# Comprehensive Program Review

## Self-Assessment Report

## Columbus State University

## College of Letters and Sciences

## Department of Earth and Space Sciences

BS Earth and Space Sciences, 2016-2017

EXECUTIVE SUMMARY FOR THE
BS EARTH AND SPACE SCIENCES DEGREE

**Major Findings of the Program's Quality and Productivity**

This detailed self-study of the BS Earth and Space Sciences program assesses key indicators of program quality and productivity as specified in the institution's Comprehensive Program Review procedures. Rating categories for each indicator are assigned as Very Strong, Above Average, Satisfactory, Below Average, or Very Weak. Indicators rated as Very Strong or Above Average are listed as program strengths, while indicators rated as Satisfactory are listed as program weaknesses. In our self-assessment, we did not identify any program indicator as Below Average or Very Weak.

The BS Earth and Space Sciences degree in the Department of Earth and Space Sciences (ESS) is, in essence, 4 concentrations under one "umbrella" degree offered by a group of well qualified, well respected, and highly productive faculty. The program ranks in the top 3 Earth and Space Science programs in the state in terms of conferred degrees – and in fact is only outperformed in this area by 2 research institutions (University of Georgia and Georgia State University). This feat is especially impressive considering that over 90% of all ESS instruction is in 1000 and 2000-level core instruction – and that ESS faculty maintain active research programs which engage undergraduates in collaborative (and often published) projects. Program quality is evident in overall alumni satisfaction with the program and successful placement of graduates in post-baccalaureate employment and graduate school. Concerns with the program include long-term retention of faculty without increases in salary and adjustments in workload; improvement of faculty diversity; weaknesses in formalized, broad-based outreach efforts to the community; weaknesses in formalized alumni engagement; needed improvements in laboratory equipment; potential issues with retention and/or analysis of student retention indicators; and a lack of a formalized assessment tool for student learning outcomes.

Program Strengths with Respect to Quality

- Quality of Teaching
- Quality of Research and Scholarship
- Quality of Student and Faculty Achievement
- Quality of Curriculum

Program Weaknesses with Respect to Quality

- Quality of Faculty
- Quality of Service
- Quality of Facilities and Equipment

Program Strengths with Respect to Productivity

- Enrollment for the Past 5 Years
- Degrees Awarded for the Past 5 Years
- Comparison with CSU and USG Programs
- Graduation Rate
- Cost Effectiveness of Instructional Delivery

Program Weaknesses with Respect to Productivity

- Retention Rates
- Student Learning Indicators

**List of Recommendations for Improving Program Quality**

- Create manageable teaching loads for faculty involved in the BS program in order to enhance student-faculty engagement, provide more time for professional development, and enhance external funding pursuits – which has the potential to improve facilities and equipment and, therefore, student-faculty engagement. Concerns over faculty teaching workload were also expressed in the external reviewer report.
- Improve gender and race/ethnic diversity in the department where possible, specifically through new faculty lines which support existing degree concentrations –with the potential for adding new degree options. Strategic new faculty lines will also allow for more effective scheduling of upper level undergraduate courses and the addition of new course, as noted in the external reviewer's report.
- Increase faculty development funds to allow for a greater range of professional development opportunities; subsequently improving teaching and student-faculty engagement.
- Increase salaries for faculty earning less than those at peer institutions – especially those faculty hired since the collapse of state budgets at the onset of the Great Recession in 2008.
- Implementation of a peer-based classroom evaluation system and improved mentoring of new faculty.
- Improve community service and departmental marketing efforts through formalized K-12 outreach efforts.
- Improve alumni relations through an annual departmental newsletter.

**List of Recommendations for Improving Program Productivity**

- Develop better assessment tools for gauging student retention rates, which are not accurately reflected using the standard comparison of first time, full-time freshman cohorts.
- Develop and/or adopt tools for assessing the quality of discipline-specific ESS curriculum and student learning from both an internal (time dependent) and external (e.g. certification assessments) perspective.

**TABLE OF CONTENTS**

**BS Earth and Space Sciences – Self Study**

## I. BRIEF PROGRAM OVERVIEW

### Description of the Program

Columbus State University's Department of Earth and Space Sciences (ESS), established in 2009, is an interdisciplinary group of 14 faculty with expertise in Archaeology, Astronomy, Atmospheric Science, Engineering and Robotics, Environmental Science, Geology, Hydrology, and Physics. This diverse group of tenured and tenure-track faculty administers the BS Earth and Space Sciences degree through direct advising and instruction of essential coursework, with the support of 2 to 5 adjunct instructors during any given semester. The BS program includes concentrations in Astrophysics and Planetary Geology, Environmental Science, and Geology offered through the Department of Earth and Space Sciences, with a fourth concentration in Secondary Education coordinated between the Department of Earth and Space Sciences and the UTeach program. All degree concentrations were approved by the Board of Regents in 2009-2010, with the exception of the Environmental Science concentration, which was approved in 2011-2012.

### Program Mission and Its Relation to CSU Mission

The mission of the BS Earth and Space Sciences program…

- To provide students with a stellar educational experience through excellent teaching and experiential learning.
- To provide students with both academic and post-baccalaureate guidance, including career and graduate school pathways.
- To enhance student's undergraduate experience and post-baccalaureate success through internships and collaborative student-faculty research projects – including those leading to presentations at local/regiona/national conferences and publication.

…relates well to Columbus State University's stated 2013-2018 mission…

*"We empower people to contribute to the advancement of our local and global communities through an emphasis on excellence in teaching and research, life-long learning, cultural enrichment, public-private partnerships, and service to others."*

…in the following areas.

<u>Service to the Institution and Local Community Through Excellence in Teaching</u>

ESS faculty directly involved in the BS Earth and Space Science degree teach courses in Anthropology and Archaeology, Astronomy, Atmospheric Science, Environmental Science, Geology, and Physics. These courses serve not only our BS Earth and Space Sciences students, but also the wider university through instruction of 28 regularly offered Area B, D and E core courses. In fact, over 90% of credit hours generated in the department of Earth and Space Sciences from FY2012 through FY2016 were in 1000-level and 2000-level courses.

Not only do ESS faculty service a significant percentage of students in the core, but they also include some of the most engaging teachers and prolific researchers in the institution. Numerous faculty in the department have been honored with teaching, research, and student mentoring awards, including:

- Dr. Andrew Puckett, Assistant Professor of Astronomy
  - 2016 Outstanding Student Mentor, Columbus State University Honors College
- Dr. Kimberly Shaw, Professor of Physics
  - 2015 Georgia Professor of the Year, Council for Advancement and Support of Education
  - 2015 Rod Nave award, Southeastern Association for Science Teacher Education
- Dr. Troy Keller, Professor of Environmental Science
  - 2014-2015 William Chappell Graduate Faculty Award, Columbus State University
- Dr. Clinton Barineau, Associate Professor of Geology
  - 2015-2016 Faculty Research and Scholarship Award, Columbus State University
  - 2012-2013 Educator of the Year, Columbus State University
  - 2012-2013 Faculty Fellow of Outstanding Teaching, College of Letters and Sciences, Columbus State University
- Dr. David Schwimmer
  - 2012-2013 Faculty Fellow of Outstanding Research, College of Letters and Sciences
  - 2002-2003 Faculty Research and Scholarship Award, Columbus State University
- Dr. Shawn Cruzen, Professor of Astronomy
  - 2003-2004 Educator of the Year, Columbus State University
  - 1998-1999 Educator of the Year, Columbus State University

In addition to service through course instruction, ESS faculty also engage K-12 students and educators in the community in collaborations through the UTeach program, outreach efforts in regional secondary schools, and program development through a summer STEM camp program targeting high-school students. Finally, ESS faculty serve the general community as experts in a variety of fields by routinely sharing their expertise in media interviews and one-on-one interactions with community members (e.g. rock, mineral, and fossil identification).

Excellence in Research

Faculty in the BS Earth and Space Sciences program also engage in high caliber research, much of which includes undergraduate student collaborators. From FY2012-2016, ESS faculty have given more than 70 conference presentations and published over 130 books, peer-reviewed journal articles, technical documents, conference papers and published abstracts – including more than 40 with student coauthors. During this same time period, more than one-third of BS Earth and Space Science graduates completed senior theses, with more than 10% of graduating students completing an honors thesis during this time.

**Stakeholder's Satisfaction With the Program**

Stakeholders in the program include current students, alumni, and those graduate institutions and employers who accept and employ our students following completion of their BS Earth and Space Sciences degree. The following quantitative and qualitative information indicates the level at which these various groups are satisfied with the program.

Current Students

Qualitative assessments suggest BS Earth and Space Sciences students are generally satisfied with our program. This is primarily based on personal communications to individual ESS faculty members, but was also expressed in statements to the external reviewer…

*"The students interviewed consistently voiced a high level of satisfaction with the faculty, courses, degree programs and the department as a whole. Especially noteworthy was a high level of comradery and sense of community. For example, one student was concerned that most CSU students didn't know about her degree program (geology) and "how great it is." These attitudes seem closely tied to the high level of personal involvement of the faculty and also to the bonding that has occurred through shared off-campus educational (e.g. "Maymester trip") and research experiences. Such comradery is associated with several positive educational outcomes: retention of students who might otherwise transfer to other degree programs/universities, encouragement of students struggling with academic/financial difficulties, student continuation in advanced degree programs, and eventual alumni involvement."*

Alumni

An "Alumni Satisfaction Survey" sent to the 54 BS Earth and Space Sciences students who graduated since summer 2012 (first graduating class) was completed by 18 students (33.33% response rate). The results of this anonymous survey were overwhelmingly positive.

- On a scale from 1 (highly dissatisfied) to 100 (highly satisfied), these 18 alumni rated their undergraduate experience in the Department of Earth and Space Sciences as a 93 (average) with only 3 students rating their experience below a 90 (lowest score was 70).
- On a scale from 1 (poorly prepared) to 100 (well prepared), these 18 alumni rated their preparation in the BS Earth and Space Sciences program for life beyond their undergraduate degree as an 87 (average) with only 3 students rating their experience below an 85 (lowest score was 30).

Graduate Programs Accepting BS Earth and Space Sciences Students

More than 37% of students graduating from the BS Earth and Space Sciences program had completed or were enrolled in a graduate program at the time of this report (20 students in total). Although many remained at CSU (MS Environmental Science/MS Natural Sciences program), more than half of this group (11 students) were accepted at a variety of institutions across the U.S., including the University of Georgia, Auburn University, University of Florida, Florida State University, Penn State, Vanderbilt, Colorado School of Mines, and the New Mexico Institute of Mining and Technology.

Feedback from colleagues at these graduate programs (where available) are overwhelmingly positive, with some institutions (e.g. Auburn University) actively recruiting our BS students during visits to CSU's main campus. *Source: personal communications, letter from Dr. Mark Steltenpohl (Chair, Department of Geosciences, Auburn University.*

Employers Hiring BS Earth and Space Sciences Students

Nearly 41% of students graduating from the BS Earth and Space Sciences program (22 total) were employed in a field related to their discipline at the time of this report. This represents >65% of ESS students who were not pursuing a graduate degree at the time of this report. Additionally, this number is a minimum due to the fact that the whereabouts of some graduates are currently unknown. Although

we do not have written feedback from the employers of these graduates, at least 2 local companies – Innovar Environmental, Inc. and Building and Earth Sciences – have hired multiple ESS graduates over the past 5 years. Innovar, for example, currently employs 5 graduates of the BS Earth and Space Sciences program, while Building and Earth Sciences employs 2 graduates. ESS alumni in these companies have been promoted during their employment, suggesting these companies are satisfied with them as employees.

**Relationship of Program to Needs of Students and Societal Demands**

The BS Earth and Space Sciences program addresses student needs for pursuit of an advanced degree or employment in the private/public sector following completion of their baccalaureate. Demand for students with backgrounds in degrees of this nature is both strong and growing.

- Graduates of the Astrophysics and Planetary Geology concentration typically pursue employment or advanced degrees in the fields of Physics, Astronomy, and Geology. Of the 8 students who graduated from this concentration during the study period…
    - 3 were accepted into Astronomy graduate programs (Louisiana State University, University of Tennessee, and Vanderbilt)
    - 3 were accepted into Geology or Geophysics graduate programs (New Mexico Institute of Mining and Technology, Columbus State University), with one becoming successfully employed with a the US Geological Survey following graduation.
    - 1 was accepted into an Environmental Science graduate program (Columbus State University)
    - 1 is currently applying to graduate programs in Astronomy.
    - Employment of Physicists/Astronomers and Geoscientists is expected to experience growth of 7% and 10%, respectively, from 2014-2024 (US Bureau of Labor Statistics).
- Graduates of the Environmental Science concentration typically become employed in the field of Environmental/Geotechnical Engineering and as Environmental Scientists/Technicians. Of the 12 students who graduated from this concentration over the reporting period…
    - 6 were employed in the field of Environmental Science, either with a private company conducting environmental assessment/environmental compliance activities, or a public entity (e.g. GA Department of Natural Resources).
    - 1 student enrolled in an Environmental Science graduate program (Columbus State University)
    - 1 student was employed in a field unrelated to their degree.
    - The whereabouts of the remaining 4 students are unknown as of this report
    - Employment of Environmental Scientists and Environmental Technicians is expected to experience growth of 11% and 9%, respectively, from 2014-2024 (US Bureau of Labor Statistics).
- Graduates of the Geology concentration are just as likely to be employed in a field related to geology as they are to have enrolled in a Geology graduate program. Of the 27 students who graduated from this concentration over the reporting period…
    - 9 were employed in the field of Environmental/Geotechnical Engineering with a private company, or were employed with a government entity conducting environmental assessment/compliance (e.g. Environmental Protection Agency).

    - 8 enrolled in a Geology graduate program (Auburn, Columbus State University, University of Georgia, Colorado School of Mines, New Mexico Institute of Mining and Technology, University of Florida, Florida State University, Penn State)
    - 1 was employed with an energy exploration company.
    - 5 were employed in fields unrelated to their degree (e.g. family business)
    - The whereabouts of the remaining 4 students are unknown as of this report.
    - Employment of Geoscientists, Environmental Scientists and Environmental Technicians is expected to experience growth of 10%, 11% and 9%, respectively, from 2014-2024 (US Bureau of Labor Statistics).
- Graduates of the Secondary Education concentration either became employed as a Secondary Education teacher (2) following graduation, or their whereabouts were unknown (2) at the time of this report.
    - Curriculum in the Secondary Education concentration is aligned with the nationally recognized UTeach program. UTeach teacher education programs have been endorsed by a number of organizations, including the Association of Public and Land Grant Universities, the National Academies Commission, and the Presidential Council of Advisors on Science and Technology.
    - High teacher turnover rates coupled with decreasing enrollment in teacher certification programs, both in Georgia and nationwide, have led to widely publicized efforts to produce more STEM teachers across the U.S.
    - Ongoing and projected shortages in Georgia school systems, especially in the STEM areas, mirror nationwide trends.

**II. INDICATORS OF PROGRAM QUALITY**

**II A. Quality of Faculty**

***Self-Assessment: Satisfactory***

***Appropriateness of Faculty Credentials***

All tenure and tenure-track faculty within the Department of Earth and Space Sciences possess terminal degrees in their field.

- **Dr. Clinton Barineau, Associate Professor of Geology and Department Chair**. PhD in Geology, Florida State University, 2009. Professional Interests: Structural Geology and Tectonics, Proterozoic-Paleozoic history of eastern North America.
- **Dr. Stacey Blersch, Assistant Professor of Hydrology**. PhD in Civil, Structural and Environmental Engineering, State University of New at York Buffalo, 2016. Professional Interests: Hydraulic Ecosystem Services, Ecosystem Restoration
- **Dr. Warren Church, Professor of Anthropology**. PhD in Anthropology, Yale, 1996. Professional Interests: Environmental Anthropology, South American Archaeology; Pre-Hispanic cultural geography; Complex Societies; Geoarchaeology.
- **Dr. Shawn Cruzen, Professor of Astronomy and Director of the Coca Cola Space Science Center**. PhD in Physics, University of Nevada at Las Vegas, 1997. Professional Interests: Extragalactic Astrophysics, Observational Cosmology, Active Galactic Nuclei, Informal Science Education

- **Dr. William Gunter, Assistant Professor of Atmospheric Sciences**. PhD in Geosciences, Texas Tech, 2015. Professional Interests: Severe Weather Analysis, Wind Velocity Analysis via Doppler Radar.
- **Dr. Zdeslav Hrepic, Associate Professor of Physics**. PhD in Curriculum and Instruction: Physics and Science Education, Kansas State University, 2004. Professional Interests: Physics Education.
- **Dr. Troy Keller, Professor of Environmental Science**. PhD in Biology, University of Michigan, 1997. Professional Interests: Stream Ecology; Stream Restoration; Sustainable Energy Resources
- **Dr. Diana Ortega-Ariza, Assistant Professor of Geology**, PhD in Geology, University of Kansas at Lawrence, 2016. Professional Interests: Sequence Stratigraphy, Carbonates.
- **Dr. Andrew Puckett, Assistant Professor of Astronomy**, PhD in Astronomy and Astrophysics, University of Chicago, 2007. Professional Interests: Physics & Astronomy; Small bodies in the Solar System; Transneptunian objects (TNOs); Astronomy Education and Outreach.
- **Dr. David Schwimmer, Professor of Geology**. PhD in Earth and Space Sciences, Stony Brook, 1973. Professional Interests: Vertebrate Paleontology, Cambrian Biostratigraphy, Cretaceous Paleoecology.
- **Dr. Abiye Seifu, Professor of Engineering**. PhD in Electrical Engineering, Rensselaer Polytechnic Institute, 1991. Professional Interests: Electrical Engineering, Engineering Education.
- **Dr. Kimberly Shaw, Professor of Physics and Co-Director of UTeach Columbus**. PhD in Physics, Florida State University, 1997. Professional Interests: Physics Education.
- **Dr. Rosa Williams, Associate Professor of Astronomy**. PhD in Astronomy, University of Illinois at Urbana, 1999. Professional Interests: Supernovae Remnants, Astronomy Education.
- **Dr. Lavi Zamstein, Assistant Professor of Robotics**. PhD in Electrical Engineering, University of Florida, 2009. Professional Interests: Engineering and Robotics.

***Use of Part Time Faculty***

The Department of Earth and Space Sciences currently employs a small number of adjunct faculty, which varies from semester to semester, who primarily teach core anthropology, environmental science and geology coursework. Instruction of upper level coursework in the BS Earth and Space Sciences program does not rely on adjunct faculty, except in uncommon circumstances (e.g. temporary use during a faculty absence).

- **Mrs. Danielle Cook, Adjunct Instructor**. MA in Anthropology, University of Southern Mississippi, 2011. Courses taught: Introductory Anthropology and Archaeology
- **Dr. Diane Faulkner, Adjunct Instructor**. PhD in Physical Chemistry, Emory University, 1976. Courses taught: Integrated Studies (UTeach)
- **Mrs. Cassie Myers, Adjunct Instructor**. MS in Environmental Science, Columbus State University, 2013. Courses taught: Introductory Environmental Science.
- **Dr. Karretta Venable, Adjunct Instructor**. PhD in Atmospheric Science, Howard University, 2016. Courses taught: Introductory Atmospheric Science.
- **Mr. Justin Fairchild**, Adjunct Instructor. MS in Geology, University of Kansas, 2013. Courses taught: Introductory Geology.
- **Dr. John Studstill**, Adjunct Instructor. PhD in Cultural Anthropology, Indiana University at Bloomington, 1974. Courses taught: Introductory Anthropology.

***Diversity of Faculty***

The Department of Earth and Space Sciences employs 14 tenure and tenure-track faculty, and 6 part-time adjunct faculty. In terms of disciplines, we are one of the most diverse departments on campus, with faculty expertise in Archaeology, Astronomy, Atmospheric Science, Engineering and Robotics, Environmental Science, Geology, Hydrology, and Physics. In contrast, diversity by gender and race/ethnic background is significantly lower.

- Faculty by Gender
  - 12 male faculty – 10 full-time/2 part-time (60% of total and 71% of full-time faculty)
  - 8 female faculty – 4 full-time/4 part-time (40% of total and 29% of full-time faculty)
- Faculty by Race/Ethnic Background
  - 17 White/Caucasian – 12 full-time/5 part-time (85% of total and 86% of full-time faculty)
  - 2 Black/African American – 1 full-time/1 part-time (10% of total and 7% of full-time faculty)
  - 1 Hispanic/Latino – 1 full-time (5% of total and 7% of full-time faculty).

***Opportunities for Faculty Development***

In FY2017, funding allocated for faculty development from our departmental budget, supplemented with funds from the Office of the Provost, averaged $925 per tenure/tenure-track faculty – up from an average of $835 per faculty member in FY2016. Although these funds are not able to cover travel costs to international meetings or U.S. meetings with significant travel/registration costs for every faculty member, they have allowed ESS faculty to attend a mix of regional, national and international meetings. These funds have been supplemented with monies from the ESS Foundation account, and external grants awarded to ESS faculty (e.g. Shaw, Barineau), when state funding is insufficient to cover all travel costs. As a result, ESS faculty annually travel to professional conferences, often with undergraduates, in order to present the results of their research, attend workshops and/or short courses, and interface with their peers. ESS faculty are encouraged to engage in grant writing and research – especially projects with the potential to involve undergraduates – as these activities are excellent faculty development mechanisms and improve faculty-student engagement.

- From FY2012-FY2016, ESS faculty gave more than 70 presentations at a variety of local, regional, national and international conferences and published over 130 books, peer-reviewed journal articles, technical documents, conference papers and published abstracts – including more than 40 with student coauthors.
- From FY2012-FY2016, ESS faculty acted as PI or co-PI on external grants that yielded more than 3.4 million dollars in awards.

***Program Improvement Plans***

Plans to improve faculty quality in the BS Earth and Space Sciences program include the following…

- Create manageable teaching loads for faculty involved in the BS program.
  - ESS faculty workloads averaged 11-12 hours per semester from FY2012-FY2016. This is significant considering the fact that 4 full-time faculty (Cruzen, Williams, Shaw, and Frazier/Barineau) should have had reduced (half) teaching loads due to administrative duties during the review period. The 11-12 hour average, therefore, reflects the fact that some ESS faculty routinely teach uncompensated overloads.

    - In order for ESS faculty to continue to engage in research activities – especially research involving undergraduates – a faculty workload policy should be implemented that allows for course reductions for faculty with active research programs.
- Improve both gender and race/ethnic diversity in the department.
    - Prior to FY2016, tenured and tenure-track ESS faculty was 18% female and 82% male, and 9% minority (Black/African American) and 91% Caucasian in its makeup.
    - In FY2017, 3 new hires – 2 female and 1 minority (Hispanic/Latino) – slightly improved gender and racial/ethnic diversity in the program. Should new faculty positions be allocated to ESS in the future, significant efforts should be made to attract high-caliber female and (especially) minority candidates to apply for the position(s).
- Improve funding for faculty travel – especially for professional development.
    - High quality teaching depends on faculty being well versed in the newest scientific and pedalogical advances. Scientific conferences provide a critical mechanism for ESS scientists to advance their professional development, improve their teaching effectiveness, and engage in student-faculty research projects. Funding levels for faculty development often limit the types of conferences – especially those with expensive registration costs or travel costs – which ESS faculty are able to attend. Supplementary funding for faculty travel has largely come from the ESS Foundation account, which then limits use of those funds to purchase equipment or fund student travel and research. Increases in state funding for the purposes of professional development would significantly enhance the ability of ESS faculty to attend at least one major meeting each year.

**II B. Quality of the Teaching**

***Self-Assessment: Very Strong***

***Indicators of Good Teaching***

The quality of teaching in the BS Earth and Space Sciences program is evidenced by the following…

- 5 of 14 ESS faculty have been honored with an internal (CSU) or external teaching award.
- On a scale from 1 (highly dissatisfied) to 100 (highly satisfied), 18 alumni rated their undergraduate experience in the Department of Earth and Space Sciences as a 93 (average) with only 3 students rating their experience below a 90 (lowest score was 70).
- Student evaluations (upper and lower level) for 2015-2016 ESS courses suggest students are very pleased with the instruction they receive.
    - The normalized mean response to 7 statements on student evaluation questionnaires – all of which focus on student assessment of the instructor (e.g. instructor is well prepared, instructor encourages questions, instructor is effective, etc.) – was a 4.36, 4.48, 4.43, and 4.29 for the fall 2016, spring 2016, fall 2015 and spring 2015, respectively – out of a maximum of 5 points (departmental evaluations prior to spring 2015 were not available through the EvaluationKit at the time of this report).
    - Students rated the quality of instruction in ESS courses (questions 1 – 7) an average of 4.39 out of 5 during the period spring 2015 through fall 2016, despite the fact that they gave the average ESS course a 4.4 out of 5 with regards to academic difficulty.

