



# UNDERGRADUATE RESEARCH FOR ALL

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Watt Family Innovation Center



# Creative Inquiry is Clemson University's Signature Undergraduate Research Program

*2016 Award for Undergraduate Research  
Accomplishments  
from the  
Council on Undergraduate Research*

[http://www.cur.org/cur\\_recognizes\\_campuses\\_with\\_characteristics\\_of\\_excellence\\_in\\_undergraduate\\_research](http://www.cur.org/cur_recognizes_campuses_with_characteristics_of_excellence_in_undergraduate_research)

# Creative Inquiry – Undergraduate Research

*Team-based, intensive, discovery-oriented  
research for undergraduates in all academic  
disciplines*

## Creative Inquiry:

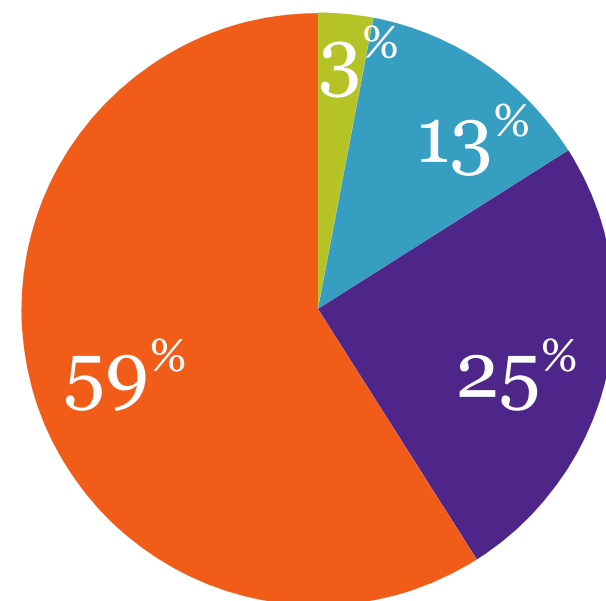
- Engages small groups of students work under the direction of faculty mentors
- Is supported by the university and industry partners
- Projects
  - are embedded within multi-semester for-credit courses
  - extend over multiple semesters
  - may address real-world problems
  - may be within disciplines or multidisciplinary

<http://www.clemson.edu/ci>

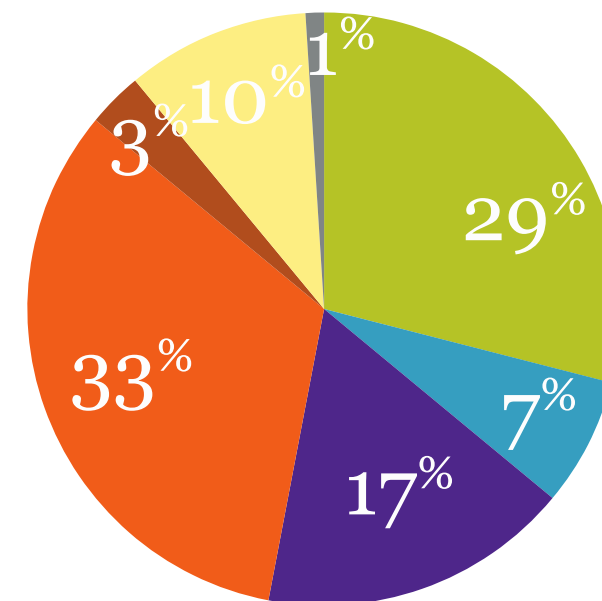


# 2015-2016 Creative Inquiry Undergraduate Enrollment

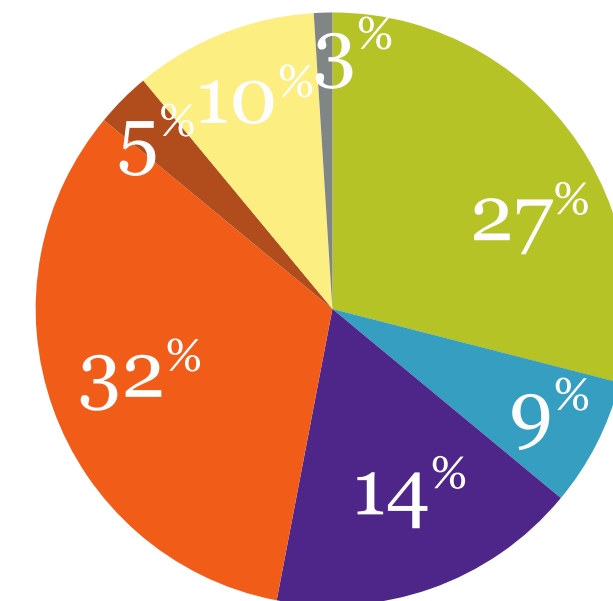
STUDENTS BY CLASS



STUDENTS BY COLLEGE



PROJECTS BY COLLEGE



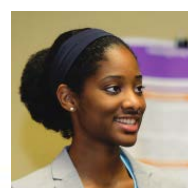
Freshman	128
Sophomore	631
Junior	1246
Senior	2915

Students - Check out [ci.clemson.edu/join](http://ci.clemson.edu/join) to find a project that fits your interests

Everyone - See current projects at [clemson.edu/ci/projects/current](http://clemson.edu/ci/projects/current)

