2020 Summer Research Internship Resource

This document contains: an example internship schedule, research project descriptions, and the 2020 Internship Evaluation Report.

First2 Network Summer Immersion Virtual Research Schedule
Example from West Virginia University
Summer 2020

Black text = Live Meeting
Green text = Project Work On Your Own

Add photos to the shared Google Photo Album
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Sunday, July 19th:

- 3:30-5pm Welcome & Introductions
- 7pm-8:30pm Evening Team Building with Adventure WV

Monday, July 20th: Research with Dr. McCusker

- 8:45am Housekeeping
- 9:00-10:30am - Introduction: What is "Community Mapping"?
- 11:00-12:00 - Registering users and demonstration of OSM website
- 1:30-3:00 - Basic elements of using OSM
    - Assignment: Generate a list of community development and/or social issues that you think needs mapped.
- 3:30pm "Understanding the COVID-19 Pandemic: The Key to Control" by Dr. Rita Rio
- 6-7pm Optional Tour of the Green Bank Telescope (*)
- 7pm How to Be an Anti-Racist national presentation by author Ibram X. Kendi (*)
- 8pm-8:30pm Debrief

Tuesday, July 21st: Research with Dr. Bergeron

- 8:45am Housekeeping
- 9-10: Intro to Zebrafish
- 11-12: Zebrafish & Human Disease Modeling lecture
- 1:30-3: The Zebrafish Film & Annotated Bibliography Activity (on your own)
- 3:30pm: First2 Scholars Program (High Rocks + GBO, confirmed)
- 7-9pm Evening with Mentors

Wednesday, July 22nd: Research with Dr. McCusker

- 8:45am Housekeeping
- 9:00-10:30 - Discussion of community issues
- 11:00-12:00 - OSM training # 1: Mapping Buildings in OSM
    - 1:30-3:00 - Individual OSM work time (guided by McCusker and Pyron)
- 3:30pm: "Mental Health: Stigma and Reaching out for Help" by Kayla Meador and Stephanie Harrison from WVU Carruth Center
- 7-9pm Evening with Mentors

Thursday, July 23rd Research with Dr. Bergeron

- 8:45am Housekeeping
- 9-10am: "Connecting zebrafish to environmental health"
- 11am-12pm: Discussions + Q&A
- 1:30-3pm: WVU Water Quality Impact Portal (on your own)
- WVU's Summer Undergraduate Research Symposium opens at 11 am (EST) will be asynchronous throughout the week. Presenters will be available in real-time from 2-4:30 pm on July 23 to answer questions and respond to comments. (First2 link to provide feedback and for attendance: https://wvu.qualtrics.com/jfe/form/SV_2aGQT8Z1yDnHgLb)
- 3:30pm: Zebrafish Lab Tour via Zoom (*)
- 7-9pm Evening with Mentors

Friday, July 24th Research with Dr. McCusker

- 8:45am Housekeeping
- 9:00 - 10:00 - OSM training #2: Mapping Roads with OSM.
- 11:00 - 12:00 - Individual Guided Work Time
- 1:30-3:30 - Community development/social issues mapping in OSM; propose a project
- 3:30pm: SPOT Presentation "Climate Change in the Mountain State" + How to Become a SPOT Ambassador by Dr. Kathryn Williamson
- 7-9pm Evening with Mentors

Saturday, July 25th

- 9-10am Check in with Mentors
- Outdoor Adventures
- 7-9pm Evening with Mentors

Sunday, July 26th

- 9-10am Check in with Mentors
- Outdoor Adventures
- 7-9pm Evening with Mentors

Monday, July 27th - Research with Dr. Bergeron

- 8:45am Housekeeping

- 9-10: Discussion of water quality portal results / The scientific method & experimental design lecture
- 11-12: Zebrafish experimenting basics / how to collect, interpret, and present data / Writing a brief research proposal with zebrafish
- 1:30-3: Perform water quality tests (on your own)
- 3:30pm: Responsible Conduct of Research
- 7-9pm with Mentors: Evening with Mentors

Tuesday, July 28th Research with Dr. McCusker

- 8:45am Housekeeping
- 9:00- 10:30 - Community mapping & Ethics of Open Mapping
- 11:00- 12:00 - Sources of Data for Mapping
- 1:30- 3:30 - Individual work on community mapping project (on your own)
- 3:30pm: Panel on Graduate and Professional School applications: What you need to know (*)
- 7-9pm with Mentors

Wednesday, July 29th Research with Dr. Bergeron

- 8:45am Housekeeping
- 9-10: Discussion of Water Quality Results
- 11-12: Writing Results, Making Tables, Practice Talk
- 1:30-3: Idea Walk (on your own)
- 3:30pm: “Teach Yourself How to Learn” and “Study Harder Not Just Smarter” Book Club
- 7-9pm with Mentors

Thursday, July 30th Project Presentations!

- 8:45am Housekeeping
- 9-10:30am: Presentations
- 11-12pm: Presentations
- 1:30-3:30pm: Presentations
- 3:30pm “How to get involved in undergraduate research during the school year” by WVU Office of UG Research
- 7-9pm with Mentors

Friday, July 31st

- 9am-10:30am Wrapping Up
- 11-12pm: Closing Ceremonies

2020 First2 Research Project Examples

GBO WVU-Tech Research Project.

The Green Bank Observatory received a substantial grant from the National Science Foundation to build an innovative receiver that will dramatically improve the Green Bank Telescope for low frequency research. A key problem to be solved in order to make this new technology work is real-time removal of Radio Frequency Interference, or RFI.

The Green Bank Telescope is the world's largest fully steerable dish, and as such is incredibly sensitive; to signals from the Universe and from earth-based technologies. The first are what we want to detect, and the second, RFI, can completely swamp astronomical data. RFI refers to any radio signals created by humans, and their technology. Think of it as light pollution, but in the radio part of the spectrum.

As a Research Intern, you will be directly contributing to the development of this new cutting-edge receiver, in one of two ways. You will work in small teams to:

1. Characterize cyclostationary RFI plots to be used for future machine learning algorithms. In teams of two-three, characterize a dataset of cyclostationary plots. Each team will have at least 100 plots to characterize. How can you sort synthesize the data that you collect? How does your analysis compare to others?

   As a Quality Assurance measure, and in order to validate your characterization data, 25% of your plots will also be analyzed by another team. You will need to meet and come to common understanding on these plots which will in term help to standardize your responses to the others. Document the outcomes of these discussions to share with the whole group.
2. Define a future database structure to enable others to continue this work while capturing the research output. Google folders won't cut it if we expand this project!!

   You have learned about cyclostationary data and also categorized some of them. You understand the various features of the plot and what data needs to be collected from the plots. Now some of you are going to learn about designing an efficient data management system for the user collected information. For this purpose, you are going to learn what databases are and how databases work with web programs. You will work in groups to design a database system and its functionalities for storing and managing cyclostationary data. If you are interested, you can also learn about Artificial Intelligence/Machine learning and work on proposing models/requirements for analyzing the collected data.