- ESS faculty in 2015 and 2016 alone produced a total of 8 different publications, presentations, and funded grants directly related to teaching, demonstrating the commitment of ESS faculty to the scholarship of teaching and learning.

***Indicators of Good Advising***

More than half of students majoring in Earth Science across the U.S. do not choose this major until their second year of college or later. In ESS, more than 60% of students enter the BS program in their sophomore or later year. It is for this reason that ESS faculty devote significant focus on engaging students in core courses and working closely with ESS majors throughout their degree, including a concerted effort to help students graduate in a timely manner – even those that enroll in ESS in their junior and senior years. For students who graduated with a BS Earth and Space Sciences degree between summer 2014 and spring 2016…

- The average time to graduation for students choosing the ESS major with 30 hours or less, 4.26 years. *Source: CSU Graduation Reports.*
- The average time to graduation for students choosing the ESS major with 30-60 hours, 3.33 years. *Source: CSU Graduation Reports.*
- The average time to graduation for students choosing the ESS major with 60-90 hours, 2.54 years. *Source: CSU Graduation Reports.*
- The average time to graduation for students choosing the ESS major with >90 hours, 2.17 years. *Source: CSU Graduation Reports.*

Additionally, ESS faculty work closely with graduating seniors to advise them in post-baccalaureate pursuits (employment and/or graduate school). The success of this type of mentoring is supported by the following…

- Approximately 69% of graduates from the BS Earth and Space Sciences program who were awarded a degree during the reporting period were employed in a field related to their degree concentration or were enrolled in a graduate program. Because the whereabouts ~16% of graduates at the time of this report are unknown, the number of students from this cohort who are in graduate school or employed in their field of study is probably higher.
- On a scale from 1 (poorly prepared) to 100 (well prepared), 18 alumni rated their preparation in the BS Earth and Space Sciences program for life beyond their undergraduate degree as an 87 (average) with only 3 students rating their experience below an 85 (lowest score was 30). *Source: Alumni Satisfaction Survey.*

Because of the challenges of advising underclassmen, BS Earth and Space Sciences freshmen and sophomores advise with both an ESS faculty member (academic advisor) and advisor in the CSU Academic Center for Excellence (ACE). The combination of an ACE and ESS advisor provides underclassmen with an opportunity to be guided by experts in both the academic aspects (ESS advisor) of being in college – but also the functional aspects of adjusting to and navigating the bureaucracy of a university (ACE advisor). Additionally, because ACE advisors do not have the additional tasks of teaching, research and service activities, they are able to closely monitor the academic progress of ESS freshmen and sophomores during the time they are most likely to struggle with adjustments to life as a college student – reaching out to those struggling students with guidance on overcoming challenges.

***Departmental Reward System***

During each spring semester the department chair conducts an annual performance evaluation for each faculty member. This evaluation includes assessment of teaching and advising performance. Recommendations for merit pay raises are then based, in part, on teaching performance as assessed in the annual evaluation. Unfortunately, merit pay raises have been largely non-existent during the period of this report – until the 2015 and 2016 fiscal years. During those years, faculty raises averaged 3%.

***Program Improvement Plans***

Plans to improve teaching within the BS Earth and Space Sciences program include the following…

- Implementation of a peer-based classroom evaluation system.
    - During the reporting period, classroom peer visits have largely been limited to untenured faculty members as part of tenure and promotion mentoring. A new university and college-level policy will require more frequent peer-evaluation of teaching – including for tenured faculty – which will be implemented as a departmental policy. This should provide all ESS faculty the opportunity to receive valuable feedback on their teaching pedagogy from a colleague.
- Mentoring of new faculty through a university-wide "New Faculty Workshop" developed by the Faculty Center for the Enhancement of Teaching and Learning, as well as formal intra- and inter-departmental mentoring.

It will also be critical that faculty salaries be improved – noted both here and in the external review. The most recent university-wide faculty salary survey suggested that average salaries for university faculty were almost 10% lower than at peer institutions. In ESS, however, that number is surely higher due to the addition of 5 new faculty members over the past 4 years – when state budgets were flat or decreasing – and due to the fact that raises have been either small or largely non-existent since FY2009.

**II C. Quality of Research and Scholarship**

***Self-Assessment: Very Strong***

***Opportunity for Student Research Projects***

ESS faculty actively recruit and engage students in student research projects – many resulting in publications and conference presentations.

- From spring 2014 through spring 2016, almost three-quarters (73%) of all graduates from the BS Earth and Space Sciences degree program participated in an undergraduate research project, an internship, or completed a senior thesis.
- From spring 2014 through spring 2016, approximately half of BS Earth and Space Science graduates co-authored one or more publications with departmental faculty prior to graduation.
- In FY2016 alone, ESS students secured funding for 8 different Student Research and Creative Endeavors grants from the Office of the Provost.

***Faculty Publications, Presentations, and Grants***

ESS faculty are encouraged to engage in grant writing and research, especially projects with the potential to involve undergraduates.

- From FY2012-FY2016, ESS faculty…
    - Gave more than 70 presentations and a variety of local, regional, national and international conferences.
    - Published over 130 books, peer-reviewed journal articles, technical documents, conference papers and published abstracts – including more than 40 with student coauthors.
- From FY2012-FY2016, ESS faculty acted as PI or co-PI on external grants that yielded more than 3.4 million dollars in awards. This included…
    - 2.6 million dollars in grants awarded to Dr. Kimberly Shaw and co-PI's in Education and Math for the UTeach and CRAFT-STEM initiatives.
    - $641,000 awarded to the "Tip of the Mitt" Council by the Environmental Protection Agency in order to improve invasive species control techniques in the Great Lakes; a grant co-written by Dr. Troy Keller.
    - $126,000 awarded to Dr. Clinton Barineau by the National Science Foundation to study the tectonic and magmatic evolution of the southernmost segment of the southern Appalachian Mountains, which funded 8 undergraduate research projects and theses.
    - Continuing funding to Dr. Rosa Williams through NASA's Space Grant, which funds multiple student internships each year at the Coca Cola Space Science Center.

***Program Improvement Plans***

BS Earth and Space Sciences faculty and students are some of the most productive members of the university. However, in order for our faculty to continue to engage our BS students in undergraduate research, it will be important for these efforts to be formally incorporated into a faculty workload policy – one in which faculty-undergraduate research activities are recognized as a critical part of our teaching workload. Although a departmental policy can be developed with this as a goal, much of that policy will be dependent on the details outlined in a developing university workload policy.

**II D. Quality of Service**

***Self-Assessment: Satisfactory***

***Activities to Enhance Program, Department, College, Institution, Community and/or Region***

All ESS faculty engage in a variety of service activities. These include…

- Departmental Service
    - Personnel Committee, Curriculum Committee, Workload Policy Committee, Standards of Excellence Committee, Faculty Search Committees, Student Organizations advisors (Students for a Sustainable World, Geology Club, American Institute of Professional Geologists, Sigma Gamma Epsilon, Astronomy Club), Scheduling Committees, ESS Seminar Series Committee, ESS Seminar presentations
- College (COLS) Service
    - COLS Curriculum Committee, COLS Personnel Committee, COLS Post-tenure Review Committee, MS Natural Sciences Program Coordinators (Geosciences and Environmental Sciences concentrations)
- University

    - Academic Technology Utilization Committee , Alpha Phi Omega Service Fraternity advisor, Co-Director STEM Honors Camp, Co-Director Uteach Program, Committee for Center of International Education, Coordinator Regents Engineering Transfer Program, Faculty Senate (including current Executive Officer, Dr. Kim Shaw), Library Committee, OneCSU Planning Committee, Quality Enhancement Plan Design Team, STEM Honors Camp, Sustainability Committee, Teaching And Learning Enhancement committee, University Engineering Advisory Board, University Grants Committee, University Institutional Review Board, University Retention, Progression and Graduation Committee, University Science Building Design Committee, Writing Center Advisory Task Force
- University System
    - Board of Regents Academic Advisory Committee on Physics and Astronomy, Chair of Regents Academic Advisory Comm. for Geology and Geography, Early Childhood Care Education Advisory Committee for Columbus Technical College, Regents Engineering Transfer Program Coordinator's Committee
- Community
    - ACT4STEM Teacher Quality Workshop, Astronomy Night through Coca Cola Space Science Center outreach efforts, Bicycle Columbus Inc. Board, City of Columbus Tree Board, Columbus Area Academic Decathalon, Columbus Regional Science and Engineering Fair, Columbus Regional Science Olympiad, Interviews with a variety of Columbus television/radio outlets, Math-Counts/Nationwide Junior High Math Program, Muscogee County School District-CSU Partnership Task Force, a variety of K-12 science presentations in Muscogee County and beyond

***Program Improvement Plans***

Although ESS faculty engage in numerous and varied service activities, it will be important in the future to formalize outreach efforts in K-12 outreach, which will enhance recruitment efforts in the program by raising the profile of ESS in the community. Although faculty associated with the Coca Cola Space Science Center are significantly involved in K-12 outreach, those efforts are not as formalized across the rest of the department. It will also be important for ESS to develop an annual newsletter for alumni in order to keep them abreast of departmental activities and maintain a relationship following their graduation. Finally, it will be critical that ESS maintain a social media presence in order to connect with ESS students and graduates – as well as connect our program with the larger community of scientists.

**II E. Quality of Faculty and Student Achievements**

***Self-Assessment: Very Strong***

***Faculty Honors***

- Collective Department
    - 2016 CSU Regents Teaching Excellence Award for a Department
- Dr. Andrew Puckett, Assistant Professor of Astronomy
    - 2016 Outstanding Student Mentor, Columbus State University Honors College
- Dr. Kimberly Shaw, Professor of Physics

    - 2015 Georgia Professor of the Year, Council for Advancement and Support of Education (CASE)
    - 2015 Rod Nave award, Southeastern Association for Science Teacher Education
- Dr. Troy Keller, Associate Professor of Environmental Science
    - 2014-2015 William Chappell Graduate Faculty Award, Columbus State University
- Dr. Clinton Barineau, Associate Professor of Geology
    - 2015-2016 Faculty Research and Scholarship Award, Columbus State University
    - 2012-2013 Educator of the Year, Columbus State University
    - 2012-2013 Faculty Fellow of Outstanding Teaching, College of Letters and Sciences, Columbus State University
- Dr. David Schwimmer
    - 2012-2013 Faculty Fellow of Outstanding Research, College of Letters and Sciences
    - 2002-2003 Faculty Research and Scholarship Award, Columbus State University

***Student Honors***

The following are honors awarded to students during FY2012 through FY2016…

- Kenneth Roop-Eckart
    - 2016 Faculty Cup finalist, 2016 CSU Phi Kappa Phi Senior Award, 2016 CSU Academic Recognition Award
- Buffy Cook
    - 2016 Woodrow Wilson Teaching Fellowship
    - 2013 Raymon G. Young Scholarship
- Zachary Edwards, 2016, Woodrow Wilson Teaching Fellowship
- Mark Allen Bair, 2016 American Institute of Professional Geologists Scholarship (Georgia)
- Jason Neale, 2016 Raymon G. Young Scholarship
- Katherine Grego
    - 2016 Who's Who in American Colleges and Universities
    - 2016 Phi Beta Delta Outstanding Student
- Wenonah Patrick
    - 2014 Raymon G. Young Scholarship
    - 2013 American Institute of Professional Geologists Scholarship (Georgia)
- Daniel Black, 2014 Raymon G. Young Scholarship
- Austin Caughey, 2014 CRAFT-STEM Internship (CSU)
- Erin Phillips, 2013 Raymon G. Young Scholarship
- Don Osborne, 2012 American Institute of Professional Geologists Scholarship (National)
- Cheryl Wilkes, 2012 American Institute of Professional Geologists Scholarship (Georgia)

***Graduate Achievements (Licensure, Certification, Admission to Graduate School, Job Offers, etc.)***

The following are BS graduate achievements awarded during FY2015 and FY2016…

- Amanda Hall, newly employed with Alabama Water Watch at Auburn University and, subsequently, the Columbus Water Works.
- Daniel Black, newly employed with the Army Corps of Engineers in Davis, CA
- Dr. Karretta Venable, awarded a PhD from Howard University
- Patsy Jo Perry, newly employed with Innovar Environmental, Inc. in Columbus, GA

- Salvador Espinosa, newly employed with ENGEO in San Francisco, CA
- Brendon O'Keeffe, Best Poster Award, CSU Tower Day
- Ryan Hutto, Best Poster Award, CSU Tower Day
- Austin Caughey, Best Poster Award, CSU Tower Day
- Amanda Hall, Best Presentation Award, CSU Tower Day
- Wenonah Patrick, newly employed at Building and Earth Sciences, Inc.
- Don Osborne, Geologist-in-Training certification, Association of State Boards of Geology
- Ross Tucker, Professional Geologist certification, Association of State Boards of Geology
- Kenneth Roop-Eckart, accepted into the PhD program at Penn State
- Cameron McCarty, accepted into PhD program at the University of Tennessee
- Matthew Perry, newly employed at the US Geological Survey National Earthquake Information Center in Golden, CO
- Rylleigh Harstad, accepted into MS program at Auburn University
- Kayla Griffin, accepted into MS program at Auburn University
- Emily Randall, accepted into PhD program at the Colorado School of Mines
- John Hood, accepted into PhD program at Vanderbilt
- Rhett Schley, accepted into MS program at CSU
- Austin Caughey, accepted into MS program at CSU
- Brandon Furnish, accepted into MS program at CSU
- Nicholas Carpenter, accepted into MS program at Florida State University
- Jeremy Miller, newly employed with Dakota Technologies
- Gerald Lawson, newly employed with the Bureau of Land Management, Oregon
- Cody Meshes, newly employed at Columbus State University
- Cliatt Parker, newly employed with Goodwyn, Mills, and Cawood, Montgomery, AL
- Joelle Zalatan, newly employed with the Georgia Department of Natural Resources
- Kayla Coble, accepted into MS program at CSU
- Jacob Maudlin, newly employed with Innovar Environmental, Inc. in Columbus, GA

**II F. Quality of Curriculum**

***Self-Assessment: Above Average***

***Relationship Between Program's Curriculum and Its Outcomes***

The BS Earth and Space Sciences program, although diverse in its curriculum, has relatively consistent program outcomes across all 4 degree concentrations. Those common program outcomes include…

- Attracting students into the program through aggressive degree "marketing"
- Student engagement through experiential learning and real world problem solving consistent with the 2018 Quality Enhancement Plan (WeSolveIt!).
- Preparation of students for post-baccalaureate employment or graduate studies

With these outcomes as a framework, ESS has designed a curriculum that…

- Attracts students enrolled into a variety of introductory level courses (e.g. Astronomy, Environmental Science, Natural Disasters, Physical Geology, Physics, Sustainability and the

Environment, Understanding the Weather, etc.) into the BS program. A significant number of these core science courses have been developed over the past decade by ESS faculty, in part to introduce students to a variety of academic opportunities available in our department.

- Attracts students from outside of the university through high profile faculty-student collaborations as part of upper level and undergraduate research courses (e.g. student research activities highlighted at the Coca Cola Space Science Center and OneCSU Sustainability Fair).
- Provides BS Earth and Space Sciences students experiential learning opportunities in courses ranging from those of an introductory nature (e.g. UTCH 1201 and UTCH1202, Step 1 and Step 2 Inquiry courses) to those focused on undergraduate research projects (e.g. ASTR4899, ENVS4999, GEOL4175, PHYS4899), as well as experiential learning through internships (e.g. UTCH4698, ENVS4698, GEOL4698).
- Provides students a curriculum aligned with traditional astronomy, environmental science, geology and teacher education programs around the nation in order to prepare them for a variety of post-baccalaureate opportunities ranging from pursuit of advanced degrees to employment in a field directly related to their degree concentration. The fact that so many of our BS students have been accepted into astronomy, environmental science, geology, and teacher education graduate programs – or – have become employed in the fields of environmental assessment, environmental regulation, environmental remediation, energy exploration, and secondary education – suggests that the BS curriculum design has been successful in preparing students for life beyond the BS Earth and Space Sciences degree. At the same time, the interdisciplinary nature of the BS program provides students with a background beyond the traditional curriculum, giving our students strengths in areas and content beyond their degree concentration.

Curriculum in the BS Earth and Space Sciences program does, however, have one significant weakness. Because curriculum for each of the 4 degree concentrations hinges on a variety of classes taught by a small number of faculty in each sub-discipline, each ESS faculty member has to teach a large number of different courses in the program in order to deliver the necessary coursework. For example, all upper level astronomy classes are taught by 3 faculty – 2 of which have significant administrative duties and reduced teaching loads. Similarly, the majority of all upper-level environmental science courses are taught by 2 faculty, who also have significant teaching duties in the MS Natural Sciences program. These teaching demands result in both teaching overloads and irregular offerings of some upper-level undergraduate courses, especially upper-level electives. It is only through the addition of new faculty – especially those with interdisciplinary expertise – that the "bare bones" curriculum and faculty overloads can be remedied.

***Incorporation of Technology***

Students in the BS Earth and Space Sciences program utilize a variety of technologies ranging from scientific instrumentation to instructional technology (e.g. tablets and personal response systems) designed to enhance classroom engagement and improve pedagogy. These include…

- Personal response systems (e.g. iClicker) used to engage and assess student understanding in courses such as ATSC1112 (formerly GEOL1112), ENVS1205K, GEOL1110, and GEOL1121.
- Interactive tablets (e.g. DyKnow) in PHYS curriculum used to enhance student-faculty interactions in real time (during class).

- Tablet PC's and field laptops used in ENVS1205K, GEOL4175, and GEOL4905 – which allow students to bring technology into a field setting and use it to collect and analyze data.
- Telescopes ranging from small portable varieties to the Planewave CDK 24-inch telescope at the MeadWestvaco Observatory, used in astronomy courses and student-faculty research.
- The Omnisphere Theater at the Coca Cola Space Science Center, a full scale planetarium used in astronomy coursework.
- A variety of devices used in Environmental Science courses and student-faculty research (e.g. water quality sondes, groundwater temperature-pressure loggers, flow meters, etc.)
- A Sokkia Total Station, prisms, and a high resolution Trimble GPS for spatial analysis in both environmental science and geology coursework and student-faculty research.
- Rock saws, rock polishers and thin-section machines for preparation of geologic samples; a jaw crusher, pulverizer, shake table, spiral panner, sieve shaker, and Frantz Isodynamic magnetic separator for mineral separation; and a Comco airbrasive and airscribe facility for paleontological sample preparation – all used in geology courses and student-faculty research.
- A variety of reflected and transmitted light microscopes used in both environmental science and geology courses, as well as student-faculty research projects.

***Utilization of Multidisciplinary Approaches***

The BS Earth and Space Sciences program was developed specifically with the intent of creating a multi/inter-disciplinary degree program. Students in all concentrations of the BS degree complete…

- 2 semesters of Chemistry and Physics
- Mathematics coursework through at least Calculus I
- Two or more courses in Astronomy, Biology, Environmental Science, and/or Geology (Area F)
- Additionally, in Area G, students in…
    - The Astrophysics & Planetary Geology concentration take courses in Engineering, Geology, and Physics.
    - The Environmental Science concentration take courses in Atmospheric Science, Biology, Chemistry, Geography and Geology.
    - The Geology concentration take courses in Astronomy.
    - The Secondary Education concentration take courses in Astronomy, Atmospheric Science, and Geology
- While in Area H, students from all 4 tracks can choose upper level electives which may include courses in Anthropology, Astronomy, Atmospheric Science, Chemistry, Computer Science, Engineering, Environmental Science, Geology, Math, and Physics.

***Utilization of Multicultural Perspectives***

The Environmental Science concentration of the BS Earth and Space Sciences program requires students to complete ENVS5226 Culture and the Environment, which is an upper level elective in the other 3 concentrations. ESS also encourages students to complete coursework in international settings (e.g. study abroad) with students often taking advantage of CSU's strong International Studies Program.

***Program Improvement Plans***

The BS Earth and Space Sciences will begin working to leverage departmental strengths to both shore up gaps in faculty expertise and develop additional academic opportunities in the Department of Earth and Space Sciences…

- ESS has faculty expertise in Anthropology and Archaeology (1 tenured and 1 adjunct faculty member), both with active research programs that involve undergraduates from within and outside the department. Creation of an additional concentration in Environmental Archeology or Geoarchaeology has the potential to increase enrollment in the BS program by attracting students with archaeological/physical anthropological interests – many who pursue degrees in other parts of the university (e.g. History) or transfer to other institutions. The first step of this long-term planning will involve demonstrating student interest through implementation of a Forensic Anthropology Certificate program. Critical to both the certificate program and potential addition of a new concentration will be the addition of a full-time lecturer and/or tenure-track faculty member with expertise in Environmental Archaeology or Geoarchaeology. Addition of a faculty line in this area will also strengthen the existing degree concentrations by allowing at least 1 existing course to be taught by a new faculty member.
- ESS has faculty expertise in Engineering and Robotics (1 tenured and 1 tenure-track faculty), which when coupled with faculty expertise in hydrology, geology and environmental science, could be used to create a degree program in Environmental Engineering or Geotechnical Engineering. The first step of this planning will involve gauging student interest. Currently students in the AS Engineering Studies program transfer to Georgia Tech and other 4-year engineering programs to complete their degrees. New changes, however, in the Regents Engineering Transfer Program (RETP) will make it more challenging for students to transfer from CSU to Georgia Tech (student's typical school of choice), potentially making completion of a 4-year degree at CSU more attractive. Addition of an Environmental or Geotechnical Engineering degree would require at least one new tenure-track faculty line. The addition of a faculty member with expertise in one or more of these fields would also strengthen existing BS degree concentrations by allowing at least one existing course to be taught by a new faculty member.

**II G. Quality of Facilities and Equipment**

***Self-Assessment: Satisfactory***

***Availability of Classroom and Laboratory Space***

Growth in the BS Earth and Space Sciences program (with the transition from the original BS Geology to BS Earth and Space Sciences degree in 2009), as well as core science courses taught in ESS, has made it more difficult to schedule classes and find appropriate classrooms in which to teach upper level lab courses. Unlike other programs across the university, courses in the sciences (i.e astronomy, archaeology, atmospheric science, environmental science, geology, physics) require significant space for important equipment (e.g. microscopes, rock samples, telescopes, field equipment, etc.). In many cases, equipment used across many different lab and class periods requires that it remain in the teaching/research lab. This often limits multiple use of certain labs and creates space "bottlenecks". In ESS, where student-faculty research and experiential learning is a critical aspect of the curriculum, storage and working space for these materials are critical. As such, the department has struggled to find suitable spaces for both teaching and student-faculty research efforts. Examples include…

- Enrollment increases in some geology courses (e.g. Sedimentary Geology) resulted in the need for a variety of upper-level undergraduate courses (i.e. Sedimentary Geology, Mineralogy, Igneous and Metamorphic Geology, Structural Geology) to share a single classroom (105 LENR), which has put a strain on the classroom seating, working and storage space in the classroom.
- The addition of the Environmental Science concentration in 2011 resulted in the need for more upper-level undergraduate classroom spaces – including requisite equipment – on main campus. Dynamic solutions to these space needs, partially alleviated through renovations in Lenoir Annex and Clearview II (later complicated by the loss of Clearview II) have allowed ESS faculty, especially in Environmental Science, to "cobble together" spaces in Lenoir Annex. However, even these space allocations have been complicated in recent years due to the growth in space needed for archaeology and the recent addition of an atmospheric scientist to the ESS faculty.

Current plans to add a lab science addition to Lenoir Hall, coupled with renovation of portions of that building, should address the majority of these space issues – provided that space allocations outlined in the design phase of the project are implemented at the conclusion of the project in 2018.