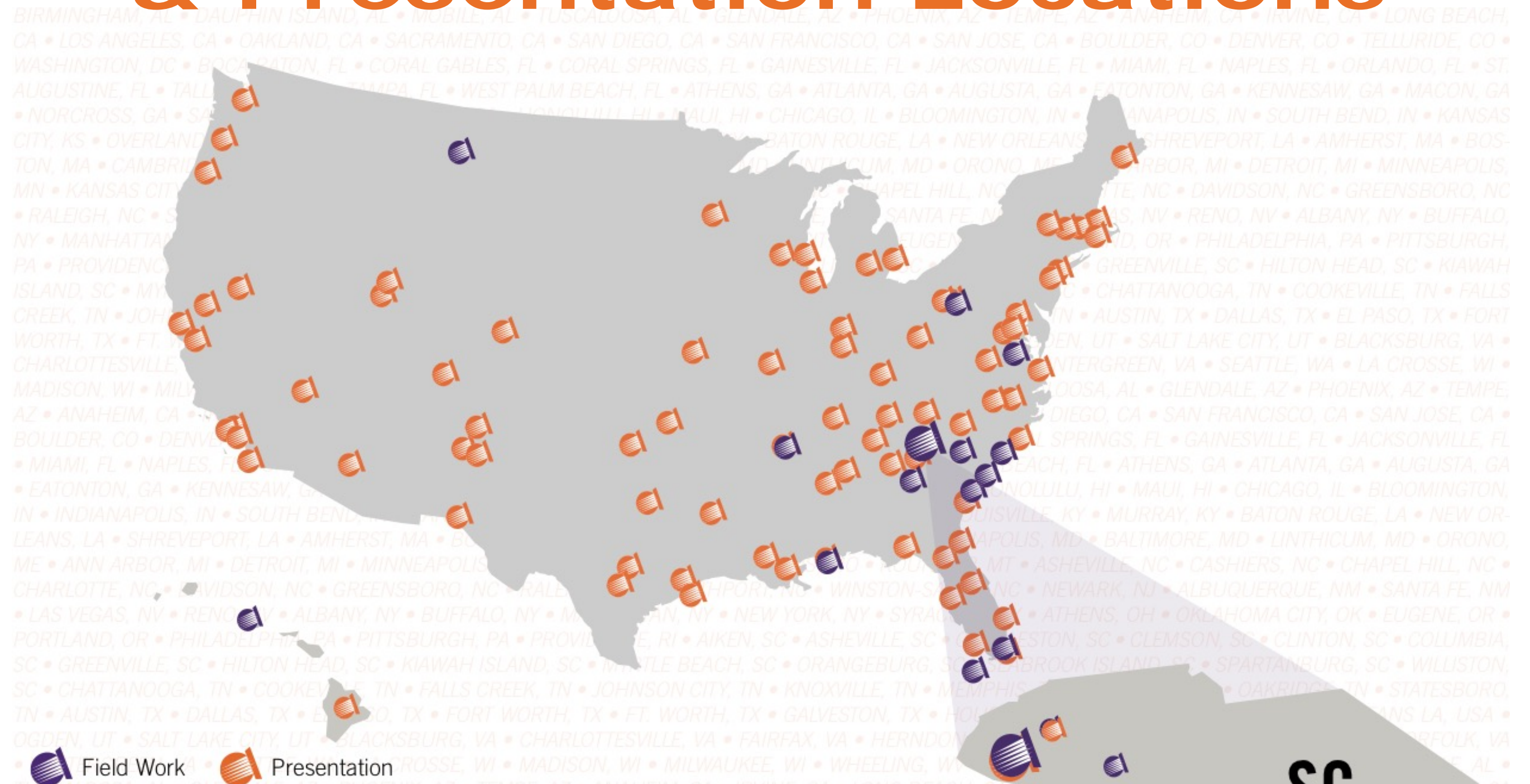
College	Students	Projects
Agriculture, Forestry And Life Sciences	1441	113
Architecture, Arts And Humanities	349	35
Business And Behavioral Sciences	854	57
Engineering And Science	1633	140
Eugene T. Moore School Of Education	160	21
Health, Education And Human Development	468	41
Interdisciplinary/Provost/Other	15	14

*Numbers reflect the 2015-2016 academic year.*



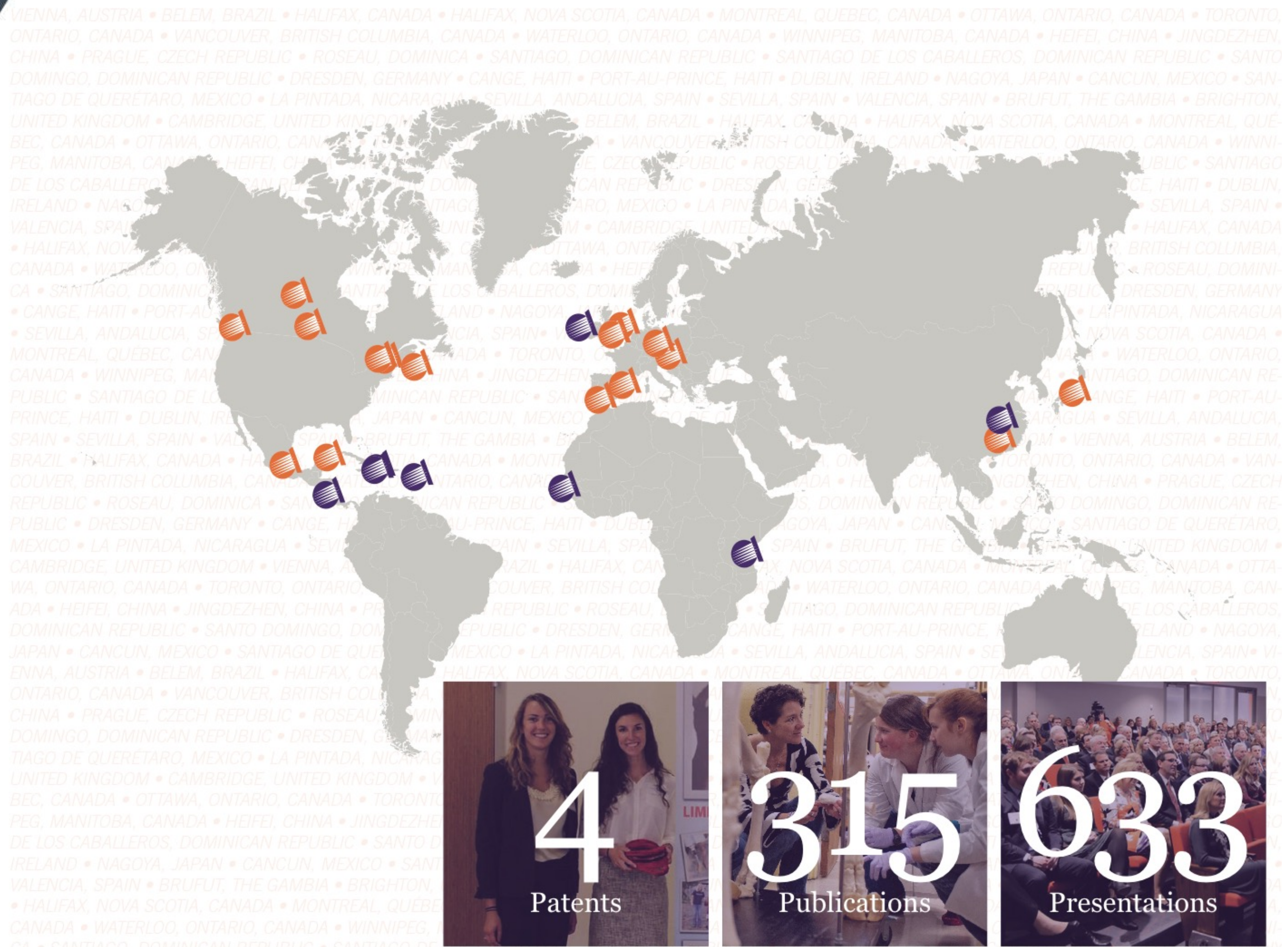


# Creative Inquiry Projects & Presentation Locations





# Creative Inquiry Projects & Presentation Locations





# CI Opportunities

## ***Focus on Creative Inquiry Poster Forum***

Poster and digital presentations in the Watt Family Innovation Center

## **CI Student Travel Grants**

For presentations at professional conferences or to complete project work

## **CI Adobe Scholars**

Use Adobe Creative Cloud programs to create interactive articles for the Decipher magazine and app

