*	1*	2*	3*	4*	5*
My knowledge about the Community Surface Dynamics Modeling System	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge about model integration challenges and solutions	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge about building a Basic Model Interface	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge about input and output specifications for my model wrapping target	( )	( )	( )	( )	( )	( )	( )	( )

12) Is there anything else you would like to share with program facilitators?

13) Select the number that best represents your interest in each of the following areas before and after this program.
RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Program					After Program				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My interest in modeling watershed hydrology	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My interest in developing or coupling watershed models	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My commitment to continue studies and/or professional development in a science, technology, engineering, and math (STEM) area	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

14) What do you think are the two most important things you have gained by attending today? Explain why.

15) How will you use or implement what you have learned?
_____
16) Please rate your overall enjoyment of this training.*
( ) Not at all enjoyable ( ) A little enjoyable ( ) Somewhat enjoyable ( ) Enjoyable ( ) Very enjoyable

17) How did you find out about this event?
[ ] Flyer
[ ] E-mail
[ ] Professor
[ ] Friend
[ ] Other (Please explain): _____

18) What are your next steps after attending this program?

19) Would you attend this event next year?
( ) Yes
( ) No
( ) Maybe
( ) Comments: _____

Thank You!

Appendix B: Tri-State Meeting Evaluation

Tri-State Meeting
The Western Consortium for Watershed Analysis, Visualization, and Exploration (WC-WAVE) Project
May 29, 2014

Thank you for participating in the evaluation of this meeting. Your responses are very important. The information you provide will help to improve future meetings. Please answer each question honestly and thoroughly. All responses are confidential. If you have questions about this survey please contact: Sara Newkirk, Project Evaluator, *snewkirk@smartstartecs.com*

Demographics -- About you
Completion of this section provides basic information to capture the demographics of NSF EPSCOR participants. NSF EPSCoR is a program of the National Science Foundation. This information strengthens future applications for funding, ultimately providing research program sustainability and growth.

With which gender do you identify?
( ) Male ( ) Female

Select the race/ethnicity with which you most closely identify.
( ) Asian
( ) African-American
( ) Caucasian/white (non-Hispanic)
( ) Hispanic/Latino
( ) Pacific Islander/Native Hawaiian ( ) Do not wish to specify
( ) Other, please specify:_____

Are you a first generation college student? (The term "first generation college student" means: An individual with both parents or guardians who did not complete a baccalaureate degree; OR in the case of an individual who regularly resided with and received support from only one parent or guardian, an individual whose only parent or guardian did not complete a baccalaureate degree.)
( ) Yes ( ) No

What is your current position?
( ) Master's student
( ) Enrolled in PhD program, but not advanced to candidacy
( ) PhD candidate
( ) Post doctorate
( ) Faculty
( ) Industry affiliate
( ) Other, please specify: _____

With which institution are you most closely affiliated? (Choose one)
( ) Boise State University
( ) College of Southern Idaho
( ) Desert Research Institute
( ) Idaho State University
( ) Nevada System of Higher Education
( ) New Mexico State University
( ) New Mexico Tech

( ) University of Idaho
( ) University of Nevada, Las Vegas
( ) University of Nevada, Reno
( ) University of New Mexico
( ) Other:

Select your main project team.

( ) Watershed Sciences
( ) Cyberinfrastructure: Data
( ) Workforce Development
( ) Cyberinfrastructure: Visualization

LOGISTICS

Please rate your satisfaction with the logistical aspects of this meeting from *not at all satisfied* to *completely satisfied.*

RATING SCALE: 1= NOT AT ALL SATISFIED 3 = SOMEWHAT SATISFIED 5 = COMPLETELY SATISFIED

Preregistration Information	1	2	3	4	5
Registration process (pre-conference information, ease of registration)	1	2	3	4	5
Meeting agenda (clear purpose, balanced, meaningful, useful)	1	2	3	4	5
Meeting management (focused, well-prepared)	1	2	3	4	5
Overall organization (sessions started/ended on time, equipment was ready)	1	2	3	4	5
Atmosphere (friendly, supportive, promoted team work)	1	2	3	4	5
Leadership (fostered working relationships, encouraged involvement)	1	2	3	4	5
Technology (availability and quality of equipment and internet connection)	1	2	3	4	5
Accommodations (physical comforts, facilities, safety, location)	1	2	3	4	5
Food (quality, dietary needs, preferences, freshness)	1	2	3	4	5
Results (productive, time well spent, beneficial)	1	2	3	4	5

Do you have any suggestions to improve the logistical aspects of this program?

MEETING COMPONENTS/SESSIONS

Please rate the following sessions of this meeting on a scale from *not useful at all* to *extremely useful.*

RATING SCALE: 1= NOT AT ALL USEFUL 3 = SOMEWHAT USEFUL5 = EXTREMELY USEFUL

Thursday, May 29, 2014							
2:30pm-3:50pm	Cross-component discussions	1	2	3	4	5
4:00pm-5:00pm	Individual component discussions	1	2	3	4	5
6:00pm-9:00pm	Evaluation group exercise/presentation	1	2	3	4	5

Please comment on how to improve the sessions.

MEETING OBJECTIVES

The objectives of the Tri-State Meeting are to share project information, discuss year 1 progress, plan for year 2, and project integration. Select the number that best represents your knowledge and understanding in each of the following areas before and after this meeting.

RATING SCALE: 1= MINIMAL3 = SOMEWHAT5 = EXTENSIVE

Before Meeting						After Meeting				
1	2	3	4	5	My knowledge of the project's progress in Year 1	1	2	3	4	5
1	2	3	4	5	My knowledge of the project's Year 2 plans	1	2	3	4	5
1	2	3	4	5	My knowledge of project integration plans	1	2	3	4	5

Do you have any suggestions to improve this meeting?

THANK YOU!

Appendix C: Stream Flow Camp: Jemez/Hiking Evaluation

Western Tri-State EPSCoR Track 2
HIKING-ONLY PARTICIPANTS
Stream Flow Camp May 30-31, 2014

Thank you for participating in the evaluation of this program. Your responses are very important. The information you provide will help to improve future programs. Please answer each question honestly and thoroughly. All responses are confidential. If you have questions about this survey please contact: Sara Newkirk, Project Evaluator, snewkirk@smartstartecs.com

Demographics -- About you
Completion of this section provides basic information to capture the demographics of NSF EPSCOR participants. NSF EPSCoR is a program of the National Science Foundation. This information strengthens future applications for funding, ultimately providing research program sustainability and growth.

1) With which gender do you identify?*
( ) Male
( ) Female

2) Select the race/ethnicity with which you most closely identify.*
( ) Asian
( ) African-American
( ) Caucasian/white (non-Hispanic)
( ) Hispanic or Latino
( ) Pacific Islander/Native Hawaiian
( ) American Indian/Alaska Native
( ) Do not wish to specify
( ) Other, please specify:

3) Are you a first generation college student?*
( ) Yes
( ) No

4) What is your current position?*
( ) Undergraduate student
( ) Masters student
( ) Ph.D. student, not advanced to candidacy
( ) Ph.D. candidate
( ) Post doctoral fellow/researcher
( ) Faculty
( ) Industry affiliate
( ) Other, please specify:

Sessions

5) Please rate the following aspects of this program on a scale from not useful at all to extremely useful.*

	Not useful at all	Slightly useful	Somewhat useful	Very useful	Extremely useful	Did not attend
May 30: Soda Dam pullout: Volcanic and geothermal history of the Jemez Mountains	( )	( )	( )	( )	( )	( )
May 30: Jemez Falls: Hike, measure discharge	( )	( )	( )	( )	( )	( )
May 30: East Fork Jemez: Hike, measure discharge and water table gradient	( )	( )	( )	( )	( )	( )

6) Please comment on what <u>was</u> useful and why.
7) Please comment on what <u>was not</u> useful and why.

8) Please comment on how to improve any aspect of this camp.

9) What other concepts, topics or activities would you like to have seen covered?

Logistics

10) Please rate your satisfaction with the logistical aspects of this program from not at all satisfied to completely satisfied. RATING SCALE: 1= NOT AT ALL SATISFIED 3 = SOMEWHAT SATISFIED 5 = COMPLETELY SATISFIED*

	1	2	3	4	5
Registration process (pre-program information, ease of registration)	( )	( )	( )	( )	( )
Transportation to Jemez, Albuquerque	( )	( )	( )	( )	( )
Accommodations at Hotel Andaluz	( )	( )	( )	( )	( )
Meals (sack lunches and dinners)	( )	( )	( )	( )	( )
Program agenda (clear purpose, balanced, meaningful, useful)	( )	( )	( )	( )	( )
Program Information (focused, well-prepared)	( )	( )	( )	( )	( )
Overall organization (followed program agenda, equipment was ready)	( )	( )	( )	( )	( )
Ease of accessing measurement sites	( )	( )	( )	( )	( )
Time (overall program and presentations started/ended on time)	( )	( )	( )	( )	( )
Your comfort level hiking to reach measurement sites	( )	( )	( )	( )	( )
Atmosphere (friendly, supportive, promoted networking)	( )	( )	( )	( )	( )
Student involvement (information at appropriate level, sufficient involvement)	( )	( )	( )	( )	( )

11) Do you have any suggestions to improve the logistical aspects of this program?