   At the end of your internship you will present the results of your work, and thoughts for future directions in a colloquium style session.

WVSOM Research Project
Characterization of Water Quality and Eukaryotic Microorganisms in West Virginia Fresh Water Sources

Hypothesis: Different water sources have different quality

Hypothesis: Different water sources serve as specialized niches to different eukaryotic organisms

Hypothesis: Different water quality is associated with different organism diversity and/or density
Hypothesis: Different data collection methods will result in different project outcomes

Specific Aim 1: To learn how to use a light microscope
Specific Aim 2: To characterize the eukaryotic microorganism is various environmental water sources
Specific Aim 3: Citizen science aim
Specific Aim 4: To understand the impact of different methodology or equipment on outcome of data collection and analysis

Methodology:
For Aim 1, we will teach the students how to properly use the light microscope and maintain its function. This can be done via remote sessions where we all have our microscopes out and teach the students, who also have their microscopes to practice. Perhaps this is where pre-made commercial slides may be useful. (Estimated time = 1 day)

Reagents and Materials:
Light microscope
Power source (electrical outlet)
Slides (commercial) Marc
Lens cleaner Marc
Lens wipes Marc
Oil (oil immersion objectives) Marc
Cover slips Marc
Phone app and magnifier unit for phones Chris

For Aim 2, the students will find water samples from various environmental locations and mark it on a map, with a description of the sample source. They will collect the water in a small sealable container/using the kits provided (see below). Once home, they will place a drop of water on the slide and use the 4X, then 10X objective to visualize the microorganisms. In their data notebook, they will draw and describe the characteristics of the organisms and their behaviors. They can take pictures of various images under the scope as well. Once they are complete, they will use sources on the internet to identify the organism. At the end of the project, they will all share their data and compare/contrast the organisms from the various locations. (Estimated time = 1 sample a day for 4-7 days. The remaining time is comparing/analyzing the data.)

They will follow the directions in the kit from EarthEcho Water Challenge for the water quality monitoring. Similar amount of time for collection of data (4-7 days). then they will have the rest of the experience for analysis, choosing/developing hypothesis and presentation.

Sources: https://microscope-microscope.org/pond-water-critters-protozoan-guide/

For AIm 3, we will have the student use the Citizen science EarthEcho kits on water quality monitoring, and collect data as described in the kits
Citizen science: EarthEcho Water Challenge www.monitorwater.org
Kits for water quality monitoring
Citizen science: EarthEcho Water Challenge (formerly World Water Monitoring Challenge
http://monitorwater.org/ Kits: https://secure.lamotte.com/wwmday/ @ $13.25/each

For Aim 4, all data collected will be analyzed with both the light microscopes and the phone app/microscope units. Values will be compared between "method" approaches.

WVU Research Projects
Fish in a dish: Using zebrafish as a model for environmental health

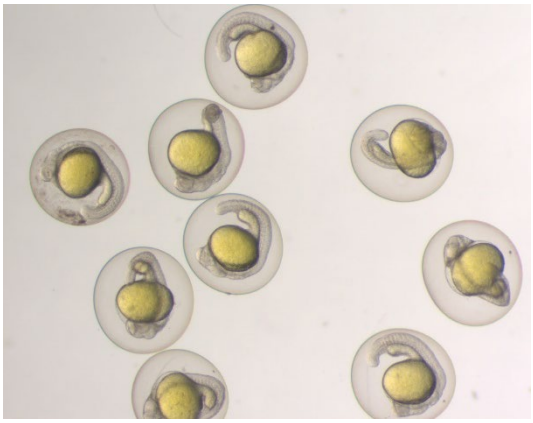
Main supervisors

Dr. Sadie Bergeron, Ph.D., Assistant Professor, Department of Biology
Becca Coltogirone, graduate student, Department of Biology

Goals of the project

Students will gain knowledge of zebrafish genetics, development, and use in biomedical research as a model for human diseases. Using knowledge of the EPA water quality test standards, students will conduct water quality tests to assess nearby water sources. They will use this information to design experiments to test the impact of various water quality parameters on the development of zebrafish body systems and behavior.

Project description



Top image: Adult zebrafish. Bottom image: Zebrafish embryos at 1 day post fertilization. Images are from Bergeron Lab.

Zebrafish (*Danio* rerio) are a popular vertebrate model system for understanding questions across many scientific disciplines. Zebrafish breed externally, can generate hundreds of embryos in a single male/female pair spawning, are transparent during the first 2 days of development, and develop rapidly, making them great for research purposes as well as student learning and experimentation.

Through our project, students will learn about and apply their knowledge of zebrafish to a theoretical problem. To begin, students will be introduced to zebrafish through lectures highlighting their biology and uses in biomedical research and education. Students will then learn about the EPA water quality standards and how zebrafish can be used to understand issues related to water quality and human and environmental health. From this, students will complete an experiment where they use water quality testing kits to assess the "health" of water sources in or around their home. Finally, students will be tasked with integrating their knowledge of zebrafish, the EPA standards, and experimental design into a research proposal describing an experiment they could do to assess the health of the same water sources.

Theoretical knowledge that participants will acquire

- Basic zebrafish biology and uses in research and education
- Zebrafish as a human health and disease model
- The scientific method and considerations in experimental design
- EPA water quality standards and implications on aquatic life

Key references for further reading

1. Hutson, Lara D., and Jennifer O. Liang. "Making an impact: zebrafish in education." *Zebrafish* 6.2 (2009): 119-121.
2. Information about the EPA water quality standards: https://www.epa.gov/standards-water-body-health/what-are-water-quality-standards

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Mapping Appalachia: Using Open, Free, Web Software to Map Community Development Issues

Main faculty supervisor

Dr. Brent McCusker, Jaimee Pyron (Department of Geology and Geography)

(https://www.geo.wvu.edu/faculty-and-staff/faculty/brent-mccusker)

Goals of the project (for the summer)

We will use open, free, and web-based software to help students identify and map local development issues that they identify as important in their communities.

Project description

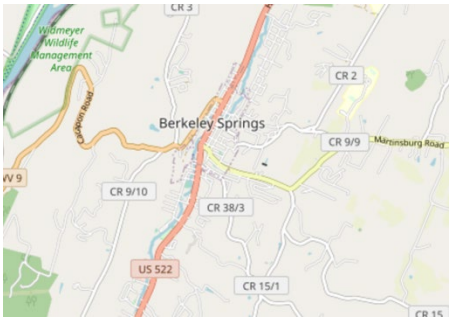
This project has two overarching goals. The first is to help students identify community development issues in their own communities. To do this, the project will review how people around the world have done this to improve their prospects for economic, environmental, social, and community development. There will be blended demonstrations and discussions to help participants begin to understand what makes a development issue and whether or not mapping technology might be useful in identifying or addressing the issue(s).