***Availability of Equipment***

ESS has a wide variety of equipment that is used in classrooms and for student-faculty research projects (see Incorporation of Technology). Currently ESS has less than adequate funding to purchase equipment and materials associated with lab courses. In order to give our students the background and experience necessary to be adequately prepared for employment and graduate studies beyond ESS, it will be important to add technology and instrumentation – including tools commonly used in environmental and geotechnical studies – to our laboratories. In many cases, this type of equipment far exceeds funding available through annual lab funds

***Program Improvement Plans***

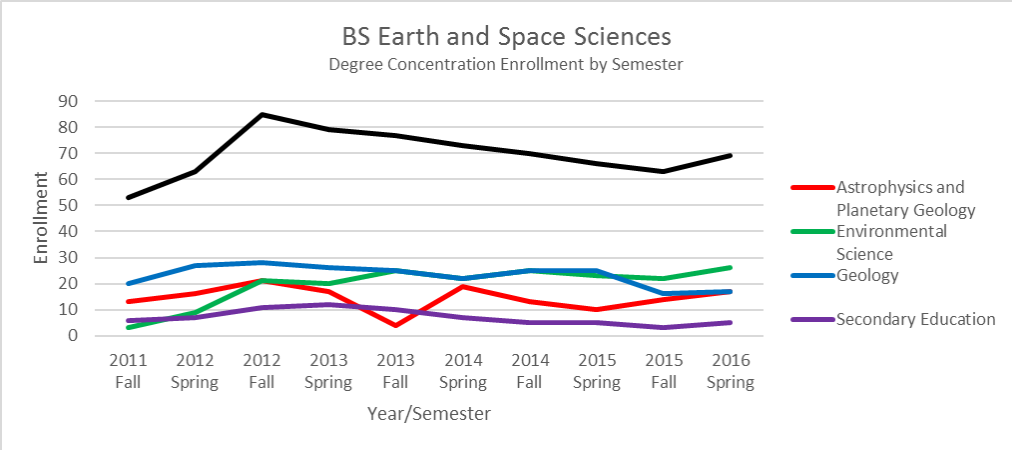
ESS will continue to allocate lab funds each semester so that faculty can purchase basic supplies and equipment, as well as enhance lab technology where possible. For equipment at the more expensive end of the budgeting spectrum (tens of thousands of dollars), external funding (e.g. grants) will be necessary. As an example, a National Science Foundation grant secured in 2012 by Assistant Professor of Geology, Dr. Clinton Barineau, included money for equipment that significantly enhanced the rock preparation laboratory (e.g. rock crusher and magnetic separator, >$30k). That equipment has been used extensively by more than a dozen geology students conducting undergraduate research, including a number of senior theses, over the past 4 years. Those research experiences were part of the critical factors that led to many of those students (6 of 8) being accepted into a geology graduate program. In order for faculty to have enough time to pursue similar funding opportunities, it will be critical that teaching workloads be managed in such a way to allow more time for writing grants –without significantly affecting the core mission of the BS program (providing a quality education for our undergraduates). A reasonable departmental workload policy, therefore, will be important for accommodating variability in faculty efforts (teaching, research, service) – especially a balance between faculty teaching and research efforts that involve student collaborators. In addition, implementation of a robust faculty "startup" fund program would allow new faculty members to acquire key lab equipment at the beginning of their time at CSU, effectively giving them an opportunity to develop student-faculty

research collaborations early in their career and allowing CSU to remain competitive with other institutions which offer more financial support for start-up.

## III. INDICATORS OF PROGRAM PRODUCTIVITY

***Self-Assessment: Above Average***

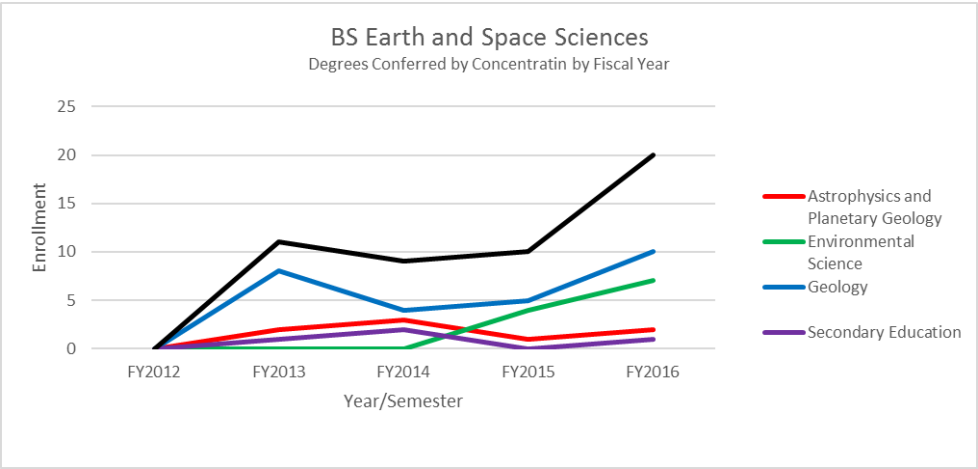
### III A. Enrollment in Program for Past 5 Years




Overall enrollment in the BS Earth and Space Sciences increased more than 30% from Fall 2011 to Spring 2016, although that growth has been highly variable, with significant increases in FY2013 and FY2016 and enrollment decreases in FY2014 and FY2015.

### III B. Degrees Awarded Over Past 5 Years

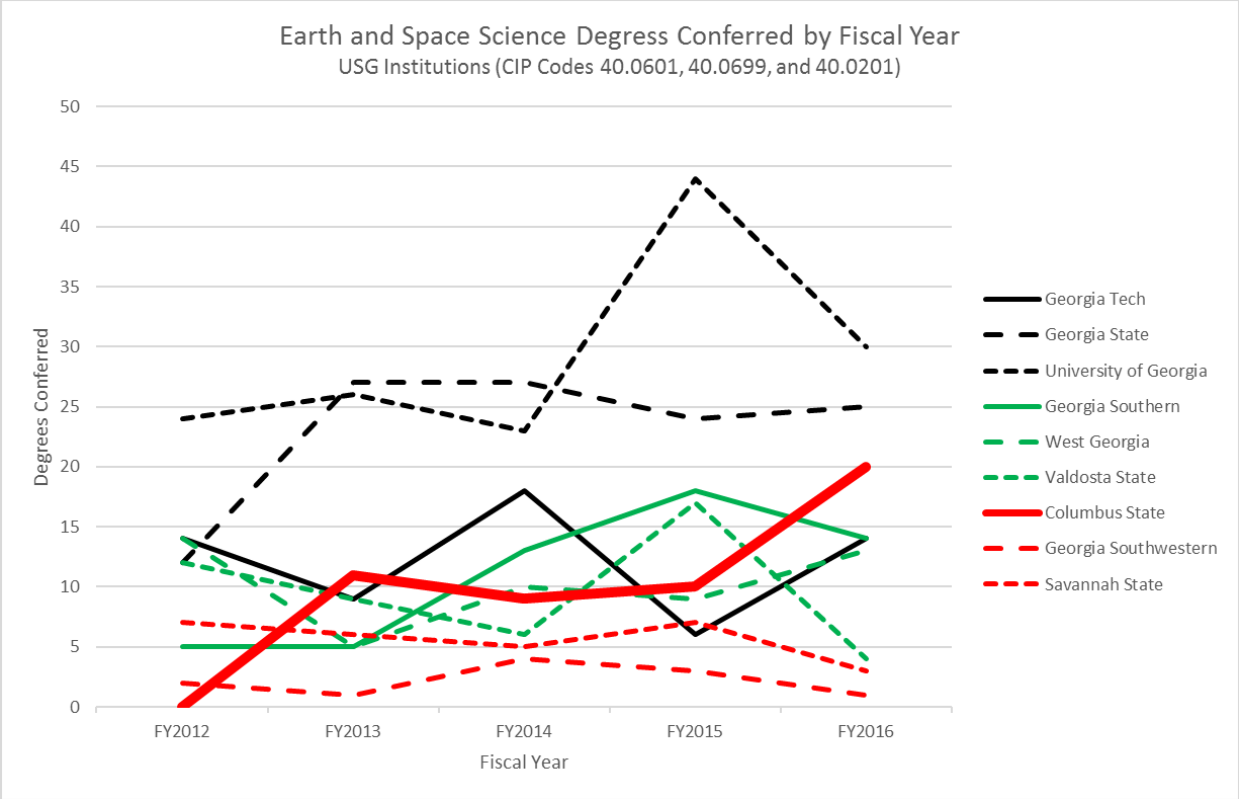
***Self-Assessment: Very Strong***



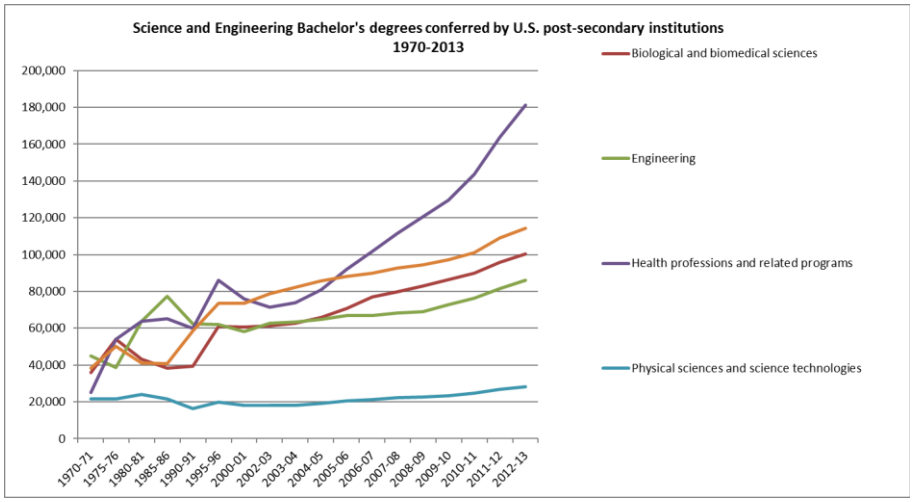

Degrees conferred in the BS Earth and Space Sciences program have dramatically increased over the past 5 years, with degrees conferred during FY2016 double that of the previous year.

### III C. Comparison With CSU & University System of Ga. Programs

***Self-Assessment: Very Strong***




Since its implementation in 2009, the BS Earth and Space Sciences program has become one of the most productive in the University System in terms of degrees conferred. In FY2016, only the University of Georgia and Georgia State University (both classified as Research Institutions by the USG) awarded more Earth Science (CIP Codes 40.0601 and 40.0699) and Space Science (CIP Code 40.0201) degrees, with ESS conferring more degrees than all other State and Comprehensive Universities in the USG.




Compared to other CSU baccalaureate program, enrollment in the BS Earth and Space Sciences program is relatively small (lower third of 37 programs), typical of U.S. undergraduate programs in the physical sciences and science technologies. For majors in these fields (astronomy, meteorology, geology, chemistry, physics, etc.) degrees conferred across the U.S. has changed very little over the past 4 decades. However, overall growth in BS Earth and Space Sciences enrollment has far outpaced that in other CSU degree programs – placing in the top 20% of programs for enrollment growth over the previous 4 years.

**III D. Retention Rates**

***Self-Assessment: Satisfactory***

More than half of U.S. students majoring in Earth Science/Geoscience do not choose their major until their second year of college or later, one of the reasons that traditional tracking of freshmen cohorts does not accurately reflect graduation rates in Geoscience programs. In the BS Earth and Space Sciences program, more than 60% of students enter the BS program in their sophomore or later year. Thus, retention rates provided for this report do not truly reflect retention of ESS majors since it is based on first-time, full-time undergraduate students. However, based on the limited data available, retention rates for ESS students are very similar to those rates reported for the institution as a whole…

- 66.7% from Fall 2010 to Fall 2011 (3 students), compared to an institutional average of 70.7%
- 50% from Fall 2011 to Fall 2012 (4 students), compared to an institutional average of 67.8%
- 75% from Fall 2012 to Fall 2013 (8 students), compared to an institutional average of 68.7%.
- 71.4% from Fall 2013 to Fall 2014 (7 students), compared to an institutional average of 75.3%
- 66.7% from Fall 2014 to Fall 2015 (3 students) , compared to an institutional average of 72.9%

The limited number of BS Earth and Space Sciences students included in these statistics, however, call into question the usefulness of the data to draw significant conclusions.

**III E. Student Learning Indicators**

***Self-Assessment: Satisfactory***

Unlike other science programs in the institution (e.g. Chemistry, Biology) there is not an external certification test that can be universally administered to BS Earth and Space Sciences students following graduation. In fact, even among individual sub-disciplines making up the degree (astronomy, environmental science, geology, secondary education), there is only one widely-administered post-baccalaureate exam – the Georgia Assessments for the Certification of Educators (GACE) – taken by BS Earth and Space students in the Secondary Education concentration. Although a limited number of students have graduated from the Secondary Education concentration of the degree (4 students from FY2012 through FY2016), of those who have taken the GACE following graduation, 100% have successfully passed the test.

Students in the Geology concentration of the degree program may sit for the Fundamental of Geology exam administered by the National Association of State Boards of Geology (ASBOG), assuming they wish to become certified as a Professional Geologist. To date, only 2 BS graduates of the program have sat for this certification exam. In both cases, however, they successfully completed the exam.

A more informal “Alumni Satisfaction Survey” was completed by 18 of 54 BS graduates (33.33% response rate). On a scale from 1 (poorly prepared) to 100 (well prepared), these 18 alumni rated their preparation in the BS Earth and Space Sciences program for life beyond their undergraduate degree as an 87 (average) with only 3 students rating their experience below an 85 (lowest score was 30). This suggests a high level of satisfaction with content learned while in the BS program.

**III F. Graduation Rate of Program**

***Self-Assessment: Above Average***

Because of the way in which graduation rates are tracked (first-time, full-time undergraduate student cohorts), and the fact that more than 60% of BS Earth and Space Sciences students do not enter the degree program until their sophomore year or later, calculated graduation rates for the program are unreliable at best. However, based on the limited data available for this report, 6-year graduation rates for this group are generally higher than those reported for the institution as a whole…

- 50% from Fall 2006 to Fall 2012 (2 students), compared to the institutional average of 40.9%
- 50% from Fall 2007 to Fall 2013 (2 students), compared to the institutional average of 38%
- There were no students in the Fall 2008 cohort, so 6 year graduation rates for the Fall 2008 to Fall 2014 cohort could not be calculated.
- 33% from Fall 2009 to Fall 2015 (3 students), compared to the institutional average of 36.4%
- 66.7% from Fall 2010 to Fall 2016 (3 students) , compared to the institutional average of 36.8%

The limited number of BS Earth and Space Sciences students included in these statistics call into question the usefulness of the data to draw significant conclusions. A more complete picture may be gathered by looking at time to graduation for students based on the number of hours completed upon entry into the program (*Source: CSU Graduation Reports*). For students who graduated with a BS Earth and Space Sciences degree between summer 2014 and spring 2016…

- Average time to graduation for entering ESS students with 30 hours or less, 4.26 years.
- Average time to graduation for entering ESS students with 30-60 hours, 3.33 years.
- Average time to graduation for entering ESS students with 60-90 hours, 2.54 years.
- Average time to graduation for entering ESS students with >90 hours, 2.17 years.

**III G. Cost Effectiveness of Instructional Delivery**

***Self-Assessment: Above Average***

| | 2012-13 | 2013-14 | 2014-15 | 2015-16 |
|---|---|---|---|---|
| ESS Credit Hours Taught Fall and Spring Semesters | 5643 | 5477 | 6367 | 7007 |
| Cost per Credit Hour - Columbus State University | $233 | $242 | $254 | $254 |
| Cost per Credit Hour - BS Earth and Space Sciences | $226 | $262 | $234 | $212 |

Instructional delivery costs for ESS courses is generally less than that of the institution as a whole. This is primarily the result of enrollment growth in core science classes across the ESS disciplines.

**IV. PROGRAM VIABILITY**

**IV A/B. Summary of Program's Viability and Improvement Plan**

***Reference supporting information previously presented in this report***

Data presented herein indicates that the BS Earth and Space Sciences program is exceedingly viable. This is based on the following observations…

- ESS faculty devote significant resources to student learning across the institution, with more than 90% of all instruction devoted to 1000 and 2000-level instruction (i.e. core courses).
- ESS faculty are among some of best teachers in the institution, with 5 faculty formally recognized by students and colleagues through awards at Columbus State University and University System of Georgia.
- ESS faculty are some of the most prolific researchers in the institution when it comes to student engagement, giving more than 70 conference presentations and publishing over 130 books, peer-reviewed journal articles, technical documents, conference papers and published abstracts from FY2012 through FY2016 – including more than 40 with student coauthors. During this same time period, more than one-third of BS Earth and Space Science graduates completed senior theses, with more than 10% of graduating students completing an honors thesis during this time under the supervision of an ESS faculty member. ESS faculty have also been recognized by CSU colleagues as some of the top researchers in the institution through awards in FY2013 and FY2016.
- ESS alumni are overwhelmingly pleased with the education they received in our program, rating their undergraduate experience in the Department of Earth and Space Sciences as a 93 (average) with only 3 students rating their experience below a 90 (lowest score was 70), on a scale from 1 (highly dissatisfied) to 100 (highly satisfied).
- ESS students are actively recruited by graduate programs around the country, with more than 33% of graduates pursuing advanced degrees at universities around the country, including the University of Georgia, Auburn University, University of Florida, Florida State University, University of Tennessee, Penn State, Vanderbilt, Colorado School of Mines, and the New Mexico Institute of Mining and Technology.
- At least 55% of students graduating from the BS Earth and Space Sciences program (who were not enrolled in a graduate program) were employed in a field related to their discipline at the time of this report. In many cases a single company has repeatedly recruited students from our program and alumni in these companies have been steadily promoted during their employment.
- The BS Earth and Space Sciences degree has become the 3$^{rd}$ most productive, in terms of degrees conferred, in the University System of Georgia, outperforming all State and Comprehensive universities granting Earth and Space Science degrees. Only the University of Georgia and Georgia State University awarded significantly more degrees than CSU.

***Summarize recommendations for the future of the program***

- Create manageable teaching loads for faculty involved in the BS program in order to enhance student-faculty engagement, provide more time for professional development, and enhance external funding pursuits – which has the potential to improve facilities and equipment.
- Improve gender and race/ethnic diversity in the department where possible.
- Implementation of a peer-based classroom evaluation system and improved mentoring of new faculty.
- Improve community service and departmental marketing efforts through K-12 outreach.

- Improve recruiting efforts for BS students at both the departmental and university level. This should include improved marketing of the MS Natural Sciences program to our own students and the possibility of implementing a "4+1" BS/MS combination degree in the geology/geosciences concentrations of those programs.
- Improve alumni relations through an annual departmental newsletter.
- Begin discussions for the potential to add additional degrees or degree concentrations to the Earth and Space Sciences program (e.g. Environmental Archaeology, Environmental/Geotechnical Engineering).
- Develop and/or adopt tools for assessing the quality of discipline-specific ESS curriculum from both an internal (time dependent) and external (e.g. certification assessments) perspective.

***Include timetable for program changes***

- A departmental workload policy is currently being developed and should be in place for FY2018.
- The potential for new degree options in the program will be solely dependent on approval of the College, University and University System. Should student interest and administrative approval coincide, new degree options could be proposed as early as Fall 2018 – with programmatic changes implemented as early as Fall 2019. The addition of new faculty for any new degree option will be critical for implementing the new program and improving faculty gender and race/ethnic diversity.
- A formalized faculty mentoring process, currently being developed at the College level, will be mirrored by efforts in ESS. A formal document and new faculty "checklist" should be in place by the end of FY2018.
- Community service efforts associated with K-12 outreach will be the focus of ongoing faculty discussions, with a formalized program implemented by the end of FY2019.
- An alumni newsletter committee will be established during fall 2017, with the first formal ESS newsletter published by the end of spring 2018.
- Development of internal assessment tools will coincide with improvements in annual assessment of program and student learning outcomes for all degree concentrations.

***Address any new or reallocated resources required to implement improvement plan***

- The addition of new faculty for any new degree option will be critical for implementation.
    - The newly proposed Forensic Anthropology Certificate program will necessitate the addition of a lecturer to ESS. Professor of Anthropology, Dr. Warren Church, and Anthropology Instructor, Danielle Cook, have significant core teaching duties. Reassigning either of them to instructional duties, in order to allow for implementation of the certificate program, would negatively impact the ability of ESS to offer core ANTH courses in Area E. Addition of a lecturer position in Anthropology would allow us to hire Danielle Cook full time and increase the number of courses she is allowed to teach each semester from 9hrs to 15hrs.
    - The addition of a degree concentration in Environmental Archeology or Geoarchaeology would necessitate adding a tenure-track faculty line for the same reasons listed above. In addition, a new faculty line in this area would improve curriculum delivery in other degree concentrations.

- The addition of a degree in Environmental/Geotechnical Engineering would require the addition of at least one tenure-track engineering faculty member. Although ESS has current faculty expertise in electrical engineering, civil engineering and robotics, those faculty members are heavily involved in instruction of curriculum in the Robotics Certificate, AS Engineering Studies program, and BS Earth and Space Sciences program. Although each of these faculty members could contribute to an engineering degree at CSU, at least one full-time, tenure-track engineering faculty would need to be added to allow instruction of upper-level courses required for a successful (and accredited) degree program. In addition, a new faculty line in this area would improve curriculum delivery in other degree concentrations.

- It will also be important for faculty retention and job satisfaction that faculty salaries, which have largely remained flat for nearly a decade, increase where possible – especially for those faculty hired in the past 5 years when starting salaries were significantly depressed.

**SUPPORTING DOCUMENTATION**

***Courses Taught and Credit Hours Generated in the Department of Earth and Space Sciences***

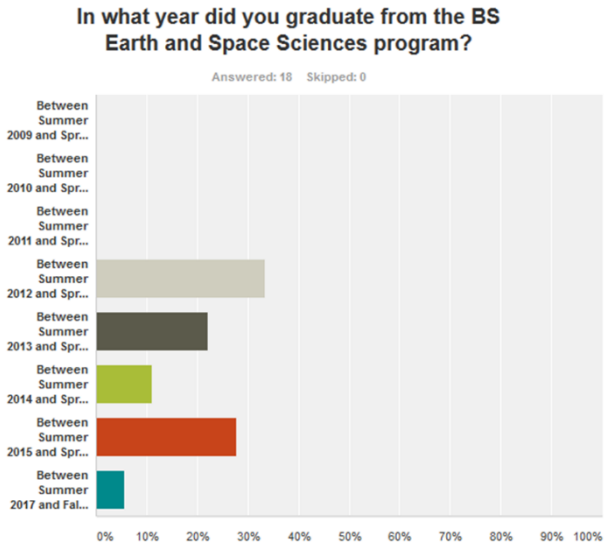
| Measure | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 5-Year Avg |
|---|---|---|---|---|---|---|
| **Credit Hour Production - Fiscal Year** | | | | | | |
| GEOL 1121 | 816 | 693 | 918 | 513 | 801 | 748 |
| GEOL 1121L | 194 | 169 | 191 | 126 | 206 | 177 |
| PHYS 1111 | 453 | 474 | 441 | 480 | 495 | 469 |
| PHYS 1112 | 198 | 246 | 213 | 261 | 294 | 242 |
| PHYS 1311 | 136 | 146 | 130 | 136 | 157 | 141 |
| PHYS 1312 | 61 | 70 | 68 | 82 | 97 | 76 |
| PHYS 2211 | 144 | 111 | 129 | 99 | 111 | 119 |
| PHYS 2212 | 93 | 78 | 81 | 57 | 87 | 79 |
| PHYS 2311 | 45 | 35 | 41 | 34 | 34 | 38 |
| PHYS 2312 | 30 | 24 | 27 | 17 | 27 | 25 |
| Other 1000-Level Courses | 3,918 | 3,074 | 3,003 | 4,214 | 4,478 | 3,737 |
| Other 2000-Level Courses | 551 | 520 | 483 | 487 | 573 | 523 |
| 1000 Level Courses | 5,776 | 4,872 | 4,964 | 5,812 | 6,528 | 5,590 |
| 2000 Level Courses | 719 | 657 | 632 | 595 | 721 | 665 |
| 3000 Level Courses | 315 | 277 | 303 | 215 | 223 | 267 |
| 4000 Level Courses | 104 | 177 | 170 | 139 | 124 | 143 |
| 5000 Level Courses | 192 | 346 | 162 | 381 | 255 | 267 |
| *Total* | *7,106* | *6,329* | *6,231* | *7,142* | *7,851* | *6,932* |

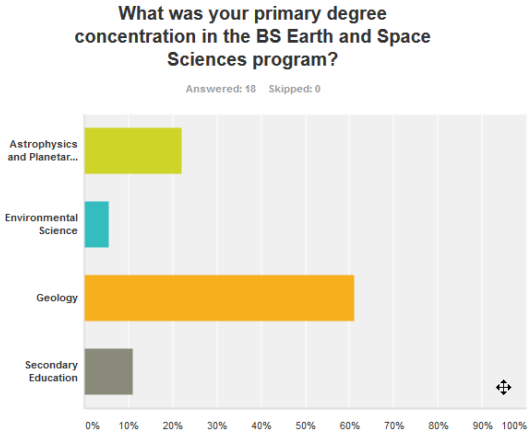
***Undergraduate Senior Theses***

- Kenneth Roop-Eckart, 2016, Strain Analysis Across the Margins of the Elkahatchee and Coley Creek Plutons: Implications for the Alexander City Fault. Senior Honors Thesis.
- Smenner, Ridge, 2015, Petrography, geochemistry, and map relationships of the Coley Creek Orthogneiss, eastern Blue Ridge of Alabama. Senior Thesis.
- Schley, Rhett, 2015, Using Petrography and Geochemistry to Assess the Zana and Kowaliga Plutons of the Eastern Blue Ridge, Alabama. Senior Thesis.
- Perry, Patsy, 2015, A Candidate for the Taconic Arc in the Southern Appalachians: The Dadeville Complex of Alabama's Inner Piedmont. Senior Thesis.
- Patrick, Wenonah, 2015, A Comparison of Hydraulic Sorting Techniques Useful for the Concentration of Zircon. Senior Honors Thesis.
- Espinosa, Salvador, 2015, Use of AutoCAD Civil 3D in the Construction of Geologic Maps. Senior Thesis
- Carpenter, Nicholas, 2015, An Updated Map of the Zana Granite and Kowaliga Gneiss Using AutcoCAD Civil 3D. Senior Thesis.
- Rylleigh Harstad, 2015, Kinematic and Age Constraints on the Alexander City Fault, Eastern Blue Ridge, Alabama. Senior Thesis.

