***SCAPE 2.0* Quarterly Report**

August – October 2019

Submitted by Dan Collins, Principal Investigator, Arizona State University

**INTRODUCTION**

Overview

*SCAPE (Sustainable Communities and Place-based Education)* is a high school and community-based science education project combining online learning and field observations involving high schools across seven western States. Initially funded by the EPA in 2016 with a $192K grant, the project utilizes recognized environmental education (EE) curriculum design guidelines and workshops and provides opportunities for science teachers to learn both the science of water quality and best practices for EE. *SCAPE* trained teachers introduce students to concepts of hydrology, methods for measuring in-stream flow, and techniques for testing water quality. Resources are provided in computer literacy, environmental history, policy, and ethics, with special emphasis on “water in the West.” *SCAPE* incorporates state and national education standards and can be used to augment existing teaching plans. The program uses EE pedagogy to create lessons related to real-world problems—in particular, water quality and supply—and gives our partner teachers the tools and methods to move from knowledge to action.

The original SCAPE 1 curriculum focused on the Colorado River Basin. The project has been expanded to encompass a much broader geographic area (some of the original “Colorado River States” plus Montana) in the areas of environmental ethics, community mapping, and occupational training.

The current program, *SCAPE 2.0*, serves six high schools across Colorado, Wyoming, and Montana. One school dropped out of the program (Paradox HS, CO); three schools were added to the program (Gunnison HS; CO; Ronan HS, MT; Columbia Falls HS, MT).

EE Teaching Skills

In Year One of *SCAPE 2.0*, master teachers, curriculum designers, and media experts met to refine the SCAPE EE curriculum. *SCAPE 2.0* classroom teachers learned about the curriculum through one-on-one training sessions, conference calls, and accessing online resources. In Year 2, during the current quarterly reporting period, classroom teachers have introduced their students to the *SCAPE 2.0* curriculum in their regular classrooms.

Participants

##### Core Team

Dan Collins—Principal Investigator, Arizona State University, AZ / Telluride Institute, CO

Kaard Bombe—Videographer, Phoenix, AZ

Monica Elser—Co-Investigator, Flathead Lake Biological Station, MT

Zora Ziazi—Evaluator, UOEEE, Arizona State University, Tempe, AZ

Elena Ortiz—Co-Investigator, Professor, Phoenix College, Phoenix, AZ

Vicki Phelps—Co-Director, Watershed Education Program, Telluride Institute, CO

Jeff Sellen—Professor, ENVS, Western Colorado U., Gunnison, CO

Renu Singh—Director, Gifted & Talented Academy., Maryvale HS, Phoenix, AZ

Shaun Ylatupa-McWhorter—Networking & Database Specialist, Arizona State University

Elizabeth Stuffings—San Miguel Watershed Coalition / Telluride Institute, Telluride, CO

##### Contributors (reflects recent updates in list of Colorado and Montana Schools)

Brian Anderson—Fiscal Specialist, HIDA, Arizona State University, Tempe, AZ

Krystal Brown—Science Teacher, Gunnison High School Gunnison, CO

Alison Cook-Davis—UOEEE, Arizona State University, Tempe, AZ

Kevin Dunbar—Science Teacher, Cedaredge High School, Cedaredge, CO

Paul Haberstroh—Professor, Mohave Community College, Lake Havasu City, AZ

John Hausdoerffer—Dean, ENVS, Western Colorado U., Gunnison, CO

Kelly Houle—Science Teacher, Columbia Falls High School, Columbia Falls, MT

Laurie Lundquist—Environmental Artist, Telluride, CO

Deb Noble—Science Teacher, Pinedale High School, Pinedale, WY

Steve Smith—Science Teacher, Animas High School, Durango, CO

Jedd Tsongas—Science Teacher, Ronan High School, Ronan, MT

SUMMARY OF MAJOR ACCOMPLISHMENTS in this Quarter (August – October 2019)

