



CC&E ROADMAP TO INCLUSION AND ENGAGEMENT

January 2024

“If you're not hopeful and optimistic, then you just give up. You have to take the long hard look and just believe that if you're consistent, you will succeed.”
Rep. John Lewis

LSU

College of the Coast
& Environment

EXECUTIVE SUMMARY

CC&E is committed to doing its part to foster diversity and ensure an inclusive, welcoming, and nurturing environment for all of its students, faculty, and staff. Although enhancing diversity, equity, and inclusion (DEI) has been a strategic priority of the LSU College of the Coast & Environment (CC&E) for many years, this plan charts the course with specific actions to make CC&E a more welcoming, inclusive, equitable, and diverse college. This plan, updated from the initial plan released in July 2020, represents the collective ideas of CC&E's leadership team, which is comprised of representatives from CC&E faculty, staff, and graduate students.

In this plan, which is aligned with the *LSU Diversity & Inclusion Roadmap 2020-2022* we 1) assess our progress since our Coastal Environmental Science BS degree was established in 2008; 2) show where progress is needed; and 3) develop strategic initiatives to ensure that the pipeline of graduate and K-12 students from underrepresented communities becomes more robust.

In preparing this plan, national demographics and scientific literature were reviewed to determine appropriate benchmarks specific to CC&E's disciplines. These fields are heavily represented by the "physical sciences" or "geosciences" (i.e., earth, oceanic, and atmospheric science), and pertain to the broader environmental sciences. According to data from the National Science Foundation, the physical sciences (and engineering) seriously lag in diversity compared to other STEM areas, such as biology.

Data indicate that CC&E's student body is representative of the national average for individuals from underrepresented communities specific to the physical sciences. However, when broken down by individual groups, such as Black students, targeted efforts are clearly needed to approach the demographics of the State of Louisiana. At 33 percent, Louisiana has the second-highest percentage of Black residents. With only two percent of the nation's PhDs in the physical sciences awarded to Black students, the applicant pool of individuals from underrepresented communities for new faculty positions has been and will continue to be, extremely challenging. Therefore, CC&E aims to work with other Gulf of Mexico universities with similar programs to clear a path for students from underrepresented communities to earn their doctorate degrees.

The action items in this plan can be accomplished within five years with the appropriate support, funding, and an "all-in" commitment from CC&E and the broader LSU campus community. We propose to undertake the following strategic initiatives to "narrow the gap":

- ❖ Augment the Student Pipeline – We must ensure that we continue to attract more students from underrepresented communities to LSU's baccalaureate and graduate STEM programs in the geosciences, continue to make retention a priority, and encourage more students from underrepresented communities to pursue graduate degrees.
- ❖ Build the Ranks of our Faculty – We are improving our strategy to recruit and retain more faculty members from underrepresented communities, including integrating adjunct faculty from underrepresented communities into our academic and extracurricular activities.
- ❖ Reinforce a Culture of Inclusion – To sustain an environment in which race, gender, and other differences are respected, appreciated, and valued, CC&E will continue to foster an atmosphere of inclusion, build collaborative alliances, and increase funding for diversity initiatives.
- ❖ Improve Pedagogy – We must continuously learn new ways to improve the quality of teaching, modifying both methods and practices as needed, to better assist a diverse student body in gaining a deeper understanding of the subject matter.

Table of Contents

Introduction	4
Current Status	4
National and State Data	6
Demographics: US and Louisiana	6
National Data on Higher Education Degrees in Earth, Atmospheric, and Ocean Sciences	6
National Data by Geographic Region of the US	9
National Data by Gender	9
.....	10
Pedagogy	11
LSU & CC&E Enrollment & Graduation Data	12
Data: Ethnic Diversity in Enrollment at LSU, Fall Semester 2021	12
Data: Louisiana & LSU Student Enrollment	12
Ethnic Diversity in Enrollment in CC&E’s Undergraduate Program (Coastal Environmental Science)	13
Ethnic Diversity in Enrollment in CC&E Graduate Programs	14
Data: Average CC&E Graduate percentages by Ethnicity, 2010-2021	16
Gender Diversity in CES Program	16
LSU & CC&E Data in Comparison with National Data	16
Faculty & Staff diversity	16
Faculty Diversity by Ethnicity	16
Faculty Diversity by Gender	17
Administrative Staff	17
Research Staff and Post-Docs	17
Outreach	17
EnvironMentors program with Scotlandville Magnet High School	18
Mayfair School (Informal K-12 Education)	19
Additional Support in K-12 Schools	19
Mastermind	20
Narrowing the Gap Initiatives	20
Augment the Student Pipeline	20
Build the Ranks for Faculty	20
Foster A Culture of Inclusion	21

Improve Pedagogy: Teach and Learn.....	21
Action Items and Outcomes.....	21
Augment the Student Pipeline.....	21
Build the Ranks for Faculty	22
Foster an Atmosphere of Inclusion.....	23
Improve Pedagogy: Teach and Learn: Improve Pedagogy.....	23
Additional Administration Actions.....	24
References and Supporting Documents	24

At times, PDFs may be inaccessible to some users. If you experience a barrier in access, please contact Kathe Falls at 225-578-3381 or kfalls1@lsu.edu for assistance.

Introduction

The LSU College of the Coast & Environment (CC&E) is firmly committed to sustaining a diverse, equitable, and inclusive community in which our students, faculty, and staff participate in, contribute to, and benefit equally from the educational and research endeavors of the college. Diversity, equity and inclusion are fundamental elements of our mission. CC&E is committed to creating and maintaining an environment that embraces individual differences, encourages multiple perspectives, and better prepares students for an increasingly diverse workforce. All faculty, students, and staff are expected to embrace these values. The CC&E Roadmap to Inclusion and Engagement is helping to narrow the gap of students and faculty from underrepresented communities in our college while maintaining an environment in which race, gender, and other differences are respected, appreciated, and valued.

Although diversity, equity, and inclusion have been a strategic priority for the college for years, this document represents CC&E's first formalized plan to address these issues. Aligning with the goals of the broader LSU Diversity & Inclusion Roadmap 2020-2022, this plan summarizes our current status with faculty, students, and staff from underrepresented communities and provides a roadmap of specific actions that CC&E's students, faculty, and staff can undertake to address areas of concerns. This document includes data for multiple ethnicities. Individuals identifying as Black, Latinx, Native American, Alaska Natives, Native Hawaiians, other Pacific Islanders, and Two or More Races are referred to as "individuals from an underrepresented community" in this document. While CC&E attracts a high percentage of international graduate students who provide diverse perspectives, both international students and Asians are not included in the definition of individuals from underrepresented communities.

Since our undergraduate program was established in 2008, the college has made progress in this area. Students from underrepresented communities have been mentored by faculty, staff, and administrators. Between 2008 and 2021 (inclusive), enrollment in CC&E's academic programs by students from underrepresented communities averaged 17 percent of CC&E's undergraduate student body and 7 percent of CC&E's graduate student body.

In 2010, the college established the LSU chapter of EnvironMentors (EM), which mentors students in grades 9-12 from underrepresented communities. This mentorship program has been successful with nearly all the program participants receiving a high school diploma and 12 of its alumni earning a college undergraduate degree, a remarkable achievement. However, much remains to be done.

We envision that this plan will be updated periodically and revised as circumstances warrant and at a minimum of every two years. Since the topics of diversity and inclusivity are everyone's responsibility, we encourage comments, suggestions, and (most of all) participation from CC&E's faculty, staff, and students in improving the plan and bringing it to fruition.

Current Status

The college firmly embraces the need to increase the diversity of our students, faculty, and staff. While we have made significant progress in some areas, there is still more work to be done. The college is faced with the national challenge of a lack of diversity in most of our fields of study. This has been documented for years, and the failure of STEM education prompted the National Science Foundation (NSF) and National Science Board (NSB) to call for the strengthening of undergraduate education to prepare the next generation of scientists and engineers (National Science Board, 1986). Among other

things, the report observed that “the great majority of undergraduate students—who will become community leaders and decision makers—are not receiving the special kinds of scientific, technical and mathematical knowledge they need, which includes the principles, practices, and techniques of science and awareness of its limits.” If that was true then, it is even more so now. The physical sciences, i.e. the geosciences—earth, atmospheric, and ocean sciences, alternatively known as earth system science, are the least diverse in STEM. Without focusing on nuances, this plan refers to physical sciences, geosciences, and earth system science interchangeably, because all three terms are used in the literature. Most of our research and course offerings fall into this category.

When reflecting on his service as NSF’s program director of the Biological Oceanography Program from 1987-89, Chris D’Elia, current professor and dean of CC&E, wrote (D’Elia, 1989): “I found many opportunities to participate in special efforts that are under way to encourage underrepresented groups at the graduate and undergraduate levels to prepare for careers in the ocean sciences and to ensure that an adequate number of ocean scientists will be available in the future.” Remarkably, the topic of underrepresented communities and diversity was unmentioned in a publication of the National Research Council resulting from a symposium discussing the development of ocean sciences over the prior 50 years, i.e., 1950-2000 (National Research Council, 2000). These challenges continue today. While we align with national diversity numbers for our fields of study and are close to aligning with the numbers at LSU in some areas, we still have much to do to narrow the gap.

Fixing the “leaks” in the STEM pipeline requires an understanding of the complex pathways from K-12 education to earning a doctoral degree. As a recent Association of Public & Land-Grant Universities (APLU) report (Bennet et al., 2020) notes, “[Those unfamiliar with STEM education] are apt to be confused by unfamiliar academic territory with extensive emotional hills and valleys and poorly marked trails as well as wide open spaces of potential.” Figure 1 is drawn from the APLU report and illustrates these complex pathways. CC&E has programs addressing the pipeline at virtually every step.