- Black, Daniel, 2013, Petrography and Geologic Setting of the Kowaliga Gneiss in Eastern Central Alabama. Senior Thesis.
- Osborne, Donald, 2013, Provenance of Detrital Sand of the Eutaw Formation in Alabama and Western Georgia: Implications for Late Cretaceous Paleogeography. Senior Honors Thesis.
- Perry, Matthew, 2013, Connecting Hydrologic, Atmospheric and Lithospheric Processes: A Correlation between the El Niño-Southern Oscillation Cycle and Seismic Activity along the Middle America Trench. Senior Honors Thesis.
- Sagul, Austin, 2013, Petrographic Analysis and Significance of the Zana Granite in the Ashland-Wedowee-Emuckfaw Belt of the Southern Appalachians in Eastern Alabama. Senior Thesis.
- Gilmer, Jess, 2012, Correlation of Ashland-Wedowee-Emuckfaw Belt and Dahlonega Gold Belt Stratigraphy, Northwestern Georgia-Northeastern Alabama, Southern Appalachians. Senior Thesis.
- Randall, Emily, 2012, A Comparative Analysis of Himalayan and Appalachian Rock Types Using a Field Test of Landsat Spectroscopic Data. Senior Honors Thesis.
- Wilkes, Cheryl, 2012, Using Comparative Mineralogy of Gneissic Rocks to Delineate Stratigraphic Contacts within the Uchee Belt. Senior Thesis.
- Pearce, Darren, 2011, Geologic Significance of the Yorkville Metagranodiorite in the Blue Ridge of Northwest Georgia. Senior Thesis.

***Alumni Satisfaction Survey – Results***



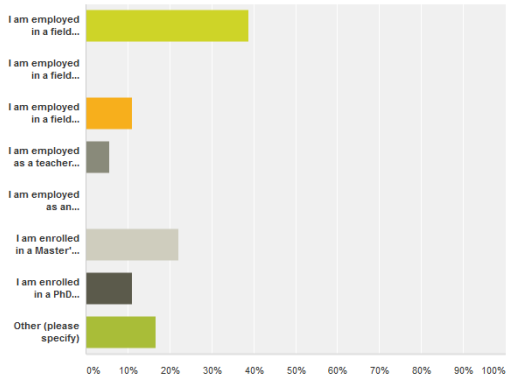

| Answer Choices | Responses | |
|---|---|---|
| Astrophysics and Planetary Geology | 22.22% | 4 |
| Environmental Science | 5.56% | 1 |
| Geology | 61.11% | 11 |
| Secondary Education | 11.11% | 2 |
| Total | | 18 |

| Answer Choices | Responses |
|---|---|
| I am employed in a field closely related to Environmental Science/Environmental Regulation/Environmental Geology | 38.89% 7 |
| I am employed in a field closely related to Energy/Mineral Exploration | 0.00% 0 |
| I am employed in a field closely related to Physics or Astronomy | 11.11% 2 |
| I am employed as a teacher in Primary or Secondary Education | 5.56% 1 |
| I am employed as an Instructor/Professor in Higher Education | 0.00% 0 |
| I am enrolled in a Master's program | 22.22% 4 |
| I am enrolled in a PhD program | 11.11% 2 |
| Other (please specify) Responses | 16.67% 3 |

Total Respondents: 18

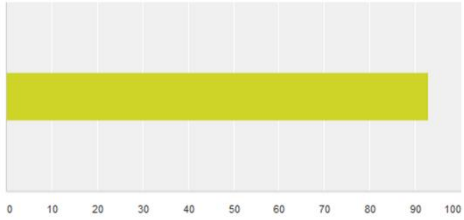
**What is your occupation or educational pursuit(s) at this time? Choose all that apply.**

Answered: 18 Skipped: 0




**On a scale from 1 (highly dissatisfied) to 100 (highly satisfied), how do you view your undergraduate experience in the Department of Earth and Space Sciences?**

Answered: 18 Skipped: 0

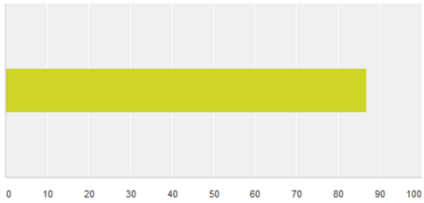



| Answer Choices | Average Number | Total Number | Responses |
|---|---|---|---|
| Responses | 93 | 1,671 | 18 |

Total Respondents: 18

**On a scale of 1 (poorly prepared) to 100 (well prepared), how well do you feel the BS Earth and Space Sciences program prepared you for life beyond your undergraduate degree?**

Answered: 18 Skipped: 0




| Answer Choices | Average Number | Total Number | Responses |
|---|---|---|---|
| Responses | 87 | 1,563 | 18 |

Total Respondents: 18

AUBURN
UNIVERSITY

COLLEGE OF SCIENCES AND MATHEMATICS
DEPARTMENT OF GEOSCIENCES

March 11, 2017

To Whom it May Concern,

Dr. Clint Barineau, Chair of the Department of Earth and Space Sciences at Columbus State University (CSU), asked me to provide an assessment of CSU students who have matriculated through our MS program. He explained to me that his department is undergoing a comprehensive program review and that part of the review is to address "stakeholder" satisfaction from graduate programs that have accepted undergraduates from their department. Over the years, we have had a good number of CSU alums pass through our MS program. Those who come to mind are Terry Knight, Sean Bingham, Cheryl Wilkes, and Ross Tucker, and also Rylleigh Harstad who is an active MS candidate. I asked their thesis supervisors in our department to supply me with information on these students, and below is my synthesis of the information that I received.

***Cheryl Wilkes Coker*** was a very good graduate student who came to Auburn with the desire to conduct Masters thesis research in planetary geology. She worked on a project on Mars and was successful; she finished her work in two years and graduated. She has a full time job as a geologist with EOG Resources in Midland, Texas. *– Dr. David King*

***Sean Bingham*** - Sean was a "non-traditional" student, having worked in a "blue collar" job before opting to pursue a degree at CSU. As an MS candidate, Sean was a solid "classroom" student and was extremely motivated and creative with respect to his thesis work, which was very fruitful; I count six peer-reviewed journal articles on which Sean and Terry are co-authors. If Sean had a weakness, it was in the area of mathematics, which potentially would have impacted his ability to gain admission into a PhD program. Sean considered PhD programs but, in part linked to his family situation (wife and two young children), he opted for employment in the petroleum industry. He is currently employed by Devon Energy in Oklahoma City and, from all reports, is doing very well. *– Dr. Chuck Savrda*

***Terrell (Terry) Knight*** – Terry graduated from CSU in 2003 with a BS in Geology and began in the MS program at Auburn in Fall 2004. At that time, he was already excited about his thesis research on Cretaceous feathers. While at AU, he did a very good job in his coursework earning all A grades, was a highly respected GTA, and completed a 218-page MS thesis that led to a number of reviewed papers. Were it not for his family obligations, he would have gone on to earn a PhD. Instead he resumed work in the gold industry, where he is doing well today, still at Barrick last I heard. *– Dr. Ron Lewis*

***Ross Tucker*** – Ross was an outstanding graduate student. He is among the two best graduate students I have ever supervised. Ross is driven and bright and came to us with good training in geology. He is a hard-working young man with excellent communication skills. I found him to be a quick learner in igneous geochemistry and secondary ion mass spectrometry. I did not detect any weaknesses in Ross. As soon as he graduated in 2011, Mr. Tucker received two job offers (TTL and Newmont Mining) and accepted the offer from TTL. In 2014, he moved to W&M Environmental in Austin, Texas.

GEOSCIENCES
2050 BEARD EAVES COLISEUM
AUBURN, AL 36849-5418
PHONE: 334-844-4282
FAX: 33-844-4486

www.auburn.edu

The only constructive criticisms raised by my faculty are as follow.

*"CSU students sometimes come in with less coursework in the other sciences than our AU graduates and others. Most do not have a year (two semesters) of physics, chemistry, biology, and calculus. I think it would be better if they did have these classes."* We require that they make up such deficiencies, which set them behind.

*"The main thing I would say in regards to some of their training is that they lack a field methods course and a fieldcamp course, which put them at a disadvantage. We require them to make up this deficiency which also puts them at a disadvantage."*

One faculty member commented that one of his former CSU students *"had taken far too long to complete a thesis proposal and to articulate her understanding of her research project, which inclines me to think writing skills were not developed sufficiently."* I would disagree with this statement, however, as my experience has been that CSU students are no different than our other students in this regard.

To summarize, it's clear that we have been very pleased with the quality of CSU students who have completed our MS program. Their successes once leaving our program also are commendable, which brings positive light on both programs – CSU's and ours. We definitely hope to see more CSU students enter our program in the future.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Dr. Mark G. Steltenpohl
Alumni Professor and Chair
Department of Geosciences
steltmg@auburn.edu

***Bureau of Labor Statistics Job Growth Data – Physicists, Astronomers, Geologists, Environmental Scientists and Environmental Technicians.***

## Summary

| Quick Facts: Physicists and Astronomers | |
|---|---|
| 2015 Median Pay | $110,980 per year<br>$53.36 per hour |
| Typical Entry-Level Education | Doctoral or professional degree |
| Work Experience in a Related Occupation | None |
| On-the-job Training | None |
| Number of Jobs, 2014 | 20,000 |
| Job Outlook, 2014-24 | 7% (As fast as average) |
| Employment Change, 2014-24 | 1,500 |

## Summary

| Quick Facts: Geoscientists | |
|---|---|
| 2015 Median Pay | $89,700 per year<br>$43.13 per hour |
| Typical Entry-Level Education | Bachelor's degree |
| Work Experience in a Related Occupation | None |
| On-the-job Training | None |
| Number of Jobs, 2014 | 36,400 |
| Job Outlook, 2014-24 | 10% (Faster than average) |
| Employment Change, 2014-24 | 3,800 |

## Summary

| Quick Facts: Environmental Scientists and Specialists | |
|---|---|
| 2015 Median Pay | $67,460 per year<br>$32.43 per hour |
| Typical Entry-Level Education | Bachelor's degree |
| Work Experience in a Related Occupation | None |
| On-the-job Training | None |
| Number of Jobs, 2014 | 94,600 |
| Job Outlook, 2014-24 | 11% (Faster than average) |
| Employment Change, 2014-24 | 10,200 |

## Summary

| Quick Facts: Environmental Science and Protection Technicians | |
|---|---|
| 2015 Median Pay | $43,030 per year<br>$20.69 per hour |
| Typical Entry-Level Education | Associate's degree |
| Work Experience in a Related Occupation | None |
| On-the-job Training | None |
| Number of Jobs, 2014 | 36,200 |
| Job Outlook, 2014-24 | 9% (Faster than average) |
| Employment Change, 2014-24 | 3,400 |

***Center for Public Education – Excerpt from 2016 "Fixing the Holes in the Teacher Pipeline: An Overview of Teacher Shortages"***

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwiawKvqgdXSAhWDSiYKHVUZD88QFgglMAE&url=http%3A%2F%2Fwww.centerforpubliceducation.org%2FMain-Menu%2FStaffingstudents%2FAn-Overview-of-Teacher-Shortages-At-a-Glance%2FOverview-of-Teacher-Shortages-Full-Report-PDF.pdf&usg=AFQjCNGMO_7Xh1L8bBBIaTZ_EUC6bPShaw



However, the overall numbers mask imbalances that are creating shortages on various fronts:

- **By state:** the nation is awarding more teacher licenses, but 20 states have seen decreases. Oklahoma, Washington, Minnesota, Virginia and New York have all seen certificates drop by one third to almost one half in the last four years (Title II HEA, 2015). Other states, such as South Dakota, struggle to find enough teachers to keep up with increases in student enrollments (South Dakota Department of Education, 2015).
- **By subject area:** schools report vacancies in STEM fields more than others. They also have more difficulty hiring special education and bilingual teachers (Cowan, 2015).
- **By school level:** there is actually a surfeit of new elementary teachers, but schools report having trouble filling positions in their middle and high schools (AACTE, 2013).

**NSBA'S COMMITMENT TO TEACHER QUALITY**

School boards and Association Members should continue to take a leadership role in improving the quality of teaching and administration in our schools. School boards and their associations should continue to support excellence in teacher education, development of standards, hiring practices, in-service education for personnel consistent with district goals and priorities, and constructive evaluation of administrative and teaching personnel.

— NSBA Beliefs and Policies, 2015

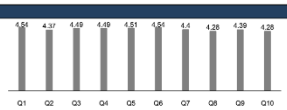
# *FY2016 Course Evaluation Data*

**Columbus State University**
**Spring 2016**

**Level:** Earth and Space Science

**At A Glance : Average Ratings**

| | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Strongly Agree | 4.54 | 4.37 | 4.49 | 4.49 | 4.51 | 4.54 | 4.4 | 4.28 | 4.39 | 4.28 |
| Agree | | | | | | | | | | |
| Neutral | | | | | | | | | | |
| Disagree | | | | | | | | | | |
| Strongly Disagree | | | | | | | | | | |



Q1 - The instructor is well prepared.
Q2 - The instructor effectively conveys the content area.
Q3 - The instructor clearly communicates all assignments including tests and papers.
Q4 - The instructor promotes a class environment conducive to learning.
Q5 - The instructor encourages questions.
Q6 - The instructor promotes an academic environment in which all are treated with respect.
Q7 - Overall the instructor is effective.
Q8 - I have progressed in my ability to think critically, to solve problems, and/or to make decisions.
Q9 - This course was academically challenging.
Q10 - I can articulate core concepts or content of this course.

**1 - The instructor is well prepared.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 369 | 63.29% | | 4.54 |
| Agree | (4) | 165 | 28.3% | | |
| Neutral | (3) | 44 | 7.55% | | |
| Disagree | (2) | 4 | 0.69% | | |
| Strongly Disagree | (1) | 1 | 0.17% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 583/1219 (46.19%) | 4.54 | 0.68 | 5.00 |

**2 - The instructor effectively conveys the content area.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 341 | 58.49% | | 4.37 |
| Agree | (4) | 151 | 25.9% | | |
| Neutral | (3) | 60 | 10.29% | | |
| Disagree | (2) | 26 | 4.46% | | |
| Strongly Disagree | (1) | 5 | 0.86% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 583/1219 (46.19%) | 4.37 | 0.90 | 5.00 |

**3 - The instructor clearly communicates all assignments including tests and papers.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 358 | 61.41% | | 4.49 |
| Agree | (4) | 163 | 27.96% | | |
| Neutral | (3) | 53 | 9.09% | | |
| Disagree | (2) | 6 | 1.03% | | |
| Strongly Disagree | (1) | 3 | 0.51% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 583/1219 (46.19%) | 4.49 | 0.75 | 5.00 |

**Columbus State University**
**Spring 2016**

**Level:** Earth and Space Science

**4 - The instructor promotes a class environment conducive to learning.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 368 | 63.12% | | 4.49 |
| Agree | (4) | 154 | 26.42% | | |
| Neutral | (3) | 47 | 8.06% | | |
| Disagree | (2) | 6 | 1.03% | | |
| Strongly Disagree | (1) | 8 | 1.37% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 563/1219 (46.19%) | 4.49 | 0.80 | 5.00 |

**5 - The instructor encourages questions.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 384 | 65.87% | | 4.51 |
| Agree | (4) | 131 | 22.47% | | |
| Neutral | (3) | 54 | 9.26% | | |
| Disagree | (2) | 8 | 1.37% | | |
| Strongly Disagree | (1) | 6 | 1.03% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 563/1219 (46.19%) | 4.51 | 0.80 | 5.00 |

**6 - The instructor promotes an academic environment in which all are treated with respect.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 389 | 66.61% | | 4.54 |
| Agree | (4) | 141 | 24.14% | | |
| Neutral | (3) | 40 | 6.85% | | |
| Disagree | (2) | 7 | 1.2% | | |
| Strongly Disagree | (1) | 7 | 1.2% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 564/1219 (46.27%) | 4.54 | 0.78 | 5.00 |

**7 - Overall the instructor is effective.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 347 | 59.42% | | 4.40 |
| Agree | (4) | 154 | 26.37% | | |
| Neutral | (3) | 58 | 9.93% | | |
| Disagree | (2) | 20 | 3.42% | | |
| Strongly Disagree | (1) | 5 | 0.86% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 564/1219 (46.27%) | 4.40 | 0.87 | 5.00 |

**Columbus State University**
**Spring 2016**

**Level:** Earth and Space Science

**8 - I have progressed in my ability to think critically, to solve problems, and/or to make decisions.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 316 | 54.11% | | 4.28 |
| Agree | (4) | 148 | 25.34% | | |
| Neutral | (3) | 91 | 15.58% | | |
| Disagree | (2) | 23 | 3.94% | | |
| Strongly Disagree | (1) | 6 | 1.03% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 564/1219 (46.27%) | 4.28 | 0.93 | 5.00 |

**9 - This course was academically challenging.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 339 | 58.05% | | 4.39 |
| Agree | (4) | 154 | 26.37% | | |
| Neutral | (3) | 74 | 12.67% | | |
| Disagree | (2) | 14 | 2.4% | | |
| Strongly Disagree | (1) | 3 | 0.51% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 564/1219 (46.27%) | 4.39 | 0.84 | 5.00 |

**10 - I can articulate core concepts or content of this course.**

| Response Option | Weight | Frequency | Percent | Percent Responses | Means |
|---|---|---|---|---|---|
| Strongly Agree | (5) | 297 | 50.86% | | 4.28 |
| Agree | (4) | 183 | 31.34% | | |
| Neutral | (3) | 81 | 13.87% | | |
| Disagree | (2) | 18 | 3.08% | | |
| Strongly Disagree | (1) | 5 | 0.86% | 0 25 50 75 100 | Course |

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 564/1219 (46.27%) | 4.28 | 0.88 | 5.00 |

| Mean of Means Calculations | Mean |
|---|---|
| **Mean of Means** | **4.43** |

**Columbus State University**
**Fall 2015**

**Level:** Earth and Space Science

**1 - The instructor is well prepared.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 313 | 66.74% |
| Agree | (4) | 105 | 22.39% |
| Neutral | (3) | 37 | 7.89% |
| Disagree | (2) | 8 | 1.71% |
| Strongly Disagree | (1) | 6 | 1.28% |

Percent Responses: 0 25 50 75 100 — Means: 4.52 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.52 | 0.82 | 5.00 |

**2 - The instructor effectively conveys the content area.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 277 | 59.06% |
| Agree | (4) | 106 | 22.6% |
| Neutral | (3) | 50 | 10.66% |
| Disagree | (2) | 17 | 3.62% |
| Strongly Disagree | (1) | 19 | 4.05% |

Percent Responses: 0 25 50 75 100 — Means: 4.29 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.29 | 1.06 | 5.00 |

**3 - The instructor clearly communicates all assignments including tests and papers.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 276 | 58.85% |
| Agree | (4) | 133 | 28.36% |
| Neutral | (3) | 48 | 10.23% |
| Disagree | (2) | 6 | 1.28% |
| Strongly Disagree | (1) | 6 | 1.28% |

Percent Responses: 0 25 50 75 100 — Means: 4.42 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.42 | 0.82 | 5.00 |

**4 - The instructor promotes a class environment conducive to learning.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 298 | 63.54% |
| Agree | (4) | 113 | 24.09% |
| Neutral | (3) | 40 | 8.53% |
| Disagree | (2) | 7 | 1.49% |
| Strongly Disagree | (1) | 11 | 2.35% |

Percent Responses: 0 25 50 75 100 — Means: 4.45 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.45 | 0.89 | 5.00 |

**Columbus State University**
**Fall 2015**

**Level:** Earth and Space Science

**5 - The instructor encourages questions.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 312 | 66.52% |
| Agree | (4) | 111 | 23.67% |
| Neutral | (3) | 31 | 6.61% |
| Disagree | (2) | 7 | 1.49% |
| Strongly Disagree | (1) | 8 | 1.71% |

Percent Responses: 0 25 50 75 100 — Means: 4.52 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.52 | 0.82 | 5.00 |

**6 - The instructor promotes an academic environment in which all are treated with respect.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 320 | 68.23% |
| Agree | (4) | 100 | 21.32% |
| Neutral | (3) | 33 | 7.04% |
| Disagree | (2) | 7 | 1.49% |
| Strongly Disagree | (1) | 9 | 1.92% |

Percent Responses: 0 25 50 75 100 — Means: 4.52 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.52 | 0.84 | 5.00 |

**7 - Overall the instructor is effective.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 268 | 57.14% |
| Agree | (4) | 115 | 24.52% |
| Neutral | (3) | 51 | 10.87% |
| Disagree | (2) | 17 | 3.62% |
| Strongly Disagree | (1) | 18 | 3.84% |

Percent Responses: 0 25 50 75 100 — Means: 4.28 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.28 | 1.05 | 5.00 |

**8 - I have progressed in my ability to think critically, to solve problems, and/or to make decisions.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 230 | 49.04% |
| Agree | (4) | 142 | 30.28% |
| Neutral | (3) | 60 | 12.79% |
| Disagree | (2) | 17 | 3.62% |
| Strongly Disagree | (1) | 20 | 4.26% |

Percent Responses: 0 25 50 75 100 — Means: 4.16 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.16 | 1.06 | 4.00 |

**Columbus State University**
**Fall 2015**

**Level:** Earth and Space Science

**9 - This course was academically challenging.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 279 | 59.49% |
| Agree | (4) | 132 | 28.14% |
| Neutral | (3) | 51 | 10.87% |
| Disagree | (2) | 6 | 1.28% |
| Strongly Disagree | (1) | 1 | 0.21% |

Percent Responses: 0 25 50 75 100 — Means: 4.45 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.45 | 0.75 | 5.00 |

**10 - I can articulate core concepts or content of this course.**

| Response Option | Weight | Frequency | Percent |
|---|---|---|---|
| Strongly Agree | (5) | 225 | 47.97% |
| Agree | (4) | 150 | 31.98% |
| Neutral | (3) | 51 | 10.87% |
| Disagree | (2) | 24 | 5.12% |
| Strongly Disagree | (1) | 19 | 4.05% |

Percent Responses: 0 25 50 75 100 — Means: 4.15 — Course

| Return Rate | Mean | STD | Median |
|---|---|---|---|
| 469/470 (99.79%) | 4.15 | 1.07 | 4.00 |

## *CSU-USG Enrollment and Degrees Conferred Data*

ENROLLMENT BY CONCENTRATION BY SEMESTER (total reflects all tracks plus students with no chosen concentration)

| Semester | Astrophysics and Planetary Geology | Environmental Science | Geology | Secondary Education | Total | Percent Growth per semester | Percent Growth per academic year |
|---|---|---|---|---|---|---|---|
| 2011 Fall | 13 | 3 | 20 | 6 | 53 | | |
| 2012 Spring | 16 | 9 | 27 | 7 | 63 | 18.87% | |
| 2012 Fall | 21 | 21 | 28 | 11 | 85 | 41.51% | |
| 2013 Spring | 17 | 20 | 26 | 12 | 79 | -11.32% | 41.38% |
| 2013 Fall | 4 | 25 | 25 | 10 | 77 | -3.77% | |
| 2014 Spring | 19 | 22 | 22 | 7 | 73 | -7.55% | -8.54% |
| 2014 Fall | 13 | 25 | 25 | 5 | 70 | -5.66% | |
| 2015 Spring | 10 | 23 | 25 | 5 | 66 | -7.55% | -9.33% |
| 2015 Fall | 14 | 22 | 16 | 3 | 63 | -5.66% | |
| 2016 Spring | 17 | 26 | 17 | 5 | 69 | 11.32% | 30.19% |

