Collaborative Research: Implementing 21st century geodesy learning through faculty development and expanded applications of data to societal issues

Project Period: 08/01/2017-07/31/2021
Reporting Period: 08/01/2020-07/31/2020
Principal Investigators: Donna Charlevoix (Co-PI), Beth Pratt-Sitaula (Co-PI)
Sponsor: NSF DUE-IUSE
Award ID: 1725347
Collaborators: Bruce Douglas (Indiana University), Rebecca Walker (Mt San Antonio College)

On the GETSI Phase 2 modules published during this reporting period – “Eyes on the Hydrosphere”. It features applications of both geodetic (vertical GPS, reflection GPS, and GRACE gravity) and traditional methods (well levels, stream gaging, SNOTEL) at a level appropriate for introductory undergraduate earth science courses.
Accomplishments

What are the major goals of the project?

GETSI (GEodetic Tools for Societal Issues) is a curriculum development and dissemination project designed to increase the use of geodetic data by both introductory and majors-level undergraduate students. This grant is for GETSI Classroom Phase 2, which continues the work started under a TUES Phase 1 “exploratory” grant.

Over the last two decades, technical advances in geodesy – the study of the size, shape, and mass of the Earth and their changes with time – have revolutionized our understanding of Earth processes and produced discoveries of major societal impact related to climate change, water resources, natural hazards, and environmental change. Overall, teaching resources and textbooks have simply not kept pace with advances in geodesy, both for introductory and upper division undergraduate courses.

Overarching Objectives
1. Improve geoscience (particularly geodetic) knowledge base of undergraduate students both for general science literacy (introductory) and future science workforce (majors-level).
2. Improve effectiveness of teaching resources and pedagogy employed by faculty members teaching geodesy, geoscience, and allied science and engineering fields.

GETSI Phase 2 Outputs
1. Development, testing, revision, and publication of six more curricular modules featuring geodesy data investigations applied to critical societal issues and supporting Earth science, climate, and quantitative literacy at both the introductory and upper division levels in diverse academic settings.
2. Extensive faculty professional development and module dissemination to ≥450 instructors through in-person and virtual short courses.
3. Educational research on the process of adaption and adoption of online undergraduate curricular materials to better serve students and instructors.
4. Educational research on the challenges and benefits of building curricular materials that serve both geoscience and allied engineering and science undergraduates.

GETSI Phase 2 Outcomes
1. Students:
   a. Are able to apply authentic geodetic data and quantitative reasoning to scientific questions
   b. Have improved understanding of nature, methods, and communication of science
   c. Gain Earth and climate science literacy and the ability to apply them to critical resource, hazard, and environmental issues

2. Faculty
   a. Adopt developed GETSI curricular modules
   b. Have improved knowledge of geodetic methods
   c. Include more connections between authentic data and addressing of critical societal issues
   d. Increase use of promising pedagogical practices in STEM education (e.g.,
3. Educational research:
   a. Better knowledge of process by which instructors adapt and adopt online resources
   b. Improved understanding of the relationship between teaching practices and materials adoption.
   c. More capabilities to develop teaching resources that bridge between geodesy learning and other STEM disciplines

What was accomplished under these goals?

Major Activities

GETSI is partnered with the SERC (Science Education Resources Center) InTeGrate project (Interdisciplinary Teaching about Earth for a Sustainable Future) for curriculum design. SERC is providing assessment consulting, independent evaluation, and webhosting.

Progress towards the major project outcomes is:

- Output #1 Module Development - significant progress; somewhat behind schedule
- Output #2 Dissemination - underway and mostly on schedule with some COVID19-related delays
- Output #3 Research on Use - feedback survey collection underway and on schedule
- Output #4 Research on Transfer - not started; first scheduled short course is fall 2020

The report from SERC, the external evaluator, also provides information on the accomplishment of project outcomes (see attached file).

