In recent years, the healthcare industry has focused increasing attention on quality improvement methods through scientific research. From logistics to operations research to human factors, students and faculty in the Industrial Engineering Department are leading the way in healthcare innovation through their work on medication errors, patient throughput, emergency preparedness and evacuation, the spread of disease, mortality rates, and facilities design. In particular, Dr. Kevin Taaffe and Ph.D. student Ashley Kay Childers are involved in several of these research projects.

For the past two years, Dr. Taaffe and Ms. Childers, with support from the James E. Clyburn University Transportation Center, have been modeling patient priorities for emergency evacuations. The typical assumption is that all patients will be transported to safety, but resource availability and time may not allow for a complete evacuation. Their research helps to determine the order in which patients should be transported when a complete evacuation is in question.

Their simulation research is also being applied to more traditional hospital services. For example, Taaffe and Childers are working with Spartanburg Regional Hospital to make improvements to perioperative services by participating in project improvement teams and developing simulations of the various processes affecting both inpatient and outpatient surgical procedures.

Most recently, Dr. Taaffe has engaged top researchers and practitioners in the State in a project funded by Health Sciences South Carolina (HSSC). This project combines the efforts of the University of South Carolina, the Medical University of South Carolina, the Greenville Memorial Hospital System and the Palmetto Health System in identifying methods for improving the allocation of operating rooms for surgical procedures. Dr. Taaffe’s team is also interested in considering how simulation and RFID can improve the decision-making process in perioperative services. Through these research initiatives, Dr. Taaffe and his colleagues hope to improve the quality and efficiency of health care.
Greetings! While the economic times have been challenging, I believe that the changes implemented by the University have positioned us well to serve our constituents in the long term. This year, the Department unveiled the Master of Engineering in Industrial Engineering in Capital Projects Supply Chain for working professionals.

As usual, we have been busy and productive. The Clemson chapter of IIE hosted the Mid-Atlantic Regional Conference. An overwhelming success, it attracted 150 IE students from visiting schools. Also, in collaboration with Health Sciences South Carolina and the Bio-Engineering Alliance, the Department took a leadership role in organizing a statewide dialogue to improve health care delivery. Many faculty members are investigating the various ways industrial engineering tools can be integrated into the health care field. These projects range from hospital emergency evacuation to pandemic flu management to improving drug quality.

Our students and faculty continue to receive recognition for their work, some of which is highlighted in this issue. Let me take this opportunity to congratulate Mickey Olsen, retired VP of Engineering from Coats North America and a Clemson alumnus who has served on the Department’s Advisory Board, for receiving IIE Fellow recognition.

Finally, we thank you, our alumni and friends, for your continued generous support. We truly appreciate your contribution to the Department. I encourage you to visit us at http://www.ces.clemson.edu/ie/ for the latest news and updates about the Department or join the Clemson IE Alumni Group on Facebook. And, please, do visit us when you are in the area.

Message from the Department Chair

Pandemic Flu Management

With the first pandemic of the 21st century underway, it is still left to be determined if we are prepared to handle what could have a major effect on the day-to-day functioning of our society. Although the current strain of influenza seems to be relatively mild, the fact that we are seeing a large number of cases during the summer could be an ominous forewarning of what to expect in the fall, when the typical influenza season begins.

Given the number of uncertainties associated with pandemics, it is important to determine “when an outbreak is going to occur before it is too late to either prevent or limit its impact” and “what will be the most effective response” according to Dr. Sandra Garrett. Her research focuses on such concerns, investigating the various strategies used to prepare for and respond to time-critical, dynamic (evolving) events and the appropriate triggers for initiating those actions. A new research project involving faculty in the industrial engineering, mathematical sciences and computer science departments centers on measuring the effectiveness of specific social distancing strategies (such as school closure) in limiting the spread of the disease. This research aims to help inform public health policy regarding non-medical interventions such as social distancing, during a pandemic.

IE Approaches to Understanding Diabetes and Obesity Epidemiology

Diabetes and obesity are growing health concerns that continue to affect the lives of women of reproductive age and their offspring. Determining if intrauterine exposure to diabetes is linked to these two conditions in the children is important in determining their generational impact. IE Ph.D. student Odette Reifsnider and Dr. Maria Mayorga are collaborating with the Medical University of South Carolina (MUSC) to utilize computational approaches and simulation tools in modeling epidemiology. The key collaborator at MUSC is Dr. Kelly Hunt, Assistant Professor in the Department of Biostatistics, Bioinformatics and Epidemiology. The team is working together to develop a discrete-event simulation model to investigate and characterize the epidemiology of diabetes during pregnancy and birth outcomes related to maternal obesity and diabetes. Model validation was achieved through the partnership with the Medical University of South Carolina.