Impact

12) Achievement of Program Objectives—Select the number that best represents your knowledge and understanding in each of the following areas before and after this training. RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Program					After Program				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My ability to measure the instantaneous discharge of a small stream (day 1)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to develop and use a rating curve relating stage to discharge (day 1)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to measure and conceptualize groundwater-stream flow interactions (day 1)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

13) Is there anything else you would like to share with program facilitators?

14) Select the number that best represents your interest in each of the following areas before and after this program.
RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Program					After Program				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My interest in working on watershed science projects	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge of the Consortium faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge of Jemez Valley watershed project field site	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to exchange ideas on research topics/develop my dissertation with Consortium faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to develop my dissertation committee from WC-WAVE faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My commitment to continue studies and/or professional development on watershed science	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

15) What do you think are the two most important things you have gained by attending? Explain why.

16) How will you use or implement what you have learned?

17) Please rate your overall enjoyment of this camp.*
( ) Not enjoyable at all ( ) A little enjoyable ( ) Somewhat enjoyable ( ) Enjoyable ( ) Very enjoyable

18) How did you find out about this event?
[ ] Flyer
[ ] E-mail
[ ] Professor
[ ] Friend
[ ] Website
[ ] Other (please explain): _____

19) What are your next steps after attending this program as related to STEM and/or watershed science?

20) Would you attend this event next year?
( ) Yes
( ) No
( ) Maybe
( ) Comments: _____

Thank You!

Appendix D: Stream Flow Camp: Rio Chama/Rafting Evaluation

Western Tri-State EPSCoR Track 2 RAFTING-ONLY PARTICIPANTS
Stream Flow Camp May 30-31, 2014

Thank you for participating in the evaluation of this program. Your responses are very important. The information you provide will help to improve future programs. Please answer each question honestly and thoroughly. All responses are confidential. If you have questions about this survey please contact: Sara Newkirk, Project Evaluator, snewkirk@smartstartecs.com

Demographics -- About you
Completion of this section provides basic information to capture the demographics of NSF EPSCOR participants. NSF EPSCoR is a program of the National Science Foundation. This information strengthens future applications for funding, ultimately providing research program sustainability and growth.

1) With which gender do you identify?*
( ) Male
( ) Female

2) Select the race/ethnicity with which you most closely identify.*
( ) Asian
( ) African-American
( ) Caucasian/white (non-Hispanic)
( ) Hispanic or Latino
( ) Pacific Islander/Native Hawaiian
( ) American Indian/Alaska Native
( ) Do not wish to specify
( ) Other, please specify:

3) Are you a first generation college student?*
( ) Yes
( ) No

4) What is your current position?*
( ) Undergraduate student
( ) Masters student
( ) Ph.D. student, not advanced to candidacy
( ) Ph.D. candidate
( ) Post doctoral fellow/researcher
( ) Faculty
( ) Industry affiliate
( ) Other, please specify:

Sessions
5) Please rate the following aspects of this program on a scale from not useful at all to extremely useful.*

	Not useful at all	Slightly useful	Somewhat useful	Very useful	Extremely useful	Did not attend
May 31 9:00am-1:00pm: Rio Grande: Raft, take flow and turbulence measurements	( )	( )	( )	( )	( )	( )

6) Please comment on what was useful and why.

7) Please comment on what was not useful and why.

8) Please comment on how to improve any aspect of this camp.

9) What other concepts, topics or activities would you like to have seen covered?

Logistics

10) Please rate your satisfaction with the logistical aspects of this program from not at all satisfied to completely satisfied. RATING SCALE: 1= NOT AT ALL SATISFIED 3 = SOMEWHAT 5 = COMPLETELY SATISFIED*

	1	2	3	4	5
Registration process (pre-program information, ease of registration)	( )	( )	( )	( )	( )
Transportation to Rio Grande, Albuquerque	( )	( )	( )	( )	( )
Accommodations at Hotel Andaluz	( )	( )	( )	( )	( )
Meals (sack lunches and dinners)	( )	( )	( )	( )	( )
Program agenda (clear purpose, balanced, meaningful, useful)	( )	( )	( )	( )	( )
Program Information (focused, well-prepared)	( )	( )	( )	( )	( )
Overall organization (followed program agenda, equipment was ready)	( )	( )	( )	( )	( )
Ease of accessing measurement sites	( )	( )	( )	( )	( )
Time (overall program and presentations started/ended on time)	( )	( )	( )	( )	( )
Your comfort level rafting to reach measurement sites	( )	( )	( )	( )	( )
Atmosphere (friendly, supportive, promoted networking)	( )	( )	( )	( )	( )
Student involvement (information at appropriate level, sufficient involvement)	( )	( )	( )	( )	( )

11) Do you have any suggestions to improve the logistical aspects of this program?

Impact

12) Achievement of Program Objectives—Select the number that best represents your knowledge and understanding in each of the following areas before and after this training. RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Program					After Program				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My ability to use flow tracers to monitor discharge, dispersion, & turbulence (day 2)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to measure the instantaneous discharge of a large stream (day 2)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

13) Is there anything else you would like to share with program facilitators?

14) Select the number that best represents your interest in each of the following areas before and after this program. RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Program					After Program				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My interest in working on watershed science projects	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge of the Consortium faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge of the Jemez Valley watershed project field site	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to exchange ideas on research topics/develop my dissertation with Consortium faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to develop my dissertation committee from WC-WAVE faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My commitment to continue studies and/or professional development on watershed science	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

15) What do you think are the two most important things you have gained by attending? Explain why.

16) How will you use or implement what you have learned?

17) Please rate your overall enjoyment of this camp.*
( ) Not enjoyable at all ( ) A little enjoyable ( ) Somewhat enjoyable ( ) Enjoyable ( ) Very enjoyable

18) How did you find out about this event?
[ ] Flyer
[ ] E-mail
[ ] Professor
[ ] Friend
[ ] Website
[ ] Other (please explain):

19) What are your next steps after attending this program as related to STEM and/or watershed science?

20) Would you attend this event next year?
( ) Yes
( ) No
( ) Maybe
( ) Comments:

Thank You!

Appendix E: Stream Flow Camp: Jemez and Rio Chama Two Day Evaluation

Western Tri-State EPSCoR Track 2
Stream Flow Camp May 30-31, 2014

Thank you for participating in the evaluation of this program. Your responses are very important. The information you provide will help to improve future programs. Please answer each question honestly and thoroughly. All responses are confidential. If you have questions about this survey please contact: Sara Newkirk, Project Evaluator, snewkirk@smartstartecs.com

Demographics -- About you
Completion of this section provides basic information to capture the demographics of NSF EPSCOR participants. NSF EPSCoR is a program of the National Science Foundation. This information strengthens future applications for funding, ultimately providing research program sustainability and growth.

1) With which gender do you identify?*
( ) Male
( ) Female

2) Select the race/ethnicity with which you most closely identify.*
( ) Asian
( ) African-American
( ) Caucasian/white (non-Hispanic)
( ) Hispanic or Latino
( ) Pacific Islander/Native Hawaiian
( ) American Indian/Alaska Native
( ) Do not wish to specify
( ) Other, please specify:

3) Are you a first generation college student?*
( ) Yes
( ) No

4) What is your current position?*
( ) Undergraduate student
( ) Masters student
( ) Ph.D. student, not advanced to candidacy
( ) Ph.D. candidate
( ) Post doctoral fellow/researcher
( ) Faculty
( ) Industry affiliate
( ) Other, please specify:

Sessions

5) Please rate the following aspects of this program on a scale from not useful at all to extremely useful.*

	Not useful at all	Slightly useful	Somewhat useful	Very useful	Extremely useful	Did not attend
May 30 10:00am-11:15am: Soda Dam pullout: Volcanic and geothermal history of the Jemez Mountains	( )	( )	( )	( )	( )	( )
May 30 11:15am-2:00pm: Jemez Falls: Hike, measure discharge	( )	( )	( )	( )	( )	( )
May 30 2:00pm-4:30pm: East Fork Jemez: Hike, measure discharge and water table gradient	( )	( )	( )	( )	( )	( )
May 31 9:00am-1:00pm: Rio Grande: Raft, take flow and turbulence measurements	( )	( )	( )	( )	( )	( )

6) Please comment on what <u>was</u> useful and why.
7) Please comment on what <u>was not</u> useful and why.
8) Please comment on how to improve any aspect of this camp.
9) What other concepts, topics or activities would you like to have seen covered?