Secondly, students will learn how to use mapping technologies to make sure that both their communities and their development issues are "on the map" and represented as they see them. The online mapping platform is designed to be easily accessed without any specialized computer equipment, however, a computer or tablet, and internet connection is required. Computers can be Mac, Linux, or PC. Tablets can be iOS or Android.

Training will be interspersed with discussion of development and mapping strategies. Students will have to identify and begin to map a local development issue by the end of the workshop. The lecturer and an assistant will help students in breakout sessions

Skills that participants will acquire

- Identification of community development problems
- Basic map making
- Application of development concepts to mapping technologies
- General research and problem-solving skills



Location of the project

Online

Key references for further reading

1. http://osm.org (OpenStreetMap)
2. http://teachosm.org (self-paced training modules)

WV State University Research Projects

Light Up West Virginia – participate in Citizen Science project with WV DNR

Fireflies (also known as lightning bugs) numbers have been declining over the years due to habitat loss, pesticide use and other environmental causes such as light pollution. There has never been a formal assessment of fireflies in West Virginia but it is expected from work in other states that we have somewhere between 23-41 firefly species. The WV Department of Natural Resources (DNR) started a project to understand declining firefly populations and they need our help. With data collected by you and others in our state, they hope to better understand the scope of the decline and what species are present in our state.

Almost all of us have watched fireflies' flashing displays. So what are they? Fireflies are soft-bodied beetles that produce light via a chemical process called bioluminescence to attract mates and prey. Each species has its own unique flashing patterns, but it is male species that has its own unique flash as females are rarely seen. Because they use this light to reproduce, fireflies are extremely sensitive to light pollution and artificial light at night.

What will you do: We need students to go to a location or two away from light pollution and artificial light to observe fireflies, take required and optional data and hopefully photos or videos as well. Then submit the data via the survey app to the WV DNR (with a pdf of the data to the WVSU coordinator for us to assemble our data). Using our data

1) locate where we are finding fireflies and are these different then what is on the current WV map at WV DNR?

2) tentatively identify species tracked

What is needed:

- A location away from light pollution and artificial light to be able to observe fireflies
- A cell phone with service to be able to collect data. The survey can be filled out later via the survey app.
    - Survey123 App and link to https://arcg.is/CyfT0
    - stopwatch app (timing)
    - Google Maps (GPS coordinates)
    - weather app (temperature)
    - voice recorder to take notes during the survey to be transcribed later
- Optional: Conserving the Jewels of the Night (downloadable pdf) https://xerces.org/publications/guidelines/conserving-jewels-of-night
- Optional: Milkweeds and Nectar Resources https://www.wvmonarch.org/milkweeds-and-nectar-resources.html
- Optional: Glass jar to temporarily collect fireflies for observation

Research project duration: 2-3 days/evenings for observation and data collection

Number of students that can be involved: as many as are interested, as this is part of a larger statewide initiative by the WV DNR

Data that must be collected:

- Date of survey
- Location (GPS coordinates)
- Observation times (start and end)
- Temperature (weather app or outdoor thermometer)
- Was this a daytime, non-flashing species?
- Flash color
- Flash shape
- Flash synchrony

Optional data that should be collected if possible:

- Additional weather descriptions
- Habitat description
- Milkweed plants in the area?
- Flash number – follow one individual among a group (preferably) several times to gather this data which helps to identify the species
    - Number of flashes of one individual in a 15 second time period
    - Were there two flashes per second instead of only one?
    - Number of seconds in-between a flash ("dark period) of one individual
- Additional notes
- Pictures and videos

Survey participants also are encouraged to share photos on social media with the hashtag #LightUpWV.

Additional Resources:

- Lewis Lab https://ase.tufts.edu/biology/labs/lewis/Default.htm
- Ted Talk by Sara Lewis https://www.ted.com/talks/sara_lewis_the_loves_and_lies_of_fireflies?language=en
- Why the lights are going out for fireflies https://www.theguardian.com/environment/2020/feb/22/why-lights-going-out-fireflies-conservation-pollution
- Silent Sparks: the wondrous world of fireflies blog https://silentsparks.com/category/blog/
- World Firefly Day https://fireflyersinternational.net/world-firefly-day

First 2 WVSU Summer Research Proposal 2

Submitted By: John Lucas (WVSU site student mentor)
Study Title: Assessment of Local Surface Water Quality

Summary: Experiential learning is essential for student success and skill development. In this two-week summer internship program students will conduct a water quality assessment of local surface waters. Under the COVID 19 pandemic guidelines this project will be conducted remotely. Surface water quality in West Virginia is of ongoing concern due to human activity and impact thereof on our natural environment. Students will learn about the impact of water quality on human and environmental well-being and how a water quality assessment is conducted (selection of a site to be measured, documentation of their work, and data analysis).

Introduction: Experiential learning is a critical function of the modern higher education system. It is common for a college student today to pursue and work in at least one internship. The goal of these internships is to provide students experiential learning to broaden their education and prepare them for the workplace. It has been noted that undergraduate students who participate in part-time work relevant to their field of study see an improvement in terms of academic performance and graduation rates[1]. Integrating incoming college students into a university's existing experiential learning framework will ease the student's transition from secondary to post-secondary education. Conducting an experiential learning program under the COVID-19 protocols presents challenges in running the program remotely.

West Virginia is located at the headwaters of the Potomac River Basin and Ohio River Basin and nearly all rivers and streams in WV ultimately flow into these river systems. Anthropogenic activities (mining, chemical industry, etc.) and natural processes (sedimentation, erosion) impact the water quality of the state's surface waters. Managing the quality of surface water in WV is critical to maintaining the health of both the waterways in the state and the health of the river systems these tributaries feed into. According to the 2018-2019 water resource report published by the West Virginia Department of Environmental Protection, WV experienced 65 inches of rainfall in 2018[2]. After a rain event this water moves through WV's watersheds, with the quality of these waters impacted by natural processes and land use. A study published in 2018 explored the design of a survey to monitor the quality of surface water at a sub watershed level with respect to different land use impact on water quality. The study noted that the impact on stream water physio-chemical characteristics correlated with land use and spatial parameters (where the water is compared to the source of contamination)[3]. Surface waters impacted by anthropogenic activity differ in the changes in their composition with respect to different land use; urban, agricultural, mining, and industrially impacted streams will demonstrate different water quality issues. Surveying and monitoring water quality parameters is critical to the identification of sources of contamination, the maintenance of healthy waterways, and the remediation of contaminated water ways. To that end several watershed associations have been formed to monitor and remediate waterways in local watersheds. These organizations collect simple initial data on the chemistry of the waterway (pH, temperature, etc.), sample the waterway, send these samples off for detailed chemical analysis, and remediate the waterway where necessary. In this project students will assess surface water quality at sites of their choosing and evaluate the quality of water at their chosen sites while maintaining social distance. The list of objectives this project aims to achieve is given below.