Output #1: All six curricular modules developed as part of this Phase 2 endeavor are done or very near completion. They have all been publicly published but a few modules have some minor last tasks underway. These include:

- Monitoring Volcanoes and Communicating Risk (Introductory) - pending copy editing and final technical review
- Eyes on the Hydrosphere: Tracking Water Resources (Introductory) - pending copy editing and final technical review
- Measuring the Earth with GPS: Plate Tectonics and Changing Ice-Water (Introductory) - completed
- Modeling Flood Hazards (Majors level) - pending copy editing and final technical review
- Planning for Failure: Landslide Analysis for a Safer Society (Majors level) - pending copy editing and final technical review
- Understanding Our Changing Climate: Data Behind Melting Ice and Changing Sea Level (Majors level) - completed

The modules underwent a rigorous review process including four checkpoints prior to classroom testing. Classroom testing was conducted in the classes of the two authors and a non-author pilot tester. After analysis of student data and tester reflections, there are another three checkpoints during the revision and publication process.
All of the GETSI modules underwent further review by the National Association of Geoscience Teachers (NAGT) annual review panel for possible inclusion in the exemplary Teach the Earth collection. Results will be forthcoming in late summer 2020.

GETSI Project manager, Pratt-Sitaula, has also been working on tagging the different units for their ease of conversion to online teaching, in order to promote the mass transfer to that teaching mode.

Output #2: GETSI held three short courses with a total of 83 participants. The GETSI website showed increased usage in association with the start of GETSI Phase 2. Details on short courses, webinar, and website use are included in the SERC Evaluation Report. In addition, GETSI modules have been disseminated through posters presentations at 2020 Earth Educators Rendezvous and 2019 Geological Society of American Annual Meeting, SAGE/GAGE Science Workshop, and the American Geophysical Union (AGU) Annual Meeting as well as through UNAVCO and partner organization listservs. The GETSI project engaged in outreach from the UNAVCO and National Association of Geoscience Teachers (NAGT) booths at both GSA and AGU annual meetings. In addition, we ran five webinars about GETSI modules as part of the NAGT Webinar Series and contributed to two SAGE2YC workshops (total of 237 attendees). In addition to the webinars specifically about GETSI content, GETSI Project Manager, Pratt-Sitaula, was very active this past spring with supporting the mass move to online teaching. She organized the NAGT webinar “(Suddenly) Teaching Geoscience Online” with 265 attendees and participated in other NAGT online teaching activities.

Outcome #3: The “Share You Experience” feedback surveys are available on the GETSI website (https://serc.carleton.edu/getsi/share_experience.html). A total of 35 surveys have been completed (see also SERC Evaluation Report). In addition, more than 83 participants in short courses have given information on intended use. This information will be folded into the final analysis.

Significant Results
See Appendix for report from SERC, external evaluator.

Opportunities for training and professional development?
GETSI materials authors receive professional development related to pedagogical best practices for geoscience teaching. Participants in short courses and webinars receive professional development related to both pedagogy and geodesy content.

How have results been disseminated to communities of interest?
As described above in Major Activities Output #2, modules have been disseminated via short courses, conference booths, conference presentations, listservs, and websites. GETSI is also featured on the UNAVCO website as a major project (http://www.unavco.org/projects/projects.html#Major) giving it prominence beyond just the Educational section, which tends to be limited to a smaller subset of the UNAVCO community.
Plan for next reporting period?

Outcome #1: The last couple tasks for the module complete will be done very shortly and then this outcome will be complete. Outcome #2: Dissemination will efforts will be continued with at least three short courses (virtual due to the pandemic) and one or two webinars. Additional emphasis will be places on the research elements Outcomes #3 and 4 as more surveys are returned from users and we are able to expand use to instructors in other disciplines.