ESS DEGREES CONFERRED BY SEMESTER

| Semester | Astrophysics and Planetary Geology | Environmental Science | Geology | Secondary Education | Total |
|---|---|---|---|---|---|
| FY2012 | 0 | 0 | 0 | 0 | 0 |
| FY2013 | 2 | 0 | 8 | 1 | 11 |
| FY2014 | 3 | 0 | 4 | 2 | 9 |
| FY2015 | 1 | 4 | 5 | 0 | 10 |
| FY2016 | 2 | 7 | 10 | 1 | 20 |

USG DEGREES CONFERRED BY INSTITUTION/CIP CODE

| | Institution | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Fiscal Year** | **Georgia Tech** | **Georgia State** | **University of Georgia** | **Georgia Southern** | **West Georgia** | **Valdosta State** | **Columbus State** | **Georgia Southwestern** | **Savannah State** |
| **FY2012** | 14 | 12 | 24 | 5 | 14 | 12 | 0 | 2 | 7 |
| **FY2013** | 9 | 27 | 26 | 5 | 5 | 9 | 11 | 1 | 6 |
| **FY2014** | 18 | 27 | 23 | 13 | 10 | 6 | 9 | 4 | 5 |
| **FY2015** | 6 | 24 | 44 | 18 | 9 | 17 | 10 | 3 | 7 |
| **FY2016** | 14 | 25 | 30 | 14 | 13 | 4 | 20 | 1 | 3 |
| | | | | | | | | | |
| **Notes** | 40.0699 Geological and Earth Sciences/Geosciences, Other | 40.0201 Astronomy, 40.0601 Geology/Earth Science, General, and 40.0699 Geological and Earth Sciences/Geosciences, Other | 40.0201 Astronomy and 40.0601 Geology/Earth Science, General | 40.0601 Geology/Earth Science, General | 40.0601 Geology/Earth Science, General | 40.0601 Geology/Earth Science, General | 40.0699 Geological and Earth Sciences/Geosciences, Other | 40.0601 Geology/Earth Science, General | 40.0601 Geology/Earth Science, General |

## *CSU Undergraduate Enrollment by Major Program of Study*

| Undergraduate Enrollment by Major Program of Study | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Fall 2011 | Fall 2012 | Fall 2013 | Fall 2014 | Fall 2015 | 4-Year # Change | 4-Year % Change |
| Certificate | | | | | | | |
| Army Medic Health Science | NA | NA | 39 | 0 | 2 | | |
| Criminal Justice | 339 | 347 | 332 | 325 | 322 | -17 | -5.0% |
| Intrernational Studies | NA | NA | NA | 1 | 0 | | |
| Medieval & Renaissance Studies | NA | NA | NA | NA | 1 | | |
| Social Media | NA | NA | NA | NA | 1 | | |
| Teaching English As a Sec Lang | 1 | 3 | 3 | 0 | 2 | 1 | 100.0% |
| *Total Certificate* | *340* | *350* | *374* | *326* | *328* | *-12* | *-3.5%* |
| Associate | | | | | | | |
| Computer Science | 1 | NA | NA | NA | NA | | |
| Criminal Justice | 20 | 23 | 24 | 9 | 10 | -10 | -50.0% |
| Core Curriculum | 135 | 142 | 133 | 137 | 144 | 9 | 6.7% |
| *Total Associate* | *156* | *165* | *157* | *146* | *154* | *-2* | *-1.3%* |
| Baccalaureate | | | | | | | |
| Accounting | 183 | 187 | 193 | 171 | 169 | -14 | -7.7% |
| Art | 114 | 98 | 98 | 108 | 106 | -8 | -7.0% |
| Art Education | 44 | 38 | 24 | 22 | 21 | -23 | -52.3% |
| Art History | NA | 9 | 12 | 20 | 21 | | |
| Biology | 441 | 448 | 449 | 420 | 435 | -6 | -1.4% |
| Chemistry | 114 | 122 | 101 | 100 | 103 | -11 | -9.6% |
| Communication | 180 | 217 | 231 | 274 | 296 | 116 | 64.4% |
| Computer Science | 212 | 254 | 288 | 287 | 320 | 108 | 50.9% |
| Criminal Justice | 386 | 363 | 331 | 370 | 321 | -65 | -16.8% |
| Early Childhood Education | 380 | 317 | 328 | 298 | 269 | -111 | -29.2% |
| Earth & Space Science | 50 | 80 | 71 | 70 | 68 | 18 | 36.0% |
| English Language | 202 | 184 | 170 | 169 | 146 | -56 | -27.7% |
| Exercise Science | 225 | 280 | 267 | 251 | 259 | 34 | 15.1% |
| Finance | 84 | 84 | 88 | 81 | 105 | 21 | 25.0% |
| General Business | 164 | 234 | 298 | 299 | 317 | 153 | 93.3% |
| Health & Physical Education | 77 | 67 | 62 | 60 | 54 | -23 | -29.9% |
| Health Science | 234 | 236 | 249 | 240 | 271 | 37 | 15.8% |
| History | 144 | 123 | 118 | 111 | 91 | -53 | -36.8% |
| Information Technology | 78 | 72 | 84 | 112 | 127 | 49 | 62.8% |
| Liberal Arts | 26 | 38 | 45 | 38 | 36 | 10 | 38.5% |
| Management | 206 | 193 | 176 | 181 | 198 | -8 | -3.9% |
| Management Info Systems | 53 | 48 | 46 | 41 | 47 | -6 | -11.3% |
| Marketing | 125 | 155 | 146 | 149 | 163 | 38 | 30.4% |
| Mathematics | 67 | 86 | 71 | 62 | 71 | 4 | 6.0% |
| Middle Grades Education | 82 | 77 | 70 | 67 | 59 | -23 | -28.0% |
| Modern Language & Culture | 50 | 46 | 42 | 25 | 21 | -29 | -58.0% |
| Music Performance | 100 | 98 | 107 | 85 | 87 | -13 | -13.0% |
| Music Education | 85 | 73 | 80 | 84 | 76 | -9 | -10.6% |
| Music, General | 40 | 42 | 22 | 22 | 28 | -12 | -30.0% |
| Nursing | 666 | 745 | 830 | 845 | 824 | 158 | 23.7% |
| Political Science | 114 | 100 | 78 | 70 | 61 | -53 | -46.5% |
| Pre-Business | 101 | 12 | 5 | 1 | 0 | -101 | -100.0% |
| Psychology | 292 | 270 | 286 | 267 | 279 | -13 | -4.5% |
| Sociology | 112 | 155 | 173 | 188 | 200 | 88 | 78.6% |
| Spec Ed - General Curriculum | 84 | 85 | 74 | 64 | 48 | -36 | -42.9% |
| Theatre | 119 | 125 | 128 | 113 | 122 | 3 | 2.5% |
| Theatre Education | 30 | 36 | 26 | 30 | 37 | 7 | 23.3% |
| *Total Baccalaureate* | *5,664* | *5,797* | *5,867* | *5,795* | *5,856* | *192* | *3.4%* |
| Undeclared/Non-Degree | 399 | 383 | 355 | 335 | 308 | -91 | -22.8% |
| Basic Studies | 478 | 330 | 268 | 277 | 291 | -187 | -39.1% |
| *Total Undergraduate* | *7,037* | *7,025* | *7,021* | *6,879* | *6,937* | *-100* | *-1.4%* |

| Major Program | Fall 2010 Cohort | Returning Fall 2011 Number | Returning Fall 2011 Rate | Fall 2011 Cohort | Returning Fall 2012 Number | Returning Fall 2012 Rate | Fall 2012 Cohort | Returning Fall 2013 Number | Returning Fall 2013 Rate | Fall 2013 Cohort | Returning Fall 2014 Number | Returning Fall 2014 Rate | Fall 2014 Cohort | Returning Fall 2015 Number | Returning Fall 2015 Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Baccalaureate** | | | | | | | | | | | | | | | |
| Accounting | 0 | | | 9 | 3 | 33.3% | 12 | 5 | 41.7% | 20 | 12 | 60.0% | 12 | 8 | 66.7% |
| Art | 27 | 17 | 63.0% | 13 | 6 | 46.2% | 16 | 8 | 50.0% | 17 | 12 | 70.6% | 18 | 8 | 44.4% |
| Art Education | 6 | 4 | 66.7% | 5 | 3 | 60.0% | 2 | 1 | 50.0% | 1 | 1 | 100.0% | 2 | 2 | 100.0% |
| Art History | NA | | | NA | | | NA | | | 3 | 3 | 100.0% | 1 | 1 | 100.0% |
| Biology | 88 | 61 | 69.3% | 113 | 80 | 70.8% | 98 | 68 | 69.4% | 85 | 62 | 72.9% | 71 | 50 | 70.4% |
| Chemistry | 13 | 11 | 84.6% | 24 | 19 | 79.2% | 33 | 21 | 63.6% | 18 | 14 | 77.8% | 23 | 19 | 82.6% |
| Communication | 19 | 16 | 84.2% | 24 | 17 | 70.8% | 34 | 24 | 70.6% | 27 | 19 | 70.4% | 28 | 19 | 67.9% |
| Computer Science | 33 | 26 | 78.8% | 42 | 27 | 64.3% | 57 | 35 | 61.4% | 51 | 34 | 66.7% | 42 | 31 | 73.8% |
| Criminal Justice | 33 | 19 | 57.6% | 46 | 21 | 45.7% | 40 | 26 | 65.0% | 34 | 28 | 82.4% | 24 | 13 | 54.2% |
| Early Childhood Education | 51 | 40 | 78.4% | 36 | 26 | 72.2% | 31 | 27 | 87.1% | 42 | 31 | 73.8% | 25 | 15 | 60.0% |
| Earth & Space Science/Geology | 3 | 2 | 66.7% | 4 | 2 | 50.0% | 8 | 6 | 75.0% | 7 | 5 | 71.4% | 3 | 2 | 66.7% |
| English Language | 25 | 16 | 64.0% | 25 | 19 | 76.0% | 16 | 11 | 68.8% | 16 | 14 | 87.5% | 21 | 17 | 81.0% |
| Exercise Science | 30 | 22 | 73.3% | 31 | 21 | 67.7% | 42 | 31 | 73.8% | 32 | 23 | 71.9% | 28 | 23 | 82.1% |
| Finance | 0 | | | 6 | 5 | 83.3% | 1 | 1 | 100.0% | 3 | 1 | 33.3% | 3 | 2 | 66.7% |
| General Business | 0 | | | 28 | 18 | 64.3% | 39 | 22 | 56.4% | 51 | 41 | 80.4% | 36 | 29 | 80.6% |
| Health & Physical Education | 4 | 2 | 50.0% | 5 | 2 | 40.0% | 5 | 4 | 80.0% | 4 | 3 | 75.0% | 6 | 3 | 50.0% |
| Health Science | 10 | 8 | 80.0% | 18 | 11 | 61.1% | 15 | 11 | 73.3% | 11 | 6 | 54.5% | 9 | 7 | 77.8% |
| History | 18 | 11 | 61.1% | 18 | 14 | 77.8% | 11 | 8 | 72.7% | 11 | 9 | 81.8% | 10 | 8 | 80.0% |
| Information Technology | 8 | 5 | 62.5% | 4 | 4 | 100.0% | 8 | 5 | 62.5% | 5 | 2 | 40.0% | 12 | 10 | 83.3% |
| Liberal Arts | 0 | | | 0 | | | 4 | 3 | 75.0% | 2 | 0 | 0.0% | 1 | 0 | 0.0% |
| Management | 0 | | | 12 | 6 | 50.0% | 8 | 5 | 62.5% | 15 | 10 | 66.7% | 7 | 5 | 71.4% |
| Management Information Systems | 0 | | | 3 | 1 | 33.3% | 1 | 0 | 0.0% | 2 | 2 | 100.0% | 2 | 2 | 100.0% |
| Marketing | 1 | 0 | 0.0% | 15 | 13 | 86.7% | 15 | 13 | 86.7% | 17 | 15 | 88.2% | 22 | 14 | 63.6% |
| Mathematics | 6 | 4 | 66.7% | 9 | 7 | 77.8% | 11 | 4 | 36.4% | 4 | 3 | 75.0% | 6 | 4 | 66.7% |
| Middle Grades Education | 8 | 7 | 87.5% | 8 | 5 | 62.5% | 6 | 5 | 83.3% | 7 | 5 | 71.4% | 2 | 1 | 50.0% |
| Modern Language & Culture | 4 | 4 | 100.0% | 4 | 3 | 75.0% | 4 | 4 | 100.0% | 3 | 3 | 100.0% | 0 | | |
| Music Performance | 32 | 27 | 84.4% | 24 | 15 | 62.5% | 24 | 23 | 95.8% | 28 | 23 | 82.1% | 18 | 16 | 88.9% |
| Music Education | 20 | 16 | 80.0% | 24 | 22 | 91.7% | 24 | 21 | 87.5% | 17 | 13 | 76.5% | 20 | 19 | 95.0% |
| Music, General | 8 | 6 | 75.0% | 8 | 5 | 62.5% | 12 | 9 | 75.0% | 2 | 2 | 100.0% | 3 | 2 | 66.7% |
| Nursing | 99 | 65 | 65.7% | 126 | 87 | 69.0% | 134 | 91 | 67.9% | 130 | 103 | 79.2% | 109 | 76 | 69.7% |
| Political Science | 14 | 11 | 78.6% | 14 | 9 | 64.3% | 14 | 11 | 78.6% | 11 | 10 | 90.9% | 9 | 9 | 100.0% |
| Pre-Business | 77 | 56 | 72.7% | 17 | 9 | 52.9% | NA | | | NA | | | NA | | |
| Psychology | 47 | 24 | 51.1% | 59 | 40 | 67.8% | 44 | 24 | 54.5% | 46 | 31 | 67.4% | 41 | 29 | 70.7% |
| Sociology | 4 | 2 | 50.0% | 8 | 6 | 75.0% | 7 | 5 | 71.4% | 8 | 6 | 75.0% | 8 | 6 | 75.0% |
| Spec Ed - General Curriculum | 4 | 2 | 50.0% | 5 | 4 | 80.0% | 3 | 2 | 66.7% | 7 | 5 | 71.4% | 5 | 4 | 80.0% |
| Theatre Arts | 53 | 43 | 81.1% | 19 | 17 | 89.5% | 28 | 22 | 78.6% | 27 | 23 | 85.2% | 13 | 12 | 92.3% |
| Theatre Education | 0 | | | 7 | 4 | 57.1% | 12 | 7 | 58.3% | 8 | 7 | 87.5% | 5 | 4 | 80.0% |
| *Total Baccalaureate* | *745* | *527* | *70.7%* | *813* | *551* | *67.8%* | *819* | *563* | *68.7%* | *772* | *581* | *75.3%* | *645* | *470* | *72.9%* |

* The cohorts below are first-time full-time undergraduate students enrolled in a baccalaureate program fall semester who entered CSU in the fall or the preceding summer term.

| Major Program | Number in Fall 2006 Cohort | Fall 2006 Cohort Graduating by 2012 Number | Rate | Number in Fall 2007 Cohort | Fall 2007 Cohort Graduating by 2013 Number | Rate | Number in Fall 2008 Cohort | Fall 2008 Cohort Graduating by 2014 Number | Rate | Number in Fall 2009 Cohort | Fall 2009 Cohort Graduating by 2015 Number | Rate | Number in Fall 2010 Cohort | Fall 2010 Cohort Graduating by 2016 Number | Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Baccalaureate** | | | | | | | | | | | | | | | |
| Accounting | 23 | 10 | 43.5% | 20 | 6 | 30.0% | 19 | 8 | 42.1% | 0 | | | 0 | | |
| Art | 18 | 4 | 22.2% | 18 | 7 | 38.9% | 22 | 10 | 45.5% | 25 | 11 | 44.0% | 27 | 7 | 25.9% |
| Art Education | 1 | 0 | 0.0% | 2 | 0 | 0.0% | 2 | 0 | 0.0% | 2 | 0 | 0.0% | 6 | 3 | 50.0% |
| Biology | 83 | 33 | 39.8% | 85 | 29 | 34.1% | 99 | 33 | 33.3% | 106 | 30 | 28.3% | 88 | 24 | 27.3% |
| Chemistry | 23 | 6 | 26.1% | 13 | 4 | 30.8% | 31 | 14 | 45.2% | 10 | 4 | 40.0% | 13 | 4 | 30.8% |
| Communication | 23 | 8 | 34.8% | 13 | 2 | 15.4% | 20 | 5 | 25.0% | 13 | 7 | 53.8% | 19 | 9 | 47.4% |
| Computer Science | 24 | 7 | 29.2% | 40 | 19 | 47.5% | 51 | 14 | 27.5% | 39 | 11 | 28.2% | 33 | 10 | 30.3% |
| Criminal Justice | 20 | 9 | 45.0% | 20 | 8 | 40.0% | 19 | 8 | 42.1% | 33 | 13 | 39.4% | 33 | 9 | 27.3% |
| Early Childhood Education | 51 | 23 | 45.1% | 42 | 27 | 64.3% | 40 | 24 | 60.0% | 40 | 20 | 50.0% | 51 | 20 | 39.2% |
| Earth & Space Science/Geology | 2 | 1 | 50.0% | 2 | 1 | 50.0% | 0 | | | 3 | 1 | 33.3% | 3 | 2 | 66.7% |
| English Language | 22 | 11 | 50.0% | 15 | 8 | 53.3% | 18 | 9 | 50.0% | 27 | 11 | 40.7% | 25 | 10 | 40.0% |
| Exercise Science | 10 | 7 | 70.0% | 12 | 5 | 41.7% | 11 | 5 | 45.5% | 21 | 10 | 47.6% | 30 | 12 | 40.0% |
| Finance | 11 | 4 | 36.4% | 9 | 4 | 44.4% | 13 | 8 | 61.5% | 0 | | | 0 | | |
| General Business | 32 | 9 | 28.1% | 40 | 13 | 32.5% | 40 | 13 | 32.5% | 0 | | | 0 | | |
| Health & Physical Education | 3 | 2 | 66.7% | 4 | 0 | 0.0% | 3 | 1 | 33.3% | 6 | 1 | 16.7% | 4 | 1 | 25.0% |
| Health Science | 8 | 1 | 12.5% | 2 | 0 | 0.0% | 9 | 2 | 22.2% | 15 | 6 | 40.0% | 10 | 4 | 40.0% |
| History | 18 | 9 | 50.0% | 17 | 7 | 41.2% | 19 | 5 | 26.3% | 21 | 9 | 42.9% | 18 | 5 | 27.8% |
| Information Technlogy | NA | | | NA | | | 1 | 0 | 0.0% | 3 | 1 | 33.3% | 8 | 4 | 50.0% |
| Management | 34 | 12 | 35.3% | 21 | 5 | 23.8% | 24 | 7 | 29.2% | 0 | | | 0 | | |
| Management Information Systems | 13 | 3 | 23.1% | 6 | 2 | 33.3% | 3 | 1 | 33.3% | 0 | | | 0 | | |
| Marketing | 16 | 5 | 31.3% | 18 | 7 | 38.9% | 14 | 6 | 42.9% | 0 | | | 1 | 0 | 0.0% |
| Mathematics | 15 | 5 | 33.3% | 9 | 1 | 11.1% | 16 | 5 | 31.3% | 17 | 7 | 41.2% | 6 | 3 | 50.0% |
| Middle Grades Education | 2 | 2 | 100.0% | 5 | 0 | 0.0% | 3 | 1 | 33.3% | 7 | 3 | 42.9% | 8 | 6 | 75.0% |
| Modern Language & Culture | 7 | 2 | 28.6% | 2 | 1 | 50.0% | 0 | | | 7 | 1 | 14.3% | 4 | 3 | 75.0% |
| Music Performance | 19 | 10 | 52.6% | 14 | 5 | 35.7% | 22 | 13 | 59.1% | 28 | 12 | 42.9% | 32 | 22 | 68.8% |
| Music Education | 22 | 20 | 90.9% | 28 | 14 | 50.0% | 30 | 16 | 53.3% | 22 | 10 | 45.5% | 20 | 7 | 35.0% |
| Music, General | 3 | 2 | 66.7% | 9 | 3 | 33.3% | 8 | 4 | 50.0% | 6 | 2 | 33.3% | 8 | 4 | 50.0% |
| Nursing | 75 | 32 | 42.7% | 53 | 23 | 43.4% | 73 | 29 | 39.7% | 91 | 41 | 45.1% | 99 | 35 | 35.4% |
| Political Science | 17 | 3 | 17.6% | 9 | 2 | 22.2% | 12 | 6 | 50.0% | 20 | 11 | 55.0% | 14 | 3 | 21.4% |
| Pre-Business | NA | | | NA | | | NA | | | 123 | 43 | 35.0% | 77 | 24 | 31.2% |
| Psychology | 42 | 16 | 38.1% | 34 | 11 | 32.4% | 39 | 14 | 35.9% | 43 | 16 | 37.2% | 47 | 11 | 23.4% |
| Sociology | 3 | 1 | 33.3% | 10 | 3 | 30.0% | 7 | 2 | 28.6% | 5 | 1 | 20.0% | 4 | 1 | 25.0% |
| Spec Ed - General Curriculum | 1 | 0 | 0.0% | 2 | 2 | 100.0% | 3 | 2 | 66.7% | 3 | 1 | 33.3% | 4 | 2 | 50.0% |
| Theatre | 38 | 18 | 47.4% | 27 | 9 | 33.3% | 26 | 10 | 38.5% | 49 | 20 | 40.8% | 53 | 29 | 54.7% |
| Theatre Education | 11 | 7 | 63.6% | 9 | 4 | 44.4% | 17 | 9 | 52.9% | 5 | 0 | 0.0% | 0 | | |
| *Total Baccalaureate* | *690* | *282* | *40.9%* | *610* | *232* | *38.0%* | *714* | *284* | *39.8%* | *790* | *303* | *38.4%* | *745* | *274* | *36.8%* |

***Faculty and Faculty-Student Books/Publications/Presentations (by Faculty Member)***

Barineau, Clinton – Associate Professor of Geology

Barineau, Clinton I., Tull, James F. and Holm-Denoma, Christopher S., 2015, A Laurentian margin back-arc: The Ordovician Wedowee-Emuckfaw-Dahlonega basin, in Holmes, A.E., ed., Diverse Excursions in the Southeast: Paleozoic to Present: Geological Society of America Field Guide 39, p. 21-78.

Barineau, C.I., 2015, Coastal Plain Unconformity of Eastern Alabama-Western Georgia: Geologic Overview: in Barineau, C.I. and Carrick, B. ed., Geology of the Coastal Plain Unconformity: Western Georgia-Eastern Alabama. Southeastern Geological Society Guidebook No. 65, p. 2–14.

Barineau, C.I., and Miller, J., 2015, Implications of Ordovician and Silurian Magmatism in the Southern Appalachians: in Barineau, C.I. and Carrick, B. ed., Geology of the Coastal Plain Unconformity: Western Georgia-Eastern Alabama. Southeastern Geological Society Guidebook No. 65, p. 45–56.

Black, D.L., Clinton I. Barineau, and Frazier, W.J., 2015, Paleorelief on the Coastal Plain Unconformity of Southwestern Georgia: Evidence for a Long-Lived, Late Cretaceous Paleodrainange System.: in Barineau, C.I. and Carrick B. ed., Geology of the Coastal Plain Unconformity: Western Georgia-Eastern Alabama. Southeastern Geological Society Guidebook No. 65, p. 15–34.

Tull, James F., Holm-Denoma, Christopher S., and Barineau, Clinton I., 2014. Early to Middle Ordovician back-arc basin in the southern Appalachian Blue Ridge: Characteristics, extent, and tectonic significance. Geological Society of America Bulletin. v. 126; no. 7/8; p. 990–1015.

Barineau, Clinton I. and Tull, James F., 2012, The Talladega and Ashland-Wedowee-Emuckfaw Belts of Alabama: Geological Overview. Alabama Geological Society 49th Annual Field Trip Guidebook, p. 1-11.