Logistics

10) Please rate your satisfaction with the logistical aspects of this program from not at all satisfied to completely satisfied. RATING SCALE: 1= NOT AT ALL SATISFIED 3 = SOMEWHAT 5 = COMPLETELY SATISFIED*

	1	2	3	4	5
Registration process (pre-program information, ease of registration)	( )	( )	( )	( )	( )
Transportation to Jemez, El Rito, Albuquerque	( )	( )	( )	( )	( )
Accommodations at Hotel Andaluz and El Rito Campus of Northern New Mexico College	( )	( )	( )	( )	( )
Meals (sack lunches and dinners)	( )	( )	( )	( )	( )
Program agenda (clear purpose, balanced, meaningful, useful)	( )	( )	( )	( )	( )
Program Information (focused, well-prepared)	( )	( )	( )	( )	( )
Overall organization (followed program agenda, equipment was ready)	( )	( )	( )	( )	( )
Ease of accessing measurement sites	( )	( )	( )	( )	( )
Time (overall program and presentations started/ended on time)	( )	( )	( )	( )	( )
Your comfort level hiking and rafting to reach measurement sites	( )	( )	( )	( )	( )
Atmosphere (friendly, supportive, promoted networking)	( )	( )	( )	( )	( )
Student involvement (information at appropriate level, sufficient involvement)	( )	( )	( )	( )	( )

11) Do you have any suggestions to improve the logistical aspects of this program?

Impact

12) Achievement of Program Objectives—Select the number that best represents your knowledge and understanding in each of the following areas before and after this training. RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Program					After Program				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My ability to measure the instantaneous discharge of a small stream (day 1)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to develop and use a rating curve relating stage to discharge (day 1)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to measure and conceptualize groundwater-stream flow interactions (day 1)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to use flow tracers to monitor discharge, dispersion, & turbulence (day 2)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to measure the instantaneous discharge of a large stream (day 2)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

13) Is there anything else you would like to share with program facilitators?

14) Select the number that best represents your interest in each of the following areas before and after this program. RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Program					After Program				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My interest in working on watershed science projects	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge of the Consortium faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge of the Jemez watershed project field site	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to exchange ideas on research topics/develop my dissertation with Consortium faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to develop my dissertation committee from WC-WAVE faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My commitment to continue studies and/or professional development on watershed science	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

15) What do you think are the two most important things you have gained by attending? Explain why.

16) How will you use or implement what you have learned?

17) Please rate your overall enjoyment of this camp.*
( ) Not enjoyable at all ( ) A little enjoyable ( ) Somewhat enjoyable ( ) Enjoyable ( ) Very enjoyable

18) How did you find out about this event?
[ ] Flyer
[ ] E-mail
[ ] Professor
[ ] Friend
[ ] Website
[ ] Other (please explain):

19) What are your next steps after attending this program as related to STEM and/or watershed science?

20) Would you attend this event next year?
( ) Yes
( ) No
( ) Maybe
( ) Comments:

Thank You!

Appendix F: UVMN Content Pre-Survey

Demographics

Thank you for participating in the evaluation of the UVMN Workshop content. Your responses are very important. The purpose of this pre/post evaluation is to determine a baseline of knowledge for all participants, which will help instructors adapt their course delivery to address participant needs and interests. It will also be used to measure changes in participant knowledge in the areas of spatial understanding, modeling, and visualization from the workshop training. Please take the survey without doing any research or studying. The project directors want to see everyone's current knowledge on these items and it is important that you answer as accurately as possible.

If you have questions about this survey please contact:
Sara Newkirk, Project Evaluator, Smart Start Educational Consulting Services

1) With which gender do you identify?*
( ) Male
( ) Female

2) Select the race/ethnicity with which you most closely identify.*
( ) American Indian or Alaska Native
( ) Asian
( ) African-American
( ) Hispanic/Latino
( ) Caucasian/white (non-Hispanic)
( ) Pacific Islander/Native Hawaiian
( ) Do not wish to specify
( ) Other:

3) What is your age (in years)?*
( ) 18-25
( ) 26-32
( ) 33-40
( ) 41-48
( ) 49-56
( ) 57-64
( ) 65-72
( ) 73-80
( ) 80+

4) Are you a first generation college student? (The term "first generation college student" means: An individual both of whose parents or guardians did not complete a baccalaureate degree; OR in the case of an individual who regularly resided with and received support from only one parent or guardian, an individual whose only parent or guardian did not complete a baccalaureate degree.)*
( ) Yes
( ) No

5) What is your academic status?*
( ) Undergraduate student
( ) University Faculty
( ) Community College Faculty
( ) College Faculty

What year are you?
( ) Freshman
( ) Sophomore
( ) Junior

( ) Senior

Please provide the following information about your university work.
Number of years: _____
Department: _____
Research Focus: _____

Please describe all of your previous teaching experiences, including subjects taught and number of years.

Do you have experience with the following?

	Yes	No
I teach or have taught courses in Geographic Information Systems (GIS)	( )	( )
I teach or have taught courses in cartography	( )	( )
I teach or have taught courses in computer modeling/statistics	( )	( )

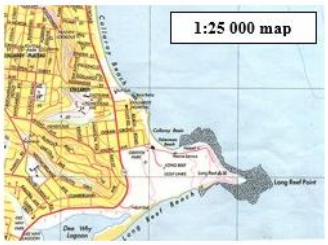
6) With which institution are you most closely affiliated? (Choose one)*
( ) Boise State University
( ) College of Southern Idaho
( ) College of Western Idaho
( ) Desert Research Institute
( ) Idaho State University
( ) Nevada System of Higher Education
( ) New Mexico State University
( ) New Mexico Tech
( ) University of Idaho
( ) University of Nevada, Las Vegas
( ) University of Nevada, Reno
( ) University of New Mexico
( ) Other:

Content

7) Please rate your proficiency level with use of the following from 1-5 by checking the appropriate column*

	1= Not Proficient	2= Limited Proficiency	3= Some Proficiency	4= Proficient	5= Very Proficient
Basic GIS knowledge	( )	( )	( )	( )	( )
Use of ArcGIS	( )	( )	( )	( )	( )
Use of Google Earth	( )	( )	( )	( )	( )
Hydrological modelling	( )	( )	( )	( )	( )
Creating Virtual Tours	( )	( )	( )	( )	( )
Use of Microsoft Kinect	( )	( )	( )	( )	( )
Structure from Motion	( )	( )	( )	( )	( )
Use of aerial drones	( )	( )	( )	( )	( )

8) Which one is a large-scale map?



( ) 1:25 000 map
( ) 1:100 000 map

9) Which of the following representative fractions would show the most detail on a map?*
( ) 1:1,000,000
( ) 1:24,000
( ) 1:63,360
( ) 1:10,000,000

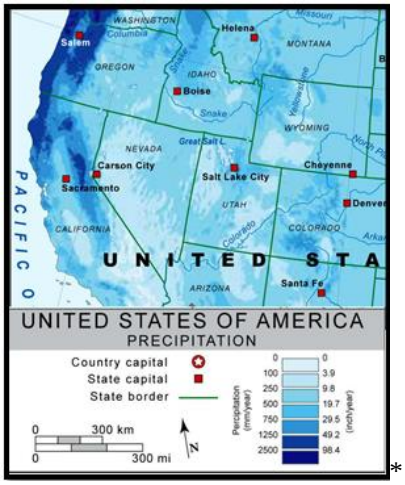
10) The Prime Meridian runs through:*
( ) New York City, New York
( ) Quito, Ecuador
( ) Greenwich, England
( ) Pacific Ocean

11) Convert latitude of Las Vegas 36° 6' 52" N as degree decimal number.*
( ) 36.652
( ) 36.652° N
( ) 36.114 N
( ) 36.114° N

12) When we say that a city is located at longitude 120°E, we mean that it is located:*
( ) West of the Prime Meridian
( ) East of the Equator
( ) North of the Equator
( ) East of the Prime Meridian

13) Which of the following is the main purpose of a thematic map?*
( ) Show population of a state
( ) Show natural features and elevation
( ) Show boundaries of countries and continents
( ) Show a specific topic or theme
( ) Show major bodies of water

14) What is the amount of rainfall in Cheyenne?

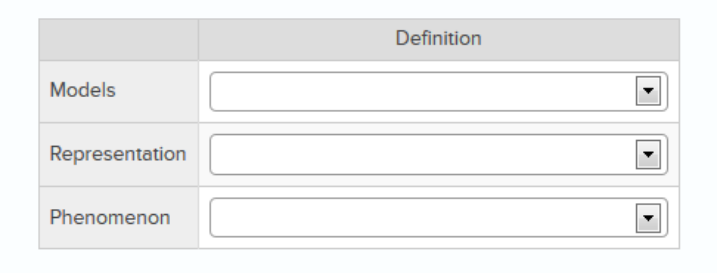


*

( ) 0-100
( ) 100-250
( ) 250-500
( ) 500-750

15) Salem, Oregon receives more rainfall than Cheyenne, Wyoming.*
( ) True
( ) False

16) Match the columns*



17) A series of logical steps that is followed in order to solve a problem is called the*
( ) Experimental process
( ) Scientific theory
( ) Scientific method
( ) Model method

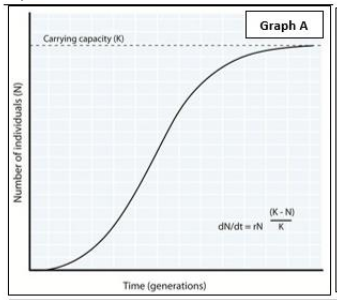
18) A scientific model is a*
( ) representation of a real event or object.
( ) small building used to conduct experiments.
( ) mathematical statement of a theory.
( ) new theory that takes the place of an incorrect one.