Objectives:

1. Students will conduct a water quality assessment is conducted and how to document their work.
2. Students will learn about water quality and how it affects people and the environment.

Approach: To meet Objective 1 students will be asked to measure different parameters that pertain to water quality at specific area(s) of interest close to their home. A protocol will be developed to provide safe guidelines on how to identify a site to assess, take measurements, and to sample of the site. Students will document the sites they choose to measure including GPS position of where measurements were taken and pictures of the site. Measured parameters will include pH, conductivity, hardness, ammonia, nitrate, nitrite, phosphate, and total iron at each site. Students will be asked to take samples and measurements at 3 locations per site: upstream of the point of interest, at the point of interest, and downstream from the point of interest. The students will repeat this process at 3 different sites. At each of the measured points students will collect a 125 mL sample to be sent to Dr. Amir Hass's lab where analysis of the sample will be performed. To meet Objective 2 the Zoom program will be used to provide an educational platform to teach the students about water quality and to show the lab analysis of their samples with an explanation of what is being done and why. Student mentor and faculty will review the data with the students and guide them through the data analysis and conclusions drawn from the data. Finally, students will prepare a presentation of their assessment and results to be given at the end of the program. The proposed budget is detailed in the following section.

Budget: Total cost of the project: $536.05. This will support four students in conducting the water quality assessment survey. Table 1 shows the itemized cost for the project.

Table 1. Itemized Budget Estimate

Item	Unit Cost	Units	Total
Total Hardness Test Strips	$9.25	4	$37.00
Ammonia (Nitrogen) Test Strips	$25.75	4	$103.00
Nitrate and Nitrite Test Strips	$14.99	4	$59.96
Total Iron Test Strips	$19.83	4	$79.32
Conductivity, TDS, and Temperature Meter	$14.97	4	$59.88
pH Test Strips	$9.04	4	$36.16
Phosphate Test Strips	$19.86	4	$79.44
125 mL Sample Bottles (pkg of 12)	$19.11	3	$57.33
Tape	$5.99	4	$23.96
Total Cost			$536.05

References:

1. Gilbert, B. L.; Banks, J.; Houser, J. H. W.; Rhodes, S. J.; Lees, N. D. Student Development in an Experiential Learning Program. *Journal of College Student Development* **2014**, *55* (7), 707–713.
2. 2019 Annual Water Resources Report - WV Department of Environmental Protection (accessed Jun 2, 2020).
3. Kellner, E.; Hubbart, J.; Stephan, K.; Morrissey, E.; Freedman, Z.; Kutta, E.; Kelly, C. Characterization of Sub-Watershed-Scale Stream Chemistry Regimes in an Appalachian Mixed-Land-Use Watershed. *Environmental Monitoring and Assessment* **2018**, *190* (10).

University of Charleston Research Project
The Great WV Beechdrop Quest: the state of Beech tree conditions in WV.

Researcher: Aida Jimenez

Research Project Background: Fagus grandifolia (American Beech) is an abundant hardwood tree covering a vast range of forests in the in the Midwest and Eastern United States. Although this tree is not very popular with the foresting industry, it has many important ecological functions. For example, many vertebrates depend on the nut produced by the beech tree as a food source (Gilman & Watson, 1993 and Frost, 2019) . The Beech tree also happens to have leaves with the highest Nitrogen content compared to other canopy trees in nearby forests (Latty, Canham, & Marks, 2004). In addition the larger trees can provide cavities as long-term habitat for forest wild life (Frohn, 2019).

The Epifagus virginiana, also known as a Epifagus, is a non-photosynthetic plant that belongs to the family Orobanchaceae and it parasitizes the roots of the American Beech tree (Cui et al., 2018; Grafton, 2008). Epifagus can be spread randomly around the tree's base either individually or in clusters. This holoparasitic plant uses its haustorium to cheat the tree of nutrients, but it does not appear to negatively affect the tree otherwise (Grafton, 2008).

Currently very little is known about how the connection between the Beech tree (host) and the Epifagus (parasite) forms. No research is available that explains how the Epifagus colonizes the beech tree and what chemicals are involved in the colonization of the tree. The availability of these two plants in the eastern US, makes it a good model system to understand holoparasitic interactions and we have begun to study this plant.

Need for Citizen Scientists: In order to have a larger sample size to study this ecological community of beechdrops and beech trees, and to learn more about the abundance and distribution of Epifagus in WV, we want to identify beech trees across different WV landscapes which are colonized to eventually see if the trends we have identified at the plants sampled from the Kanawha State Forest are also present elsewhere. We also want to use this opportunity to assess the overall health of the beech trees in the areas you hike, so we are asking you to look at the trees to spot the presence of beech back disease and beech leaf disease.

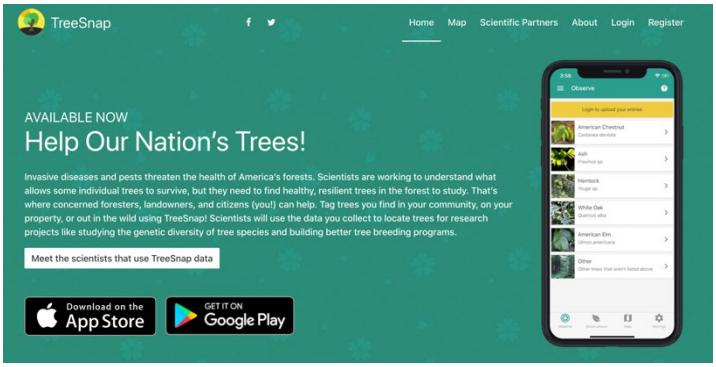
We can leverage the power of crowdsourcing and the availability of the free app TreeSnap ® to collect much needed data while you are out hiking the trails at the New River Gorge hiking trails. If you are hiking the following trails in the Grandview or Sandstone Areas

- Grandview Rim Trail
- Little Laurel Trail
- Castle Rock Trail
- Big Buck Trail
- Island Loop Trail
- Gwinn Ridge Trail
- Big Branch Trai

Or if you are hiking anywhere else in the state or have beech trees in your property, help us by keeping an eye out for beech trees and then identifying whether they have Epifagus or not. Every observation from anywhere in the park will help.

First read this document with images of the plants you are looking for. Luckily, beech trees are very easy to spot, so all skill levels are welcomed to do this project.