* 1. Refined *SCAPE*, a 320 page EE curriculum combining classroom, field, and online learning;
	2. Trained 3 new teachers to create and interact with *SCAPE 2.0* in InterMountain high schools and institutions (Brown, Houle, Tsongas)
	3. Taught students and citizens sustainability, water quality/supply, and environmental protection through hands on field experience and introduction of digital research skills (archiving, collaborative threaded discussion, mapping, web-site authoring). (All teachers).
	4. Refined the computing resources “in the cloud” for uploading and sharing data and doing comparative analysis across our schools (Ylatupa-McWhorter)
	5. Refined funding mechanism for sub-awardee grants of $5000 or less for *SCAPE 2* schools and institutions (Anderson)
	6. Added significantly to a library of documentary videos and an archive of photographs (Bombe)
	7. Presented the *SCAPE 2* concept and curriculum at major regional and national conferences as well as partner academic institutions (Western Colorado University/ENVS, University of Montana/FLBS).
	8. Conducted quarterly Survey of participating teachers (UOEEE, ASU). Table 1 in the appendix shows participants’ responses to the survey. All data are de-identified to protect participants’ privacy.
	9. Conducted a quarterly video conference call with participating teachers and SCAPE 2.0 staff.

***i. A comparison of actual accomplishments to the outputs/outcomes established in the work plan for the performance period (8/1/19 – 10/31/19)***

OUTPUTS & OUTCOMES

|  |  |
| --- | --- |
| **Outputs** | **Outcomes** |
| **Short-term** | **Medium-term** | **Long-term** |
| **Objectives**Develop and implement recruitment plan for teachers and students withemphasis on rural and low income/high minority school districts**Accomplishments** Recruitment plan developed for *SCAPE 2* with a focus on rural and underserved communities. | **Objectives**Identify 5 schools and teachers and ~250 students. Increased access and engagement by under-represented communities to EE resources**Accomplishments** Six schools successfully recruited for *SCAPE 2.* | **Objectives**Participants will demonstrate increased awareness and comprehension of environmental issues and how policies and practices affect their community’s environment.**Accomplishments** Teachers demonstrated increased awareness by tying *SCAPE 2.0* objectives to research on local “experts” (Gunnison, CO) and community partnerships (Mountain Studies Institute, City of Durango). | **Objectives**Establish sustainable EE programs on water conservation and quality in targeted regions featuring well-defined, professionally formatted curricula across an expanded geographic base.**Accomplishments** TBD |
| **Objectives**Develop training for high school teachers and community educators **Accomplishments** Met one on one (in some cases via ZOOM or phone) with each of the project teachers to discuss opportunities and challenges of introducing SCAPE 2 in their school. |  **Objectives**High school teachers and community educators participated in Fal training, online tutorials, and service learning work to increase awareness.**Accomplishments** Met one on one with all project teachers either FTF or via ZOOM or phone. | **Objectives**Teachers to integrate increased knowledge of EE best practices into the classroom. Teachers and students will lead environmentally- focused projects in their schools and their communities.**Accomplishments** Classroom rollout, Fall 2019. Successful funding and equipping of project schools. | **Objectives**Share materials online and with educators at local and national EE and science teacher conferences **Accomplishments**Western Colorado U./ENSV (August 2019). Widely distributed video documentation via *SCAPE* Vimeo channel. |
| **Objectives**Develop high quality online-accessible curricular materials on sustainable water use and quality, assist teachers in developing materials for wider use**Accomplishments** Online materials refined; specific enhancements made by select schools (e.g., Animas High School). |  **Objectives**Increase capacity and motivation for teachers to develop quality EE materials. Reinforce local identity. Assessment and evaluation of materials**Accomplishments** Teachers (Animas HS, Ronan HS; Cedaredge HS, Pinedale HS) developed site-specific adaptations of the curriculum. | **Objectives**Specific actions on water conservation and quality undertaken at campus and community levels to reinforce local identity.**Accomplishments** Classroom rollout begun in Fall 2019. Classroom projects reflect local conditions and career paths in environmental fields. | **Objectives**Students and teachers will demonstrate behaviors and commitments to environmental protection and educated others outside of program about environmental issues— especially in under-served communities. Persistence in and knowledge of STEM skills. Wide adoption and dissemination of *SCAPE 2.0* curriculum. Comprehensive summative report to be completed and submitted to EPA (July 2020).**Accomplishments** Classroom rollout started in Fall 2019. Students will demonstrate learning outcomes in Spring 2020 school-based exhibitions, online publications, and public colloquia. |
| **Objectives**Support teachers in implementing STEM-driven environmental education (EE) program focused on sustainable water use and quality.**Accomplishments** Discussions with individual teachers about appropriate application of *SCAPE* learning outcomes to local school curricula—especially those limited by State Standards and mandated testing.  | **Objectives**Increased capacity for teachers to implement EE programs tied to STEM learning objectives. Increased teacher and student understanding and awareness of water quality across the InterMountain West.**Accomplishments** Teachers and students engaged in discussions about the landscape and water use in and around their school.  | **Objectives**Formative assessment of student and teacher actions will be completed quarterly by UOEEE tracking local environmental outcomes and STEM learning. We are looking for persistent application of proven STEM and EE learning methods.**Accomplishments** Assessment process begun with teachers by UOEEE via phone interviews, surveys, and conference calls. |