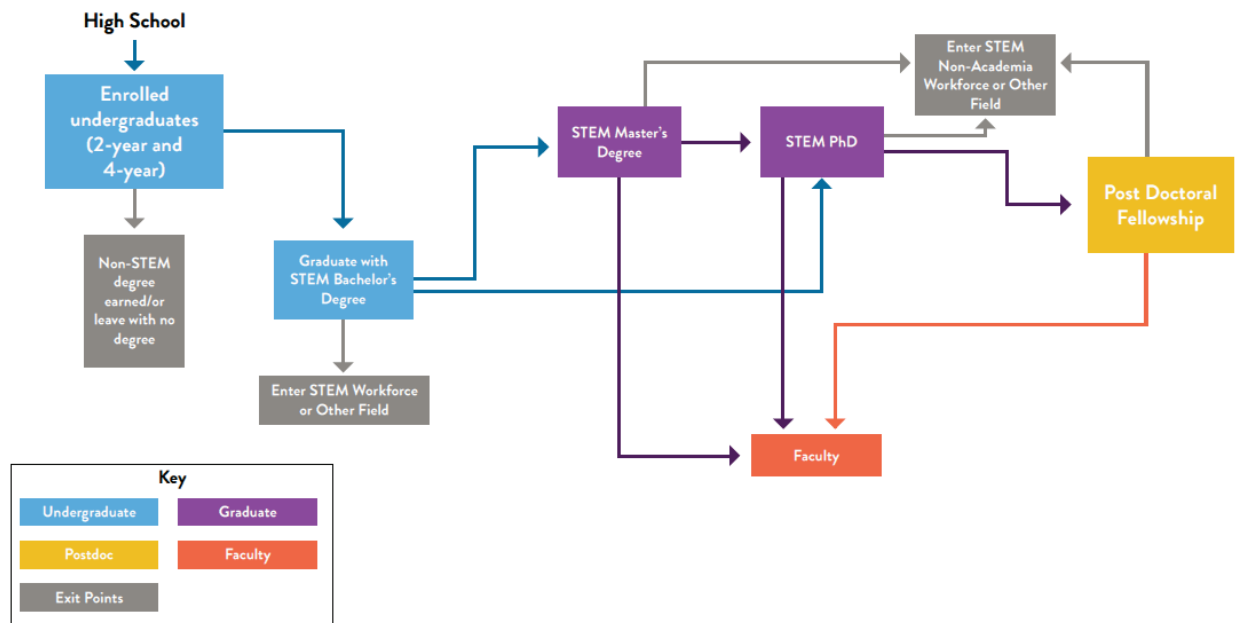


Figure 1. The complex pathways leading from K-12 to earned PhDs prepared for the professoriate (Bennet et al. 2020).

NATIONAL AND STATE DATA

DEMOGRAPHICS: US AND LOUISIANA

To put CC&E’s enrollment numbers in perspective, we must first compare U.S. national data and Louisiana state data. The following data present demographic information obtained from the U.S. Census Bureau for 2021. As indicated, approximately 60.1 percent of the U.S. and 58.4 percent of Louisiana populations identify as White. Black individuals comprise the largest underrepresented community in our state making up 33 percent of Louisiana’s population. Louisiana also ranks as the nation’s second-largest home to Black individuals.

2021 US Bureau Racial Estimates by Ethnicity	U.S.	Louisiana
White alone, not Hispanic or Latinx	60.1%	58.4%
Hispanic and Latinx Americans (or any race)	18.5%	5.3%
Black	13.4%	32.8%
Asian	5.9%	1.8%
Native American and Alaska Natives	1.3%	0.8%
Native Hawaiians and Other Pacific Islanders	0.2%	0.1%
Two or more races	2.8%	1.8%

Table 1: 2021 US Bureau Racial Estimates by Ethnicity. Source: U.S. Census Bureau “Quick Facts” July 1, 2021

NATIONAL DATA ON HIGHER EDUCATION DEGREES IN EARTH, ATMOSPHERIC, AND OCEAN SCIENCES

In what the NSF categorizes as the “physical sciences,” i.e., Earth (Geoscience), Atmospheric, and Ocean Science, less than three percent of the nation’s Black students earn an undergraduate degree; for graduate degrees in these fields, it is only two percent. The physical sciences are the lowest performing among all STEM degrees awarded to Black students. For the Latinx community, the percentages are slightly higher with nearly 10 percent earning an undergraduate degree and approximately five percent earning graduate degrees in these fields.

National Average Earth, Atmospheric, and Ocean Degrees Awarded to Latinx and Black Individuals

Ethnicity	Bachelor’s Degree	Master’s Degree	Doctoral Degree
Black	<3%	2%	<2%
Latinx	9.7%	6.6%	6.1%

Table 2: Science and engineering degrees awarded to Hispanics or Latinos and Blacks, by degree level and field, 2017. Source: National Science Board (2019).

These data are also summarized in the graphs below.

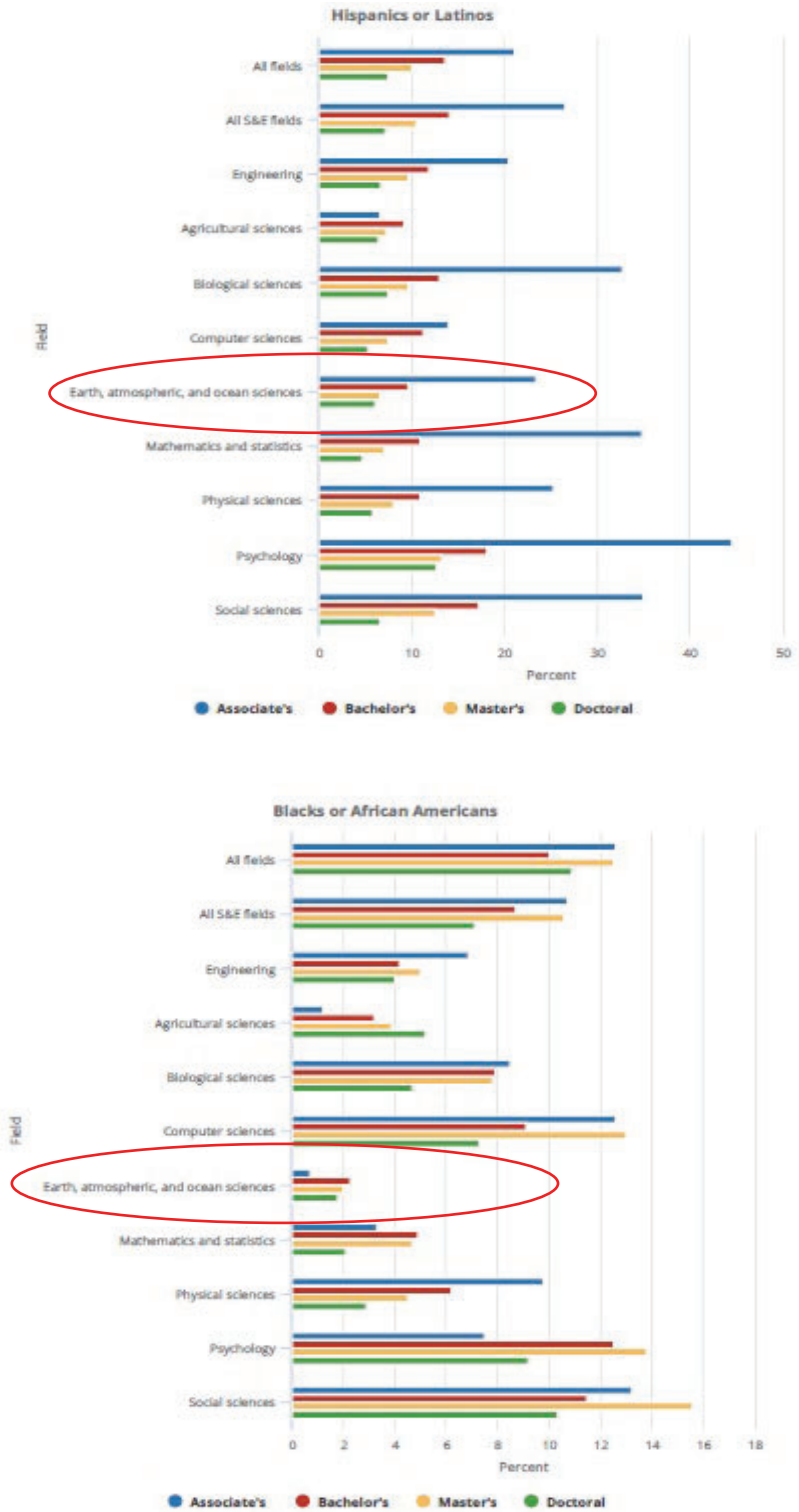


Figure 2: Science and engineering degrees awarded to Hispanics or Latinos and Blacks, by degree level and field, 2017. Source: National Science Board (2019).

This dismal situation has been recognized for some time. Stokes et al. (2015) recognize the stark paradox faced in the geosciences:

Geoscience faces dual recruiting challenges: a pending workforce shortage and a lack of diversity. Already suffering from low visibility, geoscience does not resemble the makeup of the general population in terms of either race/ethnicity or gender and is among the least diverse of all science, technology, engineering, and math fields in the U.S.

One could attribute this to a lack of attention by those in the physical sciences. Unfortunately, as Bernard and Cooperdock (2018) so clearly state,

...the proportion of underrepresented minorities among PhD recipients in the geosciences has not improved in any meaningful metric over more than four decades, despite the efforts by our community to try to increase diversity, particularly in the past 20 years following the development of the National Science Foundation (NSF)'s Broader Impacts initiative.

