

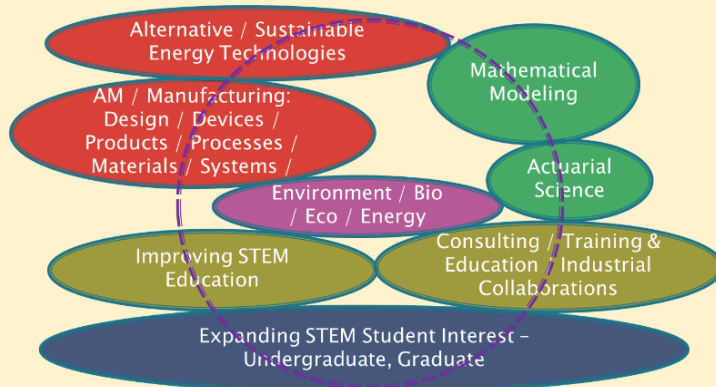
# Research Highlights

Fall 2016 Edition

- Human-Centered Thinking Design
- Interdisciplinary Collaboration
- Manufacturing Innovation
- Product Design
- Engaged Learning



SEMS has been leading the way in technological innovation, interdisciplinary collaboration, pedagogy, and cutting edge research over the past decade. The focus has been to address and find solutions for complex, human centered problems. Some of the highlights of the cross-disciplinary research in technology and STEM education are described in this newsletter.



*The figure shows interdisciplinary nature of STEM research and teaching within RMU. Collaboration with other departments and schools including media arts, communication, business, nursing and education has been an ongoing endeavor for SEMS.*

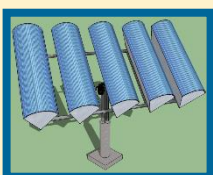
Some examples of interdisciplinary work:



*SEMS & Business & Media Arts: Product and Tool Design class, collaboration to develop sustainability conference. This Flint Hills teapot is an example of art, created using different manufacturing materials such as copper, sterling silver, acrylic and silver plating.*



*SEMS & School of Nursing and Health Sciences: Engineering built ear models for the Sim Men and low-cost vein finder projects. Coulter College engineering teams, RISE center and engineering students projects. Bag-mask ventilation simulation technique demonstrated to the SNHS students.*



*SEMS: Solar Energy: A linear concentrating photovoltaic (LCPV) System – designed and manufactured in collaboration with the University of Pittsburgh. Several 3D printing research projects undertaken in collaboration with U. Pitt and CMU. SEMS & SCIS: software verification and validation NSF funded project, SEMS students teaching blind SCIS students using 3D printed Models*

## Cross-Disciplinary Research and Innovation in the School of Engineering, Mathematics and Science (SEMS)

From the Desk of:

Dean of SEMS  
Dr. Maria V.  
Kalevitch

Director of Research  
Dr. Priyadarshan  
Manohar



*SEMS: Traumatic Head Injury Study: Functional regions of brain (left) are correlated to a computational finite element model (right).*

### STEM Research:

In response to the need of interdisciplinary research, the School of Engineering, Mathematics and Science (SEMS) at Robert Morris University (RMU) formed a Research and Outreach Center (ROC) in the year 2010. The center activities support the development of interdisciplinary curricula and encourage faculty and student engagement in interdisciplinary research projects that could be later presented at the university, regional, national and international levels. Research activities tend to cluster around several broad topic areas involving faculty from across SEMS disciplines as well as in some cases, from other Schools at RMU and also other institutions around the country. Some of the cross-disciplinary research topics explored are (see also Figure on the left):

- ❖ 3D printing and product development
- ❖ Robotics and mechatronics
- ❖ Alternative energy and photovoltaic cells
- ❖ Pesticides and their effects on ecosystems
- ❖ Soil analysis and acid mine water damage remediation

This has led to many successful cross-disciplinary collaborative research projects within SEMS.

**Human Centered Thinking Design:** The inherently complex approach to problems that deal with energy and resources sustainability, balance of eco system, quality of life, and healthcare maintenance need to be addressed in a cross-disciplinary manner. Several projects have been undertaken in SEMS that involve all disciplines of STEM as well as business, marketing, communications, and arts. Some examples of active projects are given below:

**Development of shoulder implant for senior population:** Pedestrian crashes lead to shoulder injuries for senior population and this project aims to develop appropriate shoulder implants as a remedial countermeasure.

**Design of touch-screen friendly artificial fingertips:** The project involves making a prosthesis that is capable of using touch screen by disabled people.

**Environmental impact of fast food premium toys:** The project investigates the ability of the electronic toys given out by fast food outlets to leach toxic metals into the environment.

## Cross-Disciplinary Research and Innovation in the School of Engineering, Mathematics and Science (SEMS)



### STEM Undergraduate Education:

High quality STEM education entails a wide range of knowledge including not only engineering, science, and mathematics but also liberal arts education such as ergonomics (operation, safety, usability), business (economics, marketing, management, planning, corporate identity), aesthetics (form, visualization, style), and social, environmental and cultural issues.

An interdisciplinary course in Product and Tool Design (ENGR 3650) was developed in 2006 and led by Engineering faculty, along with Marketing faculty and Media Arts faculty to bring all three disciplines together to the students' realistic experience on product design. The students were given a set of engineering and other criteria based on which the interdisciplinary student teams designed a competitive product. Art students created a drawing of the product ideas and subsequently the marketing students conducted market research to determine the price point and potential for market success for the designs under consideration. The students then made presentations to marketing experts who were invited from the industry and they picked products that they believed had the best chance for success. Fully functional prototypes of these products were then built by engineering students as proof of concept.

This class provides a wonderful opportunity for the students to learn all important aspects such as business, marketing, product strategy, project management, communication, aesthetics, intellectual property rights, ethics and economy of an engineering project.

### STEM Graduate Education:

SEMS is in the process of creating a Master's Degree program that is in collaboration with the School of Nursing and Health Sciences. This new master's degree in Engineering Management in Health Care will meet the needs of skilled professionals to manage effectively the ever growing and complex healthcare industry. Basic principles of large-scale systems engineering, quality engineering, service design, patient care and safety, and communication technologies within healthcare organizations are covered in detail.



For more information on research at RMU – SEMS please contact: Dr. Priyadarshan Manohar, Co-Director, SEMS-ROC, Research and Grants, E-mail: [manohar@rmu.edu](mailto:manohar@rmu.edu), Tel.: (412) 397-4027

This newsletter presents the research conducted within the School of Engineering, Mathematics and Science (SEMS) at Robert Morris University (RMU). It covers various relevant topics including: interdisciplinary efforts, successful research grants, student research, posters and papers, journal publications, presentations at national and international conferences, contribution to professional societies, STEM educational research, industrial consulting collaborations and applied research.

This is a publication of SEMS Research and Outreach Center (ROC) which was established in 2010 by the SEMS Dean Dr. Maria Kalevitch.

SEMS-ROC connects SEMS faculty and students with the region, the nation and the globe, demonstrates diversity and interdisciplinary interests of all three departments in the school.