The team will utilize data routinely collected at birth by the State of South Carolina to provide information regarding the initial cohort. Using racial/ethnic data as inputs to the model and analyzing the output will allow the team to quantify the impact of maternal disparities among the various racial/ethnic groups on future health disparities at the generational level. The team will then be able to estimate the extent to which intrauterine exposure to diabetes and obesity could be driving these health disparities. The model will aid decision makers in recognizing the impact of preventative-care initiatives as well as in the evaluation of possible alternatives.

“This work may help us understand what key risk factors to look for among pregnant women.”

-Dr. Mayorga
Synergy Among Automakers Allows for Efficient Improvement Efforts

Recently, the Industrial Engineering Department has become actively involved in a partnership between BMW Manufacturing Co. and Clemson University. The goal of this partnership is to expand research and development to improve vehicle production and customer service.

Lead by Dr. Maria Mayorga (IE) and Dr. Laine Mears (ME), four IE graduate students are completing three projects for improving the stocking, handling, and assembly of parts for the BMW Sports Utility Vehicles manufactured at the Spartanburg plant. Upon completion, the IE faculty are hopeful that these synergistic solutions will lead to improved quality and a more efficient supply chain, one that will exceed customer expectations.

Improving Drug Quality through Optimization

The pharmaceutical manufacturing process operates in a heavily regulated environment overseen by the Food and Drug Administration (FDA). In this environment, any changes to the process must be explicitly documented and approved by the Agency. However, recent changes to regulations will allow pharmaceutical manufacturers flexibility in their process by having predetermined settings for drug components and process parameters with the hopes to expedite production and reduce delays.

New research conducted by Dr. Byung Rae Cho and his PhD students, Melissa I. Zelaya and Yang Yang, aims to determine the optimal drug proportions and varying process parameters while giving insight into sources of variability; whether it be from components, process parameters or nuisance variables. The research also intends to give practitioners diverse optimization techniques to best suit their product’s needs. Utilizing these techniques in the later stages of the Research and Development process of new drugs allows for the possibility of accelerating the introduction of said drugs into the market by allowing them to be ready for the manufacturing process.

Regional IIE Student Conference Success!

The Clemson IIE Chapter hosted the Mid-Atlantic Regional Conference on February 5-7. An overwhelming success, the event attracted 150 industrial engineering students from visiting schools. Participants were welcomed to a professionally rewarding weekend of inspirational speakers, plant tours, team building challenges, games, and social activities. Included in the Conference were visits to local facilities and a career fair. This event would not have been possible without all the hard work of the Conference Organizing Committee, in particular Dr. Kevin Taaffe and Danielle Lanigan. We expect that all participants headed for home with a sense of the Clemson Pride that our IIE students possess!
Dr. Joel Greenstein and his students are exploring some of those experiences and opportunities. They recently reported the results of their first study at the 52nd Annual Meeting of the Human Factors and Ergonomics Society. Their work considered whether participating in an educational experience using Second Life enhanced college students' learning. The study compared the educational experience when Second Life was used with the experience when traditional learning methods were used (e.g. a handout). After participating in each of the learning experiences, the ten students in this study completed an exam and a satisfaction survey.

The results indicate that Second Life might indeed improve the learning experience. For example, the exam and satisfaction scores for students using Second Life were significantly higher than their scores when they studied a handout alone. As such, virtual world experiences appear to be a useful supplement to traditional methods of instruction.

Building on this initial work, IE graduate student Rachana Ranade is currently exploring how SL can be used to train globally distributed workers to work together effectively in a team. Additionally, IE graduate students Necmettin Firat Ozkan, Madathil Kapil Chalil, and Vikas Vadlapatla are looking at how another virtual world, Wonderland, can be used to support the work of globally distributed product development teams.