Tull, James F., Barineau, Clinton I., and Holm-Denoma, Christopher S., 2012, Characteristics, Extent, and Tectonic Significance of a Middle Ordovician Back-arc Basin in the Southern Appalachian Blue Ridge. Alabama Geological Society 49th Annual Field Trip Guidebook, p. 12-26.

Barineau, Clinton I., Tull, James F. and Woodall, Jessica D., 2012, Strain Analysis on the Sub-Lay Dam Unconformity Near Jumbo, Alabama. Geological Society 49th Annual Field Trip Guidebook, p. 38-46.

Tull, J.F., and Barineau, C.I., 2012, Overview of the stratigraphic and structural evolution of the Talladega slate belt, Alabama Appalachians, in Eppes, M.C., and Bartholomew, M.J., eds., From the Blue Ridge to the Coastal Plain: Field Excursions in the Southeastern United States: Geological Society of America Field Guide 29, p. 263–302, doi:10.1130/2012.0029(08).

Miller, J.L., and Barineau, C.I., 2016, A Case of Mistaken Identity: The “Woodbury Structure” of South Central Georgia, *in* Geological Society of America Abstracts With Programs, Denver, CO, Geological Society of America, v. 48.

Tull, J.F., Barineau, C.I., Holm-Denoma, C.S., Farris, D.W., Mueller, P.A., and Davis, B.L., 2016, Remnants of a Paired Laurentian Taconic Arc/Back-arc System in the Southernmost Appalachians, *in*

Geological Society of America Abstracts with Programs., Columbia, SC, Geological Society of America, v. 48.

Miller, J., and Barineau, C.I., 2016, The "Woodbury Structure" of the Pine Mountain Belt in Meriwether County, Georgia: Impact Crater vs. Structural Dome Interpretation, in Geological Society of America Abstracts with Programs, Columbia, SC, Geological Society of America, v. 48, doi: 10.1130/abs/2016SE-273995.

Barineau, Clinton I., Tull, James F. and Holm-Denoma, Christopher S., 2015, Ordovician Events in the Southern Appalachians: Synthesizing the Igneous, Sedimentary and Metamorphic Record of the Taconic Orogeny: Geological Society of America Abstracts with Programs. Vol. 47, No. 2.

Sagul, Douglas A., Mueller, Paul A. and Barineau, Clinton I., 2015, Geochemical Analysis of the Zana Granite and Kowaliga Gneiss, Eastern Blue Ridge, Alabama. Geological Society of America Abstracts with Programs. Vol. 47, No. 2.

Barineau, Clinton I., Roop-Eckart, Kenneth J., Schley, Rhett D, and Carpenter, Nicholas D., 2015, Geologic Mapping with Google Earth: A GIS Alternative: Geological Society of America Abstracts with Programs. Vol. 47, No. 2.

Harstad, Rylleigh P. and Barineau, Clinton I., Kinematic and Age Constraints on the Alexander City Fault, Eastern Blue Ridge, Alabama.: Geological Society of America Abstracts with Programs, Vol. 46, No. 6, p.504.

Barineau, Clinton I., Tull, James F. and Holm-Denoma, Christopher S., 2014, The Sea of Japan as a Cenozoic Analogue for the Ordovician Wedowee-Emuckfaw-Dahlonega Back-Arc Basin: Southern Appalachians: Geological Society of America Abstracts with Programs. Vol. 46, No. 3, p.86.

Patrick, Wenonah J. and Barineau, Clinton I., 2014, Effective Use of a Low-Cost Spiral Panning Machine for Zircon Separation: Geological Society of America Abstracts with Programs. Vol. 46, No. 3, p.79.

Barineau, Clinton I., Espinosa, Salvador, Harstad, Rylleigh P., and Smenner, Ridge A., 2014, Mapping and Structural Analysis across Emuckfaw Group-Wedowee Group Contacts in the Eastern Blue Ridge of Alabama: Geological Society of America Abstracts with Programs. Vol. 46, No. 3, p.13.

Tull, James F. and Barineau, Clinton I., 2014, Alternative Tectonic Model for the Development of the Southern Appalachian Blountian Foreland Clastic Wedge: Geological Society of America Abstracts with Programs. Vol. 46, No. 3, p.36.

Barineau, Clinton I.; Holm-Denoma, Christopher S.; Tull, James F.; Mueller, Paul A.; Black, Daniel L.; and Sagul, Douglas A., 2013, A Synthesis of Recent Contributions in Southern Appalachian Mapping, Geochemistry and Geochronology of Laurentian Margin Rocks: Part II – Latest Neoproterozoic through Ordovician. Geological Society of America *Abstracts with Programs*. Vol. 45, No. 7, p.809.

Barineau, Clinton I.; Mueller, Paul A.; Holm-Denoma, Christopher S.; Tull, James F.; Sagul, Douglas A.; Black, Daniel L.; and Pazel, John Michael, 2013, A Synthesis of Recent Contributions in Southern Appalachian Mapping, Geochemistry and Geochronology of Laurentian Margin Rocks: Part II – Silurian through Permian. Geological Society of America *Abstracts with Programs*. Vol. 45, No. 7, p.809.

Barineau, Clinton I., Holm-Denoma, Christopher S., and Tull, James F., 2012, Three Phases of Taconic Accretionary Orogenesis in the Southern Appalachians. Geological Society of America *Abstracts with Programs*, Vol. 44, No. 7, p.173.

Wilkes, Cheryl; Colon, Alexander; Barineau, Clinton I.; and Hanley, Thomas B., 2012, Geology of the Fortson, Georgia, 7.5 Minute Quadrangle, Uchee Belt, Southern Appalachians. Geological Society of America *Abstracts with Programs*, Vol. 44, No. 4, p. 22.

Gilmer, Jess and Barineau, Clinton I., 2012, Correlation of Ashland-Wedowee-Emuckfaw Belt and Dahlonega Gold Belt Stratigraphy, Northwestern Georgia-Northeastern Alabama, Southern Appalachians. Geological Society of America *Abstracts with Programs*, Vol. 44, No. 4, p. 22.

Barineau, Clinton I.; Holm-Denoma, Christopher S., and Tull James F., 2012, Growing Evidence for the Presence of Laurentian Margin Ordovician Back-Arc Basin(s) in the Southern Appalachian. Geological Society of America Abstracts with Programs, vol. 44, no. 4, p. 64.

Barineau, Clinton I., 2011, Understanding the Formation and Emplacement of Back-arc Rocks: From the Pacific to the Southern Appalachians. Geological Society of America *Abstracts with Programs*, Vol. 43, No. 5, p. 45.

Barineau, Clinton I., 2011, Relationship Between the Ashland-Wedowee and Dahlonega Gold Belts, Southern Appalachians: Implications for Early Paleozoic Appalachian Tectonics. Geological Society of America *Abstracts with Programs*, Vol. 43, No. 2, p. 15

Barineau, Clinton I., 2010, Paleotectonic Reconstructions, Back-arc Evolution, and the Southern Appalachian Taconic Orogeny. Geological Society of America *Abstracts with Programs*, Vol. 42, No. 5, p. 678.

<u>Blersch, Stacy – Assistant Professor of Hydrology</u>

Habberfield, Michael W., S.S. Blersch, S. J. Bennett, and J.F. Atkinson, 2014. Rapid Geomorphic and Habitat Stream Assessment Techniques Inform Restoration Differently Based on Levels of Stream Disturbance. Journal of the American Water Resources Association (JAWRA) 50(4): 1051-1062.

Bennett, S.J., A. Simon, J.M. Castro, J.F. Atkinson, C.E. Bronner., S.S. Blersch, and A.J. Rabideau. 2011. The evolving science of stream restoration, in Stream Restoration in Dynamic Fluvial Systems: Scientific Approaches, Analyses, and Tools, Geophysical Monograph Series, Volume 194. A. Simon, S. J. Bennett & J. M. Castro (Eds.), pp. 1-8, American Geophysical Union (AGU), Washington, D.C.

S.S. Blersch. 2015. Proposed Metric for Measuring Shifts in Ecological Function of Impaired Streams. Alabama Water Resource Conference. Sept 10-11, Orange Beach, AL

Habberfield, M.H., S.S. Blersch. 2013. Comparison of rapid stream assessment techniques across a gradient of disturbance. 5th National Conference on Ecosystem Restoration. July 29-August 2, Chicago, IL.

Blersch, S.S. 2012. Hydraulic signatures of ecosystem integrity: a modeling framework for evaluating stream restoration techniques. 4th International Ecosummit, Sept 30-Oct 5, Columbus OH.

Burks-Copes, K.A., S.S.Blersch, T.S. Bridges. 2012. Incorporating ecosystem services into the evaluation, operations and maintenance of US Army Corps of Engineers Projects. 4th International Ecosummit, Sept 30-Oct 5, Columbus OH.

Blersch, S.S. 2012. The disconnect between ecosystem services concept and ecosystem function in stream restoration: Where do we go from here?. 12th Annual American Ecological Engineering Conference, Jun 6-9, SUNY ESF, Syracuse NY.

Blersch, S.S., J.F. Atkinson. 2014. Using stream metabolism to measure shifts in ecological function in impaired stream ecosystems. 2014 Ecostream: Stream Ecology and Restoration Conference. Nov 17-20, Charlotte, NC.

Blersch, S.S. 2014. Using stream metabolic measurements to quantify restoration of ecosystem services of impaired streams pre and post restoration. Conference on Ecological and Ecosystem Restoration, July 28-August 1, New Orleans, LA.

Blersch, S.S. 2011. A modeling framework for evaluating stream restoration techniques and ecosystem response. Fourth National Conference on Ecosystem Restoration, Aug 1-5, Baltimore, MD.

<u>Church, Warren – Professor of Anthropology</u>

In press *¿Qué era Chachapoyas? Avances del siglo XXI en la historia, arqueología, y geografía cultural de los Andes nororientales*. Co-edited volume with Anna Guengerich. Boletín de Arqueología de la Pontificia Universidad Católica del Perú, No. 23. Lima.

2017, Exploring Imperial Expansion Using an Isotopic Analysis of Paleodiet and Paleomobility Indicators in Chachapoyas, Peru. *American Journal of Physical Anthropology* 162(1)51-72.

2015, Climate change and the agricultural history of a mid-elevation Andean montane forest (with Mark Bush and Nicole Moshblech). *The Holocene* 25(9) 1522–1532, S.I. online.

2016, Paper: *Art, Identity, and Status at the Chachapoya Cliff Tombs of Los Pinchudos* (with J. Marla Toyne). 34th Annual Meeting of the Northeastern Conference on Andean Archaeology and Ethnohistory, October 15, Harvard University, Cambridge, MA.

2016, Invited Paper: *Beyond the Marañon: A consideration of Cajamarca's changing relationships with Chachapoyas societies*. 81st Annual Meetings of the Society for American Archaeology, April 9, Orlando, FL.

2015, Symposium Co-chair and organizer (with Anna Guengerich), "*Who Were the Chachapoya?*" 80th Annual Meetings of the Society for American Archaeology, San Francisco, CA April 19.

2015, Invited Paper, *Where Were the Chachapoya? A View from the South* for symposium "Who Were the Chachapoya?" 80th Annual Meetings of the Society for American Archaeology, San Francisco, CA April 19.

2014, Invited Paper, *Pre-Hispanic Travel and Transport Assemblages from Perú's Northeastern Tropical Montane Forest* for symposium "Reassembling the Sacred Bundle: Multifaceted Approaches to Understanding the Past" 79th Annual Meetings of the Society for American Archaeology, Austin, TX, April 26, 2014.

2013, Paper, *Archaeological Demography and "Cultural Origins" in the Northeastern Perúvian Montane Forest* (with Luis Valle Alvarez) at 32nd Annual Meeting of the Northeastern Conference on Andean Archaeology and Ethnohistory, November 16, Yale University.

2015, *Conservation Status Report on Gran Pajatén, Perú* for Global Heritage Fund. Palo Alto.

Cruzen, Shawn – Professor of Astronomy

April 2012: Gave invited talk to the *Georgia Space Working Group*, a state-wide consortium of aerospace professionals dedicated to growing existing Georgia space companies and attracting more space industry employers to the state. This talk featured the addition of NASA Space Shuttle artifacts to the CCSSC collection and educational programs at CCSSC relating to commercial space.

October 2011: Gave a NEON session presentation at the national meeting of the *Association of Science and Technology Centers* on CCSSC's Teacher-On-Loan program and the production of a peer-reviewed podcast library, both collaborations with the Muscogee County School District.

Gunter, William – Assistant Professor of Atmospheric Science

Denbath, M. G.V. Iungo, W.A. Brewer, A. Choukulkar, R. Delgado, S. Gunter, J.K. Lundquist, J.L. Schroeder, J.M. Wilczak, and D. Wolfe, 2017: Assessment of virtual towers performed with wind scanning lidars amd Ka-band radars during the XPIA experiment, Atmospheric Measurement Techniques, Final Review.

Gunter, W.S., J.L. Schroeder, C.C. Weiss, and E.B. Bruning, 2017: "Surface measurements of the 5 June 2013 damaging thunderstorm wind event near Pep, Texas", Wind and Structures, 24, 185-204. Lundquist, J.K., J. M. Wilczak, R. Ashton, L. Bianco, W. A. Brewer, A. Choukulkar, A. J. Clifton, M. Debnath, R. Delgado, K. Friedrich1, W.S. Gunter, A. Hamidi, G. V. Iungo, A. Kaushik, B. Kosović, P. Langan, A. Lass, E. Lavin, J. C.Y. Lee, R. K. Newsom, D. C. Noone, S. P. Oncley, P. T. Quelet, S. P. Sandberg, J. L. Schroeder, W. J. Shaw, L. Sparling, C. St. Martin, A. St. Pe, E. Strobach, K. Tay, B. J. Vanderwende, A. Weickmann, D. Wolfe, R. Worsnop, 2016: "Assessing state-of-the-art

capabilities for probing the atmospheric boundary layer: the XPIA field campaign," Bulletin of the American Meteorological Society, doi:10.1175/BAMS-D-15-00151.1, in press.

Gunter, W.S., J.L. Schroeder and B.D. Hirth, 2015: "Validation of dual-Doppler wind profiles with in situ anemometry", Journal of Atmospheric and Oceanic Technology, 32, 943-960.

Gunter, W.S., and J.L. Schroeder, 2015: "High-resolution full-scale measurements of thunderstorm outflow winds", Journal of Wind Engineering and Industrial Aerodynamics, 138, 13-26.

Hirth, B.D., J.L. Schroeder, W.S. Gunter, and J. Guynes, 2013: "Coupling Doppler radar derived wind maps with operational turbine data to document wind farm complex flows", Journal of Wind Energy, 18, 529-540.

Hirth, B.D., J.L. Schroeder, W.S. Gunter, and J. Guynes, 2012: "Measuring a utility scale 4 turbine wake using the TTUKa mobile research radars", Journal of Atmospheric and Oceanic Technology, 29, 765-771.

Krupar III, R.J., M. Mason, W.S. Gunter, J.S. Schroeder 2016: "Examining the empirical relationships between high resolution dual-Doppler wind profiles and in situ anemometry", 18th Australasian Wind Engineering Society Workshop, McLauren Vale, South Australia.

Gunter, W.S., and J.L. Schroeder, 2016: "TTUKa XPIA results: data validation and boundary layer structure", 96th Meeting American Meteorological Society, New Orleans, Louisiana.

Hirth B.D., J.L. Schroeder, and W.S. Gunter, 2015: "Dual-Doppler Investigation of Varying Wind Plant Flow Regimes using the TTUKa Radars", International Conference on Wind Engineering, Porto Alegre, Brazil.

Gunter, W.S., and J.L. Schroeder, 2015: "Dual-Doppler Radar and Surface Measurements of Thunderstorm Outflow Winds", International Conference on Wind Engineering, Porto Alegre, Brazil.

Gunter, W.S. and J.L. Schroeder, 2014: "Low-Level Wind Profiles and Surface Observations of Extreme Thunderstorm Winds", Engineering Mechanics Institute Conference, Toronto, Ontario.

Gunter, W.S., and J.L. Schroeder, 2013: "High-Resolution Full-Scale Observations of Thunderstorm Outflow Winds", 12th Americas Conference on Wind Engineering, Seattle, Washington.

Gunter, W.S. and J.L. Schroeder, 2012: "High-Resolution Full-Scale Observations of Thunderstorm Outflow Winds", 26th Conference on Severe Local Storms, Nashville, Tennessee.

Skinner, P.S., C.C. Weiss, W.S. Gunter, and J.L. Schroeder, 2012: "Near-Surface Thunderstorm Outflow Characteristics Observed by the TTUKa Mobile Doppler Radars", 26th Conference on Severe Local Storms, Nashville, Tennessee.

Gunter, W.S., and J.L. Schroeder, 2012: "High-Resolution Full-Scale Observations of Thunderstorm Outflow Winds", 3rd Annual AAWE Workshop, Hyannis, Massachusetts.

Hrepic, Zdeslav – Professor of Physics

Hrepic, Z., Zollman, D. A., & Rebello, N. S. (2016). Methodological issues in eliciting blend mental models: The context of sound propagation. *AIP Conf. Proceedings (2016 Physics Education Research Conference).* Database: INSPEC; Publication type: Journal paper.

Adams, P., Taggart, G., & Hrepic, Z. (2012). *Beginnings to New Horizons*. Paper presented at the Research Based Undergraduate Science Teaching: Investigating Reform in Classrooms (NSEUS NSF Conference Proceedings), Tuscaloosa, AL, USA. Online at http://nseus.org/.

Hrepic, Z. (2011). *Wireless computers in classrooms: Enhancing interactive physics instruction with Tablet PCs and DyKnow software.* Paper presented at the XIX Taller Internacional: Nuevas Tendencias en la Enseñanza de la Física (XIX International Workshop: New Trends in Physics Teaching), Puebla, Mexico.

Hrepic, Z. (2011). Wireless computers in classrooms: Enhancing interactive physics instruction with Tablet PCs and DyKnow software. *Latin-American Journal of Physics Education, 5*(2), 392-401. Database: EBSCO Education Research Complete; DOAJ

Hrepic, Z., & Shaw, K. (2011). Gauging instructional effectiveness of open policy for wireless computers in classrooms. In D. Sunal (Ed.), *Research Based Undergraduate Science Teaching: Investigating Reform in Classrooms (NSEUS NSF Conference Proceedings)*. Tuscaloosa, AL, USA: National Science Foundation (NSF). Online at http://nseus.org/; http://education.ua.edu/centers/ortd/background-research-papers/

Hrepic, Z., Hosson, C. D., Brookes, D., & Teodorescu, R. (2011). Delegates experience universality. *Physics Education, 46*(6), 641-644. Database: ERIC; EBSCO Education Research Complete; IoP Science

Hrepic, Z., (2013). What Is the Half-Life of Basketball Teams?. The Physics Teacher, 51(7), 415-417. Database: ERIC

Hrepic, Z., Lodder, K., & Shaw, K. A. (2013). Pedagogy and/or Technology: Making Difference in Improving Students' Problem Solving Skills. AIP Conf. Proceedings (2012 Physics Education Research Conference), 1513, 182-185. Database: INSPEC; Publication type: Journal paper.

Hrepic, Z., Nettles, C., & Bonilla, C. (2013). Demonstrating sound wave propagation with candle flame and loudspeaker. *The Physics Teacher*, 51(1), 16-19. Database: ERIC

Hrepic, Z. (2012). So Why Would a Pigeon Stand on One Leg (or Limp Without Hurting)? *The Physics Teacher,* 50, 149-151. Database: ERIC

Professional development through EU sponsored project: HR. 3.1.15-004: "School Principal: Profession and a qualification, rather than a function. In original, Croatian language: Stručna predavanja u okviru provedbe projekta HR. 3.1.15-0040 Ravnatelj: profesija i kvalifikacija, a ne funkcija)

The school reforms and initiatives in USA: Key events, intentions and outcomes of the past half century (May 10, 2016, morning, 10-12 a.m.)

Role and position of the school principals in the educational system of USA (May 10, 2016, afternoon, 1:30-3:30 p.m.)

Preparing Educational Leaders for Schools, Business and Community (May 11, 2016, morning, 10-12 a.m.)

Implementing Effective Educational Leadership Strategies and eWalkThrough System (May 11, 2016, afternoon, 1:30-3:30 p.m.). Together with guest speaker Kellie Gillespie of Southwest Plains Regional Service Center, Kansas, USA.

"Tablet computing in physics classroom: Enhancing interaction and collaborative physics problem solving". Zdeslav Hrepic. An invited presentation speaker and a leader of the associated hands on workshops. Presented at: "*XIX Taller Internacional: Nuevas Tendencias en la Enseñanza de la Física (XXI International Workshop: New Trends in Physics Teaching)*. Puebla, Mexico. May 2013.

"Wireless pen-based computing in classrooms: Advantages and possible pitfalls". Zdeslav Hrepic. **Keynote** speech presented at: "Education in the Modern European Environment". Opatija, Croatia, September 2012.

"Wireless computers in classrooms: Enhancing interactive physics instruction with Tablet PCs and DyKnow software". Zdeslav Hrepic. An invited presentation speaker and a leader of the associated hands on workshops. Presented at: "*XIX Taller Internacional: Nuevas Tendencias en la Enseñanza de la Física (XIX International Workshop: New Trends in Physics Teaching)*. Puebla, Mexico. May 2011.

"Exploring the nature of mental model blending in the context of sound propagation". Z. Hrepic, Dean A. Zollman, and N. Sanjay Rebello, *2016 Physics Education Research Conference* - Sacramento, California, USA. July 2016.

"Addressing Students' Mental Models of Sound Propagation: Overcoming the Hurdle of Hybrid Mental Models and the Real Time Elicitation". Hrepic, Z., *80th Annual Meeting of the APS Southeastern Section November 20-23, 2013 Western Kentucky University*, Bowling Greens, KY, USA. Nov 2013.

"Beginnings to New Horizons". Adams, P., Taggart, G., & Hrepic, Z., *NSEUS II (National Study of Education in Undergraduate Science) Conference - Research Based Undergraduate Science Teaching: Investigating Reform in Classrooms*, Tuscaloosa, AL, USA. May 2012.

"Gauging instructional effectiveness of open policy for wireless computers in classrooms". Zdeslav Hrepic, Kimberly Shaw, *NSEUS (National Study of Education in Undergraduate Science) Conference - Research Based Undergraduate Science Teaching: Investigating Reform in Classrooms*, Tuscaloosa, AL, USA. June 2011.

"Comparing Students and Experts' understanding of the content of a lecture: Bridging the gap with interactive software". Presented as an invited guest lecturer. Auburn State University, AL. May 2015.

Invited presentation for QEP Forum: "Opportunities and Redundancies of Pen-based Computing in Introductory Physics Problem Solving". Columbus State University, GA. May 2015.

2013 Faculty Honoree Plenary Presenter for the CSU Freshmen students and Parents Orientation (ROAR). June 2013.

Quality Enhancement Plan (QEP) on problem solving. "Opportunities and Redundancies of Pen-based Computing in Introductory Physics Problem Solving". Presented at Columbus State University, GA. June 2015.

"Nature my Teacher: Physics, Life Success Principles and Spirituality". Presentation given in Unitarian Universalist Fellowship. February 21 2016

"Nature my Teacher: Physics, Life Success Principles and Spirituality" (Invited follow up). Presentation given in Unitarian Universalist Fellowship. March 16 2016

"What do students and Professors Think: Panel Discussion about Teaching and Learning at CSU". Mariko Izumi, Phillip Bryant, Franklin Dillard, Joe Forrest, Renee Lambert, Zdeslav Hrepic. Presented at Columbus State University. October 2013

"The Reform Process: Beginnings to New Horizons" Paul Adams, Germaine Taggart, Fort Hayes State University and Zdeslav Hrepic, Columbus State University. Presented at *NSEUS II (National Study of Education in Undergraduate Science) Conference - Research Based Undergraduate Science Teaching: Investigating Reform in Classrooms*, Tuscaloosa, AL, USA. May 2012.

"Gauging effectiveness of Pen-based Computing for Collaborative introductory Physics Problem Solving". Duncan Cantrell, Kimberly A. Shaw, Zdeslav Hrepic. Poster Presentation. 2014 *American Association of Physics Teachers (AAPT) Winter National Meeting* –Orlando, Florida, USA. Jan 28-Jan 1. 2014.