Products

Conference Papers and Presentations

Title: Active Learning for Undergraduates Using Geodesy Data, Math Skills, and Societal Issues
Conference: Geological Society of America Annual Meeting 2019, Phoenix, AZ
Authors: Beth Pratt-Sitaula, Becca Walker, Bruce Douglas, Benjamin Crosby, Donna Charlevoix, Meghan Miller

Title: Geodesy Data-rich Undergraduate Teaching Materials and Instructor Professional Development
Conference: SAGE/GAGE Science Workshop 2019, Portland, OR
Authors: Beth Pratt-Sitaula, Donna Charlevoix, Becca Walker, Bruce Douglas, Benjamin Crosby, Meghan Miller

Title: Designing Data-rich Undergraduate Teaching Materials That Get Used
Conference: American Geophysical Union Annual Meeting 2019, San Francisco, CA
Authors: Beth Pratt-Sitaula, Kristin O’Connell, Bruce Douglas, Becca Walker, Benjamin Crosby, Donna Charlevoix, Meghan Miller

Title: On-Ramps to more effective teaching: Quick-start guides to strategies for actively engaging students in the classroom to improve learning
Conference: European Geophysical Union Annual Meeting 2020
Authors: Barbara Tewksbury, Florian Fusseis, Phillip Resor, Jennifer Wenner, Kim Blisniuk, Cailey Condit, Anne Egger, Kyle Fredrick, Jamie Kirkpatrick, Sara Mana, Kendra Murray, Beth Pratt-Sitaula, Christine Regalla, and Carolyn Tewksbury-Christle

Websites

GETSI Project Site: [http://serc.carleton.edu/getsi/index.html](http://serc.carleton.edu/getsi/index.html)
This is the GETSI project website. It gives background information on the project and is the primary publication site of the teaching modules when they are complete. Development workspaces allow for internal project notes and draft module text.
Participants

Individuals

Donna Charlevoix  UNAVCO  Co-PI  0 Months
As the Director of UNAVCO's Education and Community Engagement, Charlevoix is also responsible for coordination with the science community and the successful accomplishment of the work. Her salary is covered through the NSF GAGE Facility Cooperative Agreement.

Beth Pratt-Sitaula  UNAVCO  Co-PI  3 Months
A UNAVCO Educational Specialist, Pratt-Sitaula serves as the GETSI facilitator in charge of project logistics and communication. She coordinates between UNAVCO, the authors, technical experts, beta-testers, SERC, NAGT, and related organizations. She leads dissemination (meeting presentations, journal papers, articles, website content, webinars). Pratt-Sitaula's funding to work on GETSI is from this NSF IUSE grant.

Jonathan Harvey  Fort Lewis College  Faculty  0 Months
Harvey is serving as a module co-author on the adapted introductory-level module Eyes on the Hydrosphere: Tracking Water Resources. His full time job is as a faculty member at Fort Lewis College. GETSI will pay him a total of $5000 stipend over the period of work on module development and revision.

Stephen Hughes  University of Puerto Rico-Mayaguez  Faculty  0 Months
Hughes is serving as a module co-author on the new majors-level module Planning for Failure: Landslide Analysis for a Safer Society. His full time job is as a faculty member at University of Puerto Rico-Mayaguez. GETSI will pay him a total of $7500 stipend over the period of work on module development and revision.

Bobak Karimi  Wilkes University  Faculty  0 Months
Karimi is serving as a module co-author on the new majors-level module Planning for Failure: Landslide Analysis for a Safer Society. His full time job is as a faculty member at Wilkes University. GETSI will pay him a total of $7500 stipend over the period of work on module development and revision.

Susan Kaspari  Central Washington University  Faculty  0 Months
Kaspari is serving as a module co-author on the adapted majors-level module Our Changing Climate. Her full time job is as a faculty member at Central Washington University. GETSI will pay her a total of $5000 stipend over the period of work on module development and revision.

Kaatje Kraft  Whatcom Community College  Faculty  0 Months
Kraft is serving as a module co-author on the new introductory-level module Monitoring Volcanoes and Communicating Risk. Her full time job is as a faculty member at Whatcom Community College. GETSI will pay her a total of $7500 stipend over the period of work on module development and revision.