How to participate:



1. Read these instructions carefully before you start.
2. Before you are ready to go on a hike, download the TreeSnap ®app to your smart phone from the App Store or Google play.
3. Make sure you allow the app to access your location. This is really important so that we can register the GPS location of your tree automatically once you upload the picture.
4. Register with the app (create an account) and log in so that we can associate your id/name with your data. This is an educational project and we are committed to privacy. Your information will not be shared with anyone. Only the data collected will be used by the educators and researchers involved in this study.
5. Go on a hike in any of the amazing trails in the NERI system of trails and remember to follow all safety measures and social distancing procedures and have fun.
6. If you spot a beech tree, open the app and click “Other” to add a tree to the list.
7. In the “Add Entry” tab click “Images” and take a picture of the tree, a leaf, and the bottom of the trunk. Notice that if you allowed the app to use your location, your GPS location is automatically shown at the bottom of the entry form. This is the most important piece of information we need.
8. Check the tree for Epifagus colonization. Look at the base of the tree and near and around the tree. Because Epifagus can attach to any tree root they can be found anywhere in the immediate proximity to the tree. If there is Epifagus, take a picture of it also.
9. In the “tree type” start typing “American beech (Fagus grandifolia)” and it should show up as a choice. Don't worry if you are new to species identification. We will look at your picture and confirm your identification.
10. Select the habitat under “habitat” tab. Ddo your best if you do not know.
11. Under comments write whether you spot bark or leaf disease. Write “Leaf Disease” or “Bark Disease” if you notice either or both. If you do not notice any diseases, leave blank.
12. Click “Save” when you are finished! Thank you for your participation.

Notes on being a good and respectful citizen scientist:

Do your best to minimize disturbance to the area and the flora you are observing, so please:

- stay on the trail
- take only photographs
- watch where you place your feet

Additional instructions for students: As you identify the beech trees, you will also collect a soil sample nearby the tree for chemical analysis. For this you will need the materials and instructions sent to you in your package. Collect 4 spoonfuls of soil no more than 5 cm away from the Epifagus plant if present or the Beech tree if not. Place the soil in ziploc bag and store in the refrigerator until ready to use.

Species Identification guide: How to Identify a Beech Tree? Printing or downloading this guide on your phone may help with quick reference access.
https://wvforestry.com/pdf/Tree%20ID.pdf

References:

- West Virginia Division of Forestry and the Tyler County FFA Chapter. ***West Virginia Trees Basic Tree Identification For FFA Forestry Contest.*** WVforestry. https://wvforestry.com/pdf/Tree%20ID.pdf
- **Maryland Biodiversity project:** *American Beech Fagus grandifolia Ehrhart* *https://www.marylandbiodiversity.com/view/1542*
- **Wikipedia. (2020, 5, 20) *Fagus grandifolia*** https://en.wikipedia.org/wiki/Fagus_grandifolia

How to identify Epifagus (Beechdrops).

Locate a beech tree and look at the base of the tree to see if you can spot the brown twig like Epifagus. They may be found near the base of the trunk or nearby. Beechdrops are very easy to miss. Their color can vary from creamy white to brown with red or brown and deep purple accents. Beechdrops sprout in late summer, start to bloom in late August through October. By the late fall they look like any other dried up sticks in the forest and these dried sticks can persist through the winter into the spring.

Find more pictures of all developmental stages of Epifagus in this video https://www.youtube.com/watch?v=wDwhwaF98qE.

References:

WV Botanical Garden at the Tibbs Run Reserve. Beech bark disease. https://www.wvbg.org/education/invasive-species/beech-bark-disease/

Forest Invasives. Leaf beech disease. https://forestinvasives.ca/Meet-the-Species/Pathogens/Beech-Leaf-Disease#86227-signs--symptoms

Internship Evaluation Report

The intern survey is administered to student participants in the Network's immersive research experiences before and after their participation to assess changes in their STEM efficacy, identity, and education and career plans; sense of school belonging; and knowledge of, attitudes about, and skills to conduct research. Nine sites offered virtual two-week research internship experiences in Summer 2020, which included 77 students, as listed below.

- Fairmont State University (July 19-August 1, 8 students): Students gained experience in analytical chemistry, solar cells, and microbial communities.
- Green Bank Observatory (July 19-August 1, 8 students): Students worked in teams to analyze archived Radio Frequency Interference (RFI) data to curate a categorized and searchable database that includes common RFI features.
- High Rocks (July 12-25, 7 students): Students conducted research on dendrochronology in collaboration with researchers from West Virginia University.
- Marshall University (July 19-August 1, 9 students): Students conducted research activities in chemistry, biology, computer science, and forensics.
- University of Charleston (July 19-August 1, 6 students): Students learned how to conduct tests on soil samples as part of a national program with the University of Wisconsin and Yale. The participants examined the unique Appalachian forest soils for novel antibiotic producing microbes.
- West Virginia School of Osteopathic Medicine (July 19-August 1, 7 students): Students gained research experience in areas such as bacterial protein toxicity, biomechanics, chemotherapy agents, and femur morphology.
- West Virginia State University (July 19-August 1, 10 students): Students assisted faculty to conduct research on neural networks, organic synthesis, integrated pest management, novel cancer treatments, and gene expression.
- West Virginia University (July 19-August 1, 13 students): Students participated in research on developmental biology addressing questions related to human and environmental health and geographical mapping of the socio-economic needs of Appalachia.
- West Virginia University Institute of Technology (July 19-August 1, 9 students): Students collaborated with faculty to develop programs or apps in virtual or augmented reality, inventory management, and computer assisted optimization of solar cells.

Students who were 18 years or older completed an online survey at the beginning and ending of the internship. At pretest, five respondents were not yet 18 and were exited from the survey; 69 of the remaining 72 students completed a pretest survey (96% response rate). At posttest, 59 students who were 18 or older completed a posttest survey (77% response rate). Results were aggregated across all nine sites for this analysis.

Sixty-seven percent of the respondents were female, and 81% were White (7% were Asian, 6% were Black or African American, 3% were Hispanic or Latino/a, and 3% selected "other"). Sixty

percent qualified for a federal Pell grant, and 58% considered themselves as first-generation college students, and 48% described the place they grew up as rural (26% town, 22% suburb, and 4% city). Students identified a variety of majors they have or intend to declare, as shown in Table 17. Thirty-six percent reported Biology, Chemistry, or a dual Biology/Chemistry major (20%, 10%, and 6%, respectively) and 19% reported Engineering.

Table 17. Students' College Majors

Major	Number	Percent
Biology	14	20%
Biology/Chemistry	4	6%
Chemistry	7	10%
Computer/Information Science	4	6%
Cyber Security	1	1%
Dental Hygiene	2	3%
Dietetics	1	1%
Engineering	13	19%
Environmental Science	1	1%
Exercise Physiology	5	7%
Forensics	4	6%
Immunology and Medical Microbiology	3	4%
Neuroscience	1	1%
Nursing	2	3%
Occupational Safety	1	1%
Physics	3	4%
Psychology	1	1%
Science Education	1	1%
Undecided	1	1%

Notes:
- Percentages may not equal 100% due to rounding.