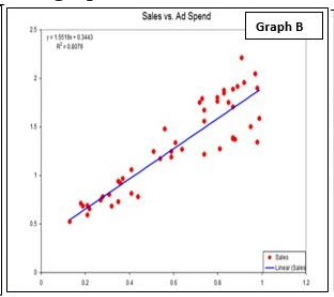
19) The first step a scientist takes in developing a model - conceptual, numerical, or physical - is to define the system that the model is meant to represent. Which of the following statements best describes a system?*
( ) A system in a model should not simplify a real system.
( ) A system has boundaries defined by a researcher.
( ) A system is a large entity with many variables and processes.
( ) A system includes many variables, all of which are equally important.

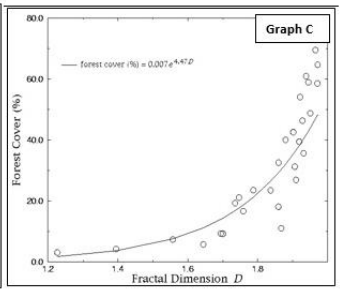
20) Computer models are superior to physical models because they are more quantitative.*
( ) True
( ) False

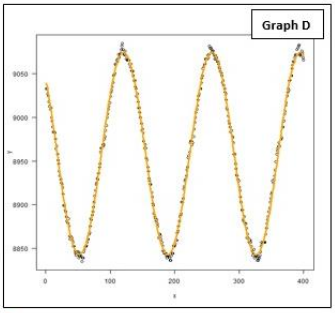
21) Hydrologists have developed a computer-based model to simulate flow of a contaminant through a groundwater reservoir. In order to develop their model, the hydrologists most likely*
( ) took an existing groundwater model and modified it to suit their needs.
( ) simplified the shape of the reservoir in the model.
( ) collected data from the reservoir they are modeling.
( ) did all of the things listed as answers.

22) Match the model name for each graph A-D





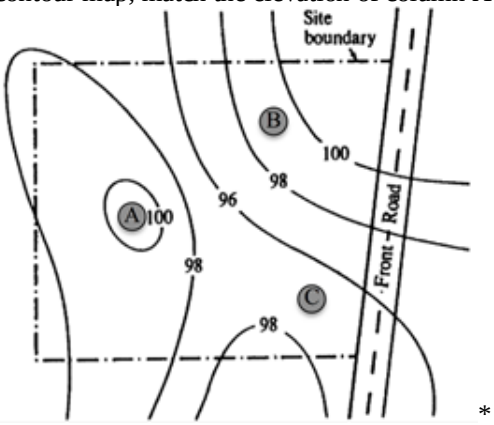




*

	Linear	Exponential	Sinusoidal Model	Logistic Model
Graph A is	_____	_____	_____	_____
Graph B is	_____	_____	_____	_____
Graph C is	_____	_____	_____	_____
Graph D is	_____	_____	_____	_____

23) Based on the shown contour map, match the elevation of column A with the point number in column B:

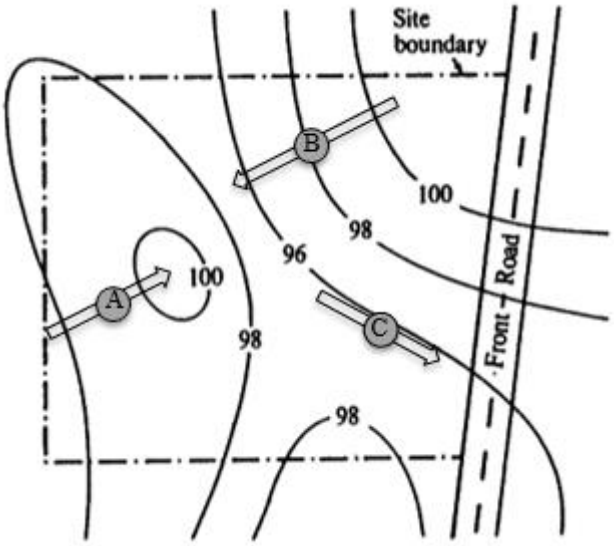


*

A -- Please Select --

B -- Please Select --

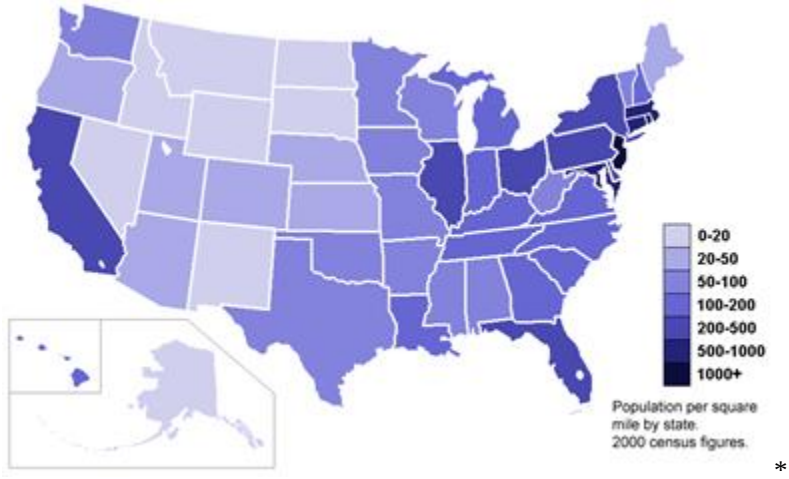
C -- Please Select --



24)
Identify the correct flow direction.*
( ) A
( ) B
( ) C

25) Visualization is the study of the visual representation of _____, meaning "information which has been abstracted in some schematic form, including attributes or variables for the units of information".*
( ) Quantitative data
( ) Qualitative data
( ) Models and processes
( ) All of the above

26) What type of map is this?



*
( ) Economic map
( ) Physical map
( ) Political map
( ) Population map

27) Match the map to the map type

Map A Map B Map C Map D

	Topographic Map	Physical Map	Thematic Map	Political Map
Map A is a	_____	_____	_____	_____
Map B is a	_____	_____	_____	_____
Map C is a	_____	_____	_____	_____
Map D is a	_____	_____	_____	_____

28) Choose the correct definition for a Gigapan*
( ) Gigapans can combine multiple images taken from multiple locations
( ) Gigapans are tool for measuring terrain data
( ) Gigapans use LiDAR data to create 3D models
( ) Gigapans are large panoramic images containing billions of pixels

29) Which of the following examples are situations where Gigapans might be used?*
( ) A. Virtual tours of building interiors
( ) B. Creating a DEM (Digital Elevation model)
( ) C. Virtual tours of study plots
( ) D. Lake basin volume
( ) A-D are all examples of where Gigapans may be used
( ) A & C are examples of where Gigapans may be used
( ) B & D are examples of where Gigapans may be used

30) What is the difference between Gigapans and Structure from Motion (SfM) image capture techniques? (check all that apply)*
[ ] SfM and Gigapans render 3D imagery
[ ] Gigapans are recorded with a pivoting-arm camera from a single vantage point, whereas (SfM) can be recorded from multiple, overlapping vantage points.
[ ] SfM can be recorded from multiple, overlapping vantage points, whereas Gigapans are recorded with a pivoting-arm camera from a single vantage point.
[ ] SfM enables accurate, georeferenced measurements to be taken from imagery, whereas Gigapans do not

31) Which of the following are examples of image processing software used to create Gigapans? (check all that apply)*
[ ] ArcGIS
[ ] Microsoft ICE (image composite editor)
[ ] Sketchfab
[ ] Photosynth

32) Gigapans can be in following formats*
( ) Partial
( ) Cylinder
( ) 360°
( ) All of the above
( ) None of the above

33) Federal Aviation Administration (FAA) regulations apply to UAS*

( ) True
( ) False

34) FAA regulations allow for commercial UAS data collection*
( ) True
( ) False

35) Which of the following sensors can be used on UAS platforms? (check all that apply)*
[ ] Digital cameras
[ ] Temperature sensors
[ ] Hyperspectral cameras
[ ] LiDAR's
[ ] Air quality samplers
[ ] All of the above

36) Digital Elevation Models (DEM's) can be produced by Structure from Motion (SfM)*
( ) True
( ) False

37) To calculate volume of an object, what method would you use to generate a 3D model?*
( ) Gigapan
( ) SfM
( ) None of the above