Where are they now?
Highlighting Clemson IE Alumni Mickey Olsen

Mickey Olsen is a 1967 graduate with a BSIE. He recently retired from Coats North America as VP of Engineering, his responsibilities including IE, Facility Engineering, Environmental Engineering, Safety Engineering, and Quality Engineering. He is as a certified Black Belt in Lean/Six Sigma and was a Shingo Prize Examiner. Active in IIE, a past member of IIE’s Council of Industrial Engineers, and a member of the Clemson IE Advisory Council from 1988 to 2006, he was recently named a recipient of the IIE Fellow Award. His son, Mike, is an IE graduate from University of Tennessee, and his daughter, Kelly, is also a graduate from Clemson. In retirement Mickey is playing tennis and golf, helping coach Little League Baseball and following Clemson sports.

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Masters Degree in Capital Projects Supply Chain

Clemson University is proud to offer a Master of Engineering in Industrial Engineering with a concentration in Capital Projects Supply Chain and Logistics designed specifically for working professionals. To achieve the objective of improving and optimizing the supply chain with specific applications in capital projects, a multidisciplinary approach has been developed that integrates coursework and appropriate fundamental tools from Industrial Engineering, Civil Engineering, and Management. This structure will provide both a diversified knowledge base for improving supply chain processes today, and durable tools and concepts that will continue to serve the graduate in facing the challenges of tomorrow. The program represents and explores the various roles and interests in the execution of capital projects, including owners, contractors, suppliers and subcontractors.

To accommodate the demanding schedules of full-time professionals, all classes are offered online through asynchronous, web-based delivery with no residency requirement. Lectures can be downloaded to a desktop, iPod, or mobile device for convenient viewing. Since these courses are self-paced and accessible on the web, students can continue their education regardless of their location worldwide.

We recommend that students take one course at a time, three per year, requiring 40 months to complete the degree. The reason for this design is simple. Courses have been constructed to require between 60 and 90 minutes every day so that students can balance pursuing a master’s degree, remain effective at work, and maintain a quality home-life, as well. Students report that this balance results in an enjoyable learning experience, better retention, and a positive impact on their current jobs.

Program Costs
All courses cost $750 per credit hour plus an estimated $50 in fees, or approximately $2,300 per course. Textbooks are an additional cost, but faculty have selected books that will be used in more than one course, creating a “library” of references for the future.

Program Prerequisites
Prerequisites for enrollment in this program are: 1) an undergraduate degree from an accredited university, 2) college mathematics consistent with a degree in engineering, business or management, and 3) relevant industry experience. Students do not need an undergraduate engineering degree to be considered for admission.

Information and Application
For more information, see our website at www.clemson.edu/ces/departments/ie/graduate_programs/M.Eng. Dr. W.G. Ferrell at fwillia@clemson.edu or at 864-656-2724.
Core Industrial Engineering Fundamentals

IE 851 Data Collection, Analysis and Interpretation
Methods for effectively working with data to extract and communicate meaningful information. Excel is the software tool used.

IE 852 Modeling and Decision Making
Techniques for modeling real-world problems and solving them to facilitate better decision making. Excel is the software tool used.

IE 853 Foundations of Quality
Discussions of selected topics from quality control, total quality management, and Six Sigma, especially those relating to supply chain analysis and improvement.

IE 854 Fundamentals of Supply Chain and Logistics
Application of model building and analytical techniques in the design, optimization, and control of the supply chain and logistics systems.

IE 857 Health, Safety and the Environment
A comprehensive look at the basics of environmental impacts and remediation programs and at the issues related to health and safety in construction, including reducing workplace injuries and implementing an effective safety management program.

Capital Projects Supply Chain Concentration Classes

IE 850 Introduction to Capital Projects Supply Chain
Introduction to the phases of capital projects and the design and control of the capital projects supply chain including the challenges associated with each of the primary roles – owners, contractors, suppliers.

IE 855 Capital Projects Supply Chain
Application of quantitative and qualitative tools and techniques in the design, control, management, and optimization of the capital projects supply chain.

MGT 856 Business Fundamentals for Supply Chain Management
Principles and techniques of leadership, human resources management, financial management, marketing and economic analysis, particularly as they relate to the capital projects supply chain.

IE 858 Case Studies in Capital Projects Supply Chain
Integration of topics covered throughout the curriculum using a series of real-world case studies in capital projects.

IE 859 Capstone Design Project
A capstone experience in industry requiring application of curriculum content to a real-world opportunity.