Results are shown in Table 18 for the five subscales of STEM Career, STEM Efficacy, School Belonging, STEM Identity, and STEM Plans (on a 5-point scale of Strongly disagree to Strongly agree), as well as the four subscales of Knowledge About Research, Attitudes and Behaviors About Research, Personal Skills, and Research Skills (on a 5-point scale of None to A great deal).[i] At pretest, the highest subscale was for STEM Plans at 4.49 (SD 0.54); lowest rated subscales were Knowledge About Research and Research Skills (means of 3.37 and 3.36; SDs of 0.68 and 0.70, respectively). At posttest, STEM Plans was again the highest rated subscale at 4.45 (SD 0.63) and STEM Career was lowest at 3.74 (SD 0.61). The Knowledge About

Research subscale showed the greatest among of change from pre to post (0.61). Figure X depicts the pre/post mean scores for all nine subscales.[1]

Table 18. Student Research Internship Pre/Post Survey Results

Subscales	Pretest Results			Posttest Results			Mean Difference (post – pre)
	Number	Mean	Std. Dev.	Number	Mean	Std. Dev.	
STEM Career	69	3.78	0.59	59	3.74	0.61	-0.04
STEM Efficacy	69	3.99	0.61	59	4.08	0.51	0.09
School Belonging	69	3.94	0.62	59	4.24	0.71	0.30
STEM Identity	69	3.80	0.67	59	4.01	0.76	0.21
STEM Plans	69	4.49	0.54	59	4.45	0.63	-0.04
Knowledge About Research	69	3.37	0.68	59	3.98	0.61	0.61
Attitudes/ Beh. About Research	69	3.59	0.80	59	3.94	0.69	0.35
Personal Skills	69	3.62	0.72	57	4.09	0.60	0.47
Research Skills	69	3.36	0.70	59	3.82	0.66	0.46

[1] Cronbach alpha reliability estimates were computed for each subscale and for the overall set of rated items. At pretest, subscale values ranged from 0.71 to 0.90, with an overall value of 0.95. At posttest, subscale values ranged from 0.72 to 0.95, with an overall value of 0.96.

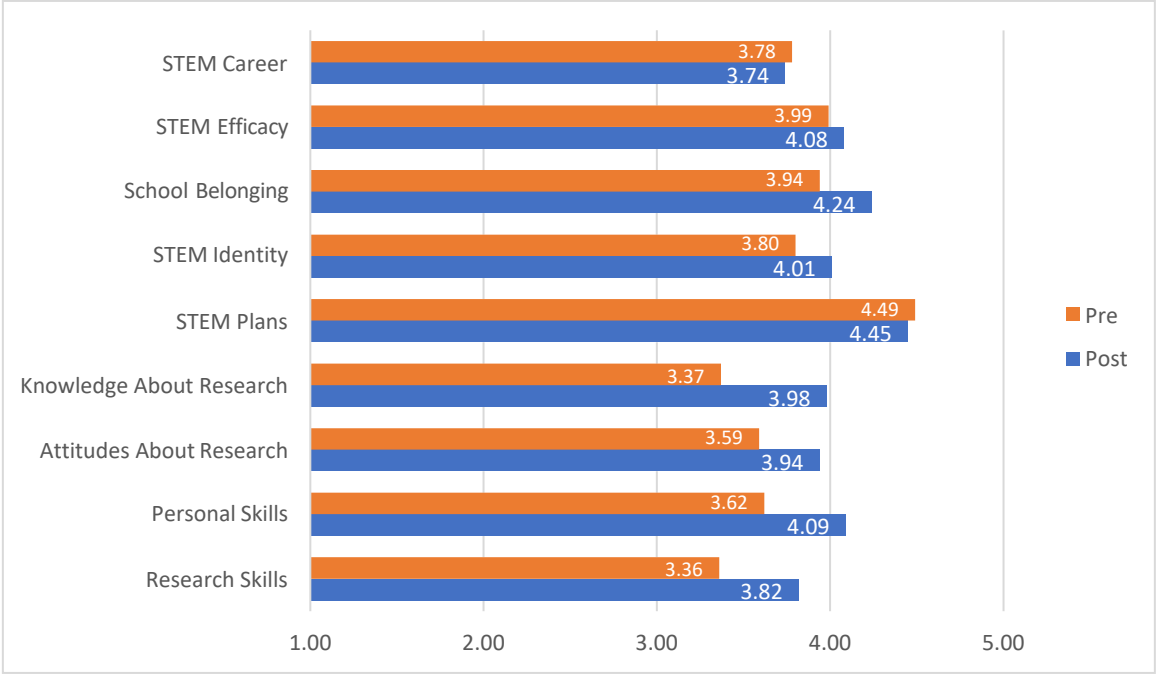


Figure X. Pre/Post Mean Subscales Scores for Student Research Internship Survey

To investigate whether any of the pre/post changes were statistically significant, a matched pairs *t* test was conducted for each of the nine subscales. A total of 58 matched pairs (linking each individual's pre/post scores) was identified for eight of the subscales; 56 matched pairs were identified for the remaining subscale (Personal Skills). This analysis revealed statistically significant results for six subscales, as shown in Table 19, in which students' posttest scores were higher than their pretest scores, including School Belonging, STEM Identity, Knowledge About Research, Attitudes and Behaviors About Research, Personal Skills, and Research Skills.

Table 19. Student Research Internship Pre/Post Matched Pairs Survey Results

Subscales	N	Post Mean	Pre Mean	Mean Diff.	*t*	df	Sig.
STEM Career	58	3.73	3.77	-0.04	-0.57	57	0.57
STEM Efficacy	58	4.08	3.98	0.10	1.40	57	0.17
School Belonging	58	4.23	3.94	0.29	3.44	57	0.00*
STEM Identity	58	4.01	3.73	0.28	3.30	57	0.00*
STEM Plans	58	4.44	4.51	-0.07	-0.67	57	0.50

Knowledge About Research	58	3.99	3.35	0.64	7.64	57	0.00*
Attitudes/ Beh. About Research	58	3.95	3.57	0.38	3.97	57	0.00*
Personal Skills	56	4.09	3.61	0.48	5.78	55	0.00*
Research Skills	58	3.82	3.29	0.53	6.04	57	0.00*

*Statistically significant at .001 (using only matched pairs for the analysis).

When asked what they told family or friends about the internship, at pretest students most frequently noted their excitement about the internship, described the internship as an opportunity to help prepare them for college and career, or just said they were participating in an internship. Several students seem to have misinterpreted the prompt, and instead shared what their family or friends said to them. A sampling of illustrative quotes is provided below.

- “That I’m really excited about getting accepted and so ready to see what it’s about.”
- “Excited for the opportunity and to gain more experience in research before classes start this fall.”
- “I tell them that it is a very interesting program that can lead me to a lot of opportunities that I might not have encountered. I say that I am hoping this program leads me in the direction of feeling comfortable with a major that I decide on.”
- “I received an amazing opportunity to do summer research and build important and valuable connections throughout the state and different universities.”
- “I am a member of a STEM research program which helps me prepare for college in multiple ways.”
- “When I mention it to someone for the first time, I describe it as a STEM internship opportunity offered to minorities and first-generation students. When the internship comes up in conversation, I tell them how nervous I am but that I’m looking forward to it!”
- “They are proud of me and know I will succeed.”