Karen Kortz  Community College of Rhode Island  Faculty  0 Months
Kortz is serving as a module co-author on the adapted introductory-level module Measuring the Earth with GPS. Her full time job is as a faculty member at Community
College of Rhode Island. GETSI will pay her a total of $5000 stipend over the period of work on module development and revision.

James McNamara  Boise State University  Faculty  0 Months
McNamara is serving as a module co-author on the new majors-level module *Modeling Flood Hazards*. His full time job is as a faculty member at Boise State University. GETSI will pay him a total of $7500 stipend over the period of work on module development and revision.

Venkatesh Merwade  Purdue University  Faculty  0 Months
Merwade is serving as a module co-author on the new majors-level module *Modeling Flood Hazards*. His full time job is as a faculty member at Boise State University. GETSI will pay him a total of $7500 stipend over the period of work on module development and revision.

Jessica Smay  San Jose City College  Faculty  0 Months
Smay is serving as a module co-author on the adapted introductory-level module *Measuring the Earth with GPS*. Her full time job is as a faculty member at San Jose City College. GETSI will pay her a total of $5000 stipend over the period of work on module development and revision.

Rachel Teasdale  California State University-Chico  Faculty  0 Months
Teasdale is serving as a module co-author on the new introductory-level module *Monitoring Volcanoes and Communicating Risk*. Her full time job is as a faculty member at California State University-Chico. GETSI will pay her a total of $7500 stipend over the period of work on module development and revision.

Ellen Iverson  SERC  Other professional  0 Months
Iverson is the lead assessment consultant and independent evaluator for the GETSI project. She is paid by SERC (Science Education Resources Center) via a subaward from this NSF IUSE project.

Kristin O’Connell  SERC  Other professional  1 Month
O’Connell supports Iverson on assessment and evaluation for the GETSI project. She is paid by SERC (Science Education Resources Center) via a service agreement with this NSF IUSE project.

Stuart Birnbaum  SERC  Faculty  0 Months
Birnbaum is the assessment consultant for the majors-level modules. He is paid by SERC (Science Education Resources Center) via a subaward from this NSF IUSE project.

Monica Bruckner  SERC  Other professional  0 Months
Bruckner is the webmaster for the GETSI project. She supports any needs related to the SERC-hosted GETSI website. She is paid by SERC (Science Education Resources Center) via a subaward from this NSF IUSE project.

Kathryn Sheriff  SERC  Other professional  0 Months
Sheriff is an evaluation program analyst. She handles all issues related to submission and preparation of student data for assessment review. She is paid by SERC (Science Education Resources Center) via a subaward from this NSF IUSE project.

Michael Stoffel  Other professional  0 Months
Stoffel does copyediting of final module text. He is paid as a consultant from this NSF-IUSE grant.

**Organizations**

Type: Academic Institution  
Name: SERC (Science Education Resource Center)  
Location: Northfield, MN  
Contribution: Assessment and evaluation; dissemination  
Details: SERC is providing assessment design, independent evaluation, and project dissemination through a designated subaward. GETSI module design and assessment are following the model of SERC's InTeGrate project. Modules are being reviewed by a SERC-recruited expert assessment consultant and student data are collected using the InTeGrate collection system. SERC is also hosting the GETSI website and providing content management assistance for the site and webinars. As needed, GETSI announcements go out through SERC channels to the wider geoscience community. Ellen Iverson and Kristin O'Connell, SERC assessment specialists, are providing independent evaluation of the GETSI project (see attached report).

Type: Other Nonprofits  
Name: National Association of Geoscience Teachers (NAGT)  
Location: Northfield, MN  
Contribution: Collaborative Research  
Details: NAGT is collaborating with GETSI on dissemination. For example, as part of publicizing GETSI webinars, announcements went out on NAGT listservs. GETSI also coordinated with NAGT for the review of GETSI modules for the Teaching the Earth collection in association with the 2020 Earth Educators Rendezvous.

Type: Other Nonprofit  
Name: American Geophysical Union  
Contribution: Collaborative Research  
Details: AGU collaborated on the hosting and recruiting for the short course held during AGU annual meeting 2019.