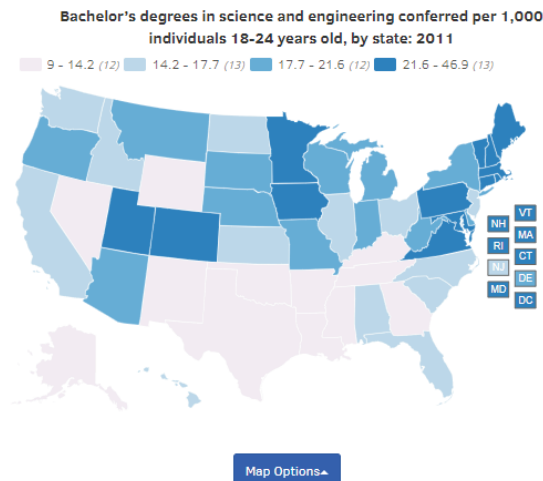
Remedies for fixing the leak in the underrepresented community pipeline with respect to the geosciences start in grades 9-12. The 1996 National Science Education Standards (National Research Council, 1996) recommend that "all students should develop an understanding of energy in the earth system; geochemical cycles; origin and evolution of the earth system; and the origin and evolution of the universe." Based on our experiences with LSU chapter of EnvironMentors, program participants struggle with these topics.

Research has been conducted into what factors influence students from underrepresented communities to study in STEM fields. Ashford-Hanserd et al. (2020) studied 14 main factors that contribute to the persistence of students from underrepresented minorities in STEM majors: commitment to diversity, personal motivation, geographic location, personal intelligence, sense of belonging, stereotypes about race/ethnicity, job opportunities, role model/mentor, stereotypes about gender, potential learning experiences, preparedness for the program, family and/or peer pressure, money/cost to be in the program, and self-confidence in the subject. Of these, three of the most influential factors were identified for all students: personal motivation, potential learning experience, and job opportunities. The last was significantly higher for students from underrepresented communities than White students. In a similar study, Sherman-Morris and McNeal (2016) got comparable results with a few new nuances.

These studies also suggest that exposure is a key element in attracting students to the geosciences such as learning about the major before attending college as well as the potential job opportunities that are associated with a degree. In a study conducted by Fouad and Walker (2005), the environment was also listed as a factor, with Black students being less likely to endorse outdoor vocations than White, Latinx, or Native American women and men. Students from underrepresented communities reacted favorably to their advisors' recommendations of science classes, emphasizing the importance of academic advisors. Students picked a course based on whether it sounded interesting, and students from underrepresented communities tended to favor helping society and the environment more than students not from underrepresented communities. Also, we bear in mind that a number of steps can be taken to make sure that the academic environment of our college is inclusive to students as suggested by Chaudhary and Berhe (2020).

Drawing on these two studies along with our own experiences, CC&E will likely have the most influence through engagement with the following factors:

- **Commitment to diversity** – CC&E must demonstrate and emphasize its deep commitment to diversity.
- **Sense of belonging** – CC&E must be welcoming to all students and foster a sense of belonging.
- **Job opportunities** – CC&E must do a better job of making it clear to potential students what job opportunities exist; in addition, it should continue to identify internship opportunities and work more closely with the LSU Career Center.
- **Vocational venues** – For those so inclined, CC&E must emphasize that not all career opportunities involve outdoor work.
- **Helping the environment and society** – CC&E must communicate more effectively about how its alumni accomplish both.
- **Role model/mentor** – Our college has already established its commitment to mentorship, but much still remains to be done. Advisors and faculty should continue to foster positive perceptions about students and help build their confidence and self-esteem. To foster a supportive learning environment and systemic institutional change, CC&E should provide professional development training for faculty, instructors, teaching assistants, and advisors.
- **Advisement** – CC&E must do a better job of helping LSU Enrollment Management advisors understand the CES major and provide better web-based information on coursework.
- **Potential learning experiences** – CC&E must continue to communicate the broad range of formal and informal learning experiences that it offers, including study abroad, and thereby enhance students from underrepresented minorities’ successful completion of their program of study. In addition, CC&E should more effectively promulgate the diversity of postgraduate study opportunities that its CES students have available to them.
- **Money/cost to be in the program** – While CC&E cannot control tuition and fees, it can continue to raise funding for scholarships and its unique study opportunities such as study abroad.



Notes:
 Science and engineering (S&E) includes biological/agricultural sciences, physical sciences, computer sciences, mathematics/statistics, engineering, psychology, and social sciences; excludes health sciences. Physical sciences = chemistry, physics, astronomy, and earth/atmospheric/ocean sciences.

Figure 3: Bachelor's degrees in science and engineering conferred per 1,000 individuals 18-24 years old, by state: 2011. Source: NSF.gov

NATIONAL DATA BY GENDER

According to Bernard and Cooperdock (2018), between 1973 and 2015, the gender gap of PhD's narrowed considerably in the physical sciences. In recent years, both the earth sciences and ocean sciences have reached virtual gender parity while in the atmospheric sciences the gap is narrowing and still closing. These data are shown in the images below.

NATIONAL DATA BY GEOGRAPHIC REGION OF THE US

States in the Southern U.S. rank among the lowest in the nation in awarding science and engineering degrees according to the National Science Foundation's "Bachelor's Degrees in Science and Engineering Conferred by 1,000 Individuals 18 - 24 Years Old." In Louisiana, 17.65 individuals were awarded a science or engineering bachelor's degree in 2019, ranking in the lowest quartile among the U.S. states. These data are shown in the figure to the left.

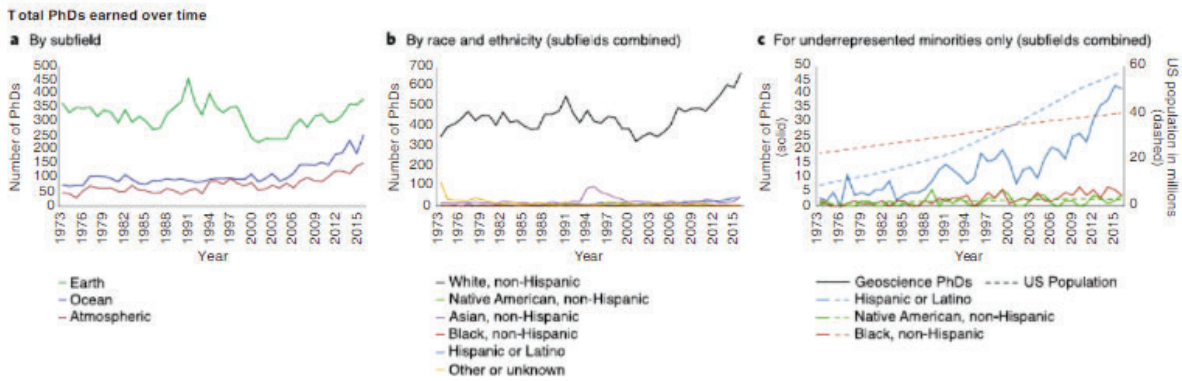


Figure 4: Number of PhDs earned from 1973 to 2015 by varying factors such as race and ethnicity. Source: Bernard and Cooperdock (2018)

In 2017, data indicated that more men than women earn degrees in the physical sciences (Figure 6); in every degree category, less than 40 percent of degree earners are women, in contrast to the mean of all fields, where women are 50 percent or more in all degree categories.

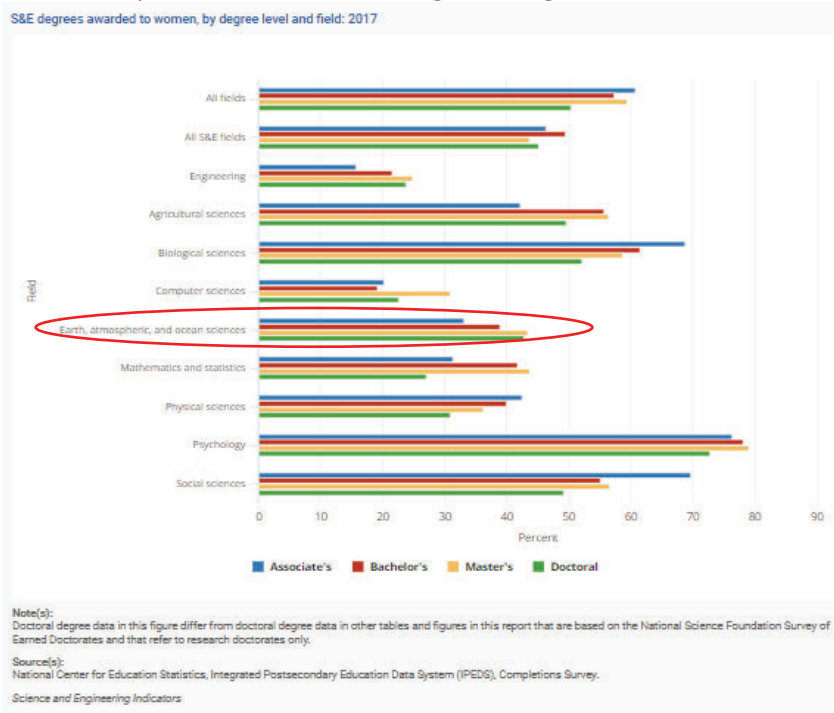


Figure 5: S&E degrees awarded by women, by degree level and field: 2017. Source: National Science Board (2019)

NATIONAL CONCERNS ABOUT THE EARTH SCIENCE EDUCATION ENTERPRISE: THE LOW PROFILE OF GEOSCIENCES K-12 EDUCATION

Recent studies by Greco and Almberg (2018) and King (2013), as well as older studies by Orion et al. (1999), indicate that earth science education in schools worldwide has retained a low profile for decades. Hoffman and Barstow (2007) have postulated that earth science concepts are often, and

wrongly, considered less substantial and rigorous than other areas of science. As an applied area of study, earth systems science draws from the basic principles of physics and chemistry in interdisciplinary, derivative, and integrative ways, which may contribute to that misperception.