## **Summer CI Student Stipends Grants**

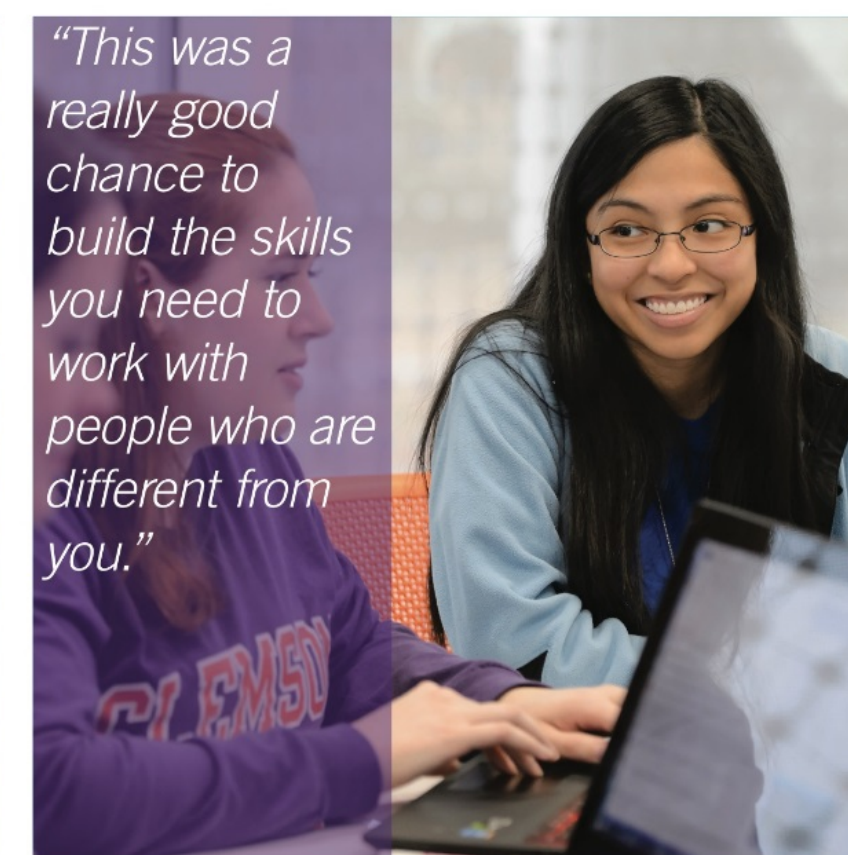
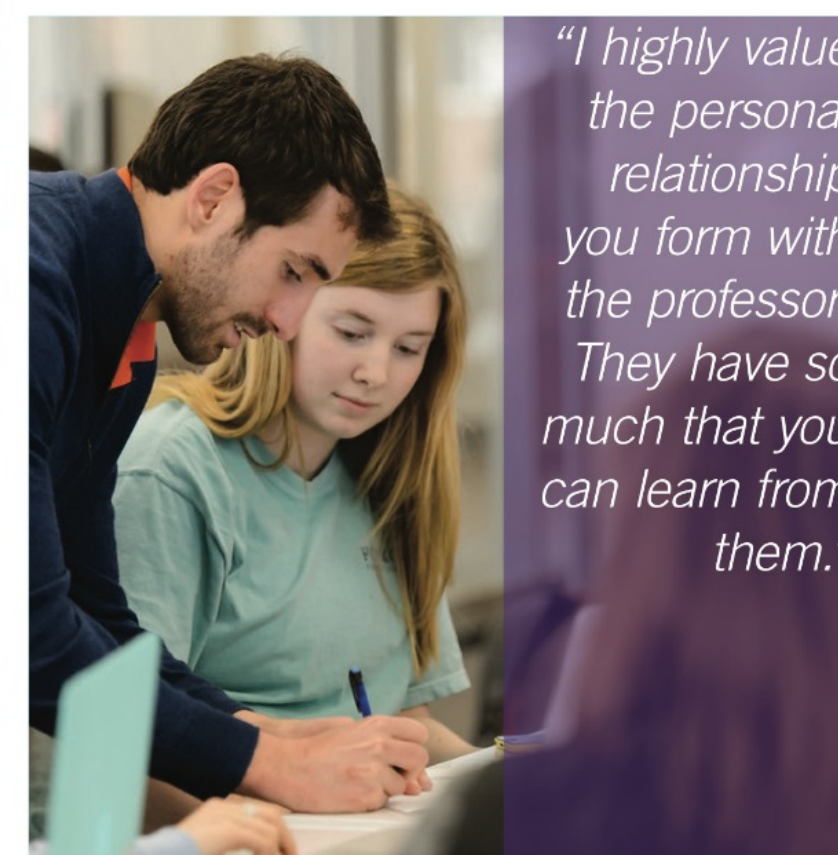
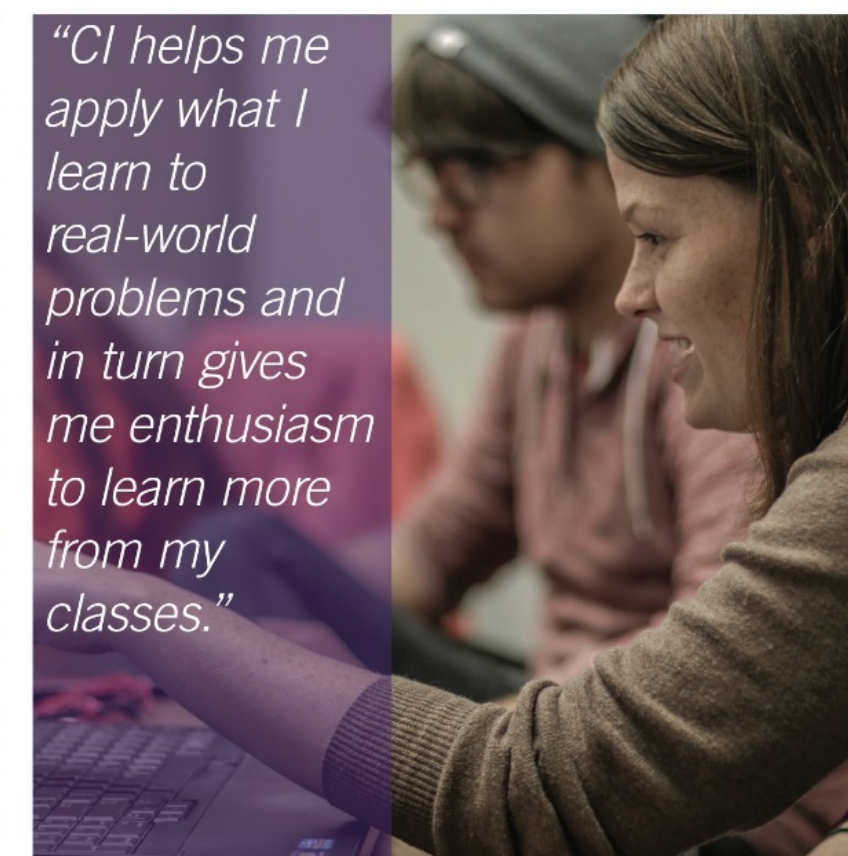
To support CI research in summers