**Impacts**

**What is the impact on the principle discipline?**

Geodesy encompasses an increasingly important set of geoscience methods for better understanding earth processes. Its scope has greatly increased from early applications of surveying and tectonic plate motions to include critical insights into natural hazards (ex. earthquake, volcanoes, landslides), climate change (ex. ice mass and sea level change), and water resources (ex. groundwater storage and change). However, the field remains fairly technical and access to some data sets is limited. Therefore undergraduate students are seldom given the chance to analyze geodesy data. This is a critical omission for a toolbox of techniques needed for the next generation of science literate citizens and geoscience workforce members. GETSI is working to address part of this gap through the development
and dissemination of high quality teaching modules for both introductory and majors-level courses that feature geodesy data analysis and quantitative skills.

**What is the impact on society beyond science and technology?**

As our global population continues to increase, living in ever more marginal lands with ever-increasing temperatures and decreasing water resources, our ability to mitigate effectively for natural hazards, respond to climate changes, and manage our common resources becomes ever more critical. The GETSI project is rooting the study of earth science through the lens of societally important questions. The aim is to increase the ability of students to analyze and address these challenges.

**Changes/Problems**

**Actual or Anticipated problems or delays and actions or plans to resolve them**

The final-final publication of the modules has taken longer than anticipated but is very close to completion. The COVID19 pandemic has caused some significant changes in this program year and we anticipate still being able to achieve the overall project goals. One short course was canceled (May 2020 in association with GSA Cordilleran) and the other three scheduled for 2020 (July, November, and December) have been switched to virtual. We will continue to aim for innovative ways to reach instructors, despite the limitations of the pandemic.
Appendix – SERC Evaluation Report
GEodesy Tools for Societal Issues (GETSI): Phase II

YEAR 3 EVALUATION REPORT

June, 2020

SERC EVALUATION TEAM

Ellen Iverson, Ph.D., Evaluation Director
Ellen Altermatt, Ph.D.
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LEAD AUTHOR

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EXECUTIVE SUMMARY

The second phase of GEodesy Tools for Societal Issues (GETSI) continues with collaborative development of geodetic teaching materials coupled with an emphasis on materials adoption. During Year 3 of Phase II, significant progress was made on project outputs (Figure 1). Adoption of materials is facilitated through professional development and dissemination. The instructor experience is characterized through feedback provided on surveys to understand the adoption /adoption of online curricular materials as well the challenges and benefits of the materials.

Goal 1: develop, test, revise, and publish six additional curricular modules (each ~two weeks in length) that are centered on geodesy applied to issues of societal importance and to aid students in achieving Earth science, climate, and quantitative literacy

- Year 3 evidence of progress includes material reviews, reporting pages, course assessment data, and publication of modules. Major accomplishments of the year include significant progress developing six modules, where two are complete, two are awaiting final reviews, and two have completed pilot tests and have nearly completed revisions (see Table 1).
Goal 2: conduct in-person and virtual short courses to disseminate GETSI teaching materials and provide faculty development to >450 instructors in geoscience and allied science/engineering fields

- Evidence for Year 3 progress on Goal 2 includes registration and end-of-event survey data from the 2019 Earth Educators’ Rendezvous workshop, GSA and AGU short courses, and eight webinars. Since 2017, there have been 181 participants at GETSI workshops or short courses and 312 attending GETSI webinars and workshop sessions in real-time. Additional exposure includes 265 participants attending the recent NAGT Suddenly Teaching Online webinar co-led by PI Pratt-Sitaula included GETSI examples.

Goal 3: research the process of adaption and adoption of curricular materials through follow up with at least 75 instructors

- Evidence of Year 3 progress for Goal 3 includes the workshop and short-course registration and end-of-event surveys as well as faculty “Share your Experience” submissions. Faculty feedback indicates that the materials are useful, the modules are flexible to be adapted in a variety of ways, and the dissemination events helped prepare participants to teach with the modules.

Goal 4: research the challenges and benefits of building curricular materials that serve students in geoscience and allied fields.