In a thoughtful and provocative paper, Orion (2019) advocates that narrowing a “disturbing gap between the educational potential of earth science and its low profile in schools requires a holistic agenda.” This holistic approach can be used to integrate earth science’s scientific aspects as well as the practical ramifications of that science. In calling for what might be termed “critical thinking” about earth system science, Orion further lamented that mired in traditional pedagogy, beginning students “still face the same huge drawers filled with hundreds of specimens of rocks, minerals and fossils.” Orion (2019) recommended that university geoscience researchers and professors “undertake a deep change in all levels of the university geoscience education programs” to include the earth systems approach, geoeconomics education, and the development of communication skills.

Methods of STEM education must change as well, with less emphasis on traditional lecture-based modes of instruction. Research has shown that learner-centered approaches, such as inquiry- and problem-based learning with alternative assessments based on team-oriented writing projects and oral presentations are more effective (Markley et al., 2009). Such assessments are encouraged by LSU’s Communication Across the Curriculum (CxC) program.

Along these lines, LSU must work collaboratively to increase the recognition of the university-wide excellence of its faculty in geosciences – i.e., earth, ocean/coastal, and atmospheric science as well as the cognate areas of ecology, biodiversity, and natural resources management. LSU must also consider the practical and ethical ramifications of these topics and seek to communicate better about them.

PEDAGOGY

How concepts are taught and the way an instructor or professor designs their course can make a tremendous difference in how students learn and retain knowledge. Traditional curricula methodologies of delivering knowledge routinely through lectures have been determined to be an insufficient way to engage students, especially students from underrepresented communities or first-generation college students (Eddy and Hogan, 2014). These students have different life experiences, learning styles, and cultural contexts that influence how they see the world and how they learn (Eddy and Hogan, 2014; Hammond et al. 2001).

During the last two decades, many studies have reported on how students learn and retain new knowledge and how teachers and instructors present this knowledge (e.g., Tinnell et al.2019; Coffman et al.,2018; McCance et al., 2020; Beckerson et al., 2020; Gherardi et al., 1998). Many of these studies support the idea that actively engaging students in the classroom results in higher exam scores and increased self-confidence in a student’s understanding of concepts and grasp of the information (Tinnell et al., 2019; McLaughlin et al., 2017).

The 2012 Engage to Excel report shows that members of underrepresented communities and women now make up 70 percent of all undergraduate students, however only 45 percent graduate with STEM degrees (Beane et al. 2019). Retention can be bolstered with inclusive and equitable learning environments (such as structured introductory courses that use active-learning measures such as clickers), in-class problem-solving activities, small group projects, and activities that demonstrate career options in STEM fields, especially discussions with minority personnel (Beane et al., 2019; Eddy and

Hogan, 2014; Keiner and Gilman, 2015). The SCALE-UP method seems to be particularly effective for student performance and knowledge retention (Keiner and Gilman, 2015).

Students also seem to benefit from developing relationships with their classmates in small group settings, allowing a sense of community and belonging to develop. This seems to be important for influencing student retention, especially among underrepresented community and first-generation students (Eddy and Hogan, 2014; Berckerson et al., 2020).

Cost and faculty training are barriers to implementing these methodologies. Funding needs include resources to teach smaller classes, purchase new equipment and technologies, conduct more-frequent lab experiments, purchase active-learning devices – such as clickers, and develop training programs for faculty. Faculty need to have time to attend and implement this training into their lesson planning (Beane et al., 2019; MacLaughlin et al., 2017). These methodologies have led to improved learning, a reduction in the knowledge-gap, an increase in student self-esteem, an increase in self-satisfaction with their performance in these classes, and a feeling of belonging within the peer group of their academic discipline –all essential elements in guiding underrepresented community and first-generation students to complete their undergraduate STEM degrees (Keiner and Gilman, 2015; Pelch and McConnell, 2016; Eddy and Hogan, 2014; and Beane et al., 2019).

LSU & CC&E Enrollment & Graduation Data

Data: Ethnic Diversity in Enrollment at LSU, Fall Semester 2021

White	64%
Black	15%
Latinx	8%
Asian	4%
International Students	4%
Two or More Races	2%
Unknown, American Indians, Pacific Islanders	1% each

Table 3: Diversity in Enrollment at LSU by Ethnicity. Source: Trend Data: Fall Enrollment, Enrollment by Race/Gender/Level-Fall 2021 report, LSU Office of Budget and Planning website

Data: Louisiana & LSU Student Enrollment

Undergraduate Students	Total	White	Black	Other
Louisiana	120,263	67,828 (56%)	31,629 (26%)	20,806 (17%)
LSU	30,272	19,850 (66%)	4,739 (16%)	5,683 (19%)
Graduate Students	Total	White	Black	Other
Louisiana	26,518	14,134 (53%)	6,512 (25%)	5,872 (22%)
LSU	6,857	3,953 (43%)	950 (14%)	1,954 (28%)

Table 4: Louisiana & LSU Enrollment – Black, White, and Other Ethnicities.

Data source: Louisiana Board of Regents, Statewide Student Profile System, [Student Headcount by Declared Major, by Student Level \(Undergraduate/Graduate\), by Race \(Black/White/Other\) \(UGGRCIP\)](#) & [Student Headcount by Level \(Undergraduate/Graduate\), by Race \(Black/White/Other\) \(SSPSRACLV\)](#), Fall 2021

Ethnic Diversity in Enrollment in CC&E’s Undergraduate Program (Coastal Environmental Science)

CC&E offers a Bachelor of Science in Coastal Environmental Science (CES). This is the only undergraduate degree program offered by CC&E and its Departments of Environmental Sciences and Oceanography & Coastal Sciences. Established in 2008 with five students – including one Black woman, the CES program has experienced growth in enrollment and its percentage of undergraduate students from underrepresented communities. In eight of the past 13 years, students from underrepresented communities have comprised 15 percent or more of our undergraduate student body. While demographics change each year, representation of underrepresented communities in the CES program tends to be Black followed by Latinx, International Students, Two or More Races, Unknown, and Native Hawaiian. However, when you separate the data by individual groups, the percentage of individuals forming underrepresented communities for some groups is generally below average compared with the population of the State of Louisiana. For example, in Fall 2021, 10 percent of the students in the CES program identified as Black; 72 percent as White.

Average Ethnic Diversity in CC&E Enrollment 2008-2021	BS (CES)	MS	PhD	Graduate Programs	CC&E
White	75.8%	74.5%	49.6%	62.6%	69.1%
International Students	2.3%	11.6%	40.5%	25.8%	13.9%
Students from an Underrepresented Community	16.3%	6.8%	5.1%	6.3%	11.5%
Asian	3.3%	2.9%	0.4%	1.7%	2.6%
Unknown	2.1%	4.2%	0.4%	4.3%	3.2%

*Table 5: Average Ethnic Diversity in Enrollment at CC&E, Fall Semester, 2008-2021.
Source: LSU 14-day enrollment reports, “Enrollment by Unit, Curriculum, Racial/Ethnic Category, and Gender.”
The bachelor of science in CES data include students enrolled in the U.C. Center for Freshman Year and University Center for Advising and Consulting with a declared intent to major in CES.*

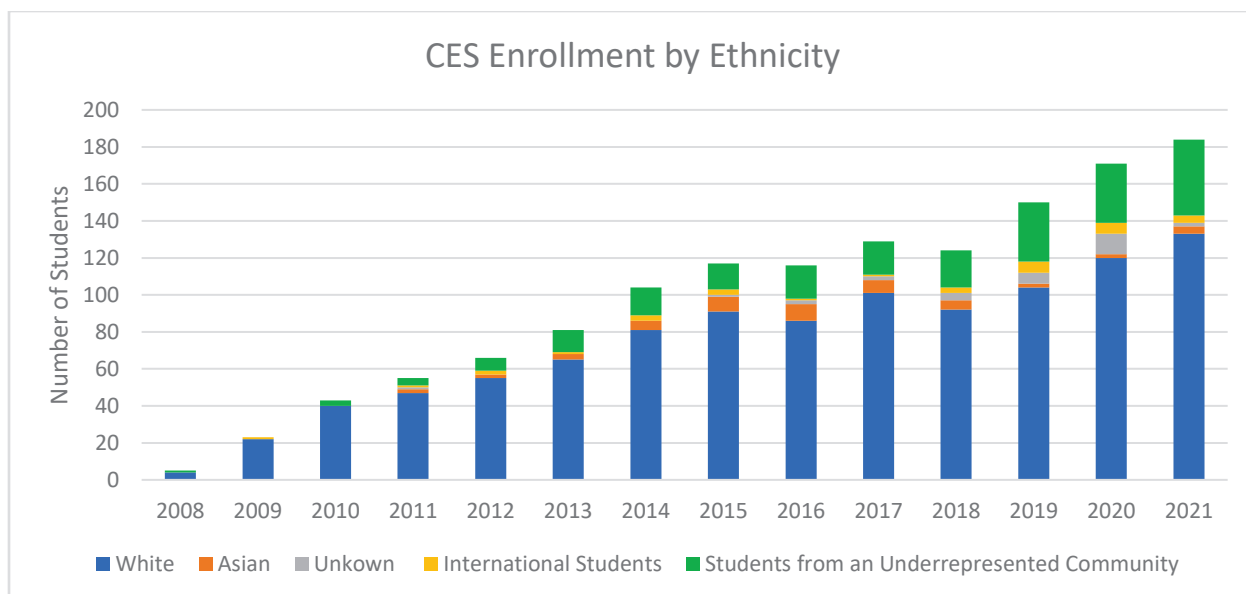


Figure 6: CES enrollment by ethnicity. Source: LSU 14-day enrollment reports, "Enrollment by Unit, Curriculum, Racial/Ethnic Category, and Gender." The bachelor of science in CES data include students enrolled in the U.C. Center for Freshman Year and University Center for Advising and Consulting with a declared intent to major in CES.