## **Bradley Award for Creative Inquiry Mentoring**

Recognizes faculty for superior contributions to CI (students select the awardee)



# Student Perspectives





# Alumni Reflections

*"To me the experience was invaluable. Employers were/are always impressed by the skills I attribute to the experience."*

*"I presented the work I did at a prestigious computer science conference. Professors approached me there and offered me doctoral positions in their labs. " "You're an undergrad? Presenting work here? We need to talk about you joining me at University of X."*

*"My CI was extremely valuable because it enabled me to learn about an area in the industry our everyday curriculum does not go into. In addition I got to network with many people in the industry I would have never gotten the opportunity to without."*

*"My experience has helped me to excel at design and research skill sets and gain team and leadership experience"*



# Data Collection and Analysis

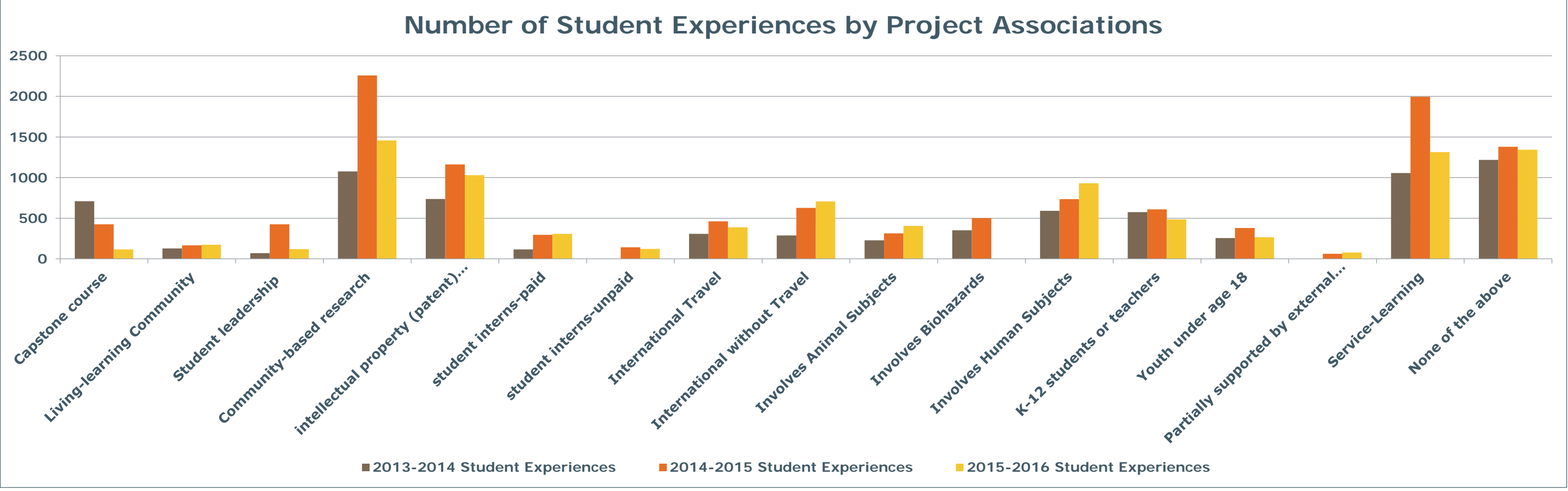
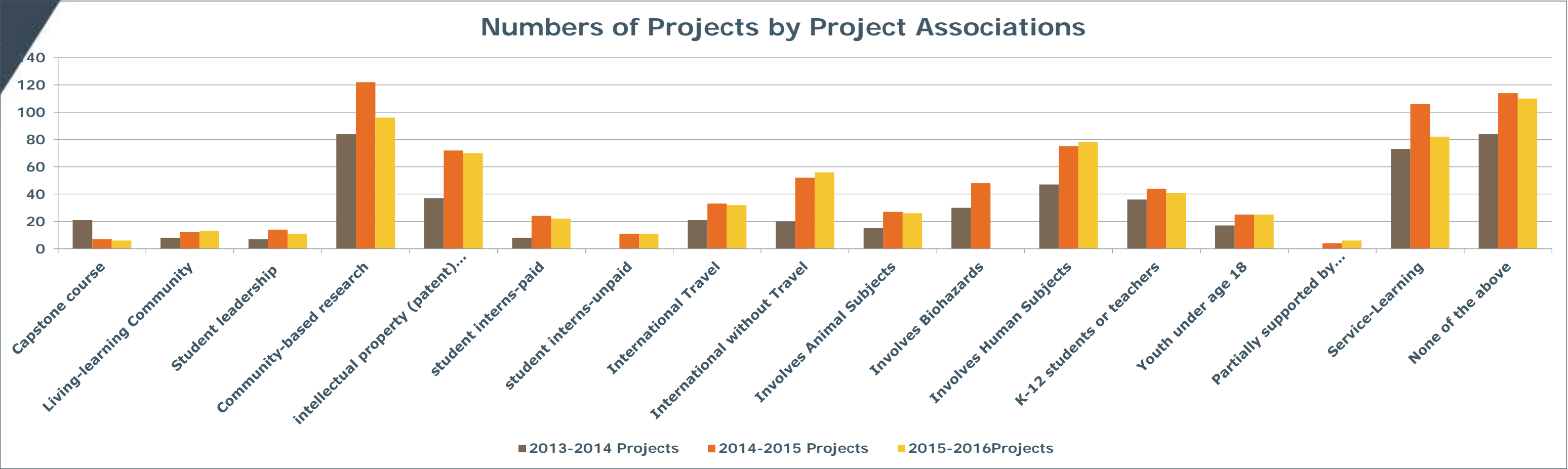
## CI website database monitors:

- Participation (students, faculty, departments, majors, demographics)
- Accomplishments (publications, presentations, awards and discipline-specific products)
- Project associations (*e.g.* international, service learning, entrepreneurial/IP, outreach)
- Financial expenditures

Annual surveys monitor student, faculty and alumni perspectives



# Project Associations





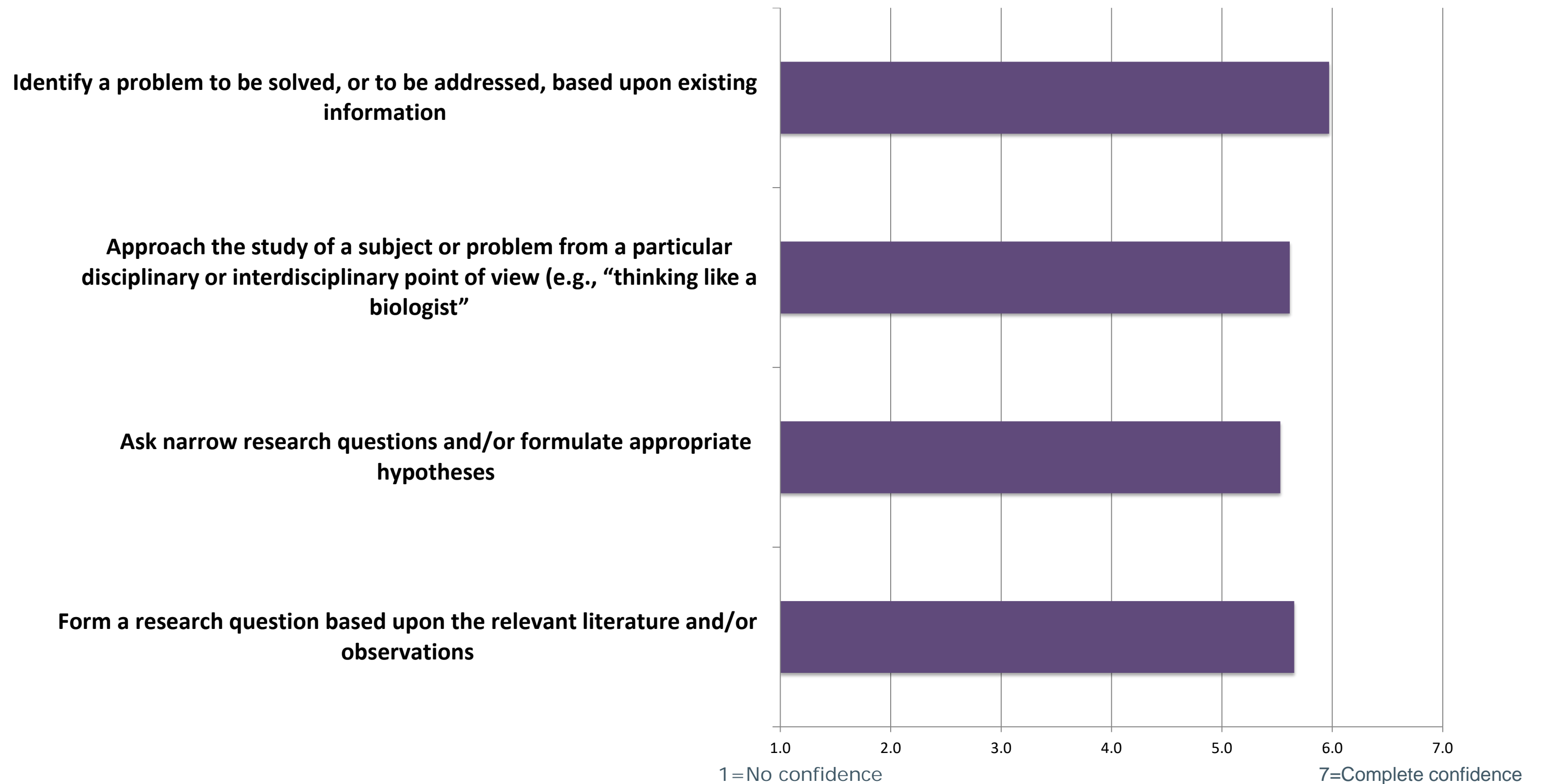
# Productivity Measures

- Awards
- Patents / Disclosures
- Posters
  - CU poster
  - Professional
  - other
- Presentations
  - CU Presentation
  - Professional
  - Other
- Publications
  - News Article
  - Other
  - University Publication
  - Professional Journal
  - Submitted to Professional Journal
  - Reports



# Annual Surveys: Student Self-Assessments

Students state that, as a result of CI, they are able to:



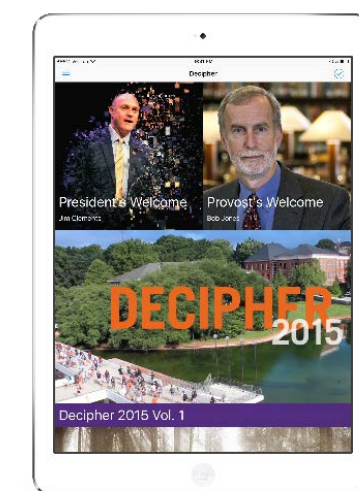
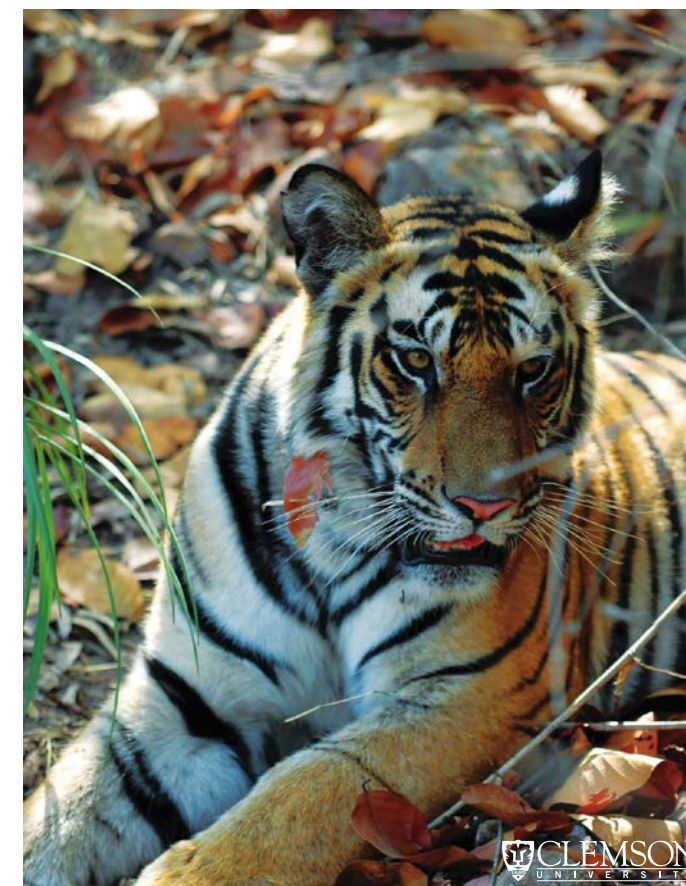
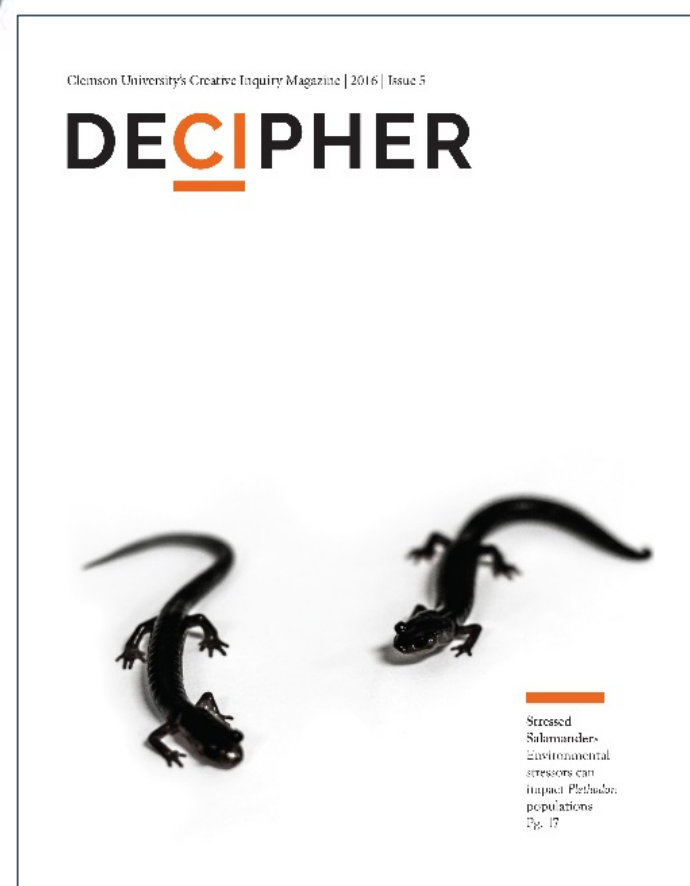
*The CI main product is creative, accomplished, and confident students*



# Creative Inquiry Publications

*Decipher* - the Creative Inquiry magazine

and iTunes app



All Creative Inquiry publications are produced by undergraduate students



# All CI Projects Are Described Online

<http://www.clemson.edu/ci>

- Click on 'Current Projects'
  - Search by any term
  - May sort by college
- Students can 'Find A Project'
  - Faculty post advertisements to recruit students
- Anyone can view and/or propose a project
  - Teams may be initiated by faculty or by students (with a faculty member as a mentor)



# International CI Project

## Building Healthier Communities in the Dominican Republic

*"Putting data to work to bring about change"*



Project uses on-site data collection, GIS mapping and analyses to map diseases and risk factors

Online communications in advance of travel strengthened partnerships and facilitated project success



# CI Project Marine Biology Conservation



## Don't be Crabby: Creative Inquiry Students are Making a Splash

By Briana Kloc

**IMAGINE GOING TO A LOCAL SEAFOOD RESTAURANT** and not being able to order your favorite dish ever again. Research being conducted by Clemson students is showing that blue crabs may disappear from the menu due to human impacts on the environment. This active group led by Dr. Michael Childress, a professor in biological sciences, introduces students to the many challenges of conserving our ocean resources. This includes studying the effects of climate change, consequences of fishing, and problems caused by human development. Students first read and discuss articles based on these topics, then conduct lab and field experiments, and eventually progress to develop and carry out their own research. The long-term goal of this team is to use the data that they collect to predict future effects of environmental change.

This Creative Inquiry team was created in 2008, and they have been actively working ever since. One of the greatest accomplishments was the creation of the Living Laboratory program at the Keys Marine Lab (KML) in Florida, a near-shore research project observing marine

communities. The team played a direct role in developing the protocols for this science outreach program, designed for school groups ranging from high school to college students. Visitors collect data by snorkeling in five locations at the KML in order to build a large data set for examining the health of marine communities in the Florida Keys. In addition, this team has been responsible for three scientific publications and an online blog.

The team studies two main topics: the effects of water salinity and drought on blue crabs in the ACE Basin National Estuarine Research Reserve in Bennett's Point, SC, and the effects of habitat loss on juvenile Caribbean spiny lobster behavior at the KML.

Not only do they travel to both of these locations, but they also attend the Benthic Ecology meeting every year where their group posters won two outstanding student

presentation awards in 2010. Recent meetings have been in Wilmington, NC, and Mobile, AL.