- In year 3, student data were analyzed from 731 students taught with GETSI modules during “phase 1” and “phase 2” of GETSI funding to assess changes in students’ geoscience knowledge and geoscience-related attitudes. While attitudinal changes were not detected, students showed small, statistically significant, gains in the GLE (Geoscience Literacy Exam) scores from pre-instruction to post-instruction.

Detailed Findings

Goal 1: Module Development
Module development was wrapping up during Year 3, where all six teams made progress towards publication. Two teams are finished and published, two teams have completed all author responsibilities and are awaiting final technical review and copy editing, and two are finalizing revisions and instructor stories. All modules are expected to be finished and published by August 15, 2020.

Goal 2: Faculty Development and Dissemination
In year three, GETSI Phase II ramped up dissemination efforts to engage the broader community with adopting and adapting GETSI materials. Since the 2019 annual report the project has led one workshop, two short courses, and six webinars, with findings detailed below.
Materials authors Becca Walker, Rachel Teasdale, and Jessica Smay led a 3-morning workshop at the 2019 GETSI workshop at the Earth Educators’ Rendezvous in Nashville, TN. The workshop was oversubscribed, with 41 participants. The workshop introduced overarching GETSI goals, such as using data and math in teaching and gave participants hands-on experience with three GETSI modules.

Of the participants, 39 responded to the end of workshop survey, and analysis indicates that all participants found value in the workshop and all planned to use at least one of the three modules highlighted during the workshop. Overall satisfaction of the workshop was very high, with an average score of 9.3/10, where 10 is very satisfied. All 39 respondents agreed (slightly, moderately, or strongly) that they know how to access online materials; 38 participants were confident (slightly, moderately, or strongly) they can use the GETSI materials presented, 37 participants agreed (slightly, moderately, or strongly) they developed a workable plan to use the materials, and 37 knew ways to contact others for support. Respondents reported that the workshop provided them with a starting point to include data or to increase the amount of data used in their courses.
Short courses

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<th>Engagement Product</th>
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| **GSA short course:** **Preparing Undergraduates -- Data-Rich Introductory Teaching Modules and Connecting Content to Geoscience Careers, September 20, 2019** | • 29 applicants, 25 participants  
• 24 completed the end of event survey (96%)  
• Respondents reported being satisfied with the workshop. (8.9/10)  
• Participants had a wide range of experience with lidar, GRACE, and GPS prior to the event.  
• All respondents planned to use some module elements in their teaching, with varying levels of modification.  
• All agreed (slightly, moderately, or strongly) that they were confident in teaching with the materials, and that they knew ways to contact others for support.  
• All but one respondent agreed (slightly, moderately, or strongly) that they developed a workable plan for implementing GETSI teaching resources during the short course. |
| **AGU short course:** **Using Geophysics Data to Teach About Flooding, Landslides, and Climate Change in Undergraduate Majors' Courses, December 8, 2019** | • 58 applicants, 28 participants  
• 27 completed the end of event survey (96%)  
• Respondents report high satisfaction with the workshop. (9.5/10).  
• Participants had a wide range of experience with lidar, GRACE, satellite altimetry, and InSAR prior to the event.  
• All respondents planned to use some module elements in their teaching, with varying levels of modification.  
• All agreed (slightly, moderately, or strongly) that they were confident in teaching with the materials, and that they knew ways to contact others for support.  
• All but two respondents agreed (slightly, moderately, or strongly) that they developed a workable plan for implementing GETSI teaching resources during the short course. |

It is notable that short course participants had widely varied backgrounds with the relevant geodedic equipment presented in the GETSI modules, yet all participants planned to use at least some aspect of the modules in their teaching and were confident that they would be able to teach with the content.