Ethnic Diversity in Enrollment in CC&E Graduate Programs

We compared data by ethnicity from Fall 2008-Fall 2021. Enrollment in CC&E's graduate programs has remained somewhat steady during this time. The largest number of diverse students in CC&E's graduate program by far is International Students, which is not included in the definition of underrepresented communities. When you separate these data by individual groups, the numbers are exceptionally low compared to the population of Louisiana.

The lack of diversity in graduate programs in our fields of study is a national issue that has been documented for years. When the CC&E dean served as program director of the NSF Biological Oceanography Program more than 30 years ago, a major effort was begun to "fix the pipeline" and get more students from underrepresented communities through STEM degree programs. While there has been some success for STEM overall, programs in the geosciences have yet to have much success and still lag behind other STEM disciplines. Dutt et al. (2016) raised the prospect of gender bias as part of the explanation for this, but to our knowledge, the root causes are still uncertain. Bernard et al. (2018) recently stated, "We noticed the lack of ethnic and racial diversity among our peers as soon as we entered our PhD programme. The uniformity worsens from undergraduate to graduate to faculty level. These data support this perception; years of outreach have yet to make any significant strides toward increasing diversity at the PhD level. Efforts to increase diversity have been focused primarily on feeding the pipeline in schools and at the undergraduate level. Yet, at all degree levels, the geosciences remain the least diverse discipline within STEM." CC&E is no exception to this problem.

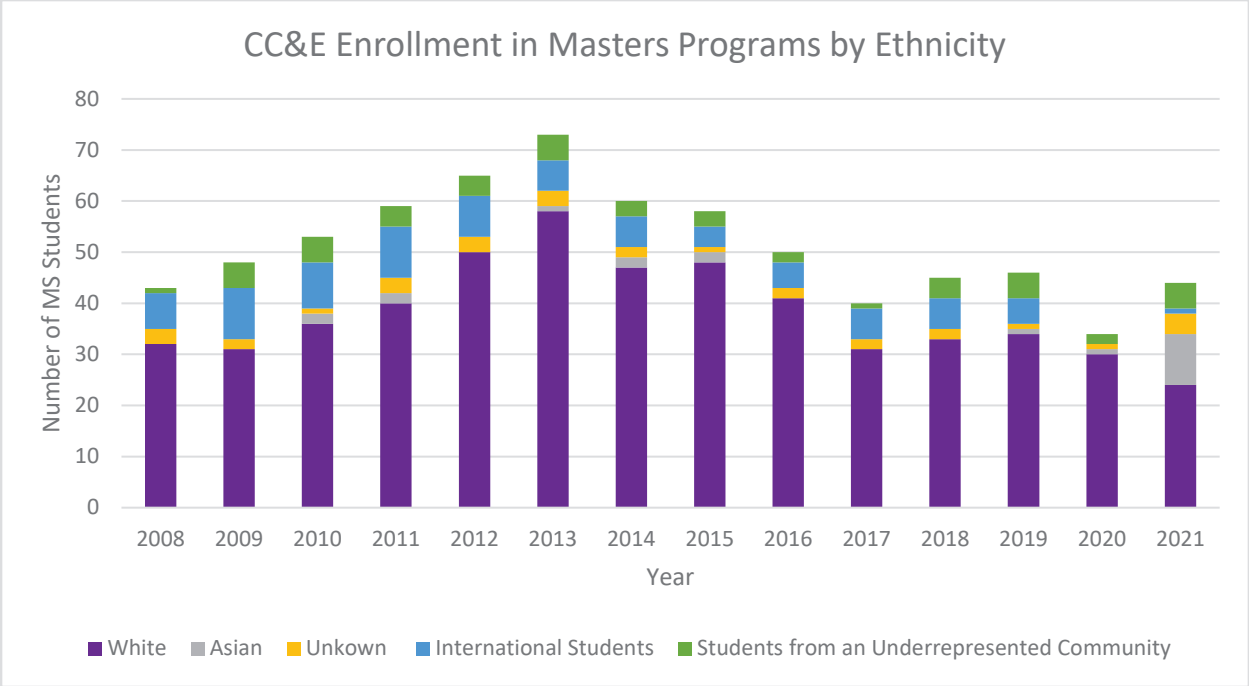


Figure 7: CC&E Enrollment in Masters Programs by Ethnicity.
 Source: LSU 14-day enrollment reports, "Enrollment by Unit, Curriculum, Racial/Ethnic Category, and Gender."

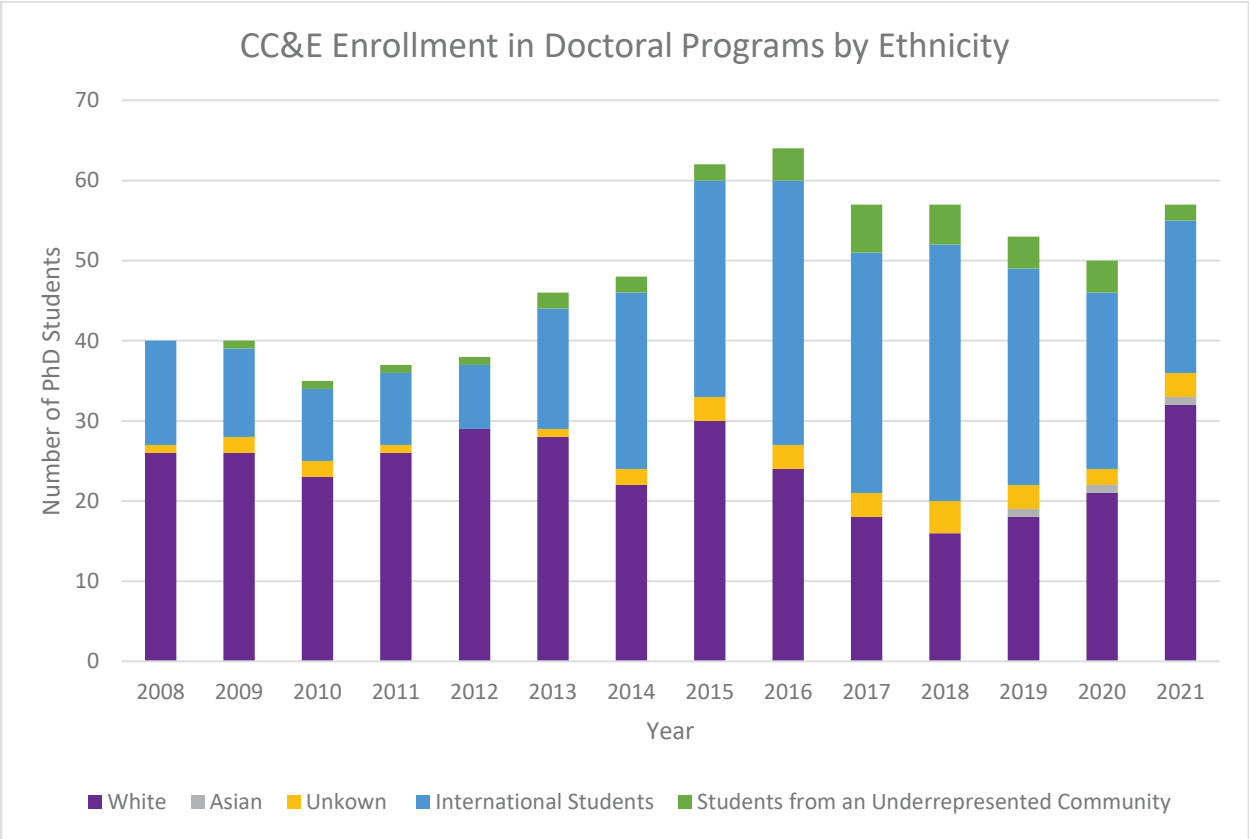


Figure 8: CC&E Enrollment in Doctoral Programs by Ethnicity.
 Source: LSU 14-day enrollment reports, "Enrollment by Unit, Curriculum, Racial/Ethnic Category, and Gender."

Data: Average CC&E Graduate percentages by Ethnicity, 2010-2021

2010-2021	BS	MS	PhD	CC&E
White	80.1%	73.1%	50.6%	67.9%
International Students	2.3%	14.4%	41.6%	19.4%
Students from Underrepresented Communities	11.6%	7.7%	3.4%	7.6%
Asian	4.2%	2.4%	1.1%	2.6%
Unknown	1.9%	2.4%	3.4%	2.6%

Table 6: Source: University Graduating Class Profile, Graduates by Degree Level, Curriculum, Racial/Ethnic Category and Gender, LSU Office of Budget & Planning website

Gender Diversity in CES Program

Gender diversity in the CES program is quite good with women making up 50 percent or more of those enrolled in the CES program in nine of the past 13 years. The CES program achieved its highest percentage of women in 2021 with 70 percent. This reflects the national trend in which more women undergraduates are enrolled than men. For our heavily STEM-focused program, this is good news, since STEM programs have been traditionally male-dominated.

LSU & CC&E Data in Comparison with National Data

We find that CC&E's diversity very much models the situation that is found at other universities with PhD programs in the physical sciences. As Bernard and Cooper (2018) state, "The lack of ethnic and racial diversity...worsens from undergraduate to graduate to faculty level." The challenge is clear for the physical sciences at LSU and especially in CC&E – while the beginning of the talent pipeline is improving, a lot of attention must be focused on education at the graduate level without forsaking the progress that has been made at the K-12 and undergraduate levels.

The same authors conclude, "Although past efforts to increase diversity at the grade school and undergraduate levels have not translated into diversity at the PhD, let alone faculty, level." This is a critically important factor that the LSU community must address with respect to both the geosciences and engineering. CC&E, the College of Science, the College of Engineering, the College of Agriculture, and the College of Humanities & Social Sciences are particularly affected.