***ii. Progress on awards to sub-grantees and any data on the sub-grant projects.***

* + 1. *Summaries of results of reviews of financial and programmatic reports.*

Prior to issuing subawards, risk assessments are performed including reviewing for relevant audit findings. Arizona State University did not identify any relevant audit findings on any subawards for this award and therefore no additional monitoring tools are being used.

* + 1. *Summaries of findings from site visits and/or desk reviews to ensure effective sub-grantee performance.*

Discussions with individual teachers about appropriate application of *SCAPE* learning outcomes to local school curricula—especially those limited by State Standards and mandated testing. Online materials refined; specific enhancements made by select schools (e.g., Animas High School expanded water-quality testing field work to include math students engaged in statistical analysis of heavy metal concentrations in the upper Animas River. Kevin Dunbar at Cedaredge high school expanded biology curriculum to include macroinvertebrate collection and developed partnerships with local environmental non-profits and National Forest Service. Jedd Tsongas and Kelly Houle worked in partnership with the Flathead Lake Bio Station to implement activities/lessons at their respective Montana schools in Ronan and Columbia Falls).

*c. Environmental Results the sub-grantee achieved.*

This data will be forthcoming later in the Fall as teachers get a chance to compile results of field studies conducted August – October.

*d. Summaries of sub-grant audit findings/related management decisions by the recipient.*

 Not applicable, there were no sub-grantee audit findings.

*e. Actions the pass-through entity has taken to correct deficiencies such as those specified at 2 CFR 200.331(e), 2 CFR 200.207 and the 2 CFR Part 200.338 Remedies for Noncompliance.*

Not applicable, there are no deficiencies to correct.

***iii. Difficulties encountered and reasons for slippage if established outputs/outcomes were not met by the recipient or any of its sub-grantees****.*

One Montana school (Ronan High School), initially had to pull out of the program due to staffing issues. However, with the hire of Jedd Tsongas as Science Teacher, we were able to reinstate this school. With the prospect of losing Ronan HS, we added another Montana school—Columbia Falls High School (just north of Flathead Lake). We now have two Montana high schools, one at the north end and one at the south end of the huge body of water (30 miles long) called “Flathead Lake.” Additionally, one of our Colorado schools (Paradox High School), recently had to leave the program due to lack of staffing. The main science teacher in this tiny rural high school, Amanda Scott, had a baby, and no satisfactory teacher replacement could be found. To make up this deficit, we identified another regional high school in Gunnison, Colorado—Gunnison High School—through our association with Western Colorado University. Ms. Krystal Brown, the new science teacher at Gunnison HS, has been a wonderful new addition to the project.