38) How are a LiDAR and a Kinect similar? (check all that apply)*
[ ] LiDAR and a Kinect are used for different purposes and thus do not have any similarities
[ ] The Kinect is significantly less expensive than a Terrestrial Ground Survey LiDAR
[ ] Both use a laser to measure distance
[ ] A Kinect is field portable due to smaller size and weight than a LiDAR

39) LiDAR stands for*
( ) Laser induction, deflection and ranging
( ) Light detection and ranging
( ) Light amplification through stimulated emission of radiation
( ) Laser induction, amplitude and reflection

40) What methods can be used for creating a Point Cloud? (check all that apply)*
[ ] Gigapans
[ ] Laser scanners
[ ] Overlapping panoramic photos
[ ] LiDAR
[ ] SfM
[ ] Kinect

41) Georeferencing is important because (check all that apply)*
[ ] Accurate coordinate locations allow for precise measurements
[ ] NAD 27 coordinates are more accurate than WGS 1984 coordinates
[ ] Raster data needs to be georeferenced to a coordinate system to be usable in GIS
[ ] Metadata can be associated with coordinate data

42) Structure from Motion (SfM) can model objects in motion*
( ) True
( ) False

43) ArcGIS maps can be imported into Google Earth using the KML format*
( ) True
( ) False

44) ArcGIS uses _____ files for representing spatial data (check all that apply)*
[ ] Raster
[ ] Image
[ ] x, y, z coordinate
[ ] batch
[ ] Vector

Which of the following best describes your experience with Google Earth? You can choose more than one answer.
[ ] Never used it.
[ ] Played with it a few times.
[ ] Used it quite a bit to look at Earth from space.
[ ] Have downloaded some kmz/kml files (data layers) from the internet and looked at them on Google Earth.
[ ] Have created my own kmz/kml files and viewed the results on Google Earth.
[ ] Used Google Earth for my research.
[ ] Other: _____

Which of the following best describes how you currently use Google Earth in your classroom? Check all that apply
[ ] I don't use it at all.
[ ] To show overhead views of Earth or features on the ground in my lectures.
[ ] To illustrate a data overlay in lecture.
[ ] Students use it in activities/homework to find features on Earth's surface.
[ ] Students use it in activities/homework to study overlays of data.
[ ] Students use it as a tool to investigate scientific problems
[ ] Other: _____

45) Rate your knowledge of the following online resources from 1=no familiarity to 5= very familiar*

	1=No familiarity	2	3=Familiar	4	5=Very familiar
arcGIS Online [not the standalone version]	( )	( )	( )	( )	( )
NASA EOSDIS worldview [Earth Observing System Data and Information System]	( )	( )	( )	( )	( )
NEO [Nasa Earth Observations]	( )	( )	( )	( )	( )
NOAA HYSPLIT	( )	( )	( )	( )	( )
gapminder.org	( )	( )	( )	( )	( )
nationalatlas.org	( )	( )	( )	( )	( )
indexmundi.com	( )	( )	( )	( )	( )
earth.nullschool.net	( )	( )	( )	( )	( )

Appendix G: UVMN Content Post-Survey and Workshop Evaluation

Please complete both parts of this survey:
Part 1: Academic content post-survey
Part 2: Overall UVMN Workshop Evaluation
It is estimated that both parts will take approximately 23 minutes to complete. As you work through the survey, responses on each page are saved when you click the submit button. If you exit the survey while it is partially complete, you can return to complete the survey later by clicking on the link from this email invitation. You will be returned to the page from which you exited. Your responses will be reported to projected directors confidentially. Please do not share this survey link as it is tied to your email address.

If you have questions about this survey please contact:
Sara Newkirk, Project Evaluator, Smart Start Educational Consulting Services

Part 1:
Thank you for participating in the evaluation of the UVMN Workshop content. Your responses are very important. The purpose of this pre/post evaluation is to determine a baseline of knowledge for all participants, which will help instructors adapt their course delivery to address participant needs and interests. It will also be used to measure changes in participant knowledge in the areas of spatial understanding, modeling, and visualization from the workshop training.

1) With which gender do you identify?*
( ) Male
( ) Female

2) Select the race/ethnicity with which you most closely identify.*
( ) American Indian or Alaska Native
( ) Asian
( ) African-American
( ) Hispanic/Latino
( ) Caucasian/white (non-Hispanic)
( ) Pacific Islander/Native Hawaiian
( ) Do not wish to specify
( ) Other: _____

3) What is your age (in years)?*
( ) 18-25
( ) 26-32
( ) 33-40
( ) 41-48
( ) 49-56
( ) 57-64
( ) 65-72
( ) 73-80
( ) 80+

4) Are you a first generation college student? (The term "first generation college student" means: An individual both of whose parents or guardians did not complete a baccalaureate degree; OR in the case of an individual who regularly resided with and received support from only one parent or guardian, an individual whose only parent or guardian did not complete a baccalaureate degree.)*
( ) Yes
( ) No

5) What is your academic status?*
( ) Undergraduate student
( ) University Faculty
( ) Community College Faculty
( ) College Faculty

What year are you?
( ) Freshman
( ) Sophomore
( ) Junior
( ) Senior

Please provide the following information about your university work.
Number of years: _____
Department: _____
Research Focus: _____

Please describe all of your previous teaching experiences, including subjects taught and number of years.

Do you have experience with the following?

	Yes	No
I teach or have taught courses in Geographic Information Systems (GIS)	( )	( )
I teach or have taught courses in cartography	( )	( )
I teach or have taught courses in computer modeling/statistics	( )	( )

6) With which institution are you most closely affiliated? (Choose one)*
( ) Boise State University
( ) College of Southern Idaho
( ) College of Western Idaho
( ) Desert Research Institute
( ) Idaho State University
( ) Luna Community College
( ) Mesalands Community College
( ) Navajo Technical University
( ) Nevada System of Higher Education
( ) New Mexico Highlands University
( ) New Mexico State University
( ) New Mexico Tech
( ) Southwestern Indian Polytechnic Institute
( ) University of Idaho
( ) University of Nevada, Las Vegas
( ) University of Nevada, Reno
( ) University of New Mexico
( ) University of New Mexico – Valencia Campus
( ) Other: _____

Content

7) Please rate your proficiency level with use of the following from 1-5 by checking the appropriate column*

	1= Not Proficient	2= Limited Proficiency	3= Some Proficiency	4= Proficient	5= Very Proficient
Basic GIS knowledge	( )	( )	( )	( )	( )
Use of ArcGIS	( )	( )	( )	( )	( )

Use of Google Earth	( )	( )	( )	( )	( )
Hydrological modelling	( )	( )	( )	( )	( )
Creating Virtual Tours	( )	( )	( )	( )	( )
Use of Microsoft Kinect	( )	( )	( )	( )	( )
Structure from Motion	( )	( )	( )	( )	( )
Use of aerial drones	( )	( )	( )	( )	( )

8) Which one is a large-scale map?

( ) 1:25 000 map
( ) 1:100 000 map

9) Which of the following representative fractions would show the most detail on a map?*
( ) 1:1,000,000
( ) 1:24,000
( ) 1:63,360
( ) 1:10,000,000

10) The Prime Meridian runs through:*
( ) New York City, New York
( ) Quito, Ecuador
( ) Greenwich, England
( ) Pacific Ocean

11) Convert latitude of Las Vegas 36° 6' 52" N as degree decimal number.*
( ) 36.652
( ) 36.652° N
( ) 36.114 N
( ) 36.114° N

12) When we say that a city is located at longitude 120°E, we mean that it is located:*
( ) West of the Prime Meridian
( ) East of the Equator
( ) North of the Equator
( ) East of the Prime Meridian

13) Which of the following is the main purpose of a thematic map?*
( ) Show population of a state
( ) Show natural features and elevation
( ) Show boundaries of countries and continents
( ) Show a specific topic or theme
( ) Show major bodies of water

Content

14) What is the amount of rainfall in Cheyenne?

*

( ) 0-100
( ) 100-250
( ) 250-500
( ) 500-750

15) Salem, Oregon receives more rainfall than Cheyenne, Wyoming.*
( ) True
( ) False

16) Match the columns*

	Definition
Models	
Representation	
Phenomenon	

17) A series of logical steps that is followed in order to solve a problem is called the*
( ) Experimental process
( ) Scientific theory
( ) Scientific method
( ) Model method

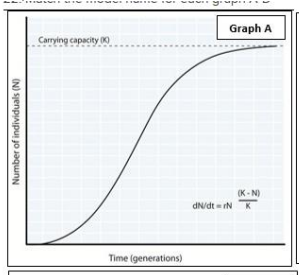
18) A scientific model is a*
( ) representation of a real event or object.
( ) small building used to conduct experiments.
( ) mathematical statement of a theory.
( ) new theory that takes the place of an incorrect one.

