



TIP: Piloting a Physics Partnership

Donald Walter¹, Wagih Abdel-Kader¹, Jennifer Cash¹, Shadia El-Teleaty¹, Richard Murphy², James Payne², Daniel Smith¹, Reginald Williams¹
¹South Carolina State University, ²Orangeburg-Calhoun Technical College



Statement of the Problem

The growing need for STEM graduates in the United States is well documented [1,2] as is the underrepresentation of minorities in these fields. For example, in 2006 55% of all scientists and engineers with occupations in science and engineering were white males and 18% were white females while only 2% were black males and 1% black females. [3].

Of particular concern is the relatively small field of physics, which annually graduates only 6,000 students, while at the same time there are over 400,000 degrees awarded in the STEM fields [4]. **Fewer than 175 of those 6,000 degrees in physics are earned each year by African-Americans** [5].

Mission and Goals

We will strengthen the physics programs at a four-year, Historically Black College/University (HBCU) and a nearby two-year, Predominately Black Institution (PBI) by forging a strong partnership using shared resources.

Goal: To form a successful physics partnership between South Carolina State University (SCSU) and Orangeburg-Calhoun Technical College (OCtech) that will strengthen both programs and serve as a model of best practices for developing a STEM collaboration.

Subgoal 1: Develop a collaboration that will share resources and serve as a model for future partnerships in other STEM fields between SCSU and OCtech; and, for future SCSU STEM partnerships with other 2-year institutions.

Subgoal 2: Strengthen the physics-related programs and courses at OCtech.

Subgoal 3: Strengthen the physics program at SCSU.

Successes

- Students better prepared for class – flipped with videos
- Students like videos for study – better attitude about physics
- Developed procedure to create high quality videos
- Developed Invention Instruction Activities
- Mentoring of new, junior math faculty member at OCtech by senior physics faculty from OCtech and SCSU
- OCtech to fund additional coursework for math faculty member to become certified to teach physics
- SCSU undergrad physics major training as instructor at OCtech

Challenges

- Departure from OCtech of physics instructor who was Co-PI
- SCSU campus-wide evaluation of Gen Ed requirements is delaying physics curriculum development
- Time commitments to implement project greater than expected
- Some technical issues with full implementation of videos
- Tracking student use of video vs ease of access to videos
- Getting students in the habit of doing pre-lecture work

References

- [1] Members of the 2005 "Rising Above the Gathering Storm Committee" (2010). NAS Report. *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5.*
- [2] Members of the Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline (2011). NAS Report. *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads..*
- [3] National Science Foundation, Division of Science Resources Statistics, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011*, NSF 11-309,
- [4] Hodapp, T. 2011 *The Economics of Education: Closing Undergraduate Physics Programs*, American Physical Society, APS News, Volume 20, Number 11
- [5] American Institute of Physics, *Number of Bachelor's Degrees Earned by African Americans and Hispanic Americans, Classes of 1994 through 2010.*

ABSTRACT

Our HBCU-UP Targeted Infusion Project (TIP) has brought together the faculty and administrators of a four-year HBCU and a nearby two-year, Predominately Black Institution. Our project goal is "To form a successful physics partnership between South Carolina State University (SCSU) and Orangeburg-Calhoun Technical College (OCtech) that will strengthen both programs and serve as a model of best practices for developing a STEM collaboration." We are accomplishing this through the sharing of resources and a variety of activities. We report on our successes and challenges at the midpoint of a three year project funded by the National Science Foundation.

The OCtech faculty has conducted training for SCSU students and faculty in the use and application of LabVIEW software and alternative-energy projects. This has led to the introduction of these topics into SCSU courses. For the first time, a SCSU faculty member has taught a physics course at OCtech for their students. Invention Instruction activities have been developed for introductory physics courses and both institutions have increased the use of cyberlearning resources.

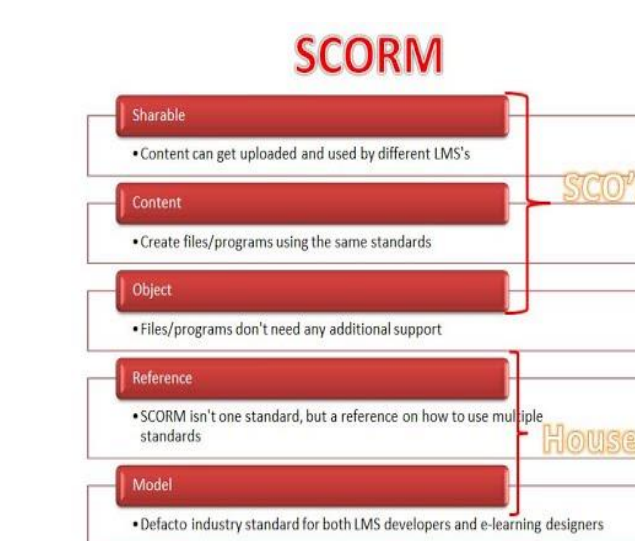
New courses and coursework have been developed at both institutions. We have completed one semester of teaching calculus-based physics using the so-called "flipped or scrambled instruction". This method requires students to preview short videos on topics in mathematics and physics prior to a live lecture and problem solving session. More than 100 videos of length two to five minutes each have been developed for the two-semester physics sequence. This hybrid method of teaching has been generally well received by our students. Technical issues and significant adjustments in time commitment have challenged faculty and students alike. A member of the SCSU education faculty has conducted an assessment of our flipped instruction during the fall 2014 term using a variety of methods including pre- and post-testing, focus groups and individual student interviews. We discuss some very preliminary assessment results.