***iv.* *Expenditures, including an overall budget summary comparing approved budget with actual expenses in each budget class including EPA and match funding.***



Financial Summary Report: 9/1/18 - 10/31/19 (Project timeframe: 9/1/18 – 8/31/20)

EPA Share:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BUDGETED CATEGORIES** | **BUDGET** | **CURRENT PERIOD EXPENSES** | **EXPENSES TO DATE** | **ENCUMBRANCES** | **AVAILABLE FUNDS** |
| SALARIES & ERE: COLLINS | $6,976.00 | $3,409.09 | $3,409.09 | $0.00 | $3,566.91 |
| SALARIES & ERE: YLATUPA-MCWHORTER | $6,768.00 | $0.00 | $0.00 | $0.00 | $6,768.00 |
| WAGES & ERE: HOURLY STUDENT WORKER | $5,052.00 | $0.00 | $0.00 | $0.00 | $5,052.00 |
| SERVICE FEES: UOEEE | $5,000.00 | $0.00 | $0.00 | $0.00 | $5,000.00 |
| SERVICE FEES: ELENA ORTIZ | $3,000.00 | $0.00 | $0.00 | $0.00 | $3,000.00 |
| SERVICE FEES: VIDEOGRAPHER | $5,040.00 | $0.00 | $0.00 | $0.00 | $5,040.00 |
| SERVICE FEES: HABERSTROH (MCC) | $500.00 | $0.00 | $0.00 | $0.00 | $500.00 |
| SERVICE TRAVEL: ELENA ORTIZ | $2,148.00 | $0.00 | $0.00 | $0.00 | $2,148.00 |
| SERVICE TRAVEL: VIDEOGRAPHER | $1,186.00 | $0.00 | $0.00 | $0.00 | $1,186.00 |
| TRAVEL | $4,499.00 | $0.00 | $0.00 | $2,466.55 | $2,032.45 |
| PUBLICATION: FEES | $999.00 | $0.00 | $0.00 | $0.00 | $999.00 |
| M&S: WATER-TESTING PROBES | $1,400.00 | $2,295.26 | $2,295.26 | $0.00 | -$895.26 |
| SUBAWARD: W. ST COLORADO UNIV | $3,000.00 | $0.00 | $0.00 | $3,000.00 | $0.00 |
| SUBAWARD: RONAN SCHOOL DISTRICT 30 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| SUBAWARD: CO: DELTA CO SCH DIST | $3,000.00 | $0.00 | $0.00 | $3,000.00 | $0.00 |
| SUBAWARD: WY: SUBLETTE COUNTY SCH DIST #1 | $3,000.00 | $0.00 | $0.00 | $3,000.00 | $0.00 |
| SUBAWARD: UNIVERSITY OF MONTANA | $3,000.00 | $0.00 | $803.98 | $2,196.02 | $0.00 |
| SUBAWARD: PARADOX VALLEY CHARTER SCH | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| SUBAWARD: CO CHARTER SCH INSTITUTE | $3,000.00 | $0.00 | $0.00 | $3,000.00 | $0.00 |
| SUBAWARD: TELLURIDE INSTITUTE | $2,000.00 | $0.00 | $0.00 | $2,000.00 | $0.00 |
| SUBAWARD: COLUMBIA FALLS SCHOOL DISTRICT | $4,000.00 | $0.00 | $0.00 | $0.00 | $4,000.00 |
| SUBAWARD: GUNNISON SCHOOL DISTRICT | $4,000.00 | $0.00 | $0.00 | $0.00 | $4,000.00 |
| ***DIRECT COSTS SUBTOTAL*** | ***$67,568.00*** | ***$5,704.35*** | ***$6,508.33*** | ***$18,662.57*** | ***$42,397.10*** |
| FACILITIES & ADMINISTRATIVE COSTS (48%) | $32,432.00 | $2,738.09 | $3,124.00 | $8,958.03 | $20,349.97 |
| **TOTAL PROJECT COSTS** | **$100,000.00** | **$8,442.44** | **$9,632.33** | **$27,620.60** | **$62,747.07** |