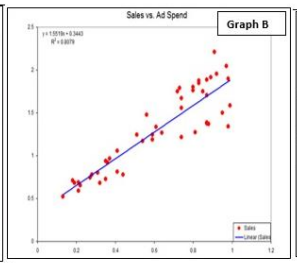
19) The first step a scientist takes in developing a model - conceptual, numerical, or physical - is to define the system that the model is meant to represent. Which of the following statements best describes a system?*
( ) A system in a model should not simplify a real system.
( ) A system has boundaries defined by a researcher.
( ) A system is a large entity with many variables and processes.
( ) A system includes many variables, all of which are equally important.

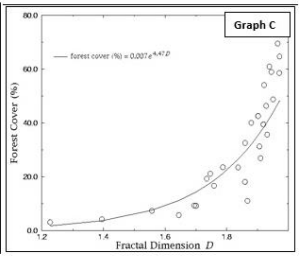
20) Computer models are superior to physical models because they are more quantitative.*
( ) True
( ) False

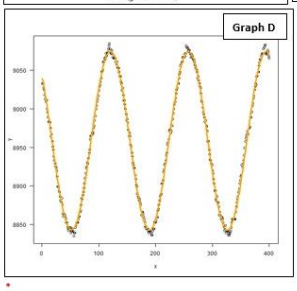
21) Hydrologists have developed a computer-based model to simulate flow of a contaminant through a groundwater reservoir. In order to develop their model, the hydrologists most likely*
( ) took an existing groundwater model and modified it to suit their needs.
( ) simplified the shape of the reservoir in the model.
( ) collected data from the reservoir they are modeling.
( ) did all of the things listed as answers.

22) Match the model name for each graph A-D



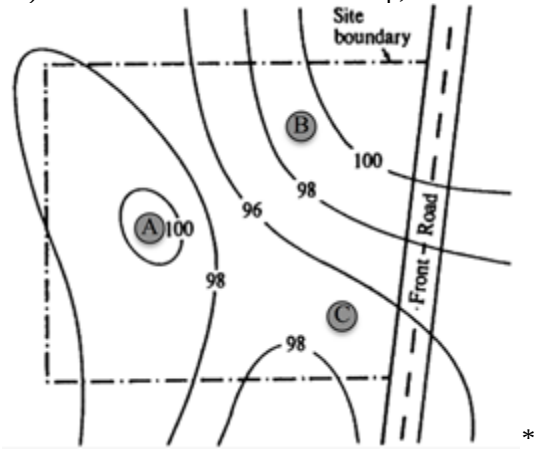






	Linear	Exponential	Sinusoidal Model	Logistic Model
Graph A is	_____	_____	_____	_____
Graph B is	_____	_____	_____	_____
Graph C is	_____	_____	_____	_____
Graph D is	_____	_____	_____	_____

23) Based on the shown contour map, match the elevation of column A with the point number in column B:

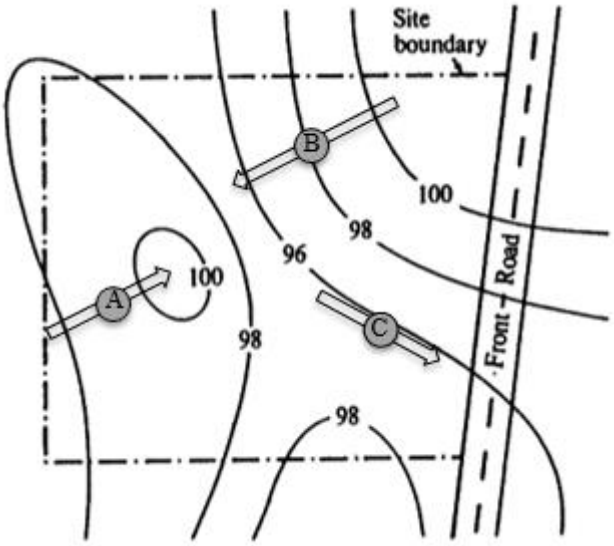


*

A -- Please Select --

B -- Please Select --

C -- Please Select --

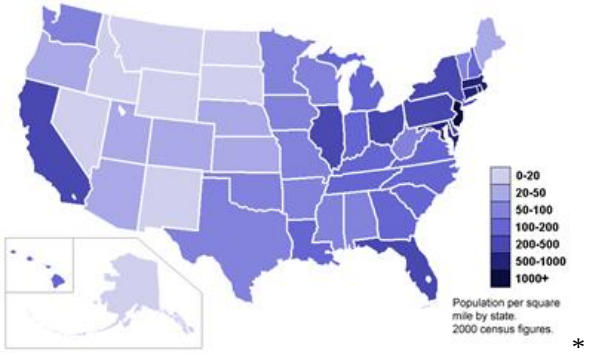


24)
Identify the correct flow direction.*
( ) A
( ) B
( ) C

Content

25) Visualization is the study of the visual representation of _____, meaning "information which has been abstracted in some schematic form, including attributes or variables for the units of information".*
( ) Quantitative data
( ) Qualitative data
( ) Models and processes
( ) All of the above

26) What type of map is this?



*

( ) Economic map
( ) Physical map
( ) Political map

( ) Population map

27) Match the map to the map type

Map A Map B Map C Map D

*

	Topographic Map	Physical Map	Thematic Map	Political Map
Map A is a	_____	_____	_____	_____
Map B is a	_____	_____	_____	_____
Map C is a	_____	_____	_____	_____
Map D is a	_____	_____	_____	_____

28) Choose the correct definition for a Gigapan*
( ) Gigapans can combine multiple images taken from multiple locations
( ) Gigapans are tool for measuring terrain data
( ) Gigapans use LiDAR data to create 3D models
( ) Gigapans are large panoramic images containing billions of pixels

29) Which of the following examples are situations where Gigapans might be used?*
( ) A. Virtual tours of building interiors
( ) B. Creating a DEM (Digital Elevation model)
( ) C. Virtual tours of study plots
( ) D. Lake basin volume
( ) A-D are all examples of where Gigapans may be used
( ) A & C are examples of where Gigapans may be used
( ) B & D are examples of where Gigapans may be used

30) What is the difference between Gigapans and Structure from Motion (SfM) image capture techniques? (check all that apply)*
[ ] SfM and Gigapans render 3D imagery
[ ] Gigapans are recorded with a pivoting-arm camera from a single vantage point, whereas (SfM) can be recorded from multiple, overlapping vantage points.
[ ] SfM can be recorded from multiple, overlapping vantage points, whereas Gigapans are recorded with a pivoting-arm camera from a single vantage point.
[ ] SfM enables accurate, georeferenced measurements to be taken from imagery, whereas Gigapans do not

31) Which of the following are examples of image processing software used to create Gigapans? (check all that apply)*
[ ] ArcGIS
[ ] Microsoft ICE (image composite editor)
[ ] Sketchfab
[ ] Photosynth

32) Gigapans can be in following formats*
( ) Partial
( ) Cylinder
( ) 360°
( ) All of the above
( ) None of the above

33) Federal Aviation Administration (FAA) regulations apply to UAS*
( ) True
( ) False

34) FAA regulations allow for commercial UAS data collection*
( ) True
( ) False

35) Which of the following sensors can be used on UAS platforms? (check all that apply)*
[ ] Digital cameras
[ ] Temperature sensors
[ ] Hyperspectral cameras
[ ] LiDAR's
[ ] Air quality samplers
[ ] All of the above

36) Digital Elevation Models (DEM's) can be produced by Structure from Motion (SfM)*
( ) True
( ) False

37) To calculate volume of an object, what method would you use to generate a 3D model?*
( ) Gigapan
( ) SfM
( ) None of the above

38) How are a LiDAR and a Kinect similar? (check all that apply)*
[ ] LiDAR and a Kinect are used for different purposes and thus do not have any similarities
[ ] The Kinect is significantly less expensive than a Terrestrial Ground Survey LiDAR
[ ] Both use a laser to measure distance
[ ] A Kinect is field portable due to smaller size and weight than a LiDAR
39) LiDAR stands for*
( ) Laser induction, deflection and ranging
( ) Light detection and ranging
( ) Light amplification through stimulated emission of radiation
( ) Laser induction, amplitude and reflection

40) What methods can be used for creating a Point Cloud? (check all that apply)*
[ ] Gigapans
[ ] Laser scanners
[ ] Overlapping panoramic photos
[ ] LiDAR
[ ] SfM
[ ] Kinect

41) Georeferencing is important because (check all that apply)*
[ ] Accurate coordinate locations allow for precise measurements
[ ] NAD 27 coordinates are more accurate than WGS 1984 coordinates
[ ] Raster data needs to be georeferenced to a coordinate system to be usable in GIS
[ ] Metadata can be associated with coordinate data

42) Structure from Motion (SfM) can model objects in motion*
( ) True
( ) False

43) ArcGIS maps can be imported into Google Earth using the KML format*
( ) True
( ) False

44) ArcGIS uses _____ files for representing spatial data (check all that apply)*
[ ] Raster
[ ] Image
[ ] x, y, z coordinate
[ ] batch
[ ] Vector