"Methodology and/or Technology: Making Difference in Improving Students' Problem Solving Skills". Zdeslav Hrepic, Katherine Lodder, Kimberly Shaw, *2012 Physics Education Research Conference* – Philadelphia, Pennsylvania, USA. August 2012.

"Statics and Dynamics of walking a narrow path: A bird's perspective". Hrepic Z, 2012 *American Association of Physics Teachers (AAPT) Summer National Meeting* –Philadelphia, Pennsylvania, USA. July 28-August 1. 2012.

"Pen-input computing and DyKnow software: Pedagogical opportunities for interactive physics instruction". Hrepic Z. *National Forum on Improving Undergraduate Education Through Active Learning Spaces* – Minneapolis MN, USA. Poster presentation. August 2011.

"Exploring the nature of mental model blending in the context of sound propagation" Hrepic Z., *SACS-AAPT (The Southern Atlantic Coast Section of the American Association of Physics Teachers) Regional Meeting*. Morrow, GA, USA. April 2016.

"Opportunities and Redundancies of Pen-based Computing in Introductory Physics Problem Solving?" Hrepic Z., Lodder K., Shaw K., Cantrell D. *SACS-AAPT (The Southern Atlantic Coast Section of the American Association of Physics Teachers) Regional Meeting*. Atlanta, GA, USA. April 2015.

"What Is the Half-Life of Basketball Teams?" Hrepic Z., *SACS-AAPT (The Southern Atlantic Coast Section of the American Association of Physics Teachers) Regional Meeting*. Gainsville, GA, USA. April 2013.

"Teaching an Old Flame New Tricks: Ramification of Multimodal Experimental Results on Teaching and Student Comprehension" Nettles C., Hrepic Z. *Georgia Undergraduate Research Conference.* Columbus, GA, USA. February 2013.

"Methodology and/or Technology: Making a Difference in Improving Students' Problem-Solving Skills" Lodder K., Hrepic Z.. Shaw K. *Georgia Undergraduate Research Conference.* Columbus, GA, USA. February 2013.

"So Why Would a Pigeon Stand on One Leg (or Limp Without Hurting)?" Hrepic Z., *SACS-AAPT (The Southern Atlantic Coast Section of the American Association of Physics Teachers) Regional Meeting*. Athens, GA, USA. April 2012.

Keller, Troy – Professor of Environmental Science

*Gilmer II. J.H.* and T.A. Keller. 2015. Groundwater chemistry and soils have limited influence on the habitat-scale distribution of *Cambarus harti* Hobbs. Freshwater Crayfish 21(1): 43-50 doi: 10.5869/fc.2015.v21-1.43

*Coble K.M.*, *A.L. Hall*, *C.C. Meshes*, *J.A. Zalatan*, G.E. Stanton and T.A. Keller. 2015. Replacement of *Procambarus acutissimus* (Girard) by non-indigenous *Procambarus clarkii* (Girard) in a disturbed wetland. Freshwater Crayfish 21(1): 153-157 doi: 10.5869/fc.2015.v21-1.153

Keller, T.A. and *E. M. Husted*. 2015. Dewatering as a non-toxic control of nuisance midge larvae in periphyton wastewater treatment floways. Water Science and Technology 71(1):9-14 doi: 10.2166/wst.2014.442

Helms, B.S., C. Figiel, *J. Rivera*, J. Stoeckel, G. Stanton, T.A. Keller. 2013. Life history observations, environmental associations, and soil preferences of the Piedmont Blue Burrower (*Cambarus* (Depressicambarus) *harti*) Hobbs. Southeastern Naturalist 12(1): 143-160

Keller, T.A., E.B. Snyder, J.W. Feminella. 2011. Mechanisms and potential implications of fragmentation in low-order streams. Journal of the North American Benthological Society 30(4): 1093-1094

*Foster, H* and T.A. Keller. 2011. Flow in culverts as a potential mechanism of stream fragmentation for native and nonindigenous crayfish species. Journal of the North American Benthological Society 30(4): 1129-1137

Keller, T.A., G.W. Shenk, M.R. Williams, and R.A. Batiuk. 2011. Development of a new indicator of pollutant loads and its application to the Chesapeake Bay watershed. River Research & Applications 27: 202-212

C.B. Ruehl and T.A. Keller 2015. Mapping Introduced Apple snail (*Pomacea insularum*) and Speckled Crayfish (*Orconectes palmeri creolanus*) Distributions in Southwest Georgia. Report to US FWS-800-037-2014-CSU (Co-PI)

Keller, T., *J. Rivera*, C. Fiegel, and G. Stanton. 2011. Ecology and Biogeography of the Piedmont Blue Burrower (*Cambarus* [Depressicambarus] *harti*). Report to Georgia Department of Natural Resources Nongame Wildlife Division (http://www.georgiawildlife.org/sites/default/files/uploads/wildlife/nongame/pdf/Cambarusharti_final.pdf)

Stahl, M.R. 2011. Characterization of watersheds on Fort Benning Military Reservation: Comparison of field data to watershed parameters. Masters Thesis. Columbus State University (Committee Member)

Ortega-Ariza, Diana – Assistant Professor of Geology

Abbott, S.S., King, D. J., Leckey, E. H., Muscente, A. D., Ortega-Ariza, D., Poole, C. R., Riedman, L. A, Tang, Q., and Wernette, S. W., 2015, Reflections on major themes in current stratigraphy by early career scientists and students, The Sedimentary Record, Vol. 13, No. 4, p. 12-14.

Ortega-Ariza, D., Franseen, E.K., Santos-Mercado, H., Ramirez-Martinez, W., and Core-Suárez, E., 2015, Strontium-isotope stratigraphy for Oligocene-Miocene carbonate systems in Puerto Rico and the Dominican Republic: Implications for Caribbean processes affecting depositional history, Journal of Geology, Vol. 123, p. 539-560.

Vélez-Juarbe, J., Martin, T., Macphee, R., and Ortega-Ariza, D., 2014, The earliest Caribbean rodents: Oligocene caviomorphs from Puerto Rico, Journal of Vertebrate Paleontology 34(1), p. 157-163.

Ortega-Ariza, D., Santos-Mercado, H., Franseen, E.K., and Ramirez-Martinez, W., 2013, Las Calizas de la Costa Norte de Puerto Rico, EspeleoRevista #9, Puerto Rico, p. 6-12.

Groot, M.H.M., Bogotá, R.G., Lourens, L.J., Hooghiemstra, H., Vriend, M., Berrio, J.C., Tuenter, E., van der Plicht, J., van Geel, B., Ziegler, M., Weber, S.L., Betancourt, A., Contreras, L., Gaviria, S., Giraldo, C., González, N., Jansen, J.H.F., Konert, M., Ortega, D., Rangel, O., Sarmiento, G., Vandenberghe, J., van der Hammen, T., van der Linden, M. and Westerhoff, W., 2011, Ultra-high resolution pollen record from the northern Andes reveals rapid shifts in montane climates within the last two glacial cycles. Climate of the Past, 7, p. 299-316.

Ortega-Ariza, D. and Franseen, E.K., 2016, Effects of sea level and upwelling on development of a Miocene shallow-water tropical carbonate ramp system, Ponce, Puerto Rico, USA, 2016, Abstract. In: Dolomieu Conference on Carbonate Platforms and Dolomite, 200+25 Years Dolomite, Talk, Selva di Val Gardena, Italy.

Core, E.E., Ramírez, W.R., Santos, H., Ortega-Ariza, D., and Franseen, E.K., 2016, MiocenePliocene Heterozoan-Dominated Systems in the Dominican Republic: Analogs for Neogene Reservoirs in the Caribbean, Abstract. AAPG Datapages/Search and Discovery Article #90259, In: AAPG Annual Convention and Exhibition, Poster, Calgary, Alberta, Canada.

Ortega-Ariza, D., Franseen, E.K., Santos-Mercado, H., Ramirez-Martinez, W., and Core-Suárez, E., 2016, Strontium-isotope stratigraphy for Oligocene-Miocene carbonate systems in Puerto Rico and the Dominican Republic: Implications for Caribbean processes affecting depositional history, XII International Scientific Research Congress, Ministry of Higher Education - Science and Technology (MESCYT), Talk, Santo Domingo, Dominican Republic.

Ortega-Ariza, D., Franseen, E.K., Santos-Mercado, H., Ramirez-Martinez, W., and Core-Suárez, E., 2015, Strontium-isotope stratigraphy for Oligocene-Miocene carbonate systems in Puerto Rico and the Dominican Republic: Implications for Caribbean processes affecting depositional history, Abstract. In: STRATI - Congress on Stratigraphy, Talk, Graz, Austria. p. 281.

Ortega-Ariza, D. and Franseen, E.K., 2015, Regional upwelling as a major control in development of a Miocene heterozoan-dominated carbonate system in a tropical setting, Puerto Rico, Extended Abstract. In: AAPG Annual Convention and Exhibition, Abstracts with Programs, Talk, Denver, CO, Search and Discovery Article #51151.

Ortega-Ariza, D. and Franseen, E.K., 2013, Evaluating Controls on Miocene Carbonate-Dominated Sequences in Puerto Rico and the Dominican Republic, Abstract. In: Southeastern Section- GSA Annual Meeting, Abstracts with Programs, Poster, San Juan, PR, Vol. 45, No. 2, p. 11.

Ortega-Ariza, D. and Franseen, E.K., 2012, Sequence Development of the Late Miocene Mixed Carbonate-Siliciclastic Cercado Formation, NW Dominican Republic, Abstract. In: AAPG Annual Convention and Exhibition, Abstracts with Programs, Poster, Long Beach, CA, Search and Discovery Article #90142.

Ortega-Ariza, D. and Franseen, E.K., 2011, Sequence Stratigraphy and Quantitative Relative Sea-Level History for Miocene-Pliocene Ponce Limestone, Puerto Rico, Abstract. In: SACNAS National Conference, Abstracts with Programs, Talk, San Jose, CA, p. 38.

Ortega-Ariza, D. and Franseen, E.K., 2011, The utility of Kuphus incrassatus bivalves for determining absolute ages and shallow water marine environments in Tertiary carbonate and siliciclastic systems in the Caribbean, In: GSA Annual Meeting, Abstracts with Programs, Poster, Minneapolis, MN, Vol. 43, No. 5, p. 94.

Ortega-Ariza, D. and Franseen, E.K., 2011, Evaluating Controls on Carbonate Sequence Development: Middle to Late Miocene Ponce Limestone, Puerto Rico, Abstract. In: AAPG Annual Convention and Exhibition, Abstracts with Program, Poster, Houston, TX, Search and Discovery Article #90124

Ortega-Ariza, D., Franseen, E.K., Santos-Mercado, H., Ramirez-Martinez, W., and Core-Suárez, E., 2015, Strontium-isotope stratigraphy for Oligocene-Miocene carbonate systems in Puerto Rico and the Dominican Republic: Implications for Caribbean processes affecting depositional history, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Talk, Lawrence, KS, p. 97-100.

Ortega-Ariza, D. and Franseen, E.K., 2014, Nutrients in the Miocene Caribbean Sea: A significant control on Carbonate Systems in the Region?, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Talk, Lawrence, KS, p. 95-98.

Ortega-Ariza, D. and Franseen, E.K., 2014, A New Strontium Isotope Stratigraphy for Late OligoceneLate Miocene Carbonate Systems in Puerto Rico and the Dominican Republic, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Poster, Lawrence, KS, p. 99-102.

Franseen, E.K., 2013 and Ortega-Ariza, D., 2013, Controls on Mississippian (Osagean) Inner Ramp Heterozoan Carbonate and Biosiliceous Deposits in a Midcontinent Setting, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Talk, Lawrence, KS, p. 16-19.

Ortega-Ariza, D. and Franseen, E.K., 2013, Contrasting Records of Deposition for Two Carbonate Systems in the Caribbean: The Role of Depositional Setting, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Talk, Lawrence, KS, p. 26-29.

Ortega-Ariza, D. and Franseen, E.K., 2013, Miocene Carbonate Sequences in Puerto Rico and the Dominican Republic: An Update, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Poster, Lawrence, KS, p. 142-145.

Ortega-Ariza, D. and Franseen, E.K., 2012, Evaluating Controls on Miocene Carbonate-Dominated Sequences in Puerto Rico and the Dominican Republic: Progress Report, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Talk, Lawrence, KS, p. 33-36.

Ortega-Ariza, D. and Franseen, E.K., 2012, The utility of Kuphus incrassatus bivalves for determining absolute ages and shallow water marine environments in Tertiary carbonate and siliciclastic systems in the Caribbean, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Poster, Lawrence, KS, p. 129-132.

Ortega-Ariza, D. and Franseen, E.K., 2012, Sequence Development of the Late Miocene Mixed Carbonate-Siliciclastic Cercado Formation, NW Dominican Republic, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consotium Annual Review Meeting, Poster, Lawrence, KS, p. 133-136.

Ortega-Ariza, D. and Franseen, E.K., 2011, Evaluating Controls on Carbonate Sequence Development: Middle to Late Miocene Ponce Limestone, Puerto Rico, Extended Abstract. In: Kansas Interdisciplinary Carbonate Consortium Annual Review Meeting, Poster, Lawrence, KS, p. 77-82

Ortega-Ariza, D. and Franseen, E.K., 2012, Sequence Development of the Late Miocene Mixed Carbonate-Siliciclastic Cercado Formation, NW Dominican Republic, Abstract. In: G-Hawk Student Symposium, Poster, Department of Geology, University of Kansas, Lawrence, KS, p. 14-15.

Ortega-Ariza, D. and Franseen, E.K., 2011, Sequence Stratigraphy and Quantitative Relative Sea-Level History for Miocene-Pliocene Ponce Limestone, Puerto Rico, Abstract. In: G-Hawk Student Symposium, Poster, Department of Geology, University of Kansas, Lawrence, KS, p. 9.

<u>Puckett, Andrew – Assistant Professor of Astronomy</u>

M. Solontoi, M. Hammergren, G. Gyuk, A.W. Puckett, \AVAST Survey 0.4-1.0 µm Spectroscopy of Igneous Asteroids in the Inner and Middle Main Belt', Icarus, 220, 577 (2012), [arXiv:1202.4424v2].

N.A. Kaib, A.C. Becker, R.L. Jones, A.W. Puckett, D. Bizyaev, B. Dilday, J.A. Frieman, D.J. Oravetz, K. Pan, T. Quinn, D.P. Schneider, S. Watters, \2006 SQ372: A Likely Long-Period Comet from the Inner Oort Cloud", Astrophys. J., 695, 268 (2009).

M. Hammergren, G. Gyuk, A.W. Puckett, \(21238) 1995 WV7: A New Basaltic Asteroid Outside the 3:1 Mean Motion Resonance", ArXiv eprint, [astro-ph/0609420]

J. Hood, N.D. Carpenter, C.B. McCarty, J.H Samford, M. Johnson, A.W. Puckett, R.N. Williams, S.T. Cruzen, \CSU's MWV Observatory: A Facility for Research, Education, and Outreach", AAS Meeting Abstracts, 223, 446.01, (2014)

M. Wooten, T.A. Rector, A.W. Puckett, K.A. Coble, \What Non-science Majors Gain from Participating in Authentic Scientific Research: The Results from a Decade-long Assessment Program", AAS Meeting Abstracts, 222, 120.12, (2013)

B. Elwood, A.W. Puckett, K. Coble, S. Cortes, \Searching for Hazardous Asteroids", AAS Meeting Abstracts, 218, 224.04 (2011).

M. Hammergren, G. Gyuk, M. Solontoi, A.W. Puckett, \Basaltic Asteroids in the Middle and Outer Main Belt Observed by the AVAST Survey", LPI Science Conference Abstracts, 42, 2821 (2011)

K. McLin, A.W. Puckett, K.T. Whitmore, \Minor Planet Observations [U54 Hume Observatory, Santa Rosa]", Minor Planet Circ., 94266, 2 (2015).

V.L. Hoette, T.R. Linder, A.W. Puckett, J.E. Brown, A.L. Caughey, \Minor Planet Observations [754 Yerkes Observatory, Williams Bay]", Minor Planet Circ., 93860, 4 (2015).

M. Johnson, J.E. Brown, A.W. Puckett, T.A. Rector, A.L. Caughey, \Minor Planet Observations [W22 Mead WestVaco Observatory, Columbus]", Minor Planet Circ., 93578, 7 (2015).

V.L. Hoette, A.W. Puckett, T.A. Rector, J.E. Brown, A.L. Caughey, T.R. Linder, \Minor Planet Observations [754 Yerkes Observatory, Williams Bay]", Minor Planet Circ., 93194, 5 (2015).

A.W. Puckett, V.L. Hoette, A.L. Caughey, J.E. Brown, \Comet Observations [754 Yerkes Observatory, Williams Bay]", Minor Planet Circ., 93073, 25 (2015).

S. Stepanenko, S. Verbytskyi, S. Plaksa, S. Nazarov, P. Bacci, L. Tesi, G. Fagioli, K. Cernis, H. Selevicius, M. Jaeger, E. Prosperi, S. Prosperi, W. Vollmann, S. Foglia, G. Galli, R. Naves, M. Campas, W. Hasubick, S. Donati, M. Tichy, J. Ticha, M. Kocer, M.-T. Hui, J.-Y. Li, M.S.P. Kelley, N.H. Samarasinha, D. Bodewits, M.F. A'Hearn, C.M. Lisse, W.A. Delamere, M. Mutchler, T.L. Farnham, M. Micheli, D. Farnocchia, J.D. Giorgini, K. Kadota, T. Kobayashi, H. Abe, T. Seki, K. Sarneczky, L. Molnar, A.C. Gilmore, P.M. Kilmartin, H. Bill, M. Jung, D.J. Tholen, R.J. Wainscoat, P. Forshay, A. Baransky, K. Churyumov, V. Ponomarenko, A. Simon, M. Melnyk, R. Parnikoza, T.H. Bressi, A.F. Tubbiolo, R.S. McMillan, R.A. Mastaler, D.C. Fuls, R.E. Hill, R.A. Kowalski, R.G. Matheny, J.A. Johnson, E.J. Christensen, A.R. Gibbs, A.D. Grauer, S.M. Larson, F.C. Shelly, A.W. Puckett, V. Hoette, A.L. Caughey, J.E. Brown, and 175 coauthors, \Observations and Orbits of Comets", Minor Planet Electronic Circ., 2015-G03 (2015).

V.L. Hoette, R. Treffers, A.W. Puckett, A. L. Caughey, T. R. Linder, \Minor Planet Observations [G52 Stone Edge Observatory, El Verano]", Minor Planet Circ., 92898, 2 (2015).

T. H. Bressi, J. A. Johnson, E. J. Christensen, D. C. Fuls, A. R. Gibbs, A. D. Grauer, R. E. Hill, R. A. Kowalski, S. M. Larson, R. G. Matheny, F. C. Shelly, V. L. Hoette, J. E. Brown, A. L. Caughey, A. W. Puckett, T. R. Linder, B. Gibson, T. Goggia, N. Primak, A. Schultz, M. Willman, K. Chambers, S. Chastel, L. Denneau, H. Flewelling, M. Huber, E. Magnier, E. Schunova, R. Wainscoat, C. Waters, R. Weryk, G. McKeegan, W. H. Ryan, L. Buzzi, S. Foglia, T. Vorobjov, 2015 FL290, Minor Planet Electronic Circ., 2015-F163 (2015).

D.B. Caton, V.L. Hoette, L. Hawkins, D. Glace, D.E. Reichart, J.B. Haislip, K.M. Ivarsen, C.B. McCarty, A.W. Puckett, A.B. Smith, T.R. Linder, M.M. Wooten, \Minor Planet Observations [W38 Dark Sky Observatory, Boone]", Minor Planet Circ., 91604, 3 (2015)

R. Holmes, T. Linder, A.W. Puckett, M.M. Wooten, D.E. Reichart, K.M. Ivarsen, J.B. Haislip, L. Buzzi, S. Foglia, T. Vorobjov, T. Lister, M. Urbanik, R.B. Edward, R.C. Hall, A.E. Mason, \Minor Planet Observations [H21 Astronomical Research Observatory, Westfield]", Minor Planet Circ., 91574, 1 (2015).

V. Hoette, A. Chen, D.E. Reichart, J.B. Haislip, K.M. Ivarsen, J.A. Crain, A. Foster, A.W. Puckett, A.L. Caughey, T.R. Linder, \Minor Planet Observations [754 Yerkes Observatory, Williams Bay]", Minor Planet Circ., 91090, 4 (2015).

M.W. Buie, D. Wittman, L.H. Wasserman, R. Holmes, A.W. Puckett, T. Linder, A.W. Puckett, M.M. Wooten, D.E. Reichart, K.M. Ivarsen, J.B. Haislip, A.P. LaCluyze, J.P. Moore, M.C. Nysewander, B. Fredrick, M. Kim, J. Lamant, T. Curry, Z. M. Thiele, M. S. Ogden, C. N. Marlow, I. M. Venson, T. Huynh, K. Erasmo, J. Erickson, J. Poole, E. Goodman, M. Holtan, D. Igeta, J. P. Gonka, C. N. Schafer, T. L. Dooley, B. R. Kirby, D. Alexander, A. Lewis, K. Lindsey, C. Lovelace, A. Englishbee, H. Faust, C. Gallagher, C. R. Smith, W. Kirkpatrick, K. Kuhn, A. Smith, \Minor Planet Observations [807 Cerro Tololo]", Minor Planet Circ., 91090, 5 (2015).

M.W. Buie, D. Wittman, W. Romanishin, J.W. Parker, L.H. Wasserman, A.W. Puckett, M. Trueblood, R.S. McMillan, G. Gelderman, A.N. Heinze, T. Vorobjov, L. Lebofsky, D. Bell, J.V. Scotti, J.R. Lovering, E.I. Chiang, M. Micheli, M.M. Wooten, R. Armbrust, V. Campbell, N. Hewitt, S. Peterson, \Minor Planet Observations [695 Kitt Peak]", Minor Planet Circ., 91015, 1 (2015).

M. Maturi, A.W. Puckett, M.M. Wooten, D.E. Reichart, K.M. Ivarsen, J.B. Haislip, A.C. Tziolas, S. Lahti, B. Woodland, J. Zimin, A.D. Bickford, R.C. Main, A. Livingston, S. Cooper, D. Siebs, L. Duran, N. Rowland, J. Rapoza, \Minor Planet Observations [C81 Dolomites Astronomical Observatory]", Minor Planet Circ., 80001, 1 (2012).

V. Hoette, A.W. Puckett, M.M. Wooten, D.E. Reichart, K.M. Ivarsen, J.B. Haislip, K. Cudworth, D. Loranz, C. Alcala, B. Andrews, D. Ariganello, D. Black, J. Ferguson, C. Gallagher, N. Hale, M. Hernandez, A. Hillis, S. Louie, D. Neuffer, N. Ruiz, S. Wheeler, L. Wood, \Minor Planet Observations [754 Yerkes Observatory, Williams Bay]", Minor Planet Circ., 79996, 1 (2012).

M. W. Buie, D. Wittman, L. H. Wasserman, M. E. Schwamb, R. Holmes, A.W. Puckett, T. Linder, M. M. Wooten, D. E. Reichart, K. M. Ivarsen, J. B. Haislip, M. C. Nysewander, A. P. LaCluyze, A. C. Tziolas, C. Booth, D. Ramos, N. Smith, P. Brooker, T. Davis, A. Phillips, A. Garcia, K. Smith, H. Ward, R. Smith, S. Carter, A. Miller, M. A. Mendez, A. S. Lenig, C. P. Reynolds, C. Fletcher, C. Stepp, S. Uehlin, R. AmelineGarrett, J. McAlister, L. Velasco, E. Waugh, S. A. Reynolds, O.

Garnett-Young, M. K. Sumulong, A. I. Ivanova, S. Kitchpanich, C. Balog, C. Sumey, B. Thao, B. Aspelund, T. McMahon, V. Salmon, J. K. Ball, J. J. Patarini, J. F. Hogins, A. Akers, M. Betz, \Minor Planet Observations [807 Cerro Tololo]", Minor Planet Circ., 79996, 3 (2012).

V.L. Hoette, R. Treffers, T.R. Linder, A.W. Puckett, \Minor Planet Observations [G52 Stone Edge Observatory, El Verano]", Minor Planet Circ., 94628, 2 (2015).