Recipient Share:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **RECIPIENT SHARE BUDGETED CATEGORIES** | **BUDGET** | **CURRENT EXPENSES** | **EXPENSES TO DATE** | **OUTSTANDING ENCUMBRANCES** | **AVAILABLE FUNDS** |
| SALARIES & ERE: DAN COLLINS | $22,522.00 | $7,903.41 | $7,903.41 | $0.00 | $14,618.59 |
| SAN MIGUEL WATERSHED COALITION | $500.00 | $0.00 | $0.00 | $0.00 | $500.00 |
| ***DIRECT COSTS SUBTOTAL*** | ***$23,022.00*** | ***$7,903.41*** | ***$7,903.41*** | ***$0.00*** | ***$15,118.59*** |
| FACILITIES & ADMINISTRATIVE COSTS (48%) | $10,811.00 | $3,793.64 | $3,793.64 | $0.00 | $7,256.92 |
| **TOTAL PROJECT COSTS** | **$33,833.00** | **$11,697.05** | **$11,697.05** | **$0.00** | **$22,135.95** |

***v. A description of equipment, techniques, websites, software, and materials developed, used or evaluated****.*

**EQUIPMENT LIST** (developed with input from Core team & Project teachers)

**DIGITAL WATER QUALITY TEST EQUIPMENT**

|  |  |  |  |
| --- | --- | --- | --- |
| **Notes** | **Description** | **Unit Price “wired”** | **Unit price “wireless ”** |
|  | WATER QUALITY WITH VERNIER | 48.00 | 48.00 |
|  | VERNIER LabQuest2 | 329.00 | 329.00 |
|  | STAINLESS TEMP SENSOR | 28.13 |  |
|  | STAINLESS TEMP SENSOR (Go Direct wireless)\* |  | 59.00 |
|  | PH SENSOR (wired) | 79.00 |  |
|  | PH SENSOR (Go Direct wireless)\* |  | 79.00 |
|  | OPTICAL DISSOLVED OXYGEN SENSOR\*\* | 299.00 | 299.00 |
|  | CONDUCTIVITY SENSOR (wired) | 95.00 |  |
|  | CONDUCTIVITY SENSOR (Go Direct wireless)\* |  | 89.00 |
|  | TURBIDITY SENSOR\*\* | 108.64 | 108.64 |
|  | FLOW RATE SENSOR\*\* | 129.00 | 129.00 |
| Wireless link converts standard wired sensors. | Go Wireless Link (includes charging cable) | 89.00 | 89.00 |
| School choice | One Sensor chosen by school. |  |  |
|  | LABQUEST VIEWER SOFTWARE | 79.00 | 79.00 |
|  | Shipping (pro rata) | 12.90 | 12.90 |
| **Total “wired”** |  | **$1296.67** |  |
| **Total “wireless”** |  |  | **$1321.54** |

**MACROINVERTEBRATE COLLECTION KIT**

|  |
| --- |
| **Ben Meadows Scientific Supply** |
| **Measurement** | **Instrument or Material** | **# of units** | **Unit Price** | **Total Price** |
| Water sample collection | 1 cases (24 count) 250 ml plastic bottles. | 1 | 6.37 | 6.37 |
| Aquatic or terrestrial vegetation / Algae collection | Amber Narrow-Mouth Safety- Coated Glass Bottles 24 per case = 140.10 | 1 | 14.01 | 14.01 |
| Aquatic or terrestrial vegetation / Algae collection | Foam-Backed PTFE-Lined Phenolic Caps (12 count) | 1 | 1.96 | 1.90 |
| Safety Equipment | LatexGloves.100per box. | 1 | 8.79 | 8.79 |
| Safety Equipment | Safety Glasses, Uncoated, Clear, 12/Box | 1 | 20.89 | 20.89 |
| Macroinvertebratecollection | Complete Bottom Kick Net - 40in handle, Nitex, 500µm. | 1 | 187.50 | 187.50 |
| Macroinvertebratecollection | Aquatic Invertebrate Lab Kit | 1 | 333.50 | 333.50 |
| **Ben Meadows Total** |  |  |  | **$572.96** |

**TOTAL Expenses per Vendor**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Vendor Totals** | **Description** |  |  | **Total Price** |
| Vernier | Digital Water Quality Test Equipment Equipment (suggested) |  |  | 1321.54 |
| Ben Meadows | Macroinvertebrate Collection Kit |  |  | 572.96 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Grand TOTAL** | Estimated total may vary depending on your choice of Vernier Sensors.  |  |  | **$1894.50** |

**Content Management Systems: Google G-Suite**

A Content Management System (CMS) is an incredibly powerful tool. Not only does it provide an array of tools needed to complete tasks, it has a full range of enterprise critical features that provide for data management, data analysis, sharing, and security.

