



# From CURE to an Undergraduate Research Course The evolution of Undergraduate Research in a Community College

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## Goals

To improve the quality of STEM education at Green River Community College.

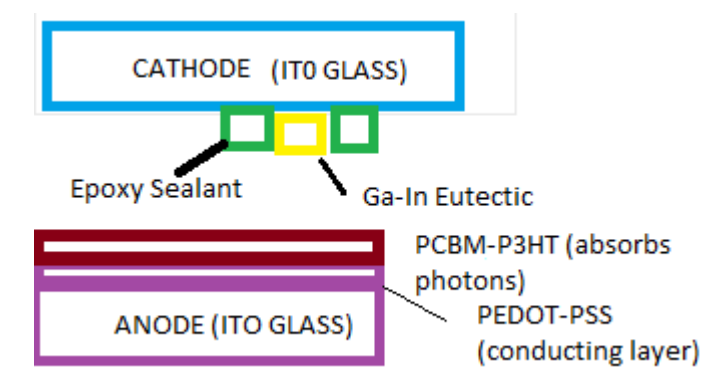
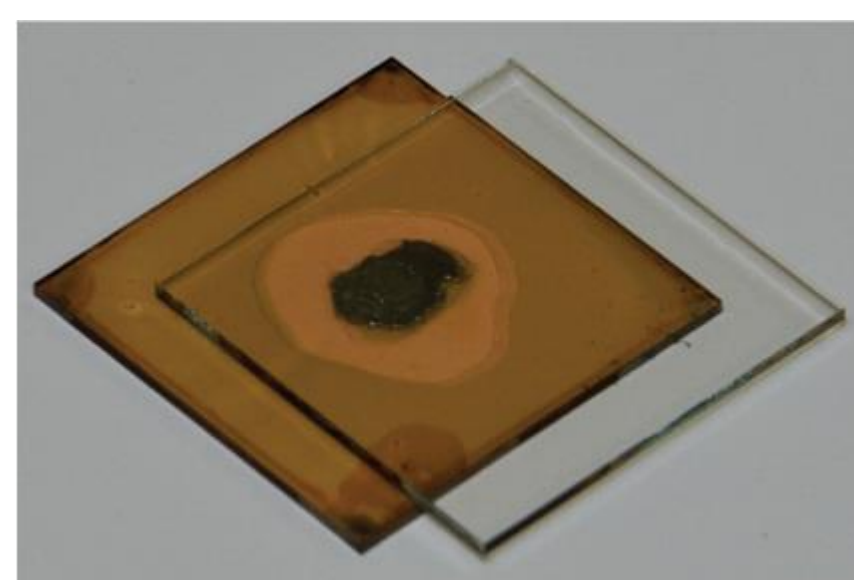
- Increase student interest in STEM fields and careers.
- Expand student knowledge about the principles and practice of basic research.
- Introduce relevant, state-of-the-art content in Organic Photovoltaics, Organic Electronics, and other fields into science education.
- Develop student inquiry and research skills, including formulating research questions, experimental design, analysis, and envisioning future steps.

## Build Capacity in STEM community

- Develop new methods to teach inquiry and research skills.
- Create a model and resources for dissemination and peer sharing.
- Train and equip STEM educators to implement methods.

## OPV project in Physics (CURE)(2012-2016)

Green River CC students fabricate, test and vary parameters on OPVs.



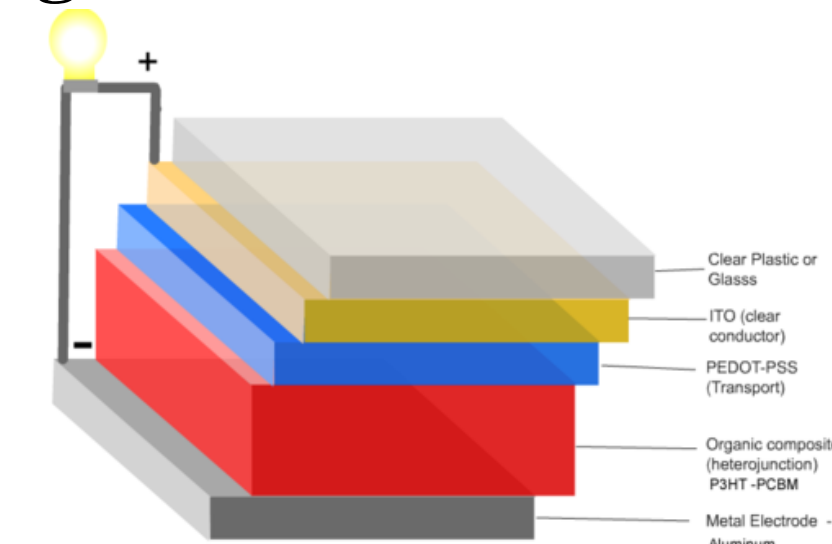
<http://www.ece.ncsu.edu>

- Optimize Fabrication Process
- Measure Efficiency of the Devices
- Change Parameters (thickness of layer, annealing time, ratio of PCBM-P3HT) and see how it affects the efficiency of the device.
- Adopt into Physics Curriculum as final project.