When there are large changes in water quality, important components of lobsters' habitat, like sea grass and sponges, die out. Lobsters use these habitats for protection while they are young, and the Creative Inquiry team studies the behavioral changes in these lobsters as the environmental conditions change. There is a



trade-off between being aggressive and owning a piece of habitat individually and being cooperative and sharing it with other lobsters. Perhaps juvenile lobsters are smarter than we think—they may be able to work together to adjust to their habitat no matter what conditions we throw at them.

The group also studies many aspects of life in juvenile blue crabs in their lab at Clemson. They're able to look at things such as settlement, survival, and growth patterns in the lab, but they also collect data on predation and disease out in the field. They use computer models to predict future population dynamics based on the data they have collected.

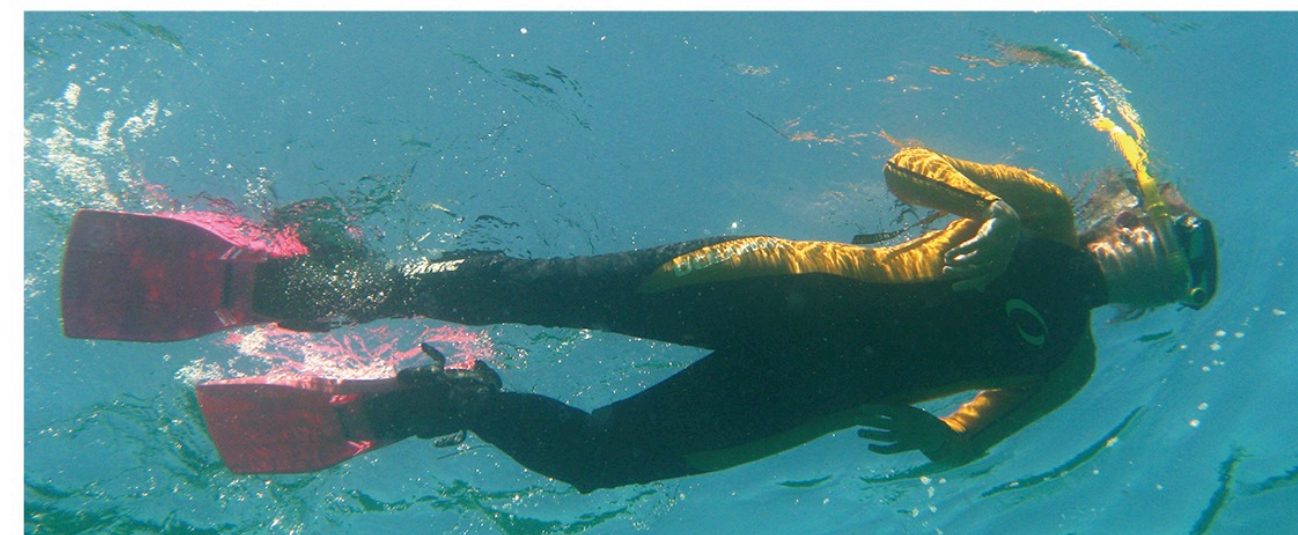
Lobsters and blue crabs are among some of the most important marine animals that we harvest, and while lobster populations are stable, blue crab populations are declining. Not only is over fishing draining the blue crab population, but water quality also plays a major role in their reproduction. Changes in estuary salinity due to human irrigation have detrimental impacts on juvenile

blue crabs. Dr. Childress believes that without both regulated fishing and water quality control, it would be very difficult to have sustainable populations of blue crabs in the future.

Kelsey McClellan, a second year student on the Creative Inquiry team, has been able to work with both the blue crabs and lobsters in Clemson. She enjoys getting involved with all aspects of lab work, from animal care to data analysis. Her experiences on this team have influenced her decision to pursue marine research as a career because she realized that research can be interactive and multi-faceted.

“Lobsters and blue crabs are among some of the most important marine animals that we harvest, and ... populations are declining.”

This Creative Inquiry shows that you don't need to live at the beach to make huge impacts in marine conservation. Not only do the team members conduct a lot of research in their own lab and in the field, but their development of the KML Living Laboratory allows students from everywhere to gain hands-on experience while contributing to an ongoing study. It's necessary to reduce man's effects on the environment as much as possible in order to sustain our planet, and studies like this Creative Inquiry bring hope that conservation can be successful. ■





# International CI Project

## Graham Greene's *The Comedian* (Haiti)



Photo by Phillip Hatfield

*"Graham Greene's 1966 novel The Comedians, is the focal point of this class trip: we are there to gather material for a set of multi-media annotations that we hope to make available for free online."*



Photo by Phillip Hatfield

<http://avidly.lareviewofbooks.org/2015/04/29/teaching-graham-greene-in-haiti/>



# CI Project Bioengineering in Africa

## Designing Medical Technology for the Developing World

By Briana Kloc

**GETTING YOUR TEMPERATURE AND PULSE TAKEN IN THE DOCTOR'S OFFICE** seem like routine tasks. Many patients even complete these tests at home. In a country with so much medical technology, it is hard to imagine life without our luxuries. However, developing countries lack some of the basic medical instruments that keep us healthy.

Bioengineering students are working on a project to create affordable medical instruments for developing countries, specifically focusing on Tanzania. While healthcare is improving in these countries, they still lack much of the medical technology found in the United States, and generally use outdated models donated from other countries. This Creative Inquiry team, led by Clemson engineering professors Dr. Delphine Dean and Dr. John DesJardins, aims to create inexpensive, easy-to-use medical technology for the countries that need it the most.

This team is crafting a number of medical products, ranging from a neonatal heating device for hospitals to an affordable glucose monitor for poor villages. Senior team member Suzanna Langworthy says, "We take concepts from our everyday line of medical care and design a device or tool that can accomplish the same goal, but that is cheaper, easier to use, can be easily implemented, and can be made locally to enhance self-sufficiency." The education for healthcare workers in developing countries is often limited, so it is vital that they have devices that they understand how to use, but at the same time are comparable to higher-end equipment.

The students have the freedom to design and work on any project that interests them, and as a team they are developing a number of problem-solving technologies. For example, Tanzania has an infant mortality rate ten times that of the United States, partly caused by failing incubators. This team designed a low-cost temperature monitor that detects the temperature of infants and a heating device to regulate their body temperature.



Another project constructs blood glucose monitors, which are an important preventative technology. These machines provide diabetes patients with a way to control their disease to prevent further health complications. Other projects include a blood volume indicator and a bacterial sensor for detecting gastrointestinal diseases, such as typhoid and cholera.