The *SCAPE 2.0* project continues to refine the CMS by Google called G-Suite and other Google cloud technologies. The following provides an overview of the G-Suite tool set:

The entire curriculum development process as well as project documentation and analysis is supported by the new G-Suite (formerly Google Apps) line of tools and cloud-based technologies. The various applications that we now utilize in the curriculum include the following Google products: My Maps (interactive mapping tool…different from Google Maps or Google Earth), Docs (a word processing app), Sheets (a spreadsheet app similar to Microsoft Excel), Forms (an easy way to create online tests and surveys), Google Analytics (a set of measurement and analysis tools that provide insight into website performance). And Google Site (to build a protected portal for project participants). Besides the distinct operations supported by each application, the integration of all of these apps in one Suite is extremely useful and efficient. When creating a set of building blocks and a “pipeline” for processing data, the products of one application can seamlessly “feed” into another. For example, data uploaded using Google Forms can be instantly viewed and manipulated in Google Sheets, which in turn can be viewed and visualized (as a map or graph or similar visualization). Further, the fact that each and every page has a unique URL allows for improved organization, navigation, and sharing. Finally, Google Analytics provides features such as automated data collection, real-time visitor tracking, and customizable reports. Analytics has also been built into popular video posting sites such as YouTube (which is now owned by Google) providing a window into student utilization and comparison of *SCAPE* video products.

Because of our relationship with the Telluride Institute, we were able to secure a non-profit account for no fee. This account, accessible to our Core Team, allows for coordination of the project. In addition, all of our researchers and teachers have dedicated user accounts (with the shared domain of @coloradoriverscape.org) that allow us to work together as an organization.

Newly developed lessons that specifically introduce the technology to the students are as follows:

Unit III / Lesson 1: Post Your data to the Cloud

Unit III / Lesson 2: Using Pivot Tables

Unit III / Lesson 3: Data Visualization

Unit IV / Lesson 3: Story Maps (using online GIS to visualize data and “stories of place.”)

Unit IV / Lesson 4: Collaborative “Smart Map” of All Partner Schools

Security and management

Security and management are critical. Careful consideration went into finding the right balance of freedom and control. The CMS had to allow viewing and engagement for a select group of researchers and teachers, but also provide a window into the project for the general public. The CMS enables secure active development and the hosting of finished forms, pages, and documents.

Implementation requires a lot of work and is loaded with many tasks such as helping people get access, applying access to users, providing a structure where people can effectively share and produce viable content, and trouble-shooting the inevitable problems that arise.

The content creators are the environmental science classes at our 10 partner schools. They have opportunities to publish different analysis spreadsheets, maps, or other documents to the *SCAPE* website and folders. Each school was set up with a web page—a “dashboard” —that hosted their data analysis and interpretive maps. As more data was added to the system there were opportunities for comparative analysis between the school and class site to the schools up and down river.

System Implementation

What are some of the key aspects of design and implementation of G-Suite as a Content Management System? We continue to support a diverse group of nearly 20 people, and these teachers, researchers, and education administrators are actively participating in the development of the written curriculum and the Water Quality survey form. The researchers have ‘write access’ to the content and the instructors have ‘read’ access.

Much time and energy has been spent creating and refining the *SCAPE* Field assessment Form, which supports the submission of water quality data. Not only is there a need to ensure that the process of entering values into the form is easy and understandable, the data being submitted needs to be secure of personally identifiable information as well as protected against erroneous data submissions.

This project is solely reliant on Google products. The services are very inexpensive, or free, but the quality of the tools only met and rarely exceeded the basic needs of the project.

Beyond any one digital tool or service, a mechanism for sharing water quality data between disparate communities across the West is now in place. Development is needed in integrating numerous online datasets (e.g., USGS, Forest Service, globe.gov; etc). This cloud-sourced data has potential for providing insights into the broader information “ecology.” It is clear that Content Management Systems can be applied to more than blogs or business—they can host environmental data for sharing and collaborative research.