Which of the following best describes your experience with Google Earth? You can choose more than one answer.
[ ] Never used it.
[ ] Played with it a few times.
[ ] Used it quite a bit to look at Earth from space.
[ ] Have downloaded some kmz/kml files (data layers) from the internet and looked at them on Google Earth.
[ ] Have created my own kmz/kml files and viewed the results on Google Earth.
[ ] Used Google Earth for my research.
[ ] Other: _____

Which of the following best describes how you currently use Google Earth in your classroom? Check all that apply
[ ] I don't use it at all.
[ ] To show overhead views of Earth or features on the ground in my lectures.
[ ] To illustrate a data overlay in lecture.
[ ] Students use it in activities/homework to find features on Earth's surface.
[ ] Students use it in activities/homework to study overlays of data.
[ ] Students use it as a tool to investigate scientific problems
[ ] Other: _____

45) Rate your knowledge of the following online resources from 1=no familiarity to 5= very familiar*

	1=No familiarity	2	3=Familiar	4	5=Very familiar
arcGIS Online [not the standalone version]	( )	( )	( )	( )	( )
NASA EOSDIS worldview [Earth Observing System Data and Information System]	( )	( )	( )	( )	( )
NEO [Nasa Earth Observations]	( )	( )	( )	( )	( )
NOAA HYSPLIT	( )	( )	( )	( )	( )
gapminder.org	( )	( )	( )	( )	( )
nationalatlas.org	( )	( )	( )	( )	( )
indexmundi.com	( )	( )	( )	( )	( )
earth.nullschool.net	( )	( )	( )	( )	( )

Workshop Sessions
Part II

Western Tri-State EPSCoR Track 2
2014 Undergraduate Visualization Network Modeling (UVMN) Workshop
May 29-31, 2014

Thank you for participating in the evaluation of this program. Your responses are very important. The information you provide will help to improve future programs. Please answer each question honestly and thoroughly. All responses are confidential.

46) Please rate the following aspects of this workshop on a scale from not useful at all to extremely useful for your professional and personal development.*

	Not useful at all	Slightly useful	Somewhat useful	Very useful	Extremely useful	Did not participate
May 29: Introduction to Hydrology and Hydrologic (Watershed) Modeling	( )	( )	( )	( )	( )	( )
May 29: Google Earth and Overlays	( )	( )	( )	( )	( )	( )
May 29: Weather Models and HYSPLIT	( )	( )	( )	( )	( )	( )
May 30: Gigapan Data Collection	( )	( )	( )	( )	( )	( )
May 30: Hacking the Kinect	( )	( )	( )	( )	( )	( )
May 30: Structure from Motion	( )	( )	( )	( )	( )	( )
May 30: GPS data collection and import	( )	( )	( )	( )	( )	( )
May 31: UAS Flight demonstration	( )	( )	( )	( )	( )	( )
May 31: Additional Classroom Visualizations	( )	( )	( )	( )	( )	( )
May 31: Developing course modules	( )	( )	( )	( )	( )	( )

47) What other concepts, topics or activities would you like to have seen covered?
48) What suggestions do you have for improving the content and presentations of the workshop?

49) How did you find out about this event?*
( ) Flyer
( ) E-mail
( ) Professor
( ) Friend
( ) Website
( ) Other (Please explain): _____

Workshop Logistics
50) Please rate your satisfaction with the logistical aspects of this program from not at all satisfied to completely satisfied. RATING SCALE: 1= NOT AT ALL SATISFIED 3 = SOMEWHAT SATISFIED 5 = COMPLETELY SATISFIED*

	1	2	3	4	5
Registration process (pre-program information, ease of registration)	( )	( )	( )	( )	( )
Meals/Breaks	( )	( )	( )	( )	( )
Transportation	( )	( )	( )	( )	( )
Program agenda (clear purpose, balanced, meaningful, useful)	( )	( )	( )	( )	( )
Program information (focused, well-prepared)	( )	( )	( )	( )	( )
Overall organization (check-in, activities)	( )	( )	( )	( )	( )
Time (activities and presentations started/ended on time)	( )	( )	( )	( )	( )
Atmosphere (friendly, supportive, promoted team-building)	( )	( )	( )	( )	( )

51) Please comment on how to improve any logistical aspects of the workshop.

Workshop Impact

52) Achievement of Learning Objectives—Select the number that best represents your abilities and knowledge in each of the following areas before and after attending this workshop. RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Workshop					After Workshop				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
Ability to create and handle KML/KMZ files	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Ability to model and visualize surface hydrology	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Ability to learn about open source GIS and free GIS data	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Basic GIS knowledge	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Use of ArcGIS	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Knowledge about data to create 3D models, terrain models and orthomosaics	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Knowledge about techniques to create 3D models, terrain models, and orthomosaics	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Use of Google Earth	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Hydrological modelling	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Creating Virtual Tours	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Use of Microsoft Kinect	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Structure from Motion	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Use of aerial drones	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

53) Is there anything you would like to share with program facilitators about the learning objectives and topics?

54) Select the number that best represents your interest in each of the following areas before and after this program. RATING SCALE: 1= MINIMAL 3 = SOMEWHAT 5 = EXTENSIVE*

	Before Workshop					After Workshop				
	1*	2*	3*	4*	5*	1*	2*	3*	4*	5*
My interest in working on Visualization/Modeling science projects	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My knowledge of the Jemez watershed project field site	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My familiarity with the WC-WAVE Consortium faculty and students	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to exchange ideas about modeling and visualization with other WC-WAVE Consortium participants	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to exchange ideas on teaching topics/develop my curriculum with other WC-WAVE Consortium faculty	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My ability to develop my dissertation committee from WC-WAVE faculty (if applicable)	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
My commitment to continue studies and/or professional development in modeling and visualization	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

55) What do you think are the two most important things you have gained by attending? Explain why.

56) Please rate the likelihood of you implementing what you've learned in this workshop to your research and/or instruction.*
( ) Extremely unlikely ( ) Unlikely ( ) Neutral ( ) Likely ( ) Extremely Likely

57) How will you use or implement what you have learned?

58) What are your next steps after attending this program as related to your STEM or watershed science studies (students) / teaching and research (faculty) (e.g. "I now plan to apply to graduate school in a related field"; "I can now collaborate with faculty with similar research interests"; etc.) ?

59) Is there anything else you would like to share with program facilitators?

Appendix H: UVMN Content Survey results by question

Pre/Post Question #	% Correct Pre (n=20)		% Correct Post (n=20)		Change in percentage points	
Cartography						
8	**50%**		**65%**		**+15**	
9	**90%**		**85%**		**-5**	
10	**85%**		**75%**		**-10**	
11	**40%**		**50%**		**+10**	
12	**90%**		**95%**		**+5**	
13	**70%**		**85%**		**+15**	
14	**75%**		**90%**		**+15**	
15	**95%**		**90%**		**-5**	
16 (all correct)	**0%**		**0%**		**0**	
16a		0%		0%		0
16b		90%		95%		+5
16c		5%		0%		-5
26	**85%**		**80%**		**-5**	
27 (all correct)	**0%**		**0%**		**0**	
27a		0%		5%		+5
27b		5%		0%		-5
27c		5%		0%		-5
27d		0%		0%		0
Scientific Method						
17	**75%**		**70%**		**-5**	
18	**80%**		**85%**		**+5**	
19	**25%**		**65%**		**+40**	
20[29]	-		-		-	
Modeling						
21	**80%**		**95%**		**+15**	
22 (all correct)	**0%**		**5%**		**+5**	
22a		0%		5%		+5
22b		0%		10%		+10
22c		5%		5%		0
22d		15%		5%		-10
Contour Analysis						
23 (all correct)	**0%**		**0%**		**0**	
23a		5%		0%		-5
23b		0%		0%		0
23c		100%		95%		-5
24	**65%**		**45%**		**-20**	
Visualization						
25	**75%**		**75%**		**0**	
Gigapans						

[29] Did not receive the answer for this question in order to calculate the percentage responding correctly

Pre/Post Question #	% Correct Pre (n=20)		% Correct Post (n=20)		Change in percentage points	
28	**60%**		**55%**		**-5**	
29	**30%**		**50%**		**+20**	
30 (both choices)	**25%**		**30%**		**+5**	
Gigapans		50%		75%		+25
SfM recorded		40%		65%		+25
31 (both choices)	**15%**		**50%**		**+35**	
Microsoft ICE		50%		90%		+40
Photosynth		50%		90%		+40
32	**80%**		**95%**		**+15**	
Unarmed Aircraft Systems						
33	**70%**		**100%**		**+30**	
34	**20%**		**55%**		**+35**	
35	**55%**		**85%**		**+30**	
36	**80%**		**90%**		**+10**	
Measurements						
37	**65%**		**75%**		**+10**	
LiDAR						
38 (all three choices)	**15%**		**25%**		**+10**	
The Kinect		30%		65%		+35
Both		75%		70%		-5
A Kinect		25%		40%		+15
39	**35%**		**75%**		**+40**	
40 (all four choices)	**0%**		**10%**		**+10**	
Laser scanners		35%		35%		0
LiDAR		55%		75%		+20
SfM		35%		65%		+30
Kinect		40%		85%		+45
Geographic Information Systems (GIS)						
41 (all three choices)	**25%**		**25%**		**0**	
Accurate		65%		90%		+25
Raster		55%		55%		0
Metadata		60%		35%		-25
42	**35%**		**50%**		**+15**	
43	**80%**		**90%**		**+10**	
44 (both choices)	**15%**		**10%**		**-5**	
Raster		60%		55%		-5
Vector		50%		50%		0
Total[30]	**41%**		**49%**		**+9**	

For items with multiple parts (indicated by the indented question number followed by lowercase letters *a-d*), participants had to correctly answer all parts in order to have the question counted as correct. These questions were developed by the workshop facilitators.