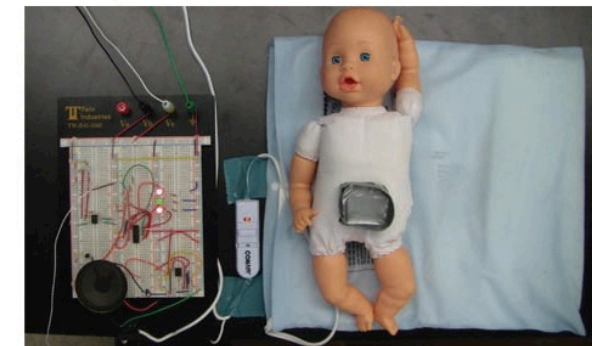
While this project allows students to learn the fine points of producing medical technology, it also emphasizes bettering healthcare around the world. Some team members have had the chance to travel to Tanzania and tour the hospitals. This helped them determine which devices are most essential to create. As Britton McCaskill remarks, "In the long-term, we hope to provide developing countries the capacity to be self-sufficient in the health-

care industry and reduce their dependence on external donations."

Many students on this team express how rewarding it is to apply their engineering skills in a real world setting to address serious health problems. Kevin Keith's favorite aspect of this project is how "this Creative Inquiry puts us in a position to impact patients who are often in the most

need." Maglin Halsey also comments, "I quickly learned once I began this Creative Inquiry that there are a lot of things involved with the state of healthcare in the developing world. Obviously, there is no quick-fix to the problems in these areas, but we are hoping to start taking small steps towards improvement. We believe that we have a great foundation to make a difference."

This Creative Inquiry provides Clemson students with knowledge and experience to become skilled professionals in bioengineering through a personally and professionally gratifying program. ■



"...we hope to provide developing countries the capacity to be self-sufficient in the healthcare industry and reduce their dependence on external donations."

### Meet the Decipher Team!



Briana Kloc graduated Clemson University in May 2012 with a degree in Biological Sciences, earning both general and departmental honors. She has a passion for conservation biology and spent a summer tagging nesting loggerhead sea turtles in North Carolina, and her newest project is tagging small mammals in the Clemson Experimental Forest. Her undergraduate research project at Clemson used zoo studbook data to look at birth-sex ratios in captive endangered primates. She will be continuing her education at the College of Charleston to pursue a M.S. in Environmental Studies. In her free time she loves practicing yoga, going hiking, and cooking.



# International CI Project

## Studies in Freshwater Ecology and Limnology (Dominica)





# CI Project

## Social Media Listening

### They're Watching You: Conversation Analysis in Social Media

By Rachel Wasyluk

**UPDATING YOUR FACEBOOK STATUS AND ADDING PICTURES FROM YOUR WEEKEND TRIP** might seem like typical college activities, but there may be a lot more to these tasks. A new Creative Inquiry team is collecting information presented in social media outlets and analyzing how this material will affect numerous aspects of society, from businesses and stocks to law enforcement.

The team, led by Dr. Jason Thatcher, is using a Social Media Listening Center (SMLC) to collect what is communicated through social media sites, including Facebook, Twitter, YouTube, and LinkedIn, as well as various blogs and online social communities. Clemson University was the first campus in the United States to start a facility like this. The SMLC is a collaborative effort through Dell, Clemson University, and Salesforce Radian6, the platform for the program. The center uses six large screens to

“There are three things in life that I absolutely love: technology, statistics, and social media. Luckily for me this project hits all three of those passions.”

monitor thousands of conversations that are taking place online in real time. Dell provided the advanced technology, while Clemson offered them the opportunity to use this system in an academic setting. Salesforce Radian6 allows the students to track, monitor trends, and analyze discussions taking place in social media posts and comments.



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In order to obtain the best results, the team works on building “profiles” using important and specific keywords. Senior Heather Woodward notes, “It isn’t easy. You have to put a lot of time and effort into your projects. If you have ever tried to use Google to search for something really specific, you have a small idea of what we do! You have to be persistent if you want to get any relevant results from your search.”

After capturing and compiling target conversations, the students work to filter, sort, and prioritize the information. While these collection procedures are interesting enough, students are taking it further and applying the results to real-life situations using analytical tools in Microsoft Excel. Woodward explains, “Social media is the great unknown in the marketing world.

No one is really sure how much it helps or hurts a company. It is important to analyze it and understand it so it can be used

correctly.” Most importantly, students are learning to monitor trends that arise from over 150 million sources of social media discussions.

The Creative Inquiry team is broken into numerous small teams that are working on independent projects simultaneously. For example, one group is currently analyzing comments about companies, like Nissan, to predict stock market changes. Another group is working with a local emergency line to set up a program that can help track or report crime. What have these efforts taught the students? “Be careful what you post! If we can formulate a search that can help find criminals, then your potential employers can probably find you,” Woodward advises.

The team is divided into two main sections based on levels of expertise, but they work in collaboration to learn and gain insight from each other. Students involved in this Creative Inquiry are majoring in a variety of disciplines, including marketing, business management, computer science, and engineering, among others. Kyle LePrevost, a student on the team, noted, “There are three things in life that I absolutely love: technology, statistics, and social media. Luckily for me this project hits all three of those passions.”

Through the real-time insight that this project provides, the students are able to use highly advanced technology to track conversations in numerous social media outlets on the internet. Businesses can use

this information to tailor their product line or marketing strategies, as well as determine the common public opinion of their company. While students are able to track information about major corporations, another question comes into view: where do we draw the line on the invasion of our privacy? ■



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# International CI Project Engineers Without Borders



Performing well yield tests and repurposing solar panels from an abandoned well

Re-purposing solar panels from an abandoned well to pump water for the farm (The Gambia).



The completed pump house (Nicaragua)



Constructing a certified hurricane-proof pump house out of recycled materials



# International CI

## Project: Clemson Engineers for Developing Countries (Haiti)

Started in 2006 with 6 Civil Engineering students designing and building a water system in the village of Canges, Haiti

- Now involves 14 projects with more than 100 students from 29 different majors



*"Serving the developing world,  
developing those who serve."*



### Experience the Class!

Join us this Friday, April 3, at 2:30 in Lowry 100

Clemson Engineers for Developing Countries is focused on bringing people from all majors and areas of interest to identify problems within the developing world and then plan, design, and implement sustainable solutions to improve the quality of life. CEDC is a peer-led CI team, organization, and internship program currently working with the local community in the Central Plateau of Haiti.

[ClemsonEngineers.com](http://ClemsonEngineers.com)



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