The *SCAPE 2.0* framework is developed, tested, and solid. Despite certain difficulties with technical implementation and meeting the needs of a diverse user-base at the beginning, the digital tools and cloud-based technologies were enthusiastically embraced and effectively utilized by project researchers, teachers, and the students

***vi. Any changes in Key Personnel. If personnel changes have occurred, submit a revised EPA Form 5700-54 (Key Contacts Form) and a resume for the new contact.***

We have had no changes in key personnel. We have had a few changes in our school/teacher roster, as described in Item #3.

***vii. A statement about activity anticipated to take place during the subsequent reporting period.***

We are pleased with the status of the roll-out of the curriculum to students this Fall (2019). Individual phone interviews and a Quarterly Survey by Dr. Zora Ziasi (UOEEE) and a Zoom video Conference Call (Nov. 8, 2019) provided evidence of a successful launch of the curriculum in all six partner schools.

**Appendix**

**Quarterly Survey Results**

Of the six teacher participants in the SCAPE 2 program, four responded to the first quarterly survey which was conducted by the University Office of Evaluation and Educational Effectiveness (UOEEE) during October 2019 for the response rate of 67% (one teacher did not complete the survey and only provided partial responses). De-identified results are shown below.

**Table 1. Participating Teachers’ Responses to the First Quarter Survey Questions Regarding the First Lesson Implemented**

|  |
| --- |
| First Lesson Implemented |
| **Survey Items** | ***Survey Responses*** |
| ***Number of Lessons Implemented*** | 1 | 2 | 2 | 7 |
| ***Lesson Name*** | 2.3 Water Characteristics and Chemistry | 2.4 Macroinvertebrates | 2.3 Water Characteristics and Chemistry | 2.4 Macroinvertebrates |
| ***Number of Classes Implemented*** | 1 | 1 | 1 | 2 |
| ***Class Name*** | Advanced Chemistry | (Name of the State) Natural History | Ecology | Environmental Science; Environmental Science |
| ***Class Grade*** | 12 | 10-11 | 10-12 | 11-12; 11-12 |
| ***Class Size*** | 17 | 17 | 32 | 9; 17 |
| ***Class Length (in Minutes)*** | 55 | 150-190 | 90 | 180; 180 |

For the first lessons that they implemented, teachers also identified strengths, weaknesses, and modifications as shown below:

***Lesson Strengths:***

* “Hands-on field work.”
* “Students were able to make connections between macroinvertebrates as indicators of water quality and local collection of macroinvertebrates. Students were highly engaged and found the lesson interesting and informative. It was clear in its instruction and helped students make meaningful connections between water quality and its effects on habitat as well as implications for human health and interactions.”
* “Use of Vernier electronic probes for data collection.”
* “I really appreciate the depth of the summative background information provided in each of the field lessons. They provide me a solid framework as an educator to build additional support materials off of for my students that need modifications and/or additional support.”

***Lesson Weaknesses:***

* “Group work doesn't include much of a built-in structure, such as group roles for students. Hyperlocal data would enhance the lesson, are their specific macroinvertebrates in my area that indicate specific issues? How do entities in the area, or do they, use macroinvertebrates to determine stream health? Access to state or local data on water quality issues in my area.”
* “My class size is too big. I needed more equipment to collect data (probes and labquest computer modules).”
* “While not so much a concern for this activity because of my previous experience collecting this field data, sometimes the instructions for operating equipment for field data collection is a bit slim.”

***Lesson Modifications:***

* “I included several other water quality tests, mostly through the River Watch curriculum.”
* “I reviewed macroinvertebrates types and had students practice identifying before we collected samples. I also do not have any of the equipment yet so we have pieced together a collection of items to use in the collection of macroinvertebrates.”
* “I used this lesson in conjunction with research designed by the students. They were to investigate macroinvertebrate populations within Surface Creek and take various parameter measurements with the electronic probes such as temperature, pH, and stream velocity in their collection zones. Abundance of specific macroinvertebrates can be used as indices of water quality.”
* “We had a 4 day weekend right before our field day for MacroInvertebrate ID, so I created a take home packet that could be used for students to familiarize themselves with macroinvertebrates. I included the macroinvertebatre general anatomy key as well as the dichotomous key that are included in the lesson. I modified the background reading and added a life cycle coloring page for dragon flies. Additionally, I included a table with a few unknown macroinvertebrates for students to practice their ID skills before heading to the field. [Name] joined me in the field for one of my classes and had some additional laminated guides for my students to ID in the field. I liked this idea and printed and placed field ID materials into pocket page protectors for the field. I included the dichotomous key provided as well as a simplified one page ID sheet.”