## Objectives

Create Learning Materials and Strategies

### Organic Photovoltaics (OPVs)



- Online videos and exercises.
- Project Website with link to UW educational page on OPVs and other online resources.
- Information Literacy Session at library-students learn to do literature search.

## Collaboration with University of WA

- PI (Green River CC instructor) worked with graduate student at UW to learn how to make OPVs and measure their I-V characteristics using a simple circuit.
- Modified process to lab at Green River College

## Undergraduate Research Course (2017-present)

- Students attend Library session on information literacy
- Submit annotated bibliography on a journal article.
- Students given an overview of the working of an organic photovoltaic cell and the factors that affect the performance of these cells.
- Students submit a proposal for the project.
- Students fabricate OPVs, changing the value of their chosen parameter and studying the effect on the efficiency of the OPV.
- Students watch online videos on alternate energy sources and the Physics of the functioning of OPVs.
- Students present their findings to their peers and submit a report at the end of the quarter.

## Assessment

### Formative Evaluation

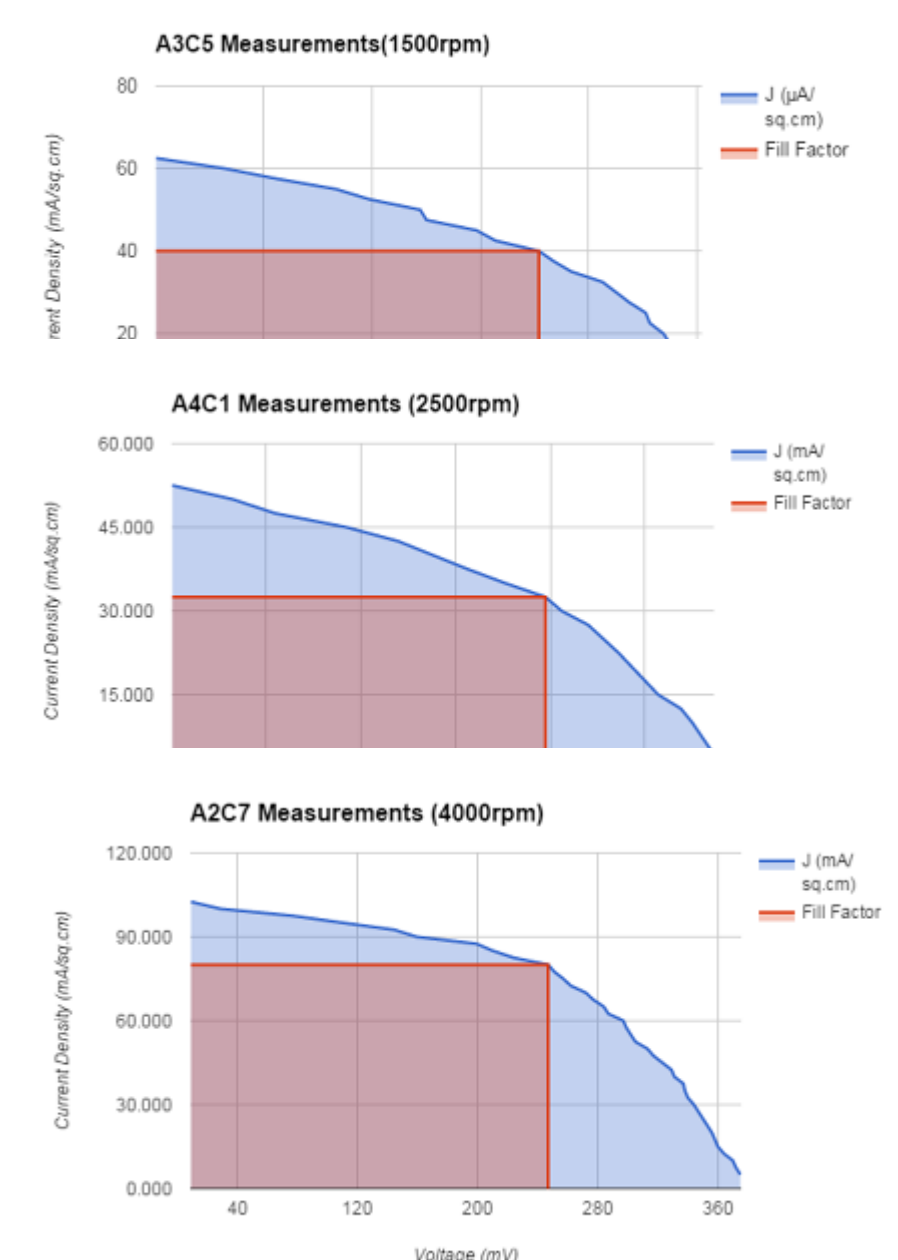
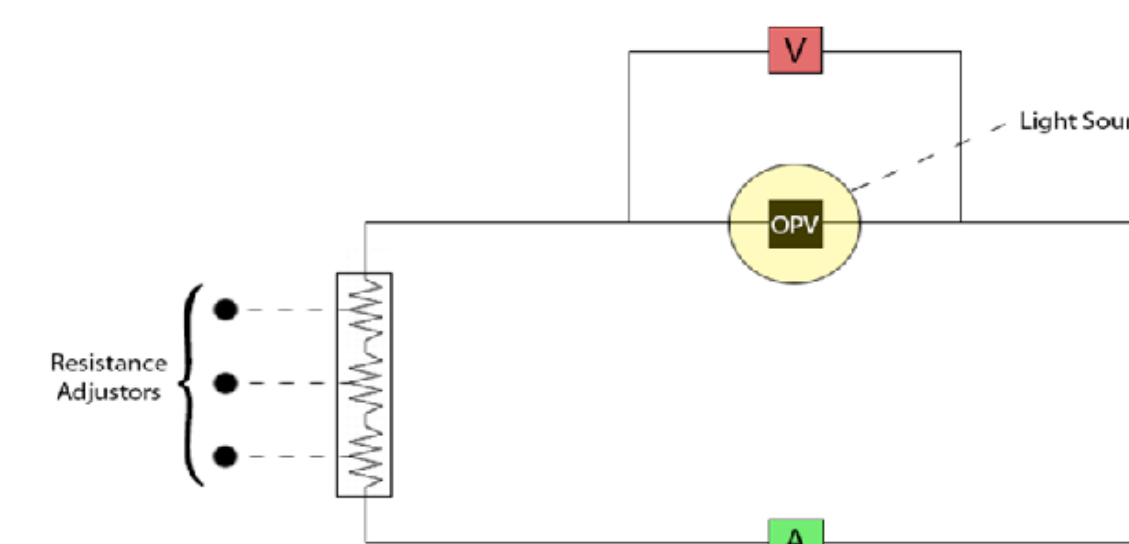
- CURE Pretest and Post test
- Observation of Student Fabrication and Characterization of Cells
- Content Pretest and Post test

### Summative Evaluation

- Presentation at campus showcase
- Project Report
- Green River Perceptions and Aspirations Survey.

## Sample Student Data

From Project Report of Jason Murray, Carlie Olson and Cedrick Cooke



## Sample Student Comments

"I was able to create something and then test its efficiency, got to experience failure, and a level of uncertainty in the final outcome." (Spring 2013)

"This project has been a positive experience to me because it showed the opportunity and potential of working as a researcher well throughout my undergraduate and graduate classes and to keep this research going." (Spring 2014)

"It was so well incorporated into the course that there was little to no difficulty. The only difficult part was finding time to meet with teammates after school to work on the project." (Winter 2014)

"The time constraint limited what we could test with the project and how much data we could collect." (Winter 2014)

## Impacts

- Development of Undergraduate Research Course
- Formation of Faculty Undergraduate Research Committee
- First showcase of student work on campus – 100 students representing over 20 courses.
- Undergraduate Research part of Strategic Plan for the College

## Challenges

- Strategy for college-wide implementation of Undergraduate Research Experiences
- Faculty Compensation / Release Time
- Lab Space and Equipment