At posttest, responses were similar in nature, but were more descriptive about what they had experienced. Illustrative quotes are provided below.

- “I just finished this wonderful internship, that first2 network. It made me feel better about going into a STEM field.”
- That it is an amazing opportunity and stepping stone to further research I would want to participate in.”
- “I’m conducting research in the name of citizen science, I’m doing something that I enjoy while getting rewarded for it.”
- “That it was a wonderful experience that makes me excited for the STEM field.”

- “It was fantastic! I loved it so much!”
- “I am an intern learning to do research so I can decide what type of career I want.”
- “I’ve been lucky enough to begin researching before I’ve even begun college, and this has been a really fun experience!”
- “I say that I was accepted into a research internship that’ll help me, as an inexperienced researcher, learn the basics and how to continue on doing research.”
- “First2 helps first gen and underrepresented students, so they can achieve their goals in STEM. The people are very welcoming.”
- “I spent two weeks during an internship that broaden[ed] my knowledge of the STEM field. The internship helped me build my network of mentors and peers that I can lean on to help me in my undergraduate career.”

Students were also asked as pretest and posttest what job or career they expected to have in 10 years. As shown in Table 20, careers in the medical field were the highest at both time points, with such jobs as doctor, pharmacist, and a variety of other medical positions. Aerospace and engineering were tied for the second most common field at pretest. At posttest, research was the second most common field, followed by aerospace, engineering, and computer science.

Table 20. Students’ Job/Career Expectations in Ten Years

Career	Pretest (n=69)		Posttest (n=59)	
	Number	Percent	Number	Percent
Aerospace	6	9%	4	7%
Animal science	2	3%	2	3%
Computer science	2	3%	4	7%
Cyber security	0	--	3	5%
Engineering	6	9%	4	7%
Environmental science	0	--	2	3%
FBI/CIA/ crime lab	2	3%	0	--
Forensics	3	4%	2	3%
Medical	29	42%	25	42%
Research	4	6%	6	10%
Safety	0	--	2	3%
Science	2	3%	0	--
Wildlife conservation	3	4%	1	2%
Miscellaneous	7	10%	2	3%
Don’t know	2	3%	2	3%

Notes:

- Percentages may not equal 100% due to rounding.

The posttest survey also included a set of 14 items about the internship components rated on a 5-point scale of Strongly disagree (1) to Strongly agree (5), 7 items about the usefulness of the internship components rated on a 5-point scale of Not at all useful (1) to Very useful (5), and three items about the usefulness of their favorite research project rated on the same 5-point usefulness scale. Table 21 depicts the results of those rated items.

Overall, respondents rated the internship experiences very favorably, with all mean scores at 4.0 or above on the 5-point scale. Nearly all (98%) agreed or strongly agreed they would recommend the immersion experience to others (mean 4.75, SD 0.48). Other highest-rated items were that the experience helped improve their research skills (mean 4.71, SD 0.46) and that it helped increase their knowledge of research within a STEM field (mean 4.71, SD 0.49). The lowest rated, unsurprisingly, was that the virtual structure of the immersion experience worked well for them, with a mean of 4.00 (SD 1.07); only 9% disagreed or strongly disagreed with that statement.

Table 21. Response Option Frequencies and Descriptive Statistics for Rated Items: Summer Research Internship Posttest Survey

[Items are arranged from highest to lowest mean scores.]	Response Frequency Percentages					Descriptive Statistics	
	(1) Strongly disagree	(2) Disagree	(3) Neither agree nor disagree	(4) Agree	(5) Strongly agree	Mean	Std. Dev.
The immersion experience met my expectations. (n=59)	--	3%	5%	39%	53%	4.41	0.75
This experience helped to improve my research skills. (n=59)	--	--	--	29%	71%	4.71	0.46
This experience helped me to increase my knowledge of research within a STEM field. (n=59)	--	--	2%	25%	73%	4.71	0.49
This experience helped me to increase my general scientific knowledge. (n=59)	--	--	2%	29%	70%	4.68	0.51
This experience helped me learn how STEM research is conducted. (n=59)	--	--	2%	32%	66%	4.64	0.52
This experience helped me see myself as someone who can do STEM. (n=58)	--	--	7%	38%	55%	4.48	0.63
I am more likely to pursue a career in research as a result of this experience. (n=58)	--	5%	24%	24%	47%	4.12	0.96
The things I learned during this experience will help me stay in my STEM major when my coursework is challenging. (n=59)	--	--	7%	36%	58%	4.51	0.63
I am more likely to pursue a STEM degree as a result of this experience. (n=59)	--	2%	14%	39%	46%	4.29	0.77
This experience will help me succeed in college. (n=59)	--	--	--	41%	59%	4.59	0.50
I would recommend this immersion experience to others. (n=59)	--	--	2%	22%	76%	4.75	0.48
The recruitment process made it easy for me to apply to this experience. (n=59)	--	--	14%	31%	56%	4.42	0.72
The recruitment information adequately prepared me for what to expect for this experience. (n=59)	--	5%	25%	31%	39%	4.03	0.93
The virtual structure of the immersion experience worked well for me. (n=59)	2%	7%	25%	22%	44%	4.00	1.07
	(1) Not at all useful	(2) A little useful	(3) Neutral	(4) Useful	(5) Very useful	Mean	Std. Dev.
Research mentoring provided by undergraduate mentors (n=59)	--	--	--	29%	71%	4.71	0.46
Community building mentoring provided by undergraduate mentors (n=58)	--	--	3%	29%	67%	4.64	0.55
Meeting/conversing with faculty members (n=59)	--	--	7%	29%	64%	4.58	0.62
Research oversight/training provided by faculty members (n=59)	--	2%	5%	27%	66%	4.58	0.68
Team-building activities (n=59)	--	2%	5%	34%	59%	4.51	0.68
College readiness activities (n=58)	2%	--	12%	21%	66%	4.48	0.84
Community building activities (n=58)	--	--	12%	28%	60%	4.48	0.71
For the favorite research project worked on during the internship:							
The activities you carried out for that project (n=59)	--	--	3%	37%	59%	4.56	0.57
The data analysis required for that project (n=59)	--	--	3%	34%	63%	4.59	0.56
The presentation of your project findings (n=59)	--	--	7%	32%	61%	4.54	0.63

Notes:

- Percentages may not equal 100% due to rounding.
- The number of individuals who responded to each item is indicated by the (n=_) notation in each row.

When looking at the items focusing on the specific research internship components, these seven items were also rated very favorably, with mean scores all above 4.45. Respondents rated the research mentoring component the highest, with a mean of 4.71 (SD 0.46). The two components rated lowest included college readiness and community building activities (means of 4.48, SDs of 0.84 and 0.71, respectively).