Shared Resources & Experiences

- OCtech trained SCSU faculty in LabView
- OCtech Alternative Energy Workshop included SCSU
- OCtech Project Based Learning Workshop included SCSU
- SCSU Faculty member teaching physics at OCtech
- SCSU & OCtech team-teaching physics lab at OCtech
- SCSU physics videos used at OCtech and SCSU

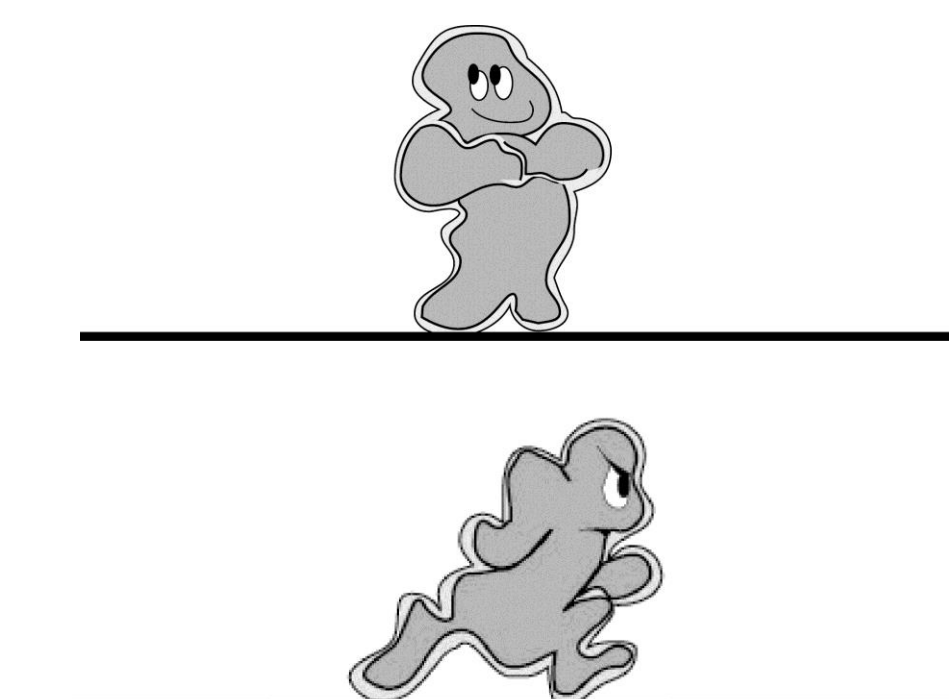


Flipped Instruction



- Created 114 new physics/math videos
- Each 2-5 minutes long
- Specific topics (e.g. vectors)
- SCORM Compliant
- Students view prior to class
- Less lecture, more hands on activities

Invention Instruction



- Prior to lecture on a topic, students "invent" a measurement outside of the subject area where the measurement is needed so that transfer to the desired subject is more easily achieved.
- Rather than tell students about vectors, they are given a easy task that requires their own invention of the concept
- We have incorporated activities on vectors, free-body diagrams and 2-D motion

Recruitment & Retention



- Support for Society of Physics Students
- Physics Fair on the SCU Plaza
- Student Travel Support to National Society of Black Physicists Conference
- Textbook funding for physics majors
- Visits to Clemson University
- Recruitment at High Schools

Evaluation Plan

	Very Comfortable	Comfortable	Uncomfortable	Very Uncomfortable
Which of the following areas do you feel comfortable doing in connection with your physics classes?				
Working with physics students from other colleges on projects.				
Working with other professors from other colleges in your classes.				
Working alone on physics class projects.				
Working with only one professor in my physics class.				
Using the library, lab, and other resources at my own college only.				
Using the library, lab, and other resources at another college as well as at my own college.				

- Fall 2014 and Spring 2015 at SCSU
- 3 sections of calculus physics
- Pre and post diagnostic test
- Online student attitude survey
- Focus groups of 3-5 students
- Individual student interviews
- Student response largely positive
- Detailed analysis in Summer 2015

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More Information
<http://physics.scsu.edu>