Webinars and workshop sessions

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<th>Engagement Product</th>
<th>Engagement Indicators</th>
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| **Webinar: Using GPS Data to Teach about the Earth in Introductory Undergraduate Courses: Plate Tectonics, Earthquakes, Water Cycle, and Ice Mass Change, October 22, 2019** | • 130 registrants, 39 participants (30%)  
• 12 completed the end of event survey (30%)  
• Respondents reported high satisfaction with the webinar. (9.5/10)  
• All respondents indicated that they planned to use the GETSI materials, with half indicating specific courses or labs. |
| **Webinar: Engaging Undergraduates with the Data Behind Melting Ice and Changing Sea Levels, November 13, 2019** | • 83 registrants, 28 participants (34%)  
• 5 completed the end of event survey (17%)  
• Respondents reported high satisfaction with the webinar. (9.2/10)  
• Respondents appreciated walking through the module. |
**Webinar: Teaching about Volcanoes with Monitoring Data and communicating Risk, January 29, 2020**
- 125 registrants, 47 participants (38%)
- 9 completed the end of event survey (19%) reporting a high satisfaction (9.3 out of 10)
- Respondents appreciated seeing the module and its components.
- Respondents plan to adapt or adopt parts of the module into their courses (6/9).

**Webinar: Teaching about the Water Cycle with Data-rich Water Resources Activities, February 27, 2020**
- 101 registrants, 40 participants (40%)
- 8 completed the end of event survey (20%) reporting a high satisfaction (9.75 out of 10)
- Respondents appreciated the hands-on experience working through the modules.

**Webinar: Teaching Landslide Analysis to Undergraduates: Planning for Failure and a Safer Society, March 26, 2020**
- 141 registrants, 61 participants (43%)
- Registrants had varied experience with GETSI but most were very unfamiliar (62/141)
- Registrants had varied experience with susceptibility analysis prior to the event
- 3 completed the end of event survey (5%) reporting a high satisfaction (9/10)
- Respondents plan to incorporate aspects of the module into their courses (2/3)

**Webinar: (Suddenly) Teaching Geoscience Online, April 1, 2020**
- 676 registrants, 265 participants (40%)
- Registrants had different levels of familiarity with NAGT before the webinar: very unfamiliar (137/676), unfamiliar (80/676), somewhat familiar (186/676), familiar (103/676), extremely familiar (205/676)
- 32 completed the end of the event survey (12%) reporting satisfaction (8.6/10)
- Respondents found the resources and experiences of online educators useful.

**Workshop session: Infusing activities with strong societal component into your teaching, Feb 21, 2020**
- 8 participants chose the 1.5 hour GETSI session as part of a longer SAGE 2YC regional workshop for community college faculty.

**Virtual workshop session: Incorporating societally-relevant, data-rich teaching materials into your curriculum: Examples from the GETSI and InTeGrate projects, June 16, 2020**
- 14 participants chose the 1.5 hour GETSI session as part of a longer SAGE 2YC faculty virtual workshop.
**Website Measures**

The website usage has continued to grow (see Table 2) with 36,151 unique users to date. Phase II has a focus on dissemination of the materials, and the site analytics continue to show a marked increase in use during this phase (see Figure 2) punctuated by periods of high use.

<table>
<thead>
<tr>
<th></th>
<th>Pageviews</th>
<th>Unique Pageviews</th>
<th>Users*</th>
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<tr>
<td>January – December 2015</td>
<td>5,114</td>
<td>3,823</td>
<td>750</td>
</tr>
<tr>
<td>January – December 2016</td>
<td>11,906</td>
<td>8,980</td>
<td>2,661</td>
</tr>
<tr>
<td>January – December 2017</td>
<td>23,833</td>
<td>17,993</td>
<td>5,852</td>
</tr>
<tr>
<td>January – December 2018</td>
<td>51,981</td>
<td>40,879</td>
<td>20,795</td>
</tr>
<tr>
<td>January – December 2019</td>
<td>50,296</td>
<td>36,896</td>
<td>14,686</td>
</tr>
<tr>
<td>January 2015 – May 2020</td>
<td>180,491</td>
<td>135,697</td>
<td>49,225</td>
</tr>
</tbody>
</table>