For the first lessons implemented, participants rated the lessons as “Effective” (2 of 4 respondents) or “Very effective” (2 of 4 respondents) and further explained their ratings as follows:

* “This is an effective tool for having students do science and have the science they do be immediately relevant to them.”
* “Overall it was a great lesson, many of the lessons are directed at the Colorado river basin, which is similar but does contain some differences between our watershed. However, this lesson was broader in its location and therefore was easier to implement with less preparation time.”
* “Students are able to investigate multiple parameters and how those parameters may affect macroinvertebrate habitat as well as learning how parameters may be affected by other factors such as anthropogenic or environmental (agriculture, domestic water use, recreational water use, climate change, etc.)”

**Table 2. Participating Teachers’ Responses to the First Quarter Survey Questions Regarding the Second Lesson Implemented**

|  |
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| Second Lesson Implemented |
| **Survey Items** | ***Survey Responses*** |
| ***Lesson Name*** | 1.1 Environmental History and the Colorado River Basin | 2.1 Riparian and Habitat Diversity  | 1.1 Environmental History and the Colorado River Basin  |
| ***Number of Classes Implemented*** | 1 | 1 | 2 |
| ***Class Name*** | (State Name) Natural History | Advanced Biology | Environmental Science |
| ***Class Grade*** |  10-11 | 11-12 | 11-12 |
| ***Class Size*** | 17 | 10 | 9 |
| ***Class Length (in Minutes)*** | 100 | 90 |  |

For the second lessons implemented, participants also identified strengths, weaknesses, and modifications. Those results are shown below:

***Lesson Strengths:***

* “It was a great lesson in regards to looking at issues facing different watersheds. Students had a nice introduction into the importance of watersheds and water quality.”
* “Using transects to measure vegetation and understanding diversity on the school campus. Students were also able to compare campus diversity and understand disturbances on school grounds that may limit diversity.”

***Lesson Weaknesses:***

* “It was not based on the area in which I teach, students are asked to examine a basin that while important, is not directly related to my own watershed.”
* “Lacking equipment such as measuring tape (we used string), proper instruments to measure tree height as well as adequate vegetation identification guides. Also, the directions in the curriculum on how to measure vegetation laterally from the transect was not completely clear.”

***Lesson Modifications:***

* “I had students compare and contrast data about the Colorado river basin and our own watershed.”
* “Used string to measure out transects and modified the distance from each transect that was measured.”

For the second lessons implemented, participants rated the lessons as “Effective” (1 of 2 respondents) or “Somewhat effective” (1 of 2 respondents) and further explained their ratings as follows:

* “Students were a bit curious as to why we were looking at the Colorado river basin and not something closer to home.”
* “This class did not feel they were able to identify plants in their transect accurately and did not measure tree height accurately.”

Participants provided final comments which included barriers/challenges as well as suggestions for improvement.

***Barriers/Challenges:***

* “The SCAPE curriculum is interdisciplinary which is fantastic from a holistic learning perspective. However, because schools teach content in a fragmented fashion, implementing the SCAPE lessons either require a partnership between a science teacher and a humanities (social studies) teacher or an elective class with considerable freedom.”
* “I do not yet have all of the equipment and material needed for the fieldwork. Time, time is a large component of all challenges in implementing the curriculum, [name of the state] Natural History is one class of 4 different content areas that I am teaching, so finding time to properly implement the curriculum can be difficult.”
* “Lack of equipment/resources and class sizes are too large.”

Only one teacher provided a ***suggestion for improvemen****t:*

* “Creation of video tutorials for each lesson may be helpful or regional refresher trainings for instructors on how to implement lessons.”