FACULTY & STAFF DIVERSITY

Faculty Diversity by Ethnicity

With nearly 30 percent of CC&E professors having been born outside of the U.S. and with 11 different native languages spoken, in some respects, it can be argued that our CC&E faculty is remarkably diverse. But unfortunately, it is not representative of the demographic data of the State of Louisiana. Currently, we have 46 faculty members drawn from all over the globe. Since 2008, the largest group of foreign-born CC&E faculty members is Asian, most of whom are Chinese. This is a common profile for STEM departments across the U.S. However, in terms of professors who identify as Black and Latinx, CC&E has

significant room for improvement. Unfortunately, this is typical of oceanography and environmental science departments nationally.

Average Ethnicity of Faculty, 2008-2021

Ethnicity	CC&E	LSU
White	67.5%	47.7%
Asian	20%	10.7%
International	7.5%	5.6%
Latinx	2.5%	0.1%
Black	2.5%	3.8%

Table 7: Average Ethnicity for Faculty, 2008-2021.

Source: Faculty data: Enterprise Information System: Full-Time Faculty by Race

Faculty Diversity by Gender

Between academic years 2008 and 2021, an average of 25 percent of CC&E’s faculty identified as women. This is far short of campus-wide data during this same period that show 35.2 percent of LSU faculty identified as women, but somewhat mirrors the gender diversity within CC&E fields of study.

According to the paper in *AGU Advances*, gender distribution varies by sub-discipline. The percentage of women faculty in Earth Sciences, Ocean Sciences, Atmospheric Sciences and Planetary Sciences range between 23 and 30 percent of the faculty in each discipline with atmospheric sciences having the lowest percentage of woman faculty (~23%) and ocean sciences having the highest percentage of woman faculty (~30%). The percent of woman faculty in Earth Sciences is approximately 30 percent (Ranganathan et al., 2021).

Administrative Staff

CC&E is extremely fortunate to have a wonderful administrative staff. In Fall 2021, CC&E’s administrative staff included professionals with responsibilities ranging from administrative assistance, accounting, recruiting, communications, IT support, facilities services, procurement, and grants management. Of these 18 individuals, three (16.6 percent) identify as Black and 16 (89 percent) as women.

Research Staff and Post-Docs

CC&E’s research team is an essential part of our college. Of the 22 researchers and post-docs (Fall 2019 data), 15 identify as men (68 percent), seven as women (32 percent), 16 as White (73 percent), four as Asian (18 percent), one as Latinx (4.5 percent), and one as Black (4.5 percent).

OUTREACH

CC&E strives to involve itself in public outreach and engagement, subject to the availability of resources. This is an important element of the underrepresented community STEM pipeline. Below we list a few of these efforts.

EnvironMentors program with Scotlandville Magnet High School

The LSU EnvironMentors (EM) chapter has been, by far, CC&E's most important contribution to K-12 education. EM is a collaborative, award-winning, and proven college access program involving underrepresented high school students and volunteer STEM student mentors from LSU (Monk et al., 2014). The LSU chapter is part of a national network of nine chapters affiliated with the National Council for Science and the Environment (NCSE). EM pairs suburban Baton Rouge high school students with LSU student mentors at a 1:2 ratio for weekly environmental science-related activities during the academic year, culminating in (1) a national science competition in Washington, D.C. and (2) an overnight trip to conduct field research in the coastal waters of South Louisiana at the Louisiana Universities Marine Consortium (LUMCON). In the field, students explore coastal Louisiana, the Mississippi River Delta, and the Gulf of Mexico.

This program at LSU, now in its 10th year, averages 40 participants per year and represents approximately 14 high school students and 28 university students majoring in STEM-related curricula. The number of high school participants in this program is limited by transportation and by the number of LSU student mentors. During the past two years, participation in this program has declined. During the 2018-2019 academic year, the program did not receive as much interest from the LSU students as in previous years resulting in decreased opportunities for high school students to participate in the program. That year, the program supported 28 participants, eight high school students and 16 LSU students. And, during the 2019-2020 academic year, interest in the program declined from the high school participants, which coincided with a lack of support from the high school and logistical changes due to COVID.

However, the program is making a difference in the lives of all who participate, as demonstrated by the high graduation rates and college attendance rates of high school participants. Since its inception in 2010, 98 percent of EM completers have graduated from high school and 80 percent have continued their education or joined the military. Twelve have obtained college diplomas, which is a startling and unexpected outcome of this program. All college mentors have reported improved mentoring and leadership skills, improved interpersonal communication skills, a sense of responsibility, and an understanding of the importance of community. Because of the decline in enrollment of Scotlandville High students in the program, we are considering revisions to produce "EnvironMentors 2.0," which will include remote activities and involve more schools and students (see below.)

To date, all EM high school participants have identified as Black with the LSU mentors, who are students in STEM areas from around campus, representing a diverse combination of ethnicities and socio-economic backgrounds. Furthermore, EM is making a difference in the capital area community, too, as evidenced by its recent recognition from the Coalition to Restore Coastal Louisiana, which awarded LSU EnvironMentors one of eight 2014 Stewardship Awards. Twice the LSU program has been awarded National Chapter of the Year (2013, 2018) by its parent organization, the National Center for Science and the Environment (NCSE). At the end of 2018, the chapter began hosting Teen Science Café events at the Carver Branch Library. The four events were attended by 60 teens, many of whom are served by the Front Yard Bikes Program and Thrive Academy. In June 2019, EM mentee Briana Coleman placed third overall at the EM national fair for her research project, "Fish Guts: Microbiome Comparison of Fish and Oysters." Additionally, Briana was selected as the inaugural intern in the NCSE's Minority Internship Program on STEM. In Fall 2019, the U.S. Environmental Protection Agency Gulf of Mexico Program named LSU EM the second-place Gulf Guardian winner for "taking positive steps to keep the Gulf

healthy, beautiful and productive. The Gulf Guardian Award exemplifies what the Gulf of Mexico Program is all about: innovative solutions that come about when we pool resources and look for creative ways to positively impact our quality of life and economic well-being.”

Mayfair School (Informal K-12 Education)

Nationally, K-12 curricula do not include sufficient treatment of subjects in the physical sciences (Dahl et al. 2005; Lewis and Baker, 2010; McNeal, 2010). This omission has a number of serious and negative consequences, such as (1) poor public understanding of environmental sciences, (2) declining enrollments in undergraduate physical sciences, (3) insufficient education of graduate students for available positions in a range of sectors, (4) insufficient national education of individuals from underrepresented communities with PhDs, (5) low representation of underrepresented communities among university faculty in the physical sciences, and (6) K-12 teachers insufficiently prepared for classroom instruction in the physical sciences.

To help with this issue, in 2018 CC&E created an initiative to help young students (kindergarten through middle school) develop an interest in the physical sciences, thus potentially increasing the future pipeline of CC&E students. So-called “EcoSTEM” hubs have been recently touted as an approach to increase STEM diversity (National Science & Technology Council, 2018).

With assistance from faculty at CC&E, Mayfair Lab School designed a student research laboratory and advanced their EcoSTEM program for students to explore current and future environmental challenges. Students apply academic concepts to real-life problems by focusing on projects that are of specific interest to their school. CC&E believes that this model program will fit well with existing curricula and can be used to foster interest in the geosciences elsewhere in the state.

While plans are still being developed, schools with established EcoSTEM programs will serve as “hubs” by playing a leading role in bringing other middle and high schools under an EcoSTEM umbrella. These schools will receive assistance in developing a curriculum for environmentally related activities and creating centers to nurture all environmental activities. Specifically, these selected schools will 1) create an Environmental Science Laboratory that promotes hands-on learning; 2) welcome assistance in creating supplemental curriculum for year-long, grade-specific student projects mentored by CES Capstone students, students from CC&E’s new Service Learning course (4000), and Louisiana Sea Grant’s education staff; 3) host guest speakers or show movies that are related to the environment; and 4) invite other schools to share in Earth Week activities such as art shows, poster displays, and show and tell (students present their projects, presenters from universities discuss current research, presentations from environmentally-focused organizations, etc.). The sustainability of these hubs is critical and therefore internal and external funding is needed.

Additional Support in K-12 Schools

On an individual basis, CC&E faculty volunteer with STEM activities at multiple elementary and middle schools.

Mastermind

For the academic year 2020-2021, CC&E embarked on a new initiative to help graduate students leverage expertise among each other. This peer-support initiative provides small groups with troubleshooting, problem-solving, social interaction, and emotional well-being. Students benefit from diverse perspectives shared in their group.

Narrowing the Gap Initiatives

Increasing diversity and inclusivity is an ongoing effort that will take time to accomplish. Since our state has the second-largest population by percent and eleventh largest by the number of Blacks individuals in the nation, our first goal is to have a student population that is representative of our national population. Therefore, CC&E will expand its diversity by increasing the number of Black students enrolled in its academic programs and increasing faculty diversity.

To narrow the gap, CC&E has developed four initiatives to improve the education of students from underrepresented communities in the physical sciences. These action items will be refined based on team input. These initiatives include:

Augment the Student Pipeline

A recent study of researchers, policymakers, and institutional leaders concluded that the following challenges must be addressed (Bennett et al., 2020):

(A) a lack of role models, mentors, and quality advising stymieing advancement and retention at points all along the pathways to the professoriate; (B) the critical nature of transition points such as between undergraduate degree completion and entry to graduate school or from graduate school to postdoctoral or faculty positions; and (C) the continued undermining of diversity efforts by pervasive and unexamined implicit bias in admissions, hiring, and promotion and tenure.

As recommended by Johnson et al. (2016), we will strengthen our mentoring of students from underrepresented communities and encourage them to pursue graduate education in geosciences. The success that we have in this area will help the national effort to augment diversity.

To enlarge the pipeline of students from underrepresented communities in our graduate and undergraduate programs, CC&E will expand its efforts to

- recruit for a diverse student body
- retain existing students, and
- build a future pipeline by helping younger students develop an interest in physical sciences.