[30] Average of bolded pre and post-survey percentages correct

Appendix J: WC-WAVE Baseline Survey

Thank you for participating in the evaluation of the WC-WAVE Track 2 Tri-State EPSCoR project. Your responses are very important. The information you provide will help improve this project and make it more valuable for participants and will help assess the impact this project has on participants and institutions and the broader impacts it may have on the scientific community and the states of Idaho, New Mexico, and Nevada.

As you're completing the survey, reflect back on when you joined this project and answer questions from that perspective. The baseline information resulting from the survey will be used to determine our progress on project goals and objectives, which is required by NSF and reported annually. Please answer each question honestly and thoroughly. All responses are confidential.

If you have questions about this survey please contact:
Sara Newkirk, Project Evaluator
Smart Start Educational Consulting Services

About You: Completion of this section provides basic information to capture the demographics of NSF EPSCoR participants. This information strengthens future applications for funding, ultimately providing research program sustainability and growth.

1) What role do you play in the NSF Track 2 EPSCoR WC-WAVE project?*
( ) Faculty/University academic researcher
( ) Governmental agency employee
( ) Graduate student
( ) Industry researcher
( ) Policy maker/politician
( ) Postdoctoral fellow
( ) Professional Staff
( ) Technician
( ) Teacher - elementary
( ) Teacher - secondary
( ) Undergraduate student
( ) Other: _____

2) With which gender do you identify?*
( ) Male
( ) Female

3) With which ethnicity or racial background do you most closely identify?*
( ) Hispanic or Latino
( ) Not Hispanic or Latino
( ) Other

4) With which ethnicity or racial background do you most closely identify?*
( ) Black or African American
( ) Asian
( ) White (non-Hispanic)
( ) Hispanic
( ) American Indian or Alaska Native
( ) Pacific Islander or Native Hawaiian
( ) Other: _____

5) With which institution are you most closely affiliated? (Choose one)*
( ) Boise State University

( ) College of Southern Idaho
( ) Desert Research Institute
( ) Idaho State University
( ) Nevada System of Higher Education
( ) New Mexico State University
( ) New Mexico Tech
( ) University of Idaho
( ) University of Nevada, Las Vegas
( ) University of Nevada, Reno
( ) University of New Mexico
( ) Other: _____

6) What year did you begin participating in the WC-WAVE project?*
( ) 2013-14
( ) 2014-15
( ) 2015-16

COMPONENT 1: WATERSHED SCIENCES
Goal 1 - Advance understanding of hydrologic interactions and their impact on ecosystem services using a virtual watershed (VW) framework.

Please rate your knowledge about the following topics. Select the response that corresponds to your level of familiarity on a scale of "not knowledgeable at all" to "extremely knowledgeable." These knowledge-based questions are based on benchmark activities identified by project leaders as areas in which knowledge is expected to grow during the 3 years of the project. There is no expectation that everyone possesses all this knowledge. Please answer honestly. Participants' baseline survey responses will be compared with annual post-survey responses to measure overall participant growth over the course of the project.

7) Objective 1. Parameterize and validate watershed models*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
Which watershed models are appropriate to use	( )	( )	( )	( )	( )
What is required to visualize watershed model outputs and inputs.	( )	( )	( )	( )	( )
Which environmental variables are important for developing test data sets for models in the VW platform.	( )	( )	( )	( )	( )
How to parameterize and coordinate model runs.	( )	( )	( )	( )	( )
Why one-way or "loose" coupling among models via cyberinfrastructure is desirable.	( )	( )	( )	( )	( )

8) Objective 2. Develop CSDMS (Community Surface Dynamics Modeling System) adapters for models*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
How modeling system adapters are developed	( )	( )	( )	( )	( )
How to ensure the reliability of adapters	( )	( )	( )	( )	( )
How to ensure that the code for model adapters is sustainable	( )	( )	( )	( )	( )

9) Objective 3. Test VW applications and answer research questions using the VW platforms to investigate watershed ecosystem services*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
How initial test cases for the Virtual Watershed are defined based on the climatology of study watersheds.	( )	( )	( )	( )	( )
How to develop synthetic datasets for the Virtual Watershed models.	( )	( )	( )	( )	( )
How to run synthetic test cases for models.	( )	( )	( )	( )	( )
How to characterize and quantify value added through two-way model coupling.	( )	( )	( )	( )	( )

COMPONENT 2: CI-VISUALIZATION
Goal 1 - Accelerate collaborative, interdisciplinary watershed research and discovery by creating innovative visualization environments

10) Please rate your knowledge about the following areas below.*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
How Visualization Environments interface with Virtual Watershed Platform adapters	( )	( )	( )	( )	( )
How interfaces for the visualization	( )	( )	( )	( )	( )

environments are developed					
How data required by models and visualization tools are defined	( )	( )	( )	( )	( )
The model and visualization tool data format requirements	( )	( )	( )	( )	( )

COMPONENT 3: CI-DATA
Goal 1: Accelerate integrated watershed scale modeling through streamlined data access, transfer of outputs and associated metadata to data management systems, visualization, model configuration.
Goal 2: Enable accelerated and broad access to research products, data and metadata through integration with national networks through interoperable data services
Goal 3: Streamline data intensive research through improved data management skills

11) Please rate your knowledge about the following areas below.*

	Not knowledgeable at all	Slightly knowledgeable	Somewhat knowledgeable	Very knowledgeable	Extremely knowledgeable
How data are integrated within and into larger networks	( )	( )	( )	( )	( )
Strategies for the acceleration of integrated watershed scale modeling	( )	( )	( )	( )	( )
How streamlined data access, transfer of outputs and associated metadata impact visualization and model configuration.	( )	( )	( )	( )	( )
Strategies for accelerated and broad access to large data sets related to the project	( )	( )	( )	( )	( )
Understanding of opportunities for streamlining data intensive research through improved data management skills	( )	( )	( )	( )	( )

COMPONENT 4: WORKFORCE DEVELOPMENT
Goal 1- Engage university faculty and graduate students in interdisciplinary team-based watershed research, and broaden undergraduate student participation in STEM through modeling and visualization.

What strategies do you use to participate in and/or support the activities of the Workforce Development component? Please place a check only by the activities and strategies in which you are currently involved.

12) I participate in collaborative fieldwork activities involving students and faculty such as pre-meeting camps by:*
[ ] Attending
[ ] Contacting students directly with information and opportunities
[ ] Recruiting college/university staff and faculty to participate
[ ] Posting opportunities on social media sites
[ ] Making announcements in classes
[ ] Playing a part in program planning
[ ] Joining in program activities
[ ] Other: _____
[ ] None

13) I participate in ongoing Graduate Inter-disciplinary Training by*
[ ] Contributing to presentations and discussions at the Tri-State meetings
[ ] Taking part in on-going interdisciplinary training through Tri-State Coordination meetings, face-to-face meetings, WebExes and conference calls
[ ] Attending/assisting/presenting at the CSDMS training (Year 1)
[ ] Attending/assisting/presenting at the Interdisciplinary Modeling Course (Year 2)
[ ] Attending/assisting/presenting at the Capstone and Leadership Institute (Year 3)
[ ] Other: _____
[ ] None

14) I participate in the Capstone and Leadership Institute by:*
[ ] Taking part in cyber seminars
[ ] Attending face-to-face summer institutes
[ ] Presenting at the Capstone Leadership Institute
[ ] Contacting graduate students directly with information about opportunities
[ ] Recruiting graduate students and faculty to participate
[ ] Posting opportunities on social media sites
[ ] Making announcements in classes
[ ] Planning the trainings
[ ] Other: _____
[ ] None

15) I participate in the Undergraduate Visualization and Modeling Network (UVMN) by:*
[ ] Developing the workshop content
[ ] Developing the application process
[ ] Recruiting the first cohort
[ ] Presenting the workshop
[ ] Developing and implementing course modules
[ ] Contacting students directly with information about opportunities
[ ] Recruiting students and faculty to participate
[ ] Posting opportunities on social media sites
[ ] Making announcements in classes
[ ] Planning or leading the follow-up webinars
[ ] Discussing/sharing information about WC-WAVE research with UVMN participants
[ ] Other: _____
[ ] None

Thank You!