A.W. Puckett, V.L. Hoette, E. Alonso, T.R. Linder, \Minor Planet Observations [754 Yerkes Observatory, Williams Bay]", Minor Planet Circ., 94465, 3 (2015)

R.A. Mastaler, R.J. Wainscoat, L. Wells, M. Micheli, V.L. Hoette, A.W. Puckett, T.R. Linder, B. Gibson, T. Goggia, N. Primak, A. Schultz, M. Willman, K. Chambers, S. Chastel, L. Denneau, H. Flewelling, M. Huber, E. Magnier, E. Schunova, C. Waters, R. Weryk, M. Mills, R. Holmes, L. Buzzi, S. Foglia, T. Vorobjov, P. Birtwhistle, \2015 FA118, Minor Planet Electronic Circ., 2015-F121 (2015).

V.L. Hoette, A.W. Puckett, T.R. Linder, \Minor Planet Observations [754 Yerkes Observatory, Williams Bay]", Minor Planet Circ., 92547, 6 (2015).

V.L. Hoette, R. Treffers, T. Linder, A.W. Puckett, \Minor Planet Observations [G52 Stone Edge Observatory, El Verano]", Minor Planet Circ., 91455, 2 (2015).

V.L. Hoette, A.W. Puckett, T.R. Linder, \Comet Observations [754 Yerkes Observatory, Williams Bay]", Minor Planet Circ., 90859, 39 (2015).

L. Buzzi, K. Sarneczky, R.J. Wainscoat, L. Wells, M. Micheli, V.L. Hoette, A.W. Puckett, T.R. Linder, P. Dupouy, J.B. de Vanssay, F. Tozzi, B. Gibson, T. Goggia, N. Primak, A. Schultz, M. Willman, B. Bolin, K. Chambers, S. Chastel, L. Denneau, H. Flewellin, M. Huber, E. Magnier, E. Schunova, R. Wainscoat, C. Waters, H. Sato, G. Baj, A. Maury, J.-F. Soulier, J.-G. Bosch, T. Noel, \Comet C/2014 Y1 (PANSTARRS), Minor Planet Electronic Circ., 2014-Y20 (2014).

A.F. Tubbiolo, A. Asami, S. Okumura, V. Hoette, D.E. Reichart, J.B. Haislip, K.M. Ivarsen, A.W. Puckett, D.T. Durig, C.J. Konoza, M. Mills, G. McKeegan, R.A. Kowalski, E.J. Christensen, A.R. Gibbs, A.D. Grauer, R.E. Hill, J.A. Johnson, S.M. Larson, R.G. Matheny, F.C. Shelly, W.H. Ryan, \2014 WU362", Minor Planet Electronic Circ., 2014-W130 (2014).

P. Bacci, L. Tesi, G. Fagioli, T.H. Bressi, J.V. Scotti, J. Pittichova, D.E. Reichart, J.B. Haislip, K.M. Ivarsen, A.W. Puckett, V. Hoette, J.A. Johnson, E.J. Christensen, A.R. Gibbs, A.D. Grauer, R.E. Hill, R.A. Kowalski, R.G. Matheny, S.M. Larson, F.C. Shelly, T. Linder, R. Holmes, L. Buzzi, S. Foglia, T. Vorobjov, G. Hug, \2014 WX120", Minor Planet Electronic Circ., 2014-W75 (2014)

<u>Schwimmer, David – Professor of Geology</u>

SCHWIMMER, D. R., A. L. SANDERS, B. R. ERICKSON, and R. M. WEEMS. 2015. *A Late Cretaceous Dinosaur and Reptile Assemblage from South Carolina, USA.* Philadelphia, Transactions of the American Philosophical Society, v. 105, part 2, 157 pp.

SCHWIMMER, D. R. and C.I. BARINEAU. In review. The Cambrian in Alabama. Encyclopedia of Alabama.

SCHWIMMER, D. R., R. E. WEEMS, and A. L. SANDERS. 2015. A Late Cretaceous shark coprolite with baby turtle vertebrae inclusions*.* PALAIOS, v. 30, p. 707-713, doi:10.2110/palo.2015.019

SCHWIMMER, D. R. and W. J. FRAZIER. 2013. The Cretaceous in Alabama. Encyclopedia of Alabama. http://www.encyclopediaofalabama.org

DUTEL, D., MAISEY, J. G., SCHWIMMER, D. R., JANVIER, P. HERBIN, M., and CLÉMENT, G. 2012. The giant Cretaceous coelacanth (Actinistia, Sarcopterygii) *Megalocoelacanthus dobiei* Schwimmer, Stewart & Williams, 1994, and its bearing on Latimerioidei interrelationships. PLoS One, v. 7(11)p. 1-26.

SCHWIMMER, D. R. and W. M. MONTANTE. 2012. An *Aphelaspis* Zone (Upper Cambrian, Paibian) trilobite faunule in the central Conasauga River Valley, North Georgia, USA. Southeastern Geology, v. 49(1) p. 31-41.

SCHWIMMER, D. R. 2016. Was there a Southern Dinosaur Province in the Late Cretaceous? **Abstracts With Programs, Southeastern Meeting Geological Society of America,** vol. 48 (2).

BAIR, M.-A. and SCHWIMMER, D. R., 2016. A paleoenvironmental analysis of the Eutaw Formation, at Ochilee Creek, Chattahoochee County, Georgia. **Abstracts With Programs, Southeastern Meeting Geological Society of America,** vol. 48 (2).

SCHWIMMER, D. R. 2015. Late Cretaceous marine coprolite record in the Southeast: getting it together. **Abstracts With Programs, Southeastern Meeting Geological Society of America,** vol. 47 (2):20.

SCHWIMMER, D. R. 2015. No transitional fossils? A response from the vertebrate fossil record. **Abstracts with Programs, Southeastern Meeting Geological Society of America,** vol. 47 (2):71.

BETZNER, T., K. CHIN, and D. R. SCHWIMMER. 2014. The smallest lines: what might the composition of lingulid growth bands tell us about paleoenvironment? **Abstracts Tenth North American Paleontological Conference, Paleontological Society Special Publications**, v. 13.

SCHWIMMER, D. R. 2013. A selachian coprolite with babuy turtle vertebrae inclusions. **Society of Vertebrate Paleontology, Annual Meeting Abstracts:** p. 209.

SCHWIMMER, D. R. 2012. Late Cretaceous (mid-Campanian) Vertebrates of the Hannahatchee Creek site, western Georgia, a nearshore marine bone bed at the Atlantic/Gulf transition. **Society of Vertebrate Paleontology, Annual Meeting Abstracts:** p. 169-170.

SCHWIMMER, D.R.., FRAZIER, W. J. and MONTANTE, W.M. 2012. Paleobiology and geochemistry of siliceous concretions with trilobites and *Brooksella*, in the Conasauga Formation, Middle Cambrian, northwestern Georgia. **Abstracts with Programs, Southeastern Meeting Geological Society of America,** vol. 44(4): p. 66-67.

DUTEL, H., MAISEY, J. G., SCHWIMMER, D. R., and CLÉMENT, G. 2011. The giant coelacanth *Megalocoelacanthus dobiei* from the Upper Cretaceous of North America and its bearing on the phylogeny of Mesozoic coelacanths. **Society of Vertebrate Paleontology, Abstracts**.

SCHWIMMER, D.R. 2011. An Upper Cretaceous bone bed at the South Atlantic-eastern Gulf junction. **Abstracts with Programs, Southeastern Meeting Geological Society of America,** vol. 43(2): p. 14.

Shaw, Kimberly – Professor of Physics

"The Influence of the CSU Robert Noyce Teacher Scholars," C.S.Ticknor, D.Gober, T.Howard, K.A.Shaw, L.Mathis, Journal Of Science Teacher Education. Submitted 10/27/15.

"Assessing the impact of tutorial services," C.S. Ticknor, K.A. Shaw, and T.Howard, Journal for College Reading & Learning. Vol 45, #1, 2014, pages 52-66.

"Peer Mentoring Communities of Practice for Early and Mid-Career Faculty: Broad Benefits from a Research-Oriented Female Peer Mentoring Group," A.Rees and K.Shaw. Journal of Faculty Development, Vol 28, #2, May 2014, pages 5-17.

"The Effect of Peer Leader Instruction on Introductory University Science and Mathematics Course Performance: Preliminary Results" K.A.Shaw, C.Ticknor, and T.Howard, Perspectives in Learning, Volume 14, Issue 1, p. 20-27, Spring 2013.

Pedagogy and/or technology: Making Difference in Improving Students Problem Solving Skills", Z.Hrepic, K.Lodder, and K.A.Shaw, 2012 Physics Education Research Conference, AIP Conference Proceedings volume 1513, p.182-185, editors: P.Engelhart, A.Churukian, S.Rebello, Philadelphia, PA, 1-2 August 2012. Published by AIP, Melville, NY, 2013.

"An Analysis of Factors Expected to Impact Student End-of-Course Grades in Introductory College Science Classes," K.A.Shaw, P.Gurkas, and Z.T.Webster, Perspectives in Learning, Volume 13, Issue 1, pp. 4 – 16, Spring 2012.

"Gauging instructional effectiveness of open policy for wireless computers in classrooms." Hrepic, Z., & Shaw, K. (2011). In D. Sunal (Ed.), Abstract in Research Based Undergraduate Science Teaching: Investigating Reform in Classrooms (NSEUS Conference Proceedings). Tuscaloosa, AL, USA: National Science Foundation (NSF). In Print. (Invited paper)

"Lessons Learned in an Internship Program to Recruit Pre-service Teachers," T.Howard, D. Gober, K. Shaw, and C.Ticknor, March 4, 2016, Georgia Scholarship of STEM Teaching & Learning Conference, Statesboro, GA. http://digitalcommons.georgiasouthern.edu/stem ).

"Use of Internship Experiences to Recruit Pre-service Math and Science Teachers," T.Howard, D. Gober, K. Shaw, and C.Ticknor, March 4, 2016, presented at the Southeastern Section of the Mathematical Association of America, Birmingham, AL.

"Comparison of Success Rates for Peer Instruction and Drop-In Tutoring," K.A. Shaw, T.Howard, C.Ticknor, March 5, 2015, Georgia Scholarship of STEM Teaching & Learning Conference, Statesboro, GA. http://digitalcommons.georgiasouthern.edu/stem )

"Examining the Influence of Internships on Teacher Recruitment," T. Howard, K.Shaw, D.Gober, C.Ticknor, March 5, 2015, Georgia Scholarship of STEM Teaching & Learning Conference, Statesboro, GA. http://digitalcommons.georgiasouthern.edu/stem )

"Investigating the Influence of the CSU Robert Noyce Teacher Scholarship Program on College Students' Teaching Plans," L.A.Mathis, C.Ticknor, D.Gober, T.Howard, K.Shaw, March 5, 2015, Georgia Scholarship of STEM Teaching & Learning Conference, Statesboro, GA. http://digitalcommons.georgiasouthern.edu/stem )

"Gauging Effectiveness of Pen-based Computing for Collaborative Introductory Physics Problem Solving," D.Cantrell, Z.Hrepic, K.A.Shaw, January 6, 2014, AAPT Conference, Orlando, FL.

"Summer Honors Camp Promotes STEM and Teaching," K.Shaw, T.Howard, to be presented January 6, 2014, AAPT Conference, Orlando, FL.

"Creativity and Inspiration in Science," Rite of Passage Invited talk, Columbus State University, October 31, 2013.

"UTeach Columbus and Other Efforts to Improve Science and Math Education at Columbus State University," invited talk to CSU Environmental Science Colloquium Series, delivered October 24, 2013.

"Developing a STEM Teacher Recruitment Pipeline," K.A.Shaw, C.Ticknor, T.Howard, Georgia Scholarship of STEM Teaching & Learning Conference, March 7, 2013.

Poster – STEM and Branches: Update on the Columbus State University STEM-II Initiative. C.Ticknor, T.Howard, K.A.Shaw, Georgia Scholarship of STEM Teaching & Learning Conference, March 7, 2013.

"Methodology and/or Technology: Making Difference in Improving Students' Problem Solving Skills," Z.Hrepic, K.Lodder, and K.A.Shaw, presented on August 1, 2012 at national Physics Education Research Conference, Philadelphia, PA.

"Research and Writing Groups Promote Goal Setting and Faculty Success," K.A.Shaw and A.Rees, presented on July 31, 2012 at national American Association of Physics Teachers conference, Philadelphia, PA. Invited talk.

"Methodology and/or Technology: Making a Difference in Improving Students' Problem Solving Skills," Z.Hrepic, K.Lodder, K.A.Shaw, presented March 9, 2012, Georgia Scholarship of STEM Teaching and Learning Conference, Statesboro, GA.

"STEM II Initiative at Columbus State," T. Howard, K.A.Shaw, presented March 9, 2012, Georgia Scholarship of STEM Teaching and Learning Conference, Statesboro, GA.

Poster "STEM II Initiative at Columbus State University," T.Howard, K.A.Shaw presented March 9, 2012, Georgia Scholarship of STEM Teaching and Learning Conference, Statesboro, GA.

"Assessing the Impact of Tutorial Services," C.Henning, K.A.Shaw, T.Howard, presented March 9, 2012, Georgia Scholarship of STEM Teaching and Learning Conference, Statesboro, GA.

Z.Hrepic, K.Lodder, and K.A.Shaw, "Methodology and/or Technology: Making Difference in Improving Students' Problem Solving Skills," November 8, 2011 SoTL-STEM seminar.

K.A.Shaw, "A Survey on Self-Efficacy in Physics Problem Solving," poster presented at the national American Association of Physics Teachers conference, August 3, 2011

<u>Williams, Rosa – Professor of Astronomy</u>

Maggi, P., Haberl, F., Kavanagh, P.J. , Sasaki, M., Bozzetto, L.M., Filipovic, M.D. , Vasilopoulos, G., Pietsch, W., Points, S.D., Chu, Y.-H., Dickel, J., Ehle, M, **Williams, R.** and Greiner, J. 2016, "The

population of X-ray supernova remnants in the Large Magellanic Cloud," *Astronomy and Astrophysics*, 585, 162.

Bozzetto, L. M., Kavanagh, P. J.; Maggi, P.; Filipović, M. D.; Stupar, M.; Parker, Q. A.; Reid, W. A.; Sasaki, M.; Haberl, F.; Urošević, D.; Dickel, J.; Sturm, R.; **Williams, R.**; Ehle, M.; Gruendl, R.; Chu, Y.-H.; Points, S.; Crawford, E. J. 2014, "Multi-frequency study of a new Fe-rich supernova remnant in the Large Magellanic Cloud, MCSNR J0508-6902", *Monthly Notices of the Royal Astronomical Society*, 439, 1110

Zhang, Ning-Xiao; Chu, You-Hua; **Williams, R.M.**; Jiang, Bing; Chen, Yang; Gruendl, R. A. 2014, "Physical Nature of the [S II]-bright Shell Nebulae N70 and N185," *Astrophysical Journal*, 792, 58

Caulet, A. & **Williams, R. M.**, 2012, "Infrared Spectral Mapping of Supernova Remnants: I. Dust in N63A and Its Environment," *Astrophysical Journal*, 2012, 761, 107

Seward, F. D., Charles, P. A.; Foster, D. L.; Dickel, J. R.; Romero, P. S.; Edwards, Z. I.; Perry, M.; **Williams, R. M**. 2012, "DEM L241, a Supernova Remnant Containing a High-mass X-Ray Binary", *Astrophysical Journal,* 759, 123

Brown, J., O'Keeffe, B., Caughey, A., Johnson, M. and Williams, R.N.M., "Progressive Research and Outreach at the Westrock Observatory" (poster at American Astronomical Society 227th meeting, Jan. 2016)

Invited talk for Georgia Space Grant Consortium meeting, "Space Grant at CSU/CCSSC: Launching Students into Astronomy", Georgia Tech, September 10, 2015 (with Dr. Shawn Cruzen).

Hood, J., Carpenter, N., McCarty, C., Samford, J., Johnson, M., Cruzen, S. and R. Williams, R.M., "Mead Observatory" (Poster at American Astronomical Society 223rd meeting, Jan. 2014)

Hood, J., Carpenter, N., McCarty, C., Brown, J., and Caughy, A., "Solar GRAM poster" (Poster at Georgia Regional Astronomy Meeting, October 2013)

Williams, R. N. M., Dickel, J. R., Chu, Y., Points, S., Winkler, F., Johnson, M., Lodder, K., & Edwards, Z. 2011, "Status and Statistics of the Multi-wavelength Magellanic Cloud SNR Database", BAAS, 43, 256.29 (poster at American Astronomical Society 217th meeting, Jan. 2011)

Johnson, M. J., Williams, R. N. M., & Edwards, Z. 2011, "Infrared Spectral Mapping of Supernova Remnants: II. N49: A First Look", BAAS, 43, 256.30 (poster at AAS 217)

Zamstein, Lavi – Assistant Professor of Robotics

Zamstein, L.; Cooper, C.; Hays, S.; Mende, I.; Sande, I.; and Sartell, A. "User Manual for Hexbot." Department of Earth and Space Science, Columbus State University, 2016.

Zamstein, L.; Chapman, J.; and Corcoran, K. "Nao Robot Documentation." TSYS School of Computer Science, Columbus State University, 2015.

Hall, H., Hood, J., Reynoso, R., Williamson, L., and Zamstein, L. "Columbus State University's Robotic Hand." Florida Conference on Recent Advances in Robotics, 2014.

Wright, S.; Arroyo, A. A.; Arroyo, I.; Simpkins, J.; Wright, B.; and Zamstein, L. "Emergent Collective Behavior in Autonomous Synergistic Swarm Robots." Florida Conference on Recent Advances in Robotics, 2011.

***Excerpts from Select ESS Alumni Letters***

The following excerpts from ESS alumni letters outline the impact our department has had on their academic and career experiences following graduation from our programs.

- "The ESS Department does so much more than just provide a piece of paper saying you stayed in college for four years. It gives students an understanding of how beautiful and complicated the world around them really is. It teaches students to think critically and research instead of just going through the motions or blindly following. Students get the confidence they need to believe in themselves, despite struggling with learning disabilities, as I do. Through a supportive environment from the professors to your peers, the full department gives guidance in a way that is more than just "what classes do I take this semester." It generates a healthy and competitive environment that pushes every student to be better, which creates a drive and determination to pursue higher degrees, the careers they want, and other life goals. This is what the ESS Department did for me."
    - *Cheryl Coker (Wilkes), BS Earth and Space Sciences, Geology track, 2012, currently employed at EOG Resources in Midland, TX.*
- "When deciding upon graduate school programs, I was confident that the ESS undergraduate courses prepared me for gaining admittance to the graduate program of my choosing. However, I remained at CSU for my graduate degree primarily due to the tremendous respect that I have for the professors within the department. They have an immense amount of dedication to preparing their students for the future. Even without the same resources available to larger universities, the ESS faculty was able to provide an education of equal merit that had me well-prepared for the beginning of my career. Additionally, the seemingly limitless opportunities for attendance at national, regional, and local scientific conferences, as well as the encouragement to attend such events, as both an observer and a presenter provided me with a level of professional development that allowed me to see the work that other researchers were conducting while also providing exposure to potential employers. I am sure that these opportunities were a vital complement to classroom experiences. Furthermore, I am confident that the range of expertise and variety of courses offered by the faculty of ESS afforded me the opportunity to be competitive in virtually any career field within the natural sciences that I chose. While some of the courses I took from ESS faculty are available from other departments (e.g. GIS), the more advanced, career specific, and hands-on training learned from the ESS faculty gave me the marketable skills necessary to attract more employers."
    - *Daniel Black, BS Earth and Space Sciences, Geology track 2013 and MS Natural Sciences, Geosciences track, 2015, currently employed by the Army Corp of Engineers in Davis, CA.*
- "There are not many institutions in the state of Georgia with a program such as ours. From experience with searching for graduate institutions within the state, I have not found many

institutions that would offer me some of the experiences that our department provided. Being in this department, the teachers I encountered every semester were always Dr. Frazier, Dr. Brown, Dr. Barineau, and Dr. Schwimmer. They were ingrained into my being as a student. I noticed that our department, before changing to Earth and Space Science, survived on those 4 professors alone. They were always going above and beyond to make sure my peers and I were offered the classes that we needed for our program and help us understand the field that they were so enthusiastic about and dedicated to. Because of them, I found my passion. Because of them, I am a proud 2012 graduate of Columbus State University. I am extremely proud to be a product of the ESS department at CSU."

    - *Randi Butler, BS Earth and Space Sciences, Geology track 2012, currently employed as a Physical Scientist with the U.S. Environmental Protection Agency.*

- "To say that the small-but-mighty ESS department and its faculty changed my life would be a gross understatement. Never have I been a part of such a tight-knit, caring, and driven community, and I would wager that all students and recent graduates share my sentiments. The mentorship and guidance provided by ESS faculty coupled with the challenging coursework provided me with the training I needed to succeed after graduation. Since then, I have completed a fully funded MS. Program at the New Mexico Institute of Mining and Technology, where I was deployed to Antarctica to study Erebus volcano. I am currently a fully-funded Ph.D. candidate at the Colorado School of Mines. I owe absolutely all of my success to the faculty of the ESS department."

    - *Emily Randall, BS Earth and Space Sciences, Geology track, 2012, Ph.D. Candidate, Colorado School of Mines.*

- I came to Columbus State University in 2010 after serving as an infantryman in the United States Army for 7 years. I was quickly adopted and cared for by the faculty members as they saw academic potential in me that I had yet to recognize. I worked closely with Drs. Rosa Williams and Shawn Cruzen at the Coca-Cola Space Science Center conducting various astronomy-related research projects, one of which resulted in peer reviewed publication. Dr. Barineau advised my honors thesis research and introduced me to the wonderfully complex world of geophysics. Drs. Shaw, Hrepic, and Seifu showed me the rules of the universe, and the joy of teaching. Dr. Frazier showed me how even the smallest grain of sand can inspire a life-time of work. The impact the ESS faculty continues to have on my life is immeasurable. They inspire me to reach for the stars, yet remain grounded in what I do every day. They taught me to step back from a difficult problem and visualize the problem rather than attack it like a brute. Some of the biggest life lessons I hold dear to my heart come from conversations with professors either after class or while on class field trips. During my final semesters at CSU, I was unsure of my future goals, but one-by-one it seemed the ESS faculty members took it upon themselves to talk to me about applying to graduate school. They approached me in the hallways, before and after class, and even scheduled meetings with me to discuss my future. Even though I had a single academic advisor, the entire ESS faculty made it their mission to ensure my success after graduation. This welcome persistence, my honors thesis research with Dr. Barineau, and the many geology and earth science classes I elected to take allowed me to clearly decide my future. I graduate with a B.S. in Earth and Space Sciences, summa cum laude, with minors in mathematics and physics in

2013, and accepted an offer to pursue my M.S. in geophysics at the New Mexico Institute of Mining and Technology (NMT)."

  - *Matthew Perry, BS Earth and Space Sciences, Astrophysics and Planetary Geology track, 2013, currently employed as a Geophysicist with the U.S. Geological Survey's Earthquakes Hazards Program.*

- "As a recent graduate (Class of 2015) of the Earth and Space Science Department, I would like to share with you just a small glimpse into the journey I had within the department that I feel made me into the person I am today. Many people graduate with their college degrees, happy to have been a part of the program they had chosen, but I feel few can say that their department became their extended family. The faculty and staff of the ESS Department go beyond what their job descriptions say they should do; they are the most incredible group of people I have had the pleasure of working with and learning from. Not only did I receive a spectacular education, but I was also presented with countless opportunities to experience life to the fullest, from hiking to the summit of a volcano to seeing the Milky Way stretched across the western night sky for the first time. The ESS Department provided me with the training to become the scientist I am today, and with the memories to fire up my soul for the rest of my life."

  - *Rylleigh Harstad, BS Earth and Space Sciences, Geology track, 2015. MS student at Auburn University.*

- "I graduated Magna Cum Laude from CSU in December of 2014. My concentration was in Geology, and in that department, I took classes and had experiences that have shaped me as a person and prepared me for graduate school and life afterward. Currently, I am pursing a Master's Degree in Geosciences at Auburn University. I am a GTA, and I feel very confident in my ability to teach labs because of all that I have learned at Columbus State. Also, many of my professors here have spoken highly of all of their graduate students who came from CSU. They are impressed by the range of courses we took especially including Geology of Georgia and Geophysics and Plate Tectonics. Because I had an opportunity for undergraduate research at CSU, I have gained a valuable and favored experience researching and making posters. This has prepared me for both work I'm doing throughout graduate school, and eventually, because I want to remain in academia, a job. I will always cherish my experience and the knowledge I've gained in the ESS department at CSU, and I would recommend it to anyone who is interested in geology."

  - *Kayla Griffin, BS Earth and Space Sciences, Geology track, 2014, MS student at Auburn University.*