Build the Ranks for Faculty

Since only two percent of the nation's PhDs in physical sciences are awarded to Black individuals, CC&E must work to increase interest among its students from underrepresented communities in academic careers. The data about the factors that influence students from underrepresented communities to study in STEM fields—see reference to Ashford-Hanserd et al. (2020) on page 8—will be helpful with this endeavor. Additionally, given the intense competition at our peer institutions to hire faculty from underrepresented communities, CC&E must be diligent about faculty retention. These challenges can be

overcome if they are approached in an “all-in” fashion. Everyone in CC&E needs to help develop, identify, attract, and retain qualified candidates from underrepresented communities for faculty positions.

To help ensure that our students are better prepared for a global and diverse workforce, CC&E must do a better job of attracting faculty from underrepresented communities to our college and developing underrepresented students for academic careers. CC&E will enhance its efforts to

- cultivate potential candidates – intentionally and continually, before positions become available;
- recruit for a diverse candidate pool;
- integrate adjunct faculty from underrepresented communities into our academic and extracurricular activities; and
- build candidates from within the Coastal Environmental Science program and the Environmental Sciences and Oceanography & Coastal Sciences master’s programs.

Foster A Culture of Inclusion

CC&E aims to sustain an environment in which race, gender, and other differences are respected, appreciated, and valued. CC&E will continue to

- foster an atmosphere of inclusion
- build collaborative alliances, and
- increase funding for diversity initiatives.

Improve Pedagogy: Teach and Learn

CC&E continually strives to improve its quality of teaching, modifying both methods and practices as needed to better assist a diverse student body in gaining a deeper understanding of the subject matter. To improve pedagogy, CC&E must

- embrace new ways to educate students from diverse backgrounds and
- reinforce its mentoring programs for new faculty and students.

An overview of the proposed action items to narrow the gap follows.

Action Items and Outcomes

The following is a list of numerous possibilities to improve diversity and inclusivity in CC&E. The college continues to find new and better ways to deal with these issues. *Included in the LSU Diversity & Inclusion Roadmap 2020-2022

Augment the Student Pipeline

- Recruiting for a Diverse Student Body
 - Encourage faculty interactions with diverse high school student groups
 - Increase outreach to students from an underrepresented community with marketing efforts to Historically Black Colleges and Universities (HBCUs). For example, Southern University has an undergraduate degree in biology that could be a source of graduate students.
 - Increase outreach to students from an underrepresented community through marketing efforts at major scientific conferences

- Increase outreach to prospective graduate students from underrepresented communities by providing travel assistance to visit CC&E
- Strengthen our mentoring of students from an underrepresented community and encourage them to pursue graduate education in the geosciences
- Retaining Existing Students
 - Increase mentoring for all students
 - Ensure that students from an underrepresented community are aware of the resources available from the LSU Office of Diversity
- Building a Future Pipeline
 - Enhance EnvironMentors to reach additional students from an underrepresented community and modify curriculum to include “college-ready” lessons
 - Help to start EcoSTEM initiatives at K-12 schools by helping younger students develop an interest in physical sciences
 - Represent CC&E at community events such as Ocean Commotion, Earth Day, Ebb & Flow, and similar events that attract youth

Build the Ranks for Faculty

- Cultivating Candidates (Intentionally) before Positions Become Available
 - Develop relationships with faculty from an underrepresented community in the physical sciences
 - Develop relationships with outstanding graduate students at other universities that align with CC&E’s fields of study
 - Invite guest scholars and lecturers from an underrepresented community to the college. Market presentations campus-wide (Travel funds may be available)
 - Invite faculty from Southern University, Xavier, and other HBCUs to serve as adjunct faculty and include in academic activities (committee members, co-teaching, proposal writing, and research collaborations)
- Recruiting Candidates from an Underrepresented Community
 - Recruit at the level appropriate to the opportunity
 - Ensure that faculty positions are posted on sites recommended by the LSU Office of Diversity and via LinkedIn’s premium service
 - Ensure that all search committee members receive diversity training and related materials from the LSU Office of Diversity
 - Expand the scope and funds for dual faculty hires to include diversity hires of qualified candidates
 - Personalize the recruitment process so that candidates feel wanted
 - Expand the candidate pool by recruiting for concentrations such as environmental law, environmental economics, environmental policy, and geography/GIS, where there are more students from underrepresented communities who earn PhDs
- Building Candidates from within CC&E's CES and MS Programs
 - Encourage CES graduates from an underrepresented community to obtain a PhD at another university (reciprocal student exchange program) so that they will be eligible for faculty openings in CC&E. (Note: There is already one such student beginning her PhD)
 - Help students to understand the complex career path to becoming a faculty member
- Retaining Faculty
 - Enhance faculty development through mentorship opportunities

- Help accelerate success by continuously monitoring teaching and service loads for faculty

Foster an Atmosphere of Inclusion

- Heighten awareness of diversity and inclusivity issues by adding language in each department handbook that states, “We strive to provide and maintain an environment that ensures diversity, equality, and inclusiveness. Any actions contrary to these values will not be tolerated.” Ensure that this code of conduct is in alignment with LSU’s code of conduct and applies to CC&E’s college community.
- Establish a library of documents on diversity issues to share with students and faculty.
- Support the educational initiatives in the LSU Roadmap to Diversity (Distinction in Diversity and Inclusion Certificate; Diversity and Inclusion Core Requirements for All Degrees)
- Establish a DEI webpage on the CC&E website
- Enhance diversity training for faculty, post-docs, staff, and TAs, if training is not offered by the LSU Office of Diversity
- Work institutionally to ensure that instructors of general education courses are sensitive to issues from students from an underrepresented community
- Host educational events such as movies or book clubs featuring movies or books written by professionals from an underrepresented community
- Make students, faculty, and staff aware of available resources (such as training options) offered by the LSU Office of Diversity
- Build Collaborative Alliances
 - Share best practices to address the shortage of students from an underrepresented community in geosciences (GOMURC workshop held)
 - Partner with internal units at LSU, such as the Depts. of Geology & Geophysics, Biological Sciences, Geography & Anthropology, and Renewable & Natural Resources, to address DEI challenges in the geosciences
 - Partner with external organizations, such as Louisiana Association of Independent Colleges & Universities (LAICU), the Consortium for Ocean Leadership, and Gulf of Mexico University Research Collaborative (GOMURC), on strategic initiatives to increase the number of students from an underrepresented community in geosciences
 - Partner with other universities with strong geoscience departments to increase DEI efforts (Note: CC&E is in discussions with Loyola University, Savannah State University, Jackson State University)
 - Partner with the LSU Office of Diversity on the implementation of CC&E’s Roadmap to Inclusion and Engagement and the LSU Diversity & Inclusion Roadmap 2020-2022
- Increase Funding for Diversity Initiatives
 - Write grant proposals to seek funding for diversity initiatives. (Note: meetings about Bridge to the Doctorate funding are underway; USGS proposal has been funded at \$180,000 over two years)

Improve Pedagogy: Teach and Learn

- Embrace new ways to educate students from diverse backgrounds
 - Host virtual seminar(s) with national expert(s) on this topic
 - Provide faculty and students interested in academic careers with mentoring in pedagogy

Additional Administration Actions

- Develop and implement a survey to determine existing attitudes about DEI among faculty, students, and staff. Use results to refine CC&E's plan
- Since diversity is a key priority and responsibility of the college's leadership team, a Diversity Task Force will be established and report to the college leadership team.
- Designate CC&E individual to serve as faculty-staff-student ombudsman for racial, gender, LBGTO, and other discrimination concerns
- Increase diversity on CC&E Advisory Council (Note: two of the last five new members were women from underrepresented communities)
- Ensure that 25% of key student points of contact begin taking diversity training
- Continuously review marketing materials/website to ensure that inclusivity is demonstrated

References and Supporting Documents

Ashford-Hanser, S., Daniel, K., García, D. M., and Idema, J.L. 2020. Factors that Influence Persistence of Biology Majors at a Hispanic-Serving Institution. *Journal of Research in Technical Careers*, 4:47-60. <https://doi.org/10.9741/2578-2118.1048>

"Bachelor's Degrees in Science and Engineering Conferred per 1,000 Individuals 18–24 Years Old." National Science Foundation. 2019.- Science & Engineering State Indicators. <https://nces.nsf.gov/indicators/states/indicator/se-bachelors-degrees-per-1000-18-24-year-olds>

Beane, R., McNeal, K.S., and Macdonald, R.H. Probing the National Geoscience Faculty Survey for reported use of practices that support inclusive learning environments in undergraduate courses. *Journal of Geoscience Education*, Vol. 67, No. 4, 2019, pp. 427-445, DOI: 10.1080/10899995.2019.1621714

Beckerson, W.C., Anderson, J.O., Perpich, J.D., and Yoder-Himes, D. 2020. An Introvert's Perspective: Analyzing the Impact of Active Learning on Multiple Levels of Class Social Personalities in an Upper Level Biology Course. *Journal of College Science Teaching*, Vol. 49, No. 3, pp. 47-57, DOI: https://doi.org/10.2505/4/jcst20_049_03_47

Bennett, J.C., Lattuca, L, Redd, K., and York, T. 2020. Strengthening pathways to faculty careers in STEM: Recommendations for systemic change to support underrepresented groups. Washington, DC: Association of Public and Land-grant Universities. DOI: <https://doi.org/10.31219/osf.io/69mec>

Bernard, R.E. and Cooperdock, E.H.G. 2018. No progress on diversity in 40 years. *Nature Geoscience*, 11, 292–295. DOI: doi.org/10.1038/s41561-018-0116-6

Chaudhary, V.B. and Berhe, A.A. 2020. Ten Simple Rules for Building an Anti-racist Lab. *EcoEvoRxiv*. June 18. DOI: [10.32942/osf.io/4a9p8](https://doi.org/10.32942/osf.io/4a9p8)