Table 2: Summary of GETSI website analytics. *Users calculated on 5/26/20, historic records can vary slightly as new information is collected about users

**Goal 3: Faculty Materials Use**

In addition to professional development feedback, requests to access protected material on the website indicates a higher level of interest and engagement with the GETSI modules. Since the last evaluation report in June 2019, an additional 215 instructors have requested access. Of those, 128 responded to a question about how they might use the materials, where 59% intended to use or had

**Figure 2: GETSI website monthly use over time**

**How do you imagine you’ll use these materials in your teaching? (n=128)**

- I am already using (or have used) these GETSI materials in a course 12
- I have a particular course in which I intend to use these materials 64
- I have a course or courses for which this material might be useful 28
- I’m just exploring for now 24

**Figure 3: Intended use of materials of those requesting access to instructor-only files**
already used the materials in a particular course (see Figure 3).

Faculty feedback is also collected through an online "Share Your Experience" form, and helps to characterize the experience of teaching with GETSI materials. New 2019-2020 feedback from 5 instructors across 6 implementations indicates that the materials are used in a variety of ways, were a good foundation to build upon and tailor to their classes, were well organized, and provided an opportunity for students to handle real data. Faculty indicated that the materials' use of geodetic data and methods, development of quantitative skills, and focus on societal issues were important and that students enjoyed working with "real" data.

Feedback from 30 instructors in 35 implementations (including all responses since 2018), indicate that faculty find different components of GETSI materials (e.g. student exercises, instructor notes, visualizations) to be somewhat to very useful (Figure 4), the quality rating of the materials as high with an average of 8.8/10 (Figure 5), and 100% indicate that they will likely or very likely to use the materials again.
Feedback also indicates that the materials are used in a variety of ways, from adopting materials closely, to significant modifications or omissions. Figure 6 highlights one aspect of varied adoption, where instructors chose to adapt or adopt different numbers of units per module. For instance, in the GPS, Strain, and Earthquakes module, five instructors adopted 26-50% of the module units and two instructors adopted 51-75% of the module units. Counter to predictions, use patterns also show that instructors adopt units that heavily emphasize societal components at a rate at or higher than data-rich units (Figure 7).

**Percent of module units adapted/adopted by instructors**

![Graph showing percent of units adapted/adopted by different instructors.](image)

**Figure 6: Percent of units adapted/adopted by different instructors**

**Level of adoption/adaption of data intensive and societally focused units**

![Graph showing level of adoption/adaption of data intensive vs societally focused units.](image)

**Figure 7: Level of adoption/adaption of data intensive vs societally focused units**
**Goal 4: Student Assessment**

Data were collected from 731 students whose instructors introduced the five “phase 1” and six “phase 2” GETSI modules in their classrooms to assess changes in students’ geoscience knowledge on the Geoscience Literacy Exam (GLE) and geoscience-related attitudes on the InTeGrate Attitudinal Instrument (IAI). The GLE Common-8 was developed as an 8-item, multiple choice, pre-instruction and post-instruction measure of changes in students’ geoscience literacy that could be used across many course contexts. Scores on the GLE can range from 1 to 12. The IAI measures student attitudes across a variety of environmental and sustainability related beliefs and behaviors. Pre-instruction to post-instruction differences in three IAI constructs were examined: 1) environmental concerns, 2) career and employment priorities, and 3) sustainability behaviors.

The sample was predominantly white (73%), included more male (54%) than female (44%) students, and was mixed in terms of school status (e.g., 24% first-year, 23% second-year, 22% third-year, and 22% fourth year).

For the subsample of students who had both pre-instruction and post-instruction data (i.e., ~400 students), repeated-measures analyses of variance (ANOVAs) were conducted to examine change in students’ responses. While the IAI did not yield statistically significant changes from pre-instruction to post-instruction, the GLE showed small, but statistically significant gains, with the greatest gains among students who scored in the lowest quartile at the pre-test (Figure 8).

**Figure 8: Quartile analysis of pre vs post instruction GLE scores**