Each of the nine sites carried out various research projects. When asked to identify their favorite project, respondents identified the following:

- Fairmont State University: water/soil testing
- Green Bank Observatory: pulsars
- High Rocks: fireflies
- Marshall University: water testing
- University of Charleston: soil testing
- West Virginia School of Osteopathic Medicine: water testing
- West Virginia State University: bumble bees
- West Virginia University: mapping
- West Virginia University Institute of Technology: database and pulsar (tied)

After identifying their favorite project, respondents were asked to rate three items based on that particular project. Respondents rated the data analysis the highest, with a mean of 4.59 (SD 0.56), followed by project activities (mean 4.56, SD 0.57), and presentation of project findings (mean 4.54, SD 0.63).

When asked which research project was least enjoyable, more than a third indicated they enjoyed all the research projects. Further, of the remaining comments, many focused not on a specific project but on some aspect of the internship, such as lectures, writing methods and procedures, making a PowerPoint, resume building, and the mini project. In looking at specific projects, most frequently identified as least enjoyable (but with only five or fewer mentions each) were fireflies, mapping, bumblebees, gel electrophoresis, pulsar, and zebrafish.

The posttest survey also included six other open-ended prompts to garner feedback about the research internship experience. Results are summarized below.

All 59 respondents provided comments about what they liked best about the internship program. The most common theme by far was the networking aspect, getting to meet their peers, mentors, faculty members, and like-minded people in general. Other emergent themes were college preparation and the various activities and research projects undertaken, along with a variety of idiosyncratic comments. Illustrative quotes for the networking aspect follow.

- “I enjoyed meeting researchers and learning from their experience in order to conduct my own research.”
- “The amazing connections that I have built with my fellow students, as well as our mentors and teachers.”

- “Making connections with both professors and fellow students for my time in college.”
- “I enjoyed having the chance to meet like-minded individuals.”
- “The community feeling and getting to know other science lovers.”
- “… having the mentors around really made the experience less stressful! They were always very understanding and helpful and just all around great people.”
- “My favorite part of the internship was collaborating and talking to the other interns and mentors in general.”

Fifty-five respondents provided comments about how the internship program should be improved. The most common theme was that nothing should be improved, followed by holding the internship in person instead of virtually, making adjustments to specific activities or structures, and improving communications. Illustrative comments for each theme are provided below.

- “I honestly loved how this experience went, I wouldn’t change a thing.”
- “I think it was great! I don’t know if the in-person internship had the nights with mentors but I think they should be kept. It was great hearing what they’ve learned about college life and giving us undergraduates life-saving tips!”
- “I thought it was really good for having to be online. It wasn’t great having to sit in front of a computer screen for so long, but I feel like the leaders and mentors tried to limit our screen time as much as possible. The outdoor activities helped a lot.”
- “Not doing it virtual, but I know with the current circumstances that wasn’t an option.”
- “In person would definitely have been a better experience, but I understand that this was completely circumstantial and if it could have been in person, it would have.”
- “Make a computer friendly schedule, less of the website-wide meetings.”
- “More in the field work.”
- “More time for talking about time management.”
- “Getting a schedule of events out to students before the internship even starts so they can better prepare for the pace and work load.”
- “I got way too many emails during the internship from the main email person about updates and stuff. I would get an email to tell me someone posted a message or something small that doesn’t need an email for.”

When asked how they learned about the First2 Network program, all 59 respondents provided a response. The three most common methods were by First2 Network members, through email messages, and by high school counselors or teachers. Fifty-five respondents provided feedback about what worked best and what didn’t work in terms of First2 Network recruitment. The most common theme was that students were unsure or had no comment. In terms of what worked well, respondents most frequently noted email messaging and talking with Network members or school staff. Several respondents noted that the First2 Network was “confusing” and several others noted the application process was “horrific” or “janky.”

Fifty-eight respondents provided comments when asked what they found most enjoyable and most challenging about doing research. The most common enjoyable aspects included learning and conducting research and networking and collaborating with others. The most common challenges included the virtual nature of the internship, networking and collaborating with others, various data issues, and presenting their findings.

Respondents were asked last how the virtual experience could have been improved. Interestingly, only four respondents suggested having it in person instead of virtually, and four didn't have any suggestions. The most common theme was that no improvements were needed, given the virtual setting; illustrative quotes follow.

- "I think that the virtual experience was as best as it could be!"
- "It went well for a remote virtual experience."
- "Nothing! I enjoyed everything!"
- "I think you guys did great for what we had to work with!"
- "It was a very enjoyable experience."
- "It worked out beautifully in my opinion."

The second most common theme focused on suggestions for improving the structure of the internship; illustrate quotes follow.

- "More hands on things and less screen time. I also felt really pressured about being on meetings all day and night. I think I'd prefer to have all the meetings in the morning and time in the evening to myself to get work completed and to get away from the computer."
- "Get rid of website wide discussions and replace them with breakout rooms for the interns and mentors to talk freely in small groups. While [First2 Network staff] are amazing people, it is harder for interns to connect well with others while under their supervision. A good example would be talking on the phone with your school friends, but your mom is listening to everything said. It causes a filter to be placed on the discussion and limiting how people can connect."
- "Maybe not as long zoom calls, maybe break them up."
- "Have more time in which we could work on our own or away from the computer."
- "Less computer time, more interaction rather than just listening all day."
- "Allow for fewer meetings or more breaks."

SUMMARY

In sum, the 2020 summer research internships seem to have been very successful. Approximately 80 students participated in these virtual experiences, of whom more than half were first-generation, Pell-grant eligible, and/or from rural locales. Six subscales showed statistically significant changes from pre to post, including School Belonging, STEM Identity, Knowledge About Research, Attitudes and Behaviors About Research, Personal Skills, and Research Skills. Of those, largest increases were found for Knowledge About Research and Research Skills. Participants rated the internship experience very favorably, with high ratings for

the experience improving their research skills and their knowledge of research within a STEM field. Specific internship components were also rated highly, especially the research mentoring provided by the mentors.

Respondents reported the best part of the internship program was the networking aspect and the most common suggestion for improvement was for an in-person rather than virtual experience (although students did recognize the necessity for the virtual setting). Suggestions for improving the virtual experience focused most frequently on structural adjustments such as less computer time and shorter zoom sessions. Students reported the most common ways of learning about the First2 Network and subsequent successful recruitment were through Network members, email messages, and high school counselors or teachers.

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[i] The student research internship survey contained 27 items that were rated on a 5-point scale of Strongly Disagree (1) to Strongly Agree (5). These items were grouped into five subscales of Career, Efficacy, Belonging, Identity, and STEM Plan. The survey also included 37 items grouped into four scales of Knowledge About Research, Attitudes and Behaviors About Research, Personal Gains Related to Research, and Skill Gains Related to Research, all rated on a 5-point scale of None (1) to A Great Deal (5). Paired sample t-tests were conducted to compare the pre and posttest responses.