## Sample Evaluation Results

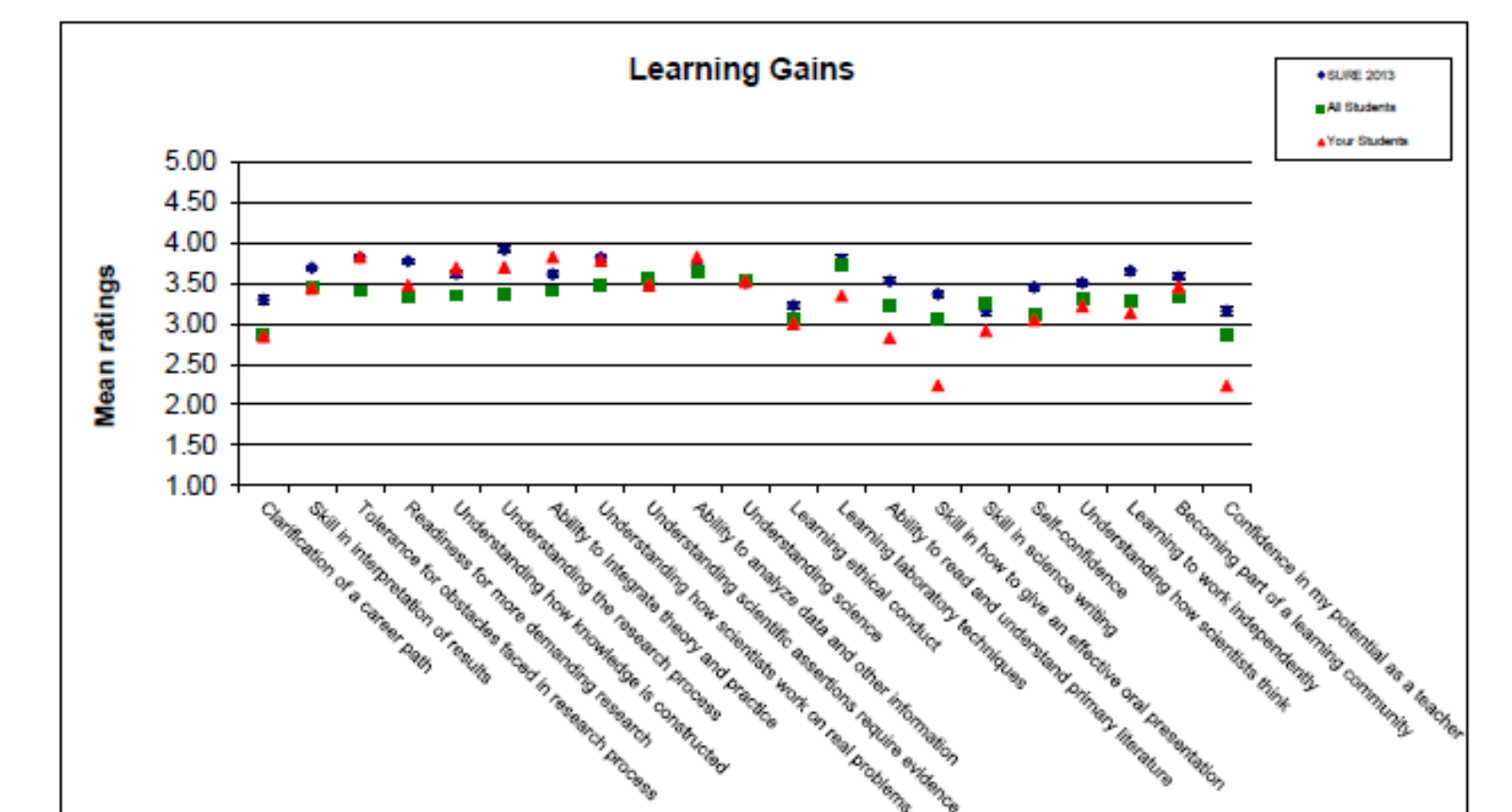


Figure 2. The figure illustrates the mean ratings by students of gains in 21 areas, corresponding to the areas above. As these same items are evaluated by students who participate in summer undergraduate research, the recent results of the Summer Undergraduate Research Experience (SURE) survey are presented for reference. Also presented (green squares) are the overall mean ratings by the reference cohort of students who completed the CURE survey in the academic year of 2013-2014. The vertical lines around the SURE means represent 2 standard errors above and below. Note: Data from students who completed the pre-course survey and those who did not are indistinguishable.

## References

- Modules available for free download from project website.  
<http://www.instruction.greenriver.edu/physics/pv/>
- CMDITR – Center on Materials and Devices for Information Technology Research(legacy website)  
<http://stc-mditr.org/>  
[http://www.ece.ncsu.edu/oleg/wiki/NSF\\_Lab Modules](http://www.ece.ncsu.edu/oleg/wiki/NSF_Lab_Modules)
- OPV Project Report: Jason Murray, Carlie Olson, Cedrick Cooke