Collins, S.N. 2020. How to get more women and people of colour into graduate school — and keep them there, Book review. *Nature*, 586: 491-492. www.nature.com/articles/d41586-020-02940-y DOI: [10.1038/d41586-020-02940-y](https://doi.org/10.1038/d41586-020-02940-y)

- Cook, S.B., Holloway, A., Lettrich, M. and Yarincik, K. 2016. The ocean science graduate education landscape: A 2015 perspective. *Oceanography* 29(1):16–21. DOI: [dx.doi.org/10.5670/oceanog.2016.04](https://doi.org/10.5670/oceanog.2016.04)
- Dahl, J., Anderson, S.W. and Libarkin, J.C. 2005. Digging into earth science: alternative conceptions held by K-12 teachers/Excavando las ciencias de la tierra: ideas alternativas de profesores de K-12. *Journal of Science Education, Bogotá*, Vol. 6(2): 65-68.
<https://jd030.k12.sd.us/images/Digging%20into%20earth%20science.pdf>
- D'Elia, C.F. 1989. A former Program Director's Perspectives on the Biological Oceanography Program at NSF. *ESA Bull.* 70:180-184. <https://www.jstor.org/stable/pdf/20167126.pdf>
- Dutt, K., Pfaff, D., Bernstein, A. et al. 2016. Gender differences in recommendation letters for postdoctoral fellowships in geoscience. *Nature Geoscience*. 9:805–808. DOI: doi.org/10.1038/ngeo2819.
- Eddy, S.L. and Hogan, K.A. 2017. Getting Under the Hood: How and for Whom Does Increasing Course Structure Work? *CBE-Life Sciences Education*, Vol. 13, No. 3, 2014, pp. 453-468, DOI: doi.org/10.1187/cbe.14-03-0050
- Fouad, N.A. and Walker, C.M. 2005. Cultural influences on responses to items on the Strong Interest Inventory. *Journal of Vocational Behavior*, 66(1), 104–123. DOI: doi.org/10.1016/j.jvb.2003.12.001
- Gherardi, S., Nicolini, D. and Odella, F. 1998. Toward a Social Understanding of How People Learn in Organizations: The Notion of Situated Curriculum. *Management Learning*, Vol. 29, No. 3, pp. 273–297, DOI: [10.1177/1350507698293002](https://doi.org/10.1177/1350507698293002)
- Greco, R. and Almborg, L. 2018. *Earth science education: Global perspectives*, (p. 355). Pouso Alegre: IFSULDEMINAS il. ISBN: 987-85-67952-14-7.
- Griffin, K.A. 2020. Institutional Barriers, Strategies, and Benefits to Increasing the Representation of Women and Men of Color in the Professoriate. In: Perna L. (eds) *Higher Education: Handbook of Theory and Research*, Vol 35., Springer Nature Switzerland AG, DOI: doi.org/10.1007/978-3-030-31365-4_4
- Hammond, L.D., Austin, K., Orcutt, S. and Rosso, J. 2001. How People Learn: Introduction to Learning Theories. *The Learning Classroom: Theory into Practice (A Telecourse for Teacher Education and Professional Development)*, Episode #1 Introduction Chapter, Stanford University School of Education, 22p., [citeseerx.ist.psu.edu/viewdoc/download? DOI:10.1.1.294. 3636&rep=rep1&type=pdf](https://citeseerx.ist.psu.edu/viewdoc/download?DOI=10.1.1.294.3636&rep=rep1&type=pdf)
- Hoffman, M. and Barstow, D. 2007. Revolutionizing Earth system science education for the 21st century. In *Report and recommendations from a 50-state analysis of earth science education standards*. Cambridge: TERC. <https://files.eric.ed.gov/fulltext/ED497331.pdf>
- “How Do States Compare in Awarding S&E Bachelor's Degrees?” 2011. *STEM Education Data and Trends*, <https://www.nsf.gov/nsb/sei/edTool/data/college-15.html>.
- Johnson, A., Huggans, M.J, Siegfried, D. and Braxton, L. 2016. Strategies for increasing diversity in the ocean science workforce through mentoring. *Oceanography* 29(1):46–54. DOI: [dx.doi.org/10.5670/oceanog.2016.11](https://doi.org/10.5670/oceanog.2016.11)

- Kania, J. and Kramer, M. 2011. Collective impact. Stanford Social Innovation Review. https://ssir.org/articles/entry/collective_impact
- Keiner, L.E. and Gilman, C.S. 2015. Implementation of Interactive Engagement Teaching Methods in a Physical Oceanography Course. *Journal of College Science Teaching*, Vol. 45, No. 2, pp. 70–77, https://doi.org/10.2505/4/jcst15_045_02_70
- King, C. 2013. Geoscience education across the globe – Results of the IUGS-COGE/IGEO survey. *Episodes*, 31, 19–30. DOI: doi.org/10.18814/epiiugs/2013/v36i1/004
- Laursen, S.L. and Austin, A.E. 2014. StratEGIC Toolkit: Strategies for Effecting Gender Equity and Institutional Change. www.strategictoolkit.org
- Lewis, E.B. and Baker, D.R. 2010. A Call for a New Geoscience Education Research Agenda. *Faculty Publications: Department of Teaching, Learning and Teacher Education*. 122. DOI: <https://doi.org/10.1002/tea.20320>
- Markley, C., Miller, H., Kneeshaw, T. and Herbert, Bruce. 2009. The Relationship Between Instructors' Conceptions of Geoscience Learning and Classroom Practice at a Research University. *Journal of Geoscience Education* 57(4):264. DOI: 10.5408/1.3544276
- McCance, K., Weston, T. and Niemeyer, E. 2020. Classroom Observations to Characterize Active Learning within Introductory Undergraduate Science Courses. *Journal of College Science Teaching*, Vol. 49, No. 4, pp. 24-29, DOI: 10.5408/1.3544276
- McLaughlin, J. S., Favre, D. E., Weinstein, S. E. and Goedhart, C. M. 2017. The Impact of a Four-Step Laboratory Pedagogical Framework on Biology Students' Perceptions of Laboratory Skills, Knowledge, and Interest in Research. *Journal of College Science Teaching*, Vol. 47, No. 1, pp. 83-91, DOI: 10.2505/4/jcst17_047_01_83
- McNeal, K.S. 2010. Editorial: The Geosciences Gap in K-12 Education. *Journal of Geoscience Education*, Bellingham 58(4): 197. DOI: <https://doi.org/10.5408/1.3534857>
- Monk, M.H., Baustian, M.M., Saari, C.R., Welsh, S., D'Elia, C.F., Powers, J.E., Gaston, S. and Francis, P. 2014. EnvironMentors: Mentoring At-Risk High School Students through University Partnerships. *Int. J. Environ. & Science Education* 9(4):385-397. DOI: <http://dx.doi.org/10.12973/ijese.2014.223a>
- National Science Board. 1986. Undergraduate Science, Mathematics and Engineering Education. NSB 86-100. <https://www.nsf.gov/nsb/publications/1986/nsb0386.pdf>
- National Science Board. 2019. Science & Engineering Indicators 2020: Higher Education in Science and Engineering. NSB-2019-7. <https://nces.nsf.gov/pubs/nsb20197/executive-summary>
- National Research Council. 1996. National Science Education Standards. Washington, DC: The National Academies Press. DOI: doi.org/10.17226/4962
- National Research Council. 2000. 50 Years of Ocean Discovery: National Science Foundation 1950-2000. Washington, DC: The National Academies Press. DOI: doi.org/10.17226/9702

National Science & Technology Council. 2018. Charting a Course for Success: America's Strategy for STEM Education: A Report by the Committee on STEM Education of the National Science & Technology Council. <https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf>

Orcutt, B.N. and Cetinic, I. 2014. Women in oceanography: continuing challenges. *Oceanography*, 27 (4) supplement: 5-13, DOI: [dx.doi.org/10.5670/oceanog.2014.106](https://doi.org/10.5670/oceanog.2014.106)

Orion, N. 2019. The future challenge of Earth science education research. *Disciplinary and Interdisciplinary Science Education Research* 1(1): 3. DOI: <https://doi.org/10.1186/s43031-019-0003-z>

Orion, N., King, C., Krockover, G.H. and Adams, P.E. 1999. The development and status of earth science education: A comparison of three case studies: Israel, England and Wales, and United States of America Part 1. *ICASE*, 10(2), 13–23. DOI: <https://doi.org/10.1186/s43031-019-0003-z>

Pelch, M.A. and McConnell, D.A. 2016. Challenging instructors to change: a mixed methods investigation on the effects of material development on the pedagogical beliefs of geoscience instructors. *International Journal of STEM Education*, 3, Article No. 5, 18p., DOI: doi.org/10.1186/s40594-016-0039-y

Ranganathan, M., Lalk, E., Freese, L. M., Freilich, M. A., Wilcots, J., Duffy, M. L., and Shivamoggi, R. (2021). Trends in the Representation of Women Among Us Geoscience Faculty from 1999-2020: The long road towards gender parity. *AGU Advances*, John Wiley & Sons, Ltd, 16 Aug. 2021. DOI: <https://doi.org/10.1002/essoar.10506485.2>

Sherman-Morris, K. and McNeal, K.S. 2016. Understanding Perceptions of the Geosciences Among Minority and Nonminority Undergraduate Students. *Journal of Geoscience Education* 64(2): 147-156. DOI: <https://doi.org/10.5408/15-112.1>

Tinnell, T. L., Ralston, P. A. S., Tretter, T. R. and Mills, M. E. 2019. Sustaining Pedagogical Change Via Faculty Learning Community. *International Journal of STEM Education*, Vol. 6, No. 1, pp. 1-16, DOI: <https://doi.org/10.1186/s40